

# Playful Recommendation: Sales Promotion That Robots Stimulate Pleasant Feelings Instead of Product Explanation

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**Abstract**—Successful cases of robot sales promotions have been increasing. Users tend to make purchases when robots properly interact with users. Most robot interactions/recommendations are created using specific products and locations within the context. Therefore, developers have to prepare a new recommendation interaction each time with each new product, which creates difficulty in responding smoothly to store’s requests. In this study, we propose Playful Recommendation, which is a situation-independent sales promotion method. This method stimulates pleasant emotions instead of presenting product information to the user, and the proposed method is less product-and location-dependent than other methods. Playful Recommendation was effective in two fieldworks. In both cases, the Playful Recommendation by the robot resulted in higher sales than the normal condition. Furthermore we have shown that the proposed method can be applied to a variety of robots and has the possibility of promoting products even when the recommended products change.

**Index Terms**—Physical Human-Robot Interaction, Social HRI.

## I. INTRODUCTION

**I**N RECENT years, sales promotion by robots has been increasing [8], [9], [19], [21], [35]. Robots use a variety of methods to encourage users to make purchases. Robots use a variety of methods to encourage users to make purchases. Kanda et al. proposed a robot recommendation system that becomes friendlier based on the number of times the robot and user interact [28]. Watanabe et al. reported that a robot sold \$100 products by chatting about color coordination with a user [11]. Thus, robots perform various interactions to successfully promote sales.

In a store, the recommended products often change depending on the season or time of the day. Based on these changes, the robot should change the recommended products. However, current robot recommendations are designed with a specific

product and location and often cannot use the same interactions when the situation changes. The developer has to create a new recommendation scenario and motion each time. Thus, the current robot recommendation system is unable to respond smoothly to changes in situations. Therefore, we considered a recommendation method that can be used in various situations. To develop a widely applicable method, it is important to be independent of specific products and locations. In other words, we need to motivate users to purchase without explaining product details. However, it has not been confirmed that a robot has successfully promoted a product without explaining the product.

About 40%–60% of purchases are unplanned purchase (impulse purchases) [1], [22] in store. Impulsive purchases is the tendency of a customer to purchase product without planning in advance. When a customer takes such buying decisions at the spur of the moment, it is usually triggered by emotions and feelings especially positive feeling [2], [3]. We focused on the state of enjoyment, as pleasant emotions are particularly effective in stimulating impulse purchasing [4] because of the increasing exploratory activity and novelty orientation [5]. Sales promotion methods that let customers have fun are widely used in shopping malls and amusement facilities [6] and are marketing methods that are accepted by users.

There is a possibility that robots can motivate users to make a purchase by stimulating pleasant emotions without a product description. This implies a recommendation that can be applied widely. Therefore we propose “Playful Recommendation” in which robots stimulate pleasant feelings and do not provide any product information to users.

Playful Recommendation is a method used by robots to recommend products to customers. It has three key points that lead to customer purchases:

*Placement of both the robots and products in users’ attention area:* This includes placing the product near the robot or having the robot hold it. The user simultaneously looks at both the product and the robot at the same time. An increase in the amount of time a user spends paying attention to a product affects interest and memory [14], [25].

*The robots stimulate pleasant feelings to the users:* Stimulate the users pleasant emotions to make them more motivated to make a purchase [26], [27].

*The robots do not tell product information:* The robot does not provide any information related to the product, such as its name, price, or features.

This method stimulates pleasant emotions without presenting the product information to the user. By showing the product

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simultaneously, the user may be motivated to purchase it. Therefore, the robot does not need to change its recommendations significantly depending on the product. Hence, developers don't need to design dialogue scenarios for each product.

We conducted two fieldworks to investigate the sales effectiveness of Playful Recommendation in a store. Our study makes three main contributions.

- 1) We present empirical evidence that Playful Recommendation can increase sales.
- 2) We identify that a self-recommendation robot (SRR) is more effective to integrate with Playful Recommendation than other robot types.
- 3) We discuss the possibility of Playful Recommendation.

## II. STUDY 1

In study 1, we consider the research question of whether Playful Recommendation works effectively for sales promotion. We set the following hypotheses to answer this question:

- H1: Playful Recommendation is more effective in promoting sales than the normal sales situation.
- H2: Playful Recommendation can promote more sales compared with the conventional descriptive recommendation method that explains product information.

To verify H1, we designed a “Normal” condition. Under the Normal condition, the placement of the products is the same as in Playful Recommendation; however, the products are placed without the robot. To investigate H2, we designed a “Description” condition. Unlike the Playful condition, the robot explained the attributes and features of the product without pleasant emotional stimuli.

### A. Interaction Design

In this study, we use “dancing” as an interaction to present pleasant emotions. Dancing has been used by many robots to attract people [7], [20]. Studies have shown that touching a product makes people more positive about purchasing it [15], [16], [18], and includes an interaction in which the robot tells the user to “pick up the product.”

*Playful condition:* The robots do not describe the product, instead provide the user a pleasant emotion in the condition. The interaction consists of “barker,” “pick up instruction,” “dancing” and “closing.” When there is no user on the side of the robot, “barker” calls out using voice and motion, “Can someone come here?” The “pick up instruction” tells the user, “I want you to pick up one of us. If you do, we will dance for you.” The “dancing” is performed after the product is taken, and the robot dances with music. In “closing,” the robot asks the user to “take the product home.”

*Description condition:* The robot describes the product in the same style as a conventional recommendation in this condition. To convey more information and attract stronger interest than audio-only descriptions, we created a video introducing the product and showed it to users. The video consists of a scene where a robot appears, takes out the contents of the product, shows them to the viewer, describes the product's advantages, and gives the product information. We replaced the “dancing” step in the interaction flow of Playful condition with the “description” step, which shows the introduction video on a 10.1-inch display. The “pick up instruction” tells the user, “I

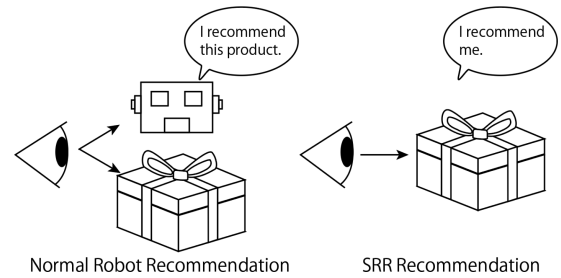


Fig. 1. Features of self-recommendation robot.

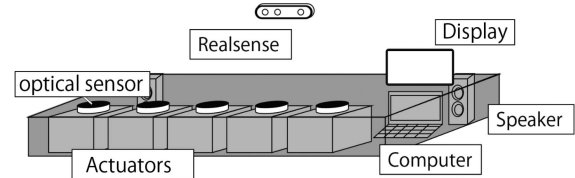


Fig. 2. System constitution.

want you to pick up one of us. If you do, we will show you an introductory video.”

*Normal condition:* There are no robots, which is a sales condition similar to a Normal condition without running the system. The display showing the video was excluded, and product placement was set as in the other conditions.

In both Playful and Description conditions, a robot performs almost the same speech and motion, except for the “dancing” and “description” steps. By comparing these conditions, we verified the effectiveness of Playful Recommendation, which present only pleasant emotions and not the product information.

### B. Robot Design

We used SRR in this case to get the product and the robot into the user's attention area. SRR is a robotic system that moves products and makes them appear as if they are robots themselves. For an SRR, recommending itself is the same as recommending products. This system is reported to be able to attract users to pay more attention to products, compared with conventional robots (Fig. 1) [14].

### C. System Configuration

The configuration of the proposed system is illustrated in Fig. 2. The system consists of five actuators that can move up and down and rotate for the product to behave like a robot (Fig. 3), Realsense to detect the presence of the user, speakers to play the sound, and a display to play video. The actuator contains two servo motors (RS304MD-FF) an optical sensor (GL5528) that detects whether a product is being placed.

We developed our own software [14] (Fig. 4) to design robots' motion. By importing the voice to the software, developers can check the voice of the robot using its waveform. The developer can design the range and speed of the motor's movement while checking the sound. In addition, the movement of the motor can be controlled by the graphical user interface and confirmed in advance by the computer graphics. The generated motion is executed on the device.



Fig. 3. Actuator.

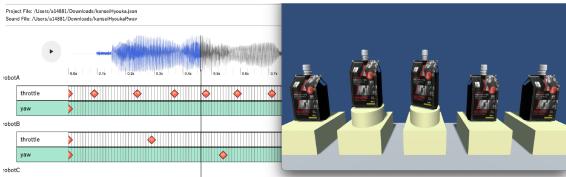


Fig. 4. Motion Generation Tool.



Fig. 5. Study 1: System overview.

#### D. Evaluation

An experiment was conducted at a store selling miscellaneous goods in a commercial facility in Osaka, Japan, from October 8 to October 24, 2021 between 11:00 and 15:30 on Fridays, Saturdays, and Sundays. To facilitate the generation of pleasant emotions, we chose a product related to a seasonal event (Halloween). We chose a product, a jack-o'-lantern motif, containing candy and priced at approximately \$4 for recommendation. Fig. 5 shows the SRR system with the product set.

Considering that seasonal events are affected by the time of the day, the experiment was divided into three slots: slot 1 from 11:00 to 12:30, slot 2 from 12:30 to 14:00, and slot 3 from 14:00 to 15:30. The experiment was designed to be counterbalanced to reduce the influence of time of the day. Cameras recorded user behavior for analysis. The sales data were provided by the stores. The system was notified that if the user did not want to be recorded, the video data would be deleted upon request. This study was conducted after receiving an ethical review from Osaka University (reference number: R-1-5-7).

### III. RESULT OF STUDY 1

The results of the experiments are listed in Table I. Customers who passed through the system were measured using human

TABLE I  
RESULTS OF STUDY 1

ID	Data	Playful	Description	Normal
a	Passengers	10356	10317	9291
b	Stopped	1516	1295	628
c	Picked up	369	398	197
d	Purchased	20	14	3
e	Pleasant Reaction	29	9	2

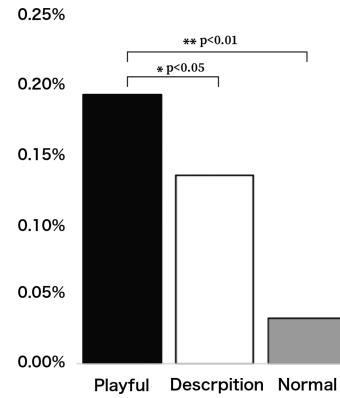


Fig. 6. Study 1: Purchase rate.

counting, and an automatic counting tool. We calculated intra-class correlation coefficients (ICC) to verify the inter-examiner reliability. As a result, ICC(2,1) was 0.98, which means that there is a certain level of agreement. We use the tool to count 36 h of video, and 4.5 h were counted by a human. Two people counted customers who stopped and picked up the product. One person counted 40.5 hours of video and the other person counted 4.5 hours of the same video. The ICC (2,1) for these two counts was 0.93 for stopped and 0.76 for picked up. We also counted the users who seemed to have pleasant emotions from the video by one person to evaluate whether Playful Recommendation stimulates pleasant emotions to users. It was difficult to observe the facial expressions of the users because of the angle of the camera and the face masks they were wearing; therefore, behaviors associated with pleasant emotions, such as “dancing with the robot,” “taking the pictures,” and “touching the head of the robot” were counted. We then calculated the Purchase rate, Stop rate, and Pick up rates from these results. The Purchase rate is calculated as  $d/a$ , Stop rate as  $b/a$  and Pick up rate as  $c/a$ . We calculated the difference in each percentage using the chi-squared test. If there was an overall difference in the statistical test, we used Ryan’s method for multiple comparisons.

Fig. 6 shows the results of calculating the Purchase rate. We found statistical differences among conditions ( $\chi^2(2) = 10.462, p < .01$ ). The Playful condition had the highest sales rate and was significantly different from the Normal condition and Description condition. Fig. 7 shows the results of calculating the Stop rate. We found statistical differences among conditions ( $\chi^2(2) = 317.18, p < .01$ ). In this case, the Playful condition succeeded in attracting significantly more users than other conditions. The Description condition attracted people more significantly than the Normal condition. Fig. 8 shows the results of calculating the Pick up rate. We found statistical differences among conditions ( $\chi^2(2) = 53.474, p < .01$ ). The playful and description conditions had almost the same Pick up rate; however, the Normal condition was significantly lower than the other two conditions. The participants exhibited pleasant

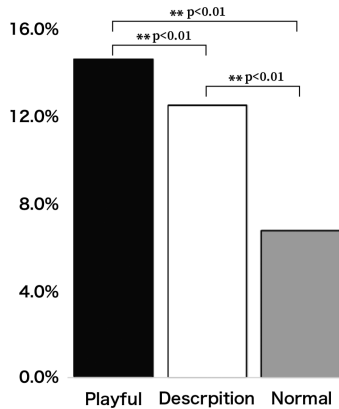


Fig. 7. Study 1: Stop rate.

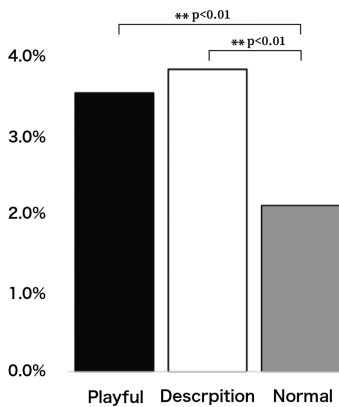


Fig. 8. Study 1: Pick up rate.

emotions 29 times for Playful, 9 times for Description, and 9 times for Normal.

#### A. Discussion of Study 1

In study 1, we investigated the “sales promotion effectiveness of Playful Recommendation” to compare the three conditions.

*Purchase Effect:* According to the data provided by the store, this product was sold once every 10 h of operation each day when the experiment was not conducted. Each condition was conducted for 13.5 h, and the sales result was 20 products for the Playful condition, 14 products for Description condition, and 3 products for Normal condition. The Playful condition and description conditions produced significantly better purchase rates than the Normal condition. The robot encouraged users to promote sales. This resulted in higher sales than the store had expected, and the inventory of products decreased, resulting in the store placing an unexpected order for products. Hence, H1 is supported.

Although no significant differences could be identified, the Playful condition achieved the highest number of sales, with a Purchase rate 1.42 times higher than that of the Description condition. In the Description condition, some customers left the booth when the video started to play because the customers were interested in the robot, but lost interest when the robot explained the product. However, in the Playful condition, few users left in the middle of the dance. The users were watching the dance and



Fig. 9. Users' reactions.

looking at the products to find information on the package [13] or looking at the products of different colors. The parents who saw their children holding a product were asking them “Do you want this? Do you want to buy it?.” We observed a scene that led to a purchase without any product description being given.

*Stopping Effect:* The Playful condition was significantly more successful in attracting customer and retaining their attention than the other two conditions. In the Playful condition, many users watched the dance until the end, which seemed to have caused a honeypot effect [10] wherein other customers were attracted by the crowd (Fig. 9). In the Description condition, people were less likely to stop while the video was playing, and this may have affected the results.

*Pick up Effect:* The Pick up rate was similar between the Playful condition and Description condition. This is considered to be because of the stimulation of the user’s interest by the robot’s explanations, such as “pick me up and we will dance” and “pick it up and we will play a video.” SRR motivates users to purchase products by creating opportunities to interact with products.

*Users' Behavior:* In the Playful condition, the robot’s dancing may have increased the user’s interest, leading the user to take a video or dance with robots. In the Description condition, the number of users who seemed to be enjoying themselves was smaller than the Playful condition, because some users left during the process. Normal condition was the same as the normal display, so while some children patted the heads of the products, many users did not behave in a pleasant behavior. The results support that Playful Recommendation was able to stimulate pleasant emotions to users than other conditions.

Considering the overall results of study 1, the Playful condition produced the best sales promotion effect among the three conditions. H2 therefore could be supported. These results confirm the effectiveness of Playful Recommendation for sales promotion.

## IV. STUDY 2

In study 2, we examined whether Playful Recommendations are effective for other types of robots. For this purpose, we prepared two patterns of Playful Recommendation using conventional robots in addition to SRR and compare them with a field experiment.

#### A. Placement of Robots

For Playful Recommendation to be effective, it is important that both the robot and products are placed in the user’s attention



Fig. 10. Robot used in Study 2.

area. We prepared three situations for the robots that satisfy this point.

*SRR condition:* Same situation as study 1. Because SRR is both a product and robot, it is possible to place it in the user's attention area at the same time.

*Nearby condition:* Place the products beside the robots. The situation is similar to conventional robot sales promotions.

*Hold condition:* Robots hold a product and make a recommendation. When the robot holds the product, the robot and product are within the user's attention area, and the user also looks at the robot.

### B. Robots Design

We prepared a simple conventional robot for this experiment. It is reported that users' purchasing behavior is influenced by the size, looks, and behavior of the robot [29], [30]. For this reason, we focused on the following conditions for the robot to be used, (1) Motion and sound are the almost same in all three conditions. (2) Similar size in all conditions. (3) Visual does not have a significant impact.

Considering these factors, we made a robot which has a face and eyes (Fig. 10). We did not add any other parts to the robot to avoid that the facial expression would affect the purchase behavior. Such a designed robots have been used in several existing studies and have been shown to be able to influence users sufficiently [31]. In order to unify the behavior of the robots, the same system as study 1 is used in this experiment. The robots placed on this actuator can move with the same motion and sound.

We prepared cases which contain an optical sensor. The products are placed in this case, and the system detects whether the products have been taken. In the Nearby condition, the case was placed just behind the robot, and in the Hold condition, the case and the product were placed above the robot's head.

### C. Interaction Design

In this experiment, we used the same interaction as the Playful Recommendations used in study 1. The only difference is in the "pick up" section, where the SRR condition says "pick me up," the Nearby condition says "pick up the product behind me," and the Hold condition says "pick up the product above me." The scenarios are completed within approximately 50 s from the time the user picks up any condition.

### D. Evaluation

The experiment was conducted from 11:00 to 16:00 on December 11–15 and 18–19, 2021, at the same store in different areas, as in study 1. As in study 1, the daily experiment was divided into three slots (slot1: 11:00–12:30, slot2: 12:45–14:15, slot3: 14:30–16:00), and all conditions were conducted in a single day. To use a product that easily stimulates pleasant emotions, we used a product from Christmas Corner. The product had a Christmas sock design with a candy inside for \$4. Fig. 11 shows the product sets for each situation, and Fig. 12 shows the area surrounding the system.

We analyzed the sales information provided by the store and information from the camera. We conducted a memory test and examined the impression of the robots. The memory test allows users to check whether Playful Recommendations are able to convey information about products. This is a quiz in which three similar products are presented to the user, who is asked to guess the recommended product. The impression test is a five-point scale of "cute" and "scary." It is used to check the differences in the robot's impressions between the conditions. We approached some users who had finished experiencing the system, and the test was conducted only for those who had given approval. This research was conducted after receiving an ethical review from Osaka University (reference number: R-1-5-7).

### E. Result of Study 2

The experimental results are presented in Table 2. Passenger information was measured by two people counting. In each count, 10% of the total number of passengers was counted in the same time period, and the agreement rate was checked using ICC. As a result, ICC(2,1) was 0.88, which means that there is a certain level of agreement. As in study 1, the Purchase, Stop, and Pick up rates were calculated from these results, and chi-square tests and Ryan's multiple comparisons were performed.

Fig. 13 shows Purchase rate. The results of the purchase were 8, 5, and 3 for the SRR, Nearby, and Hold condition, respectively. The SRR condition accounts for half of the total sales. The purchase rates were 0.1%, 0.08%, and 0.04% for SRR, Nearby, and the Hold condition, respectively. A significance test was conducted to calculate the Purchase rate, and no significant differences were identified. Fig. 14 shows result of the Stop rate. We found statistical differences between the conditions ( $\chi^2(2) = 37.798, p < .01$ ). The Nearby condition was the highest Stop rate, and a significant difference was confirmed compared to the other two conditions. Fig. 15 shows the results of the Pick up rate. We conducted a chi-square test, and the results did not reveal any significant differences among the conditions. We also measured the time spent by the people who stopped. The average times spent in the Nearby and Hold conditions were almost the same. However, the SRR condition tended to be shorter. The median stop time and Nearby condition were the longest at 28 s. As in study 1, we counted the scenes in which users showed to be feeling pleasant emotions. In the result such scenes were confirmed 24 times for SSR, 31 times for Hold, and 22 times for Nearby. We interviewed some of the users who had experienced the system and asked them to answer a questionnaire (SRR condition N = 18, Nearby condition N = 22, Hold condition N = 21). There were no significant differences among the three conditions in the memory quiz. The percentage

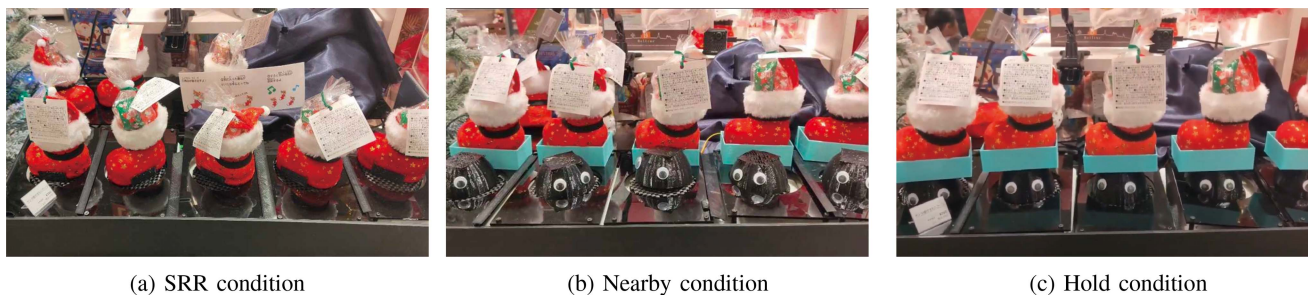


Fig. 11. Study 2: Robot conditions.

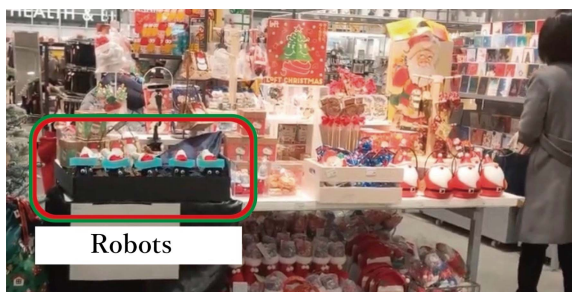


Fig. 12. Study 2: System overview.

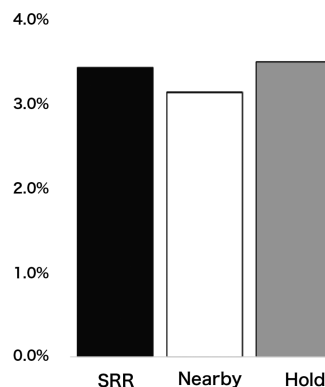


Fig. 15. Study 2: Pick up rate.

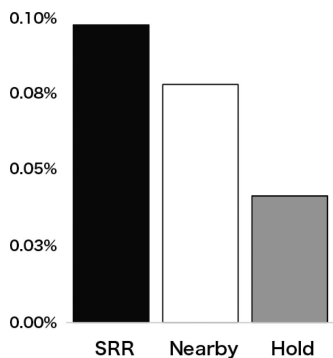


Fig. 13. Study 2: Purchase rate.

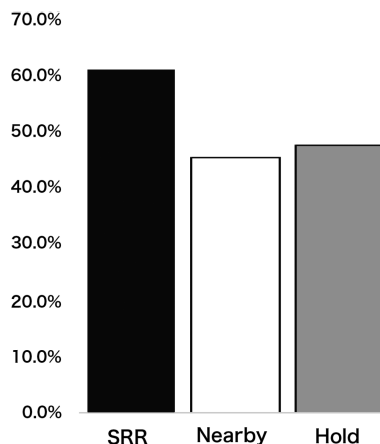


Fig. 16. Correct ratio of memory test.

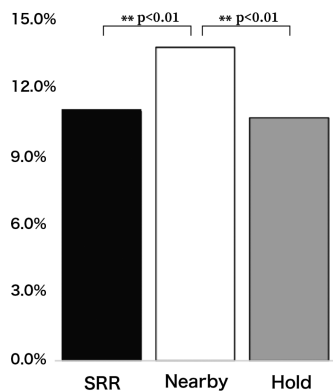


Fig. 14. Study 2: Stop rate.

of correct answers for the Nearby and Hold conditions was in the 40% range, while that for the SRR condition was over 60% (Fig. 16). The results of evaluating the impressions of the robot are shown in Fig. 17. There were no significant differences between the three conditions and the results were very similar.

F. Discussion of Study 2

We examined the effect of Playful Recommendation using multiple robot situations in study 2. We found that Playful

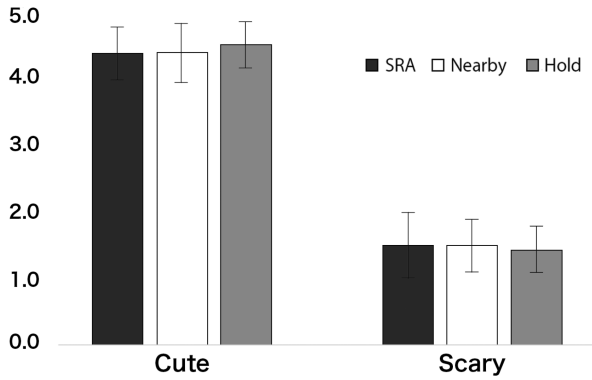


Fig. 17. Result of emotional survey.

TABLE II  
RESULT OF STUDY 2

Data	SRR	Nearby	Hold
The number of passengers	8189	6400	7179
Number of people who stopped	901	881	766
Number of people who picked up	281	201	251
Number of people who bought	8	5	3
Average stopped time(second)	32.2	44.2	43.2
Median stop time(s)	18	28	23
Pleasant reaction	24	31	22

Recommendation proved to be an effective recommendation method for some robots.

*Purchase Effect:* According to the store staff, the product sales was one in 10 h of operation per day. We ran each robot for 10.5 h and sold more than normal days under all conditions. Owing to the short duration of the experiment, we could not confirm a significant difference; however, even the lowest Hold condition resulted in approximately three times the number of sales compared with normal sales. The highest SRR conduction was approximately eight times higher. A store clerk commented, “I feel like products are selling faster than usual.” seeming to feel the effect of the Playful Recommendation. These results show that Playful Recommendation has the potential to be a recommendation method that can be applied not only to SRRs but also to other robots.

*Stopping Effect:* The Nearby condition was the most effective in attracting people. This is consistent with previous reports that robots attract humans [7], [12]. There was also a robot in the Hold condition, and a significant difference was found between these two conditions. We received a comment from a user that “when the robot was holding a product, we knew it was advertising.” The difference between the Nearby condition and Hold condition was that users did not stop when they felt it was an advertisement. When the goal is to attract people, using only robots may be effective.

*Effect on time of interest:* The Nearby condition and Hold condition tended to have a longer user stay than the SRR condition. From the experimental observations, there were many scenes in which the user touched the robot’s eyes or stroked the robot’s head (attachment behavior in Japan). It has been reported that robots are capable of attracting people; however, sometimes, users are not focused on the information conveyed by the robots [17]. This is the same phenomenon and may not lead to a purchase. In the SRR condition, the users did not perform such actions many times. Their stay tended to be shorter than

that in other conditions, perhaps because SRRs were more easily distracted.

*Pick up Effect:* There was no difference in the Pick up rate among the three conditions. When the robot instructs the user to “pick it up because we are going to dance,” the user is interested in it and is likely to have followed the instructions.

*Memory Effect:* The memory test showed that the SRR was the highest among other conditions and that the product information could be presented to the user. Previous research has shown that user gaze time affects memory [23], [24]. The percentage of time a user spends gazing at task-irrelevant information, such as robots, it interferes with the concentration and the explanation and reduces the memory rate of the users [25]. These factors may have contributed to SRR being remembered the most. From these results, it was confirmed that the robot could not only present pleasant emotions, but also promote the products.

*Users’ Behavior:* The results of impression test suggested that many users rated the robots as “cute.” In addition, we observed customers who seemed to be enjoying in all conditions. Some users purchased the products as they were, confirming the scenes where pleasant emotions influenced the sales.

As shown above, the effect may change depending on the robot type. All the robots had a sales effect, and Playful Recommendation could be widely applied. SRR was the most effective in promoting sales in study 2. We expect that the possibility of purchasing a product will increase because the user’s interest is directed toward the product. Robots even in the Hold and Nearby conditions have the possibility of making strong sales promotions if they interact with a focus on the user’s attention on the product.

### G. Potential Ethical Issues

Robot recommendations that lead to product purchase is an interesting event for sellers; however, some researchers argue that the benefits to consumers should also be fully taken into consideration [32], [33]. They are worried that robotic recommendations could lead to unnecessary purchases for consumers sometimes. Playful Recommendation is a method that encourages sales promotion by stimulating pleasant feelings without explaining. Therefore, it may cause users to make impulse purchases without considering whether they need the product or not. On the other hand, robots provide non-monetary benefits to users, such as entertaining them and providing encounters with products. Playful Recommendation should have not only potential risks, but also benefits for consumers. We need to discuss how robot recommendations will operate in society and develop them in a positive way.

### V. LIMITATION

Nonetheless, there are some limitations to this study. The impression given to the user changed depending on the product used as an SRR and the robot used in Study 2. It is unclear whether the same results can be obtained for robots with different appearances and abilities. In normal stores, small robots are often used to place products on the side of the store; therefore, we expect our findings to be versatile. In this experiment, we focused on products that are sold only during the Halloween and Christmas seasons. As pleasant emotions are easily stimulated by events, a certain degree of effect can be expected. It is unclear whether the same effect can be obtained for products sold

during normal seasons because pleasant emotions and impulse purchases may be more likely to occur than usual. The number of sales per day is also expected to change depending on the number of passing users, user attributes, and other factors, and this survey was conducted only in Japan; therefore, different results may be obtained in different countries and cultures.

## VI. CONCLUSION

In this study, we proposed Playful Recommendation, which is a situation-independent sales promotion method. This method does not require a robot interaction to be redesigned according to changes in situation. Playful Recommendation was effective in two fieldworks. In these two fieldworks, we used almost the same interactions, indicating the possibility of using the proposed method in other situations. In the sales result of the study, SRR produced the highest sales promotion effect, and we found the proposed method could be applied to other robots also.

Dance was used to present pleasant emotions; however, it can also be used in other ways. If the user becomes uninterested with the performance, it may be possible to respond by simply changing to a new performance. This recommendation can be successful without dialogue with users, requiring no high-level dialogue technology. Reducing the cost of technology and interaction design can make it easier to deploy robots in stores. In the future, we will change the method of presenting pleasant emotions and situations to determine if there is a sales effect. Cost-effectiveness is an issue for sales promotion services by robots, and functions that provide additional value, such as attracting customers, are important [34]. Therefore, we will examine methods of using playful recommendation to attract customers and increase the brand value of stores and products.

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