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Two is better than one: investigating how explanation styles by multiple robots influence the feeling of *kawaii* toward objects

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Using multiple robots in presentations can draw greater attention from customers and convey information more effectively than just deploying a single robot. Many robotics studies have leveraged this multi-robot approach in real-world settings, often distributing conversational content evenly among the robots; however, it remains unclear if balanced speech is actually necessary. For example, the effects have yet to be fully examined of a second robot that only provides back-channel responses. Likewise, although synchronized behaviors among multiple robots may further enhance audience engagement, this possibility has not been thoroughly investigated. Clarifying these points is essential for designing effective multi-robot presentation content. We conducted two video-based web surveys that addressed these questions. The first revealed that using multiple robots to recommend a product increases its attractiveness in the context of the feeling of *kawaii* compared to using only one robot. The second showed that synchronized behaviors among the robots also boost the product's attractiveness in the context of the feeling of *kawaii* more than unsynchronized behaviors.

Keywords: *kawaii*; cuteness; multiple social robots; robot-robot-interaction; synchronized behaviors

Introduction

Due to advances in robotics technologies, numerous social robots have been deployed in everyday settings as substitutes for human workers to reduce the risk of infections from flu as well as future Covid-type of pandemics [1, 2]. Their adoption has extended worldwide to shopping malls [3-6], cafeterias [7, 8], nursing homes [9-11], and exhibitions [12-14]. As the range of commercial applications expands, researchers are increasingly exploring robot presentations from an advertising perspective. For instance, prior studies have examined robots that distribute flyers in shopping malls [5, 15], leveraged multiple robots to enhance sales [16], and demonstrated how multiple robots effectively draw attention [17, 18] and boost sales in real stores [4, 19, 20].

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As multi-robot presentation methods continue to evolve, two critical issues remain unresolved: the distribution of speech among robots and the synchronization of their behaviors. These factors are central to how multiple robots coordinate and deliver information effectively. Although these two factors differ in nature, with one focusing on verbal interaction and the other on timing, both are essential for shaping the dynamics of multi-robot presentations. By investigating them within a single study through a series of experiments, we aim to clarify how different forms of coordination influence audience perception and contribute to more effective robot communication strategies.

First, most existing research is less focused on the effects of the amount of speeches between multiple robots; for instance, each robot delivers a similar amount of speech in the related studies [17, 18, 29, 30], which leaves it unclear whether balancing speech content is truly necessary. For example, if one robot merely offers back-channel responses (e.g., nods or verbal affirmations), might that still strengthen the perceived attractiveness of the recommended product? Determining whether a back-channel-oriented second robot suffices could simplify content creation if balanced speech proves non-essential.

Second, although synchronized behaviors among multiple robots might affect presentation outcomes. Synchronized behaviors can be visually compelling. Although prior work on robot synchronization suggests positive impacts on user impressions and engagement [4, 18], the aims of these studies were not investigating the specific benefits of synchronized behaviors for product promotion comparing with non-synchronized behaviors. Clarifying the roles of both speech distribution and synchronization is essential for designing multi-robot conversations. Based on these considerations, we target two research questions: **(RQ1)** how does varying the amounts of speech influence

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presentation effectiveness? (Fig. 1), and **(RQ2)** how do synchronized behaviors influence presentation effectiveness? Motivated by the emerging market for robot outfits amid the rising popularity of pet and social robots [21-24], we use a scenario where robot sales clerks endorse outfits, mirroring such human clerks in clothing stores.

In this study, we focus on *kawaii*, the Japanese notion of "cuteness" [25, 26] because many of the target items emphasize aesthetics, and this study was conducted in Japan. The term "*kawaii*" connotes not only cuteness but also loveliness and adorableness, which are related to positive emotions and have gained worldwide popularity [25, 27]. If robot sales clerks can enhance this value via their presentations, a wide range of applications becomes feasible. For this purpose, we prepared visual stimuli and conducted a series of web-based experiments to investigate these factors.

Although this paper is an extended version of a previous work by Shiomi et al. [28], we added a new research question from the perspective of the synchronized behaviors effects. This paper contains an additional experiment, analysis, and more detailed discussions with related works.

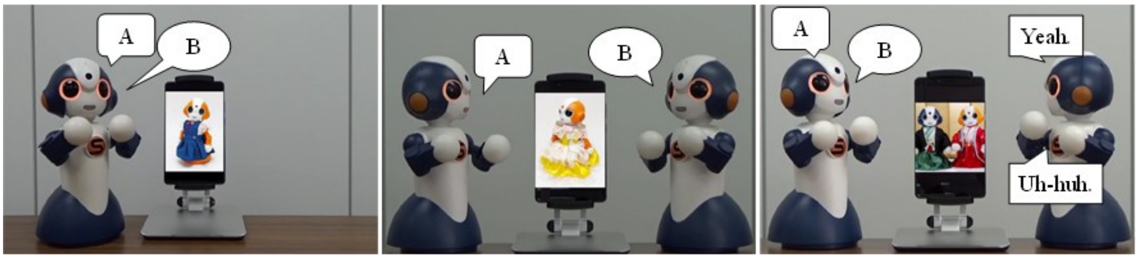

Figure 1. Scenes where robot sales clerk(s) described outfits: left: one robot; middle: two robots, each of which provided half the statement; right: one primary speaker and one passive back-channeling robot.

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Experiment 1

This first experiment focused on RQ1 (how varying amounts of speech influence presentation effectiveness) in the context of endorsing outfits by robot sales clerks.

Hypotheses and prediction

Previous work has highlighted the effectiveness of multiple robots for presentation tasks. For example, recent studies investigated the effectiveness of using multiple social robots for presentations to increase sales in actual shops in shopping environments [4, 19, 20]. Using multiple robots enables robot developers to provide effective conversational support from various perspectives, including caregiving [9] and education [29, 30], because this approach can conceal incoherent responses due to speech recognition errors [31, 32]. From another perspective, this approach enhances the impressions of the presented non-verbal behaviors of robots, such as depicting the feeling of *kawaii* [33], apologizing [34], and physical interaction between robots [35-37]. By analogy, when robots recommend *kawaii*-themed outfits, using multiple robots may yield stronger positive impressions than using just one:

Prediction 1: People will feel a greater sense of *kawaii* toward the presented outfits when multiple robots describe them compared to a single robot.

We also examined how differing amounts of speech among multiple robots influence the feeling of *kawaii*. Although many existing studies balance the conversational content between robots [17, 18, 29, 30], it remains unclear how an unbalanced approach (e.g., where one robot primarily speaks while another only offers back-channel responses) might shape perceptions. Additionally, research on positive discussions between two agents suggests balanced speech may be more agreeable [38]. Hence:

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Prediction 2: People will perceive the outfits as more *kawaii* when multiple robots equally share their speech, compared to a scenario where predominantly one speaks and the other merely provides back-channel feedback.

Conditions

We employed the *number* factor at three levels: *one* (a single robot), *two-equal* (two robots each providing half the statements), and *two-nonequal* (one primary speaker and one passive back-channeling robot). We also employed the *voice* factor at two levels: *boy* (the main speaker used a boy's voice and the listener used a girl's) and *girl* (the main speaker used a girl's voice and the listener used a boy's). In addition, we employed the three *outfit* factor conditions as described in the next subsection.

Visual stimuli

We employed a 28-cm-tall commercial robot (Sota, VSTONE, Japan) with eight degrees of freedom, a speaker, and an LED mouth that blinks according to the speech volume. We also prepared three types of outfits for the same robot: a blue dress, a yellow dress, and a traditional outfit for Japan's famous doll festival (*Hina-Matsuri*) (Fig. 2).

We created videos (25~39 seconds in length) depicting one or two robots discussing the outfits. The robots spoke via VOICE PEAK (AHS Co., Ltd.). Overall, 18 videos combined the three *number* factor conditions (*one*, *two-equal*, and *two-nonequal*), the two *voice* factor levels (*boy* and *girl*), and the three *outfit* factor conditions (*blue*, *yellow*, and *hina-matsuri*). Each video had 1280 × 720 resolution. In all the conditions, the total informational content for each outfit remained consistent; only the number of robots and voices varied.

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- *One* condition: About ten sentences per outfit (e.g., "This heart-shaped accent is very cute!").
- *Two-equal* condition: The second robot spoke half of those lines and replied to the first robot.
- *Two-nonequal* condition*:* The first robot's lines matched the content in the *one* condition, while the second robot responded only briefly to the first robot.

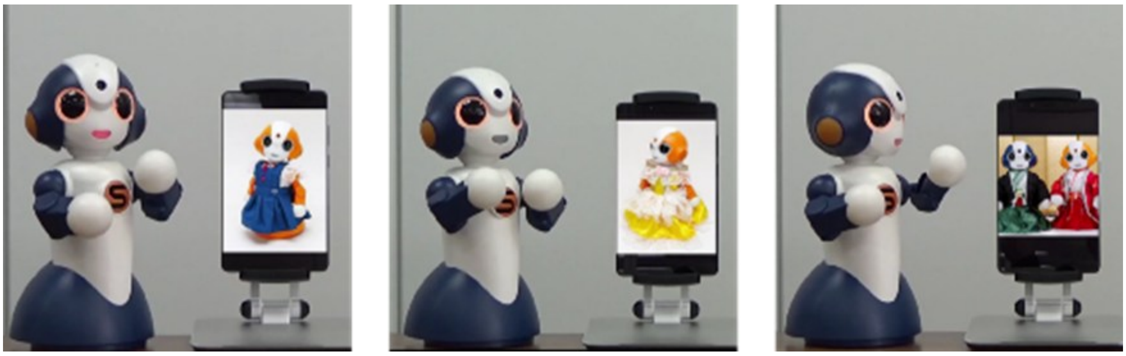

Figure 2. Outfits (blue dress, yellow dress, and traditional garb worn by emperor and empress for *Hina-Matsuri*) in Experiment 1

Measurements

The main purpose of this study is to investigate differences in impressions of the recommended items rather than the presentations themselves. Therefore, we used a questionnaire item to assess the *kawaii* responses to the clothing rather than the impressions toward their presentations. The feeling of *kawaii* strongly correlates with pleasure [39] and viewing duration [39] among Japanese participants, which are often measured by a single questionnaire item [33, 40]; responses were on an 11-point scale (0 = not *kawaii* at all and 10 = extremely *kawaii*), consistent with prior recommendations to approximate interval data [41].

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Procedure

All the procedures were approved by the Advanced Telecommunication Research Review Boards (501-3). After reading the instructions, participants viewed six videos for one outfit in a randomized order and rated each on the *kawaii* items. A within-participant design resulted in them watching 6 × 3 (18) videos, counterbalanced to mitigate order effects. Finally, participants answered three "dummy" questions adapted from an instruction-manipulation check [42, 43] to detect inattentive respondents who were then excluded.

Participants

We recruited 200 Japanese adults (100 women, 99 men, and 1 unreported gender; mean age 44.64) through a commercial survey company in Japan. After applying the aforementioned screening criteria, 161 participants (79 women and 82 men, mean age 41.43) remained in the final dataset.

Results

A three-factor repeated-measures ANOVA (number factor: *two-equal*, *two-nonequal*; voice factor*: boy, girl;* outfit factor: *blue*, *yellow*, and *hina-matsuri*) on the feeling of *kawaii* revealed significant main effects of the *number* factor (F (2,320) = 142.223, $p < 0.001$, *partial* $\eta^2 = 0.471$), the *voice* factor (F (1,160) = 49.346, $p < 0.001$, partial $\eta^2 = 0.236$), the *outfit* factor (F (2,320) = 10.129, $p < 0.001$, *partial* $\eta^2 = 0.060$), the two-way interaction effect between *number* and *voice* factors (F (2, 320) = 13.862, $p < 0.001$, *partial* $\eta^2 = 0.080$), the two-way interaction effect between *outfit* and *voice* factors (F (2, 320) = 3.453, $p = 0.033$, *partial* $\eta^2 = 0.021$), and the three-way interaction effect (F (4, 640) = 4.294, $p = 0.002$, *partial* $\eta^2 = 0.026$). There was no significant two-

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way interaction effect between *number* and *outfit* factors (F (4, 640) = 1.818, p = 0.124, *partial* η^2 = 0.011).

Firstly, we focused on the *blue* condition of the *outfit* factor (Fig. 3). In the *boy* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* (p < 0.001), *one* < *two-nonequal* (p < 0.001), and *two-nonequal* < *two-equal* (p = 0.009). In the *girl* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* (p < 0.001), *one* < *two-nonequal* (p < 0.001), and *two-nonequal* < *two-equal* (p = 0.022). In all conditions of the *number* factor, post-hoc analysis showed *boy* < *girl* (*one* : p < 0.001, *two-equal*: p < 0.001, *two-nonequal*: p < 0.001).

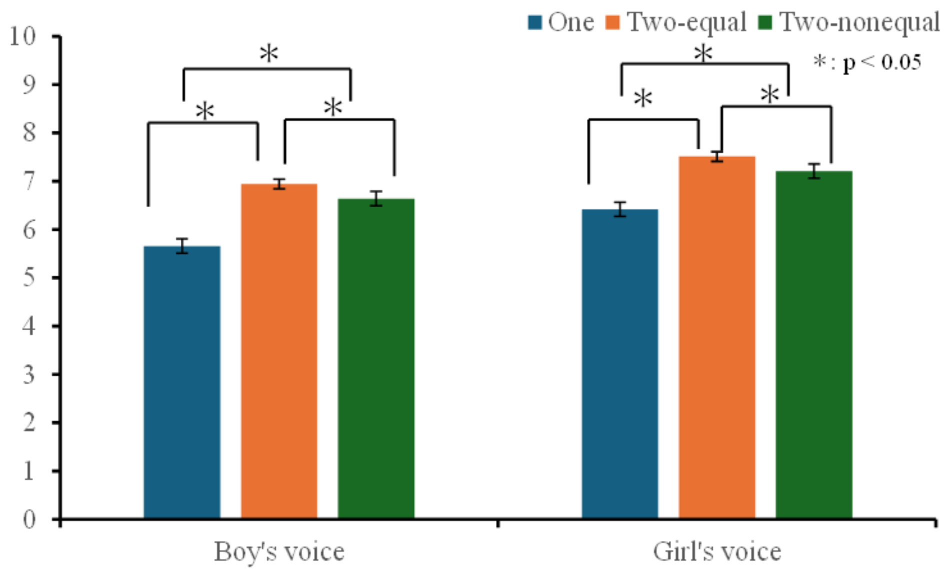

Figure 3. Mean ratings for the feeling of *kawaii* toward blue dress

Next, we focused on the *yellow* condition (Fig. 4). In the *boy* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* (p < 0.001), *one* < *two-nonequal* (p < 0.001); there was no significant difference between *two-nonequal* and *two-equal* (p = 1.000). In the *girl* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* (p < 0.001), *one* < *two-nonequal* (p < 0.001); there was no significant difference between *two-nonequal* and *two-equal* (p = 0.059). In all

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conditions of the *number* factor, post-hoc analysis showed *boy* < *girl* (*one*: $p < 0.001$, *two-equal*: $p < 0.001$, *two-nonequal*: $p = 0.017$).

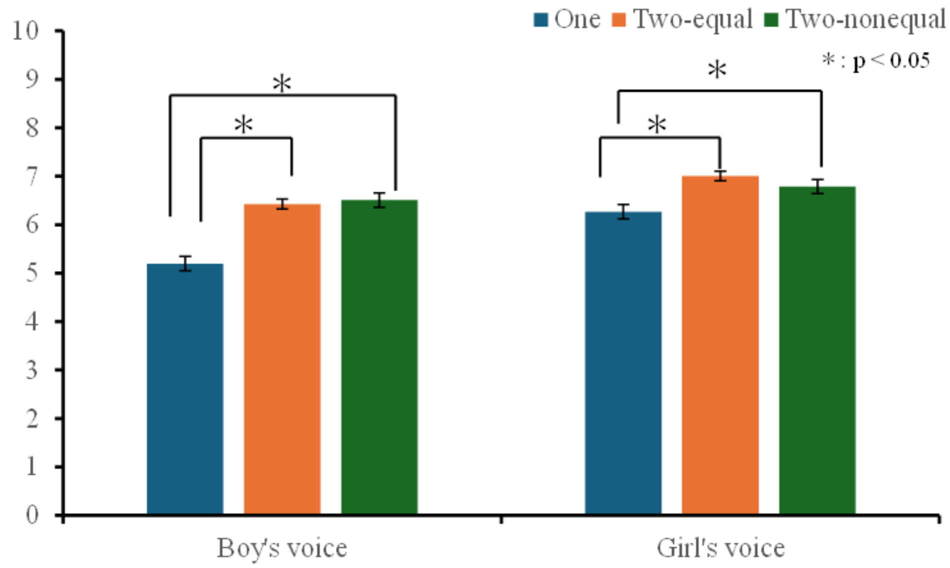

Figure 4. Mean ratings for the feeling of *kawaii* toward yellow dress

Finally, we focused on the *hina-matsuri* condition (Fig.5). In the *boy* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* ($p < 0.001$), *one* < *two-nonequal* ($p < 0.001$), and *two-nonequal* < *two-equal* ($p = 0.002$). In the *girl* condition of the *voice* factor, post-hoc Bonferroni tests showed *one* < *two-equal* ($p < 0.001$), *one* < *two-nonequal* ($p < 0.001$); there was no significant difference between *two-nonequal* and *two-equal* ($p = 1.000$). In *one* and *two-nonequal* conditions of the *number* factor, post-hoc analysis showed *boy* < *girl* (*one*: $p < 0.001$, *two-nonequal*: $p < 0.001$). There was no significant difference in the *two-equal* condition ($p = 0.095$).

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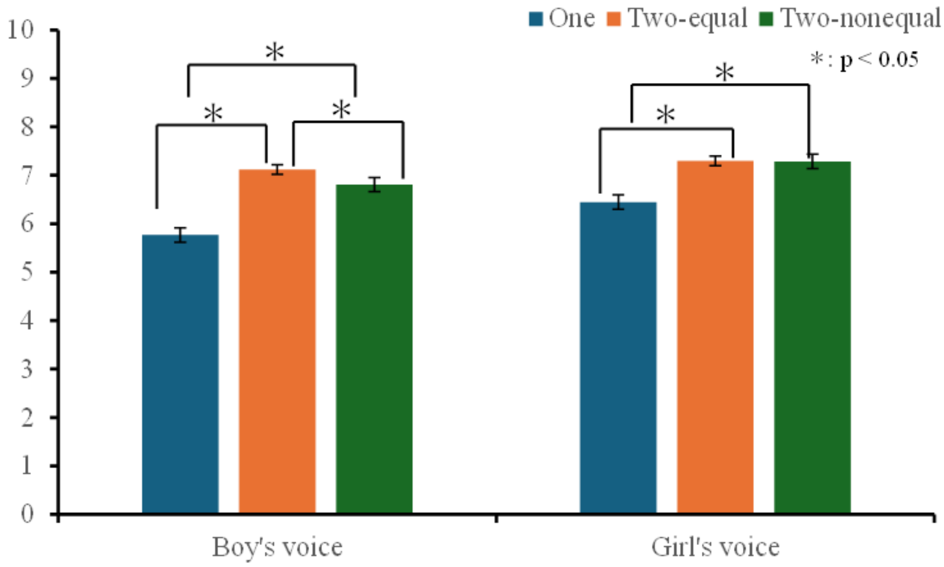

Figure 5. Mean ratings for the feeling of *kawaii* toward emperor and empress garb

Summary of results

These findings support Prediction 1: participants reported higher *kawaii* levels with multiple robots than with just one. However, Prediction 2 was only partially supported. While the *two-equal* scenario occasionally surpassed *two-nonequal*, certain combinations (e.g., the *yellow* condition and the *hina-matsuri* condition with the *girl* voice) showed no significant differences between these two multi-robot conditions. The *voice* factor also influenced the ratings; the *girl* voice generally produced more positive responses than the *boy* voice, except for the *hina-matsuri* condition.

Discussion

Our data indicate that two robots can better enhance the feeling of *kawaii* of the outfits than a single robot. This finding extends prior evidence on multi-robot strategies in commercial contexts [17, 18]. Moreover, in education and advertising contexts, showing a dialogue between human presenters was effective for conveying information to observers [44-46]. These studies suggest that the effectiveness of showing dialogues compared to monologues is common between human-human and robot-robot interactions.

Notably, even if one robot speaks considerably less than the other, both still appear more effective overall. This result suggests potential roles for "listening-only" robots in practical applications.

Perhaps multi-robot presentations may improve a variety of product-related impressions beyond *kawaii*, such as perceived attractiveness or value. Previous research indeed found positive effects on product desirability when multiple robots delivered coordinated explanations [17, 18]. Another research direction is investigating the optimal number of robots, because earlier studies indicated that adding more robots further increases attractiveness [4, 18], although the specific *kawaii* threshold remains unclear [33].

Experiment 2

Our second experiment focused on RQ2 (how synchronized behaviors influence presentation effectiveness) in the context of endorsing clothing by robot sales clerks, similar to Experiment 1.

Hypotheses and predictions

Past studies reported that synchronizing body movements with others positively affects the impressions of others [47, 48]. Such effects are not limited to human beings, i.e., movement synchrony between people and robots enhances positive attitudes toward the latter [49, 50]. Other previous work has highlighted the effectiveness of synchronized behaviors with multiple robots in changing peoples' impressions and behaviors [4, 18]. These results suggest that the synchronized behaviors of multiple robots also provide positive impressions toward observers, although they are not

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physically synchronized with others. By analogy, when robots recommend *kawaii*-themed outfits, synchronized behaviors between them may yield more positive impressions than without such synchronized behaviors:

Prediction 3: People will rate the greater feeling of *kawaii* toward the presented outfits when multiple robots use synchronized behaviors, compared to a scenario where they do not.

Conditions

To investigate how synchronized behaviors influence presentation effectiveness, this experiment directly compared synchronized and non-synchronized behaviors across both the two-equal and two-nonequal conditions. For this purpose, we employed the *synchronized* factor at two levels: *sync* (multiple robots use synchronized behaviors) and *non-sync* (multiple robots do not use them). We also employed the *number* factor at two levels: *two-equal* (two robots each making half the statements) and *two-nonequal* (one primary speaker and one passive back-channeling robot), similar to Experiment 1.

Visual stimuli

We again employed Sota robots and the same outfits from Experiment 1. We created videos (38~45 seconds in length) depicting two robots discussing the outfits. 12 videos combined the two *synchronized* factor conditions (*sync* and *non-sync*), the two *number* factor levels (*two-equal* and *two-nonequal*), and the three *outfit* factor conditions (*blue*, *yellow*, and *hina-matsuri*). Each video was 1280 × 720 in resolution.

- *Sync* condition: Here the robots showed synchronized behaviors three times during the conversations (a greeting, emphasizing the feeling of *kawaii*, a closing greeting) (Figs. 6 and 7). The speech contents in the synchronizations is identical between the *two-equal* and *two-nonequal* conditions; the other speech contents (e.g., backchannel) are identical with Experiment 1.

- *Non-sync* condition: The contents are the same with Experiment 1's *two-equal* and *two-nonequal* conditions.

In both the *sync* and *non-sync* conditions, the robots' utterances and movements were identical in content and frequency. The only difference was whether those behaviors were performed simultaneously.

In all the conditions, the total informational content for each outfit remained consistent, varying only in their synchronized behaviors and the number of robots. Note that the main speaker used a girl's voice, and the listener used a boy's voice, according to the results of Experiment 1.

Figure 6. Synchronized behaviors in *sync* and *two-equal* conditions

Figure 7. Synchronized behaviors in *sync* and *two-nonequal* conditions

Measurements

We used the same measurement from Experiment 1, i.e., a single questionnaire item to assess the feeling of *kawaii* toward the clothing. Responses were on an 11-point scale (0 = not *kawaii* at all, 10 = extremely *kawaii*).

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Procedure

All the procedures were approved by the Advanced Telecommunication Research Review Boards (501-3). Experiment 2's procedure is identical as in Experiment 1. After reading the instructions, the participants viewed four videos for one outfit in a randomized order and rated each for the item's feeling of *kawaii*. A within-participant design resulted in them watching 4 × 3 (12) videos, counterbalanced to mitigate order effects. Finally, participants answered three "dummy" questions adapted from an instruction-manipulation check [42, 43] to detect inattentive respondents who were then excluded.

Participants

We recruited 203 Japanese adults (100 women, 100 men, and 3 unreported genders; mean age 41.83) through the same commercial survey company in Japan. They did not participate in Experiment 1. After applying the aforementioned screening criteria, 178 participants (88 women, 88 men, and 2 unreported genders; mean age 41.38) remained in the final dataset.

Results

A three-factor repeated-measures ANOVA (*synchronized* factor: *sync*, *non-sync*; *number* factor: *two-equal*, *two-nonequal*; *outfit* factor: *blue*, *yellow*, and *hina-matsuri*) on the feeling of *kawaii* revealed significant main effects of the *synchronized* factor (F (1,202) = 46.286, $p < 0.001$, partial $\eta^2 =$ 0.186), the *number* factor (F (1,202) = 11.173, $p < 0.001$, *partial* $\eta^2 =$ 0.052), and the *outfit* factor (F (2,404) = 16.662, $p < 0.001$, *partial* $\eta^2 =$ 0.076). There are no significant the two-way interaction effect between *synchronized* and *number* factors (F (1, 202) = 2,243, $p = 0.136$, *partial* $\eta^2 = 0.011$), *synchronized* and *outfit* factors (F (2. 404) = 0.835, $p = 0.434$, *partial* $\eta^2 = 0.004$),

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number and *outfit* factors (F (2. 404) = 2.135, p = 0.120, *partial* η^2 = 0.010), and the three-way interaction effect (F (2. 404) = 0.098, p = 0.906, *partial* η^2 < 0.001). Post hoc analyses with the Bonferroni test showed that *yellow* < *blue* (p < 0.001) and *yellow* < *hina-matsuri* (p < 0.001) in the *outfit* factor. Figures 8 to 10 show the questionnaire results of the *blue*, *yellow* and *hina-matsuri* conditions.

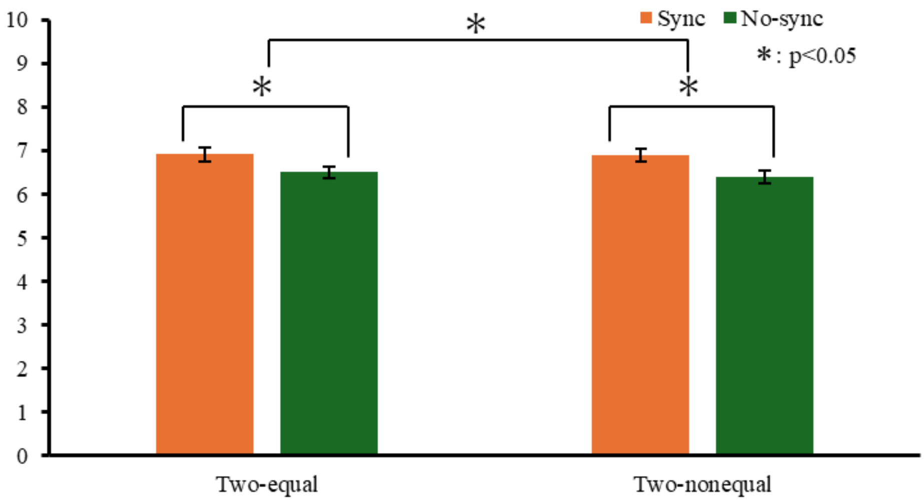

Figure 8. Mean ratings for the feeling of *kawaii* toward blue dress

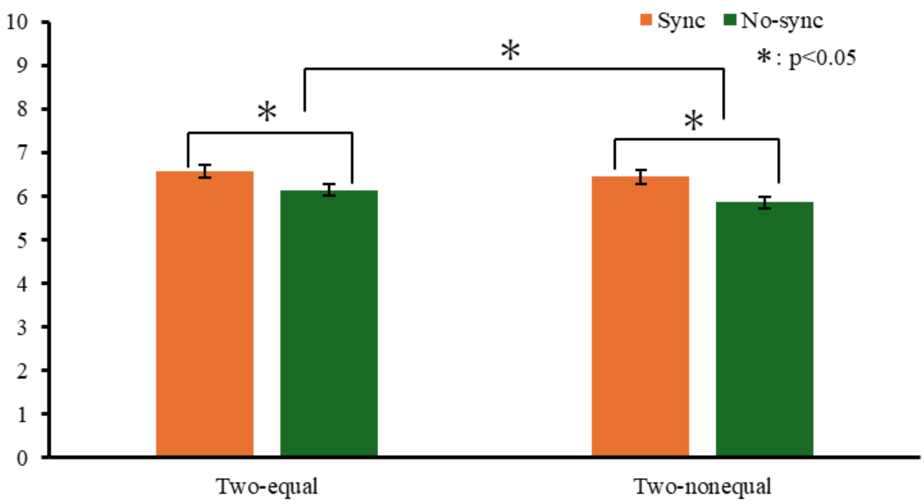

Figure 9. Mean ratings for the feeling of *kawaii* toward yellow dress

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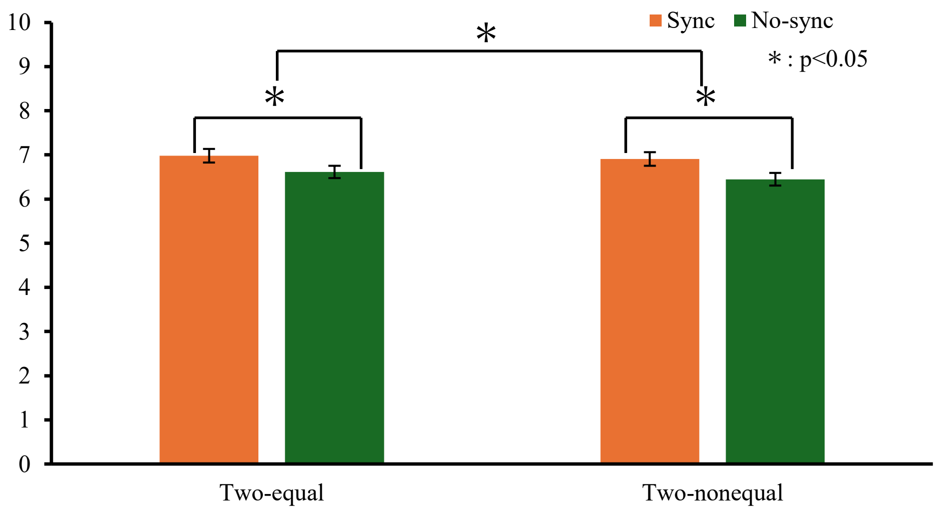

Figure 10. Mean ratings for the feeling of *kawaii* toward emperor and empress garb

Summary of results

These findings support Prediction 3: participants reported higher *kawaii* levels with multiple robots' synchronized behaviors, i.e., when two robots used synchronized behaviors, participants reported a higher feeling of *kawaii* regardless of outfit types. The results also supported prediction 2: the two-equal scenarios surpassed the two-nonequal ones regardless of outfit types, which is slightly different from Experiment 1.

Discussion

Our data indicate that synchronized behaviors between robots enhance the feeling of *kawaii* for presenting outfits. Although visual stimuli were different from the advertising context, a past investigation of the effects of synchrony in hip-hop dance appreciation reported more positive impressions and higher attraction from participants in the synchronization of movement and music than asynchronous dancing [51]. The synchronized behaviors of multiple robots might have had effects similar to those of humans.

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Similar to Experiment 1, this finding also extends previous evidence on multi-robot strategies in commercial contexts [17, 18]. Moreover, the effects of the *number* factor on the feeling of *kawaii* were limited depending on the outfits. The effect size for the *synchronized* factor exceeded that for the *number* factor, suggesting that the effects of the synchronized behaviors between robots were relatively dominant in the context of presentation tasks.

One possible future work is the ratio of synchronized behaviors in the entire task; we limited the number of synchronized behaviors two times heuristically in this experiment. If the robots completely synchronized during the presentation, observers might experience rather strange or eerie feelings. In such contexts, investigating adequate synchronization ratios is one promising future work, and our results are a baseline for future comparisons.

General Discussion

Implication

Through two experiments, our research consistently demonstrates how multiple robots in presentations increase the feeling of *kawaii*, supporting past studies that focused on the effectiveness of multiple robots in shopping contexts [4, 19, 20]. Although past studies were basically designed to provide a similar amount of speech content among robots, our series of experiments shows the effectiveness of a listening-only robot and illuminates ways to utilize non-speaking robots.

A potential future research theme is investigating the presentation effects with a different number of presenters and conversational behaviors. In this study, we fixed the roles of the robots in the experiments, although in reality, such roles often change during either the conversation or presentation contexts, like TV shows. Observing

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conversations among presenters in fixed roles might cause boredom in the context of shopping situations, and so more dynamic conversations among presenters is needed. Another interesting research topic is designing effective timing for presenting synchronized behaviors among presenters.

Exploring the scalability of multi-robot presentations is another potential future research. While prior work suggests that adding more robots may increase the perceived cuteness of the robots themselves [33], the effect is not necessarily linear and may show diminishing returns. Moreover, such studies focused on the robots' appearance rather than their collaborative presentation roles. Our findings with two robots offer an initial step, but further work is needed to examine whether increasing the number beyond two enhances or hinders the perceived feeling of *kawaii* toward the presented items.

Related to these topics, investigating the evaluations of the presentations themselves by using multiple robots or synchronizing them, and analysing the relationships between such evaluations and the perceived feeling of *kawaii* on the items would also be an interesting future work. Furthermore, although the current study controlled for voice gender, it remains unclear how other vocal characteristics, such as pitch, tone, or prosody, contribute to the feeling of *kawaii*. A deeper investigation into these voice attributes could further refine guidelines for designing multi-robot interactions that are both engaging and emotionally appealing.

Robot-Robot Interaction as a Future Perspective

While this study focused on how coordination between multiple robots can influence user impressions, it also points to a broader implication for human-robot interaction and human-agent interaction research. Specifically, our findings suggest that the interactions between robots, such as how they divide speech roles or synchronize behaviors, can shape human perceptions even when there is no direct human-robot

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interaction. This shifts the research focus from dyadic HRI to a more complex network of robot-robot interaction that indirectly affects users. In real-world applications such as public guidance, retail, and education, the design of robot-robot coordination strategies could play a critical role in enhancing user experience and trust. Future studies should further investigate how robot-to-robot dynamics influence user impressions and how these dynamics can be optimized to support various social and communicative tasks in multi-agent environments.

Vocal Characteristics and Multimodal Design

Recent studies have suggested that voice gender can shape user impressions due to psychological and cultural expectations. For example, female voices are often perceived as more helpful and warm, which can influence trust and positive affective responses toward voice agents or robots[52, 53]. This may partly explain why the girl-voiced robots in our experiments received higher kawaii ratings. Future work should further investigate how perceived personality traits associated with voice gender mediate such effects in robot presentations.

Furthermore, although the current study controlled for voice gender, it remains unclear how other vocal characteristics, such as pitch, tone, or prosody, contribute to the feeling of kawaii. A deeper investigation into these voice attributes could further refine guidelines for designing multi-robot interactions that are both engaging and emotionally appealing.

Limitations

In this study, we used only one specific robot (Sota) and specific outfits, and so future research must examine different robots and outfits to more comprehensively assess multi-robot presentation effects. Previous work indicates that both robots and

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humans can leverage similar techniques to enhance *kawaii* perceptions [40], but comparing one/two human presenters might also illuminate strategies for effective presentations. Investigating such other robot embodiments as highly humanlike androids [54-56] might also elicit a different feeling of *kawaii*. As described in the discussion section of Experiment 2, the ratio of the synchronized behaviors was heuristically decided, which is one limitation of this study. Specifically, in all outfit conditions, we implemented three synchronized behaviors during each robot presentation: (1) an initial synchronized greeting, (2) a synchronized utterance during the middle of the dialogue, and (3) a synchronized farewell. These timings were selected based on informal pilot observations and intuitive judgment, aiming to ensure that synchronized behaviors were noticeable to participants while avoiding excessive or unnatural repetition. Nonetheless, we believe our findings provide a foundational understanding of how the number of robots and their distribution of speech influences *kawaii* in presentation contexts.

Furthermore, although this study focused on kawaii-themed fashion items in a commercial presentation context, prior research has demonstrated the effectiveness of multi-robot presentations across a variety of non-commercial settings. For example, dual-robot storytelling improved children's engagement in educational contexts [29], and synchronized praise from two robots enhanced learning motivation in motor skill tasks [37]. In elderly care, robot pairs fostered more sustained and enjoyable conversations compared to single agents [9]. Multi-robot setups have also proven effective in public settings, such as encouraging health behaviors [20] and improving user impressions in service scenarios like coordinated apologies [34]. These findings collectively support the potential generalizability of our framework beyond fashion-

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oriented domains and suggest promising directions for future research in educational, caregiving, and public-service applications.

Moreover, the inconsistent support for Prediction 2 suggests that the effectiveness of multi-robot presentations may vary depending on contextual factors such as the content of the scenario, the type of voice used, and whether the behaviors are synchronized. Although this study used visually identical robots, future work should examine whether combining different robot appearances also affects user impressions. These points highlight the importance of identifying boundary conditions that influence multi-robot effectiveness.

Another limitation is conversational dynamics between the robots. While this study focused on the allocation of speech among multiple robots, future work should also consider the qualitative aspects of dialogue, such as speech content and turn-taking strategies. Exploring not only how much robots speak but also what they say and how they coordinate their conversation may provide a more comprehensive understanding of how multi-robot interactions influence kawaii perceptions.

Conclusion

Focusing on robot apparel as a target due to the emerging market for pet/social robot clothing, we explored 1) how variations in speech allocation among multiple robots and 2) how synchronized behaviors of multiple robots affect outfit recommendations. Our web-based survey results indicate that using two robots generally leads to more positive evaluations for the outfits than using just one. In certain cases, balancing each robot's share of the conversation also enhances the feeling of *kawaii* compared to a more uneven allocation of speech. The results also highlighted the effectiveness of employing synchronized behaviors between multiple robots to enhance the feeling of *kawaii*. We believe these findings contribute to the design of multi-robot presentations and will foster further investigation into the practical deployment of social robots.

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