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Women Approach Cute Objects but Avoid Cute Adult Female Faces: Verification of Correlation between Body Sway and Cuteness Rating

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Abstract

Perceived cuteness motivates people to approach cute objects, but no evidence exists of unconscious approach behavior toward objects. Given the unconscious responses associated with cuteness perception, an unconscious drive to physically approach cute objects is likely to occur. However, approach behavior may or may not occur depending on whether or not the perceived cute object is an adult, a baby, or a non-human. In this study, we recruited 24 participants and conducted a correlation study between cuteness ratings and body sway to examine whether or not the approach response is dependent on perceived cuteness. Results showed that the approach or avoidance response to cute objects was observed only in women. For babies, the approach response occurred regardless of the degree of cuteness, but for adult female faces, the cuter the face, the more the avoidance response occurred. For non-human images, the cuter the image, the more the approach response occurred only in early period of observation time. These results suggest that cuteness perception controls physical distance differently depending on the target of evaluation.

Keywords

body sway, cuteness, approaching, face, baby

The perception of cuteness enhances approach motivation and induces nurturing behavior (Glocker et al., 2009), which leads to changes in various behaviors. For example, cute faces are looked at for longer (Hahn et al., 2013, 2015; Hildebrandt & Fitzgerald, 1978; Parsons et al., 2011; Sprengelmeyer et al., 2013), and the range of attention is adjusted by the perception of cuteness (Kuraguchi & Ashida, 2015; Nittono et al., 2012). These responses are associated with a mechanism that effectively directs attention and enhances approach motivation toward the cute person, which helps make a smooth transition to nurturing behavior. These changes are perceived to reflect cognitive changes; however, the notion that they, in fact, produce approach behavior cannot be confirmed. Previous studies on approach behavior use joysticks to measure conscious approach motivation to the faces of infants (De Carli et al., 2017; Hillman et al., 2004). However, no studies investigate whether or not the perception of cuteness generates approach behavior such as moving toward a person. Together with previous studies that examine unconscious postural changes during the observation of emotional images (Brunyé et al., 2013; Eerland et al., 2012) and previous findings that point to the feeling of cuteness as an emotional state (Buckley, 2016; Nittono, 2016; Steinnes et al., 2019), the notion that the perception of cuteness may be accompanied by unconscious postural changes is possible. The perception of cuteness can appear as an unconscious physical reaction such as pupil change (Kuraguchi & Kanari, 2020, 2021),

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and it is possible that an unconscious postural change (i.e., approaching) occurs during cuteness perception. Therefore, in the present study, we examined whether the perception of cuteness elicits unconscious postural change using body sway as an indicator.

The perception of cuteness is based on baby schema features (Lorenz, 1943). Kindchenschema (baby schema) by Lorenz refers to a mechanism that evokes the perception of cuteness or nurturing behavior to a set of physical characteristics such as large eyes, small mouth, broad forehead, small chin, and round cheeks. Therefore, most cuteness research to date has focused on the relationship between baby schema and cuteness, and cuteness has been studied as an indicator of child attractiveness (Alley, 1981; Glocker et al., 2009; Little, 2012; Lobmaier et al., 2010; Sprengelmeyer et al., 2009). Baby schema features also enhance the attractiveness and cuteness of adult female faces (Kuraguchi et al., 2015). However, baby schemas in adult female faces may not be linked to nurturing behaviors, unlike baby schemas in baby faces. From an evolutionary psychology perspective, the perceived attractiveness of adult and infant faces is interpreted to be different, with the attractiveness of adult faces potentially contributing to mate selection and the attractiveness of infant faces contributing to nurturing behavior (Kou et al., 2020). In other words, even if adult female faces are evaluated as being cute, their cuteness does not necessarily elicit approach motivation, and the relationship between perceived cuteness and approach response may be different between adult female faces and baby faces. For example, since women are known to pay attention to the physical attractiveness of other women and feel jealousy (Buunk & Dijkstra, 2001; Dijkstra & Buunk, 1998), it is possible that the perceived cuteness of adult women may increase the avoidance motive rather than the approach motive, especially for female observers.

In addition, judgments of cuteness can be made for a variety of objects, such as accessories and plants (Nittono & Ihara, 2017). In an experiment that examined pupil change, the relationship between cuteness level and pupil change differed between the evaluation of cuteness of persons and other objects such as animals and plants (Kuraguchi & Kanari, 2021). Therefore, there is a possibility that the response to body sway may also differ between cuteness perceptions of humans and non-humans.

Previous studies have shown gender differences in cuteness perception, with females being more sensitive to cuteness perception (Hahn et al., 2013; Lehmann et al., 2013; Lobmaier et al., 2010, 2015; Nittono, 2016; Sprengelmeyer et al., 2009), while there is no gender difference in the occurrence of anteroposterior body sway (Kim et al., 2010). Therefore, in this study, all analyses of the relationship between body sway and cuteness perception were conducted separately for each gender of the participants. If women's sensitivity to cuteness is related to their approach response or unconscious body sway, then a correlation between the forward-backward body sway and cuteness rating would be more likely to be observed in women.

In the present study, we investigated the following three points by measuring body sway during cuteness evaluation. First, we verified whether body sway associated with cuteness perception occurs, and in particular, we clarified whether the approach and avoidance responses differed depending on the degree of cuteness. Second, we examined whether this tendency differed depending on the object of cuteness judgment using images of adult female faces (Experiment 1), baby faces (Experiment 2), and non-human images (Experiment 3). Given the finding of Kuraguchi and Kanari (2021), who revealed that pupillary changes are dependent on the object of the judgment of cuteness, body sway during the perception of cuteness may also differ according to the object. For example, participants may be more likely to lean forward for cute infant faces that evoke caregiving motivation or wanting (e.g., Glocker et al., 2009; Parsons et al., 2011). Third, we examined whether the relationship between cuteness perception and body sway differed depending on the gender of the observer. Given that women are reported to be more sensitive to cuteness perception than men are (Hahn et al., 2013; Lehmann et al., 2013; Lobmaier et al., 2010, 2015; Nittono, 2016; Sprengelmeyer et al., 2009), female participants may show more pronounced changes in body sway depending on cuteness. Specifically, when female participants observe adult female faces, an avoidance response may be generated instead of the approach response if they regard cute women with physical attractiveness as rivals (Buunk & Dijkstra, 2001; Dijkstra & Buunk, 1998).

General Methods

Participants

Twenty-four volunteers (12 men and 12 women, age range: 21–38 years, mean age: 24.88 years) participated in Experiment 1, 2 and 3. The number of participants was determined according to previous studies that examined the correlation between ratings and physical reactions (Kuraguchi & Kanari, 2020, 2021). They were unaware of the purpose of this experiment. Each experiment was conducted on a different day.

Stimuli

Twenty color face images of Japanese women (18–25 years, undergraduate and graduate students) from a

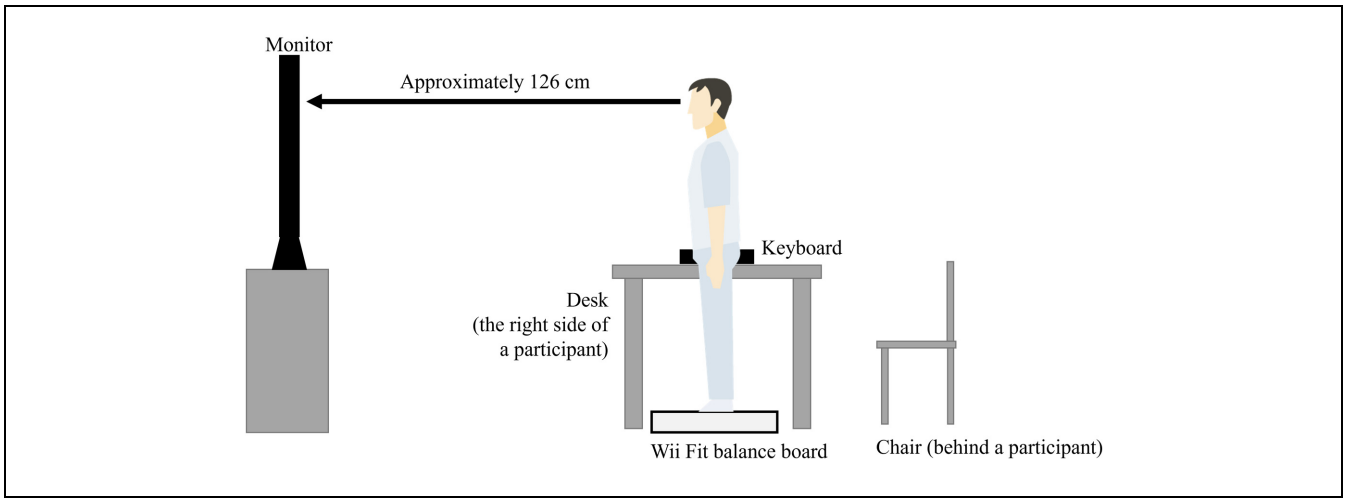

Figure 1. Setup of experiments.

frontal view and with a neutral expression were used in Experiment 1. The photographed persons were identical to those used in Kuraguchi and Kanari (2020). This study adopted these face images, because Kuraguchi and Kanari (2020) confirmed the cuteness rating values as unbiased. Twenty color images of Japanese baby were used in Experiment 2. All images were downloaded from Photo AC. Other participants (1 man and 18 women, age range: 20–22 years, mean age: 21.26 years), different from the participants in this main experiment, were asked to rate the cuteness of the babies beforehand, and based on the results, we selected 20 images for this experiment to ensure that the cuteness ratings were unbiased as much as possible. We used 25 color stimulus images other than face images, such as animals, plants, and food, in Experiment 3. These were included in the stimuli used in Kuraguchi and Kanari (2021) and adopted for the current study since cuteness rating values were unbiased in this previous study. These images were presented in the center of a screen at a viewing angle of 11.78° × 11.78° (610 pixels × 610 pixels, 26 cm × 26 cm).

Apparatus

We recorded the body sway of the participants using a Wii Fit balance board (WBB; Nintendo Co., Ltd., Kyoto, Japan). Although it is relatively low-cost compared with laboratory force platforms, Clark et al. (2018) recently conducted a systematic review that supported the reliability and concurrent validity of the WBB. Notably, the WBB has a limitation in terms of signal-to-noise ratio and inconsistent sampling rate, and data filtering and resampling are required to correct data error, as conducted in this study (see the Measurements of Body Sway section for details).

Visual stimuli were presented on a 37-inch monitor (TH-L37S2; Panasonic, Osaka, Japan). The center of the display was placed at a height of 150 cm and a distance of 126 cm away from the WBB. The responses of the participants were collected using a keyboard on the student desk (73 cm in height). A chair was placed behind the participant, such that the participant could take a break during the experiment (see Figure 1 for the schematics of the experimental setup). Stimulus presentation was performed using a PC running Windows 10 (Microsoft, Redmond, WA, United States) and PsychoPy3 (Peirce et al., 2019; Peirce & MacAskill, 2018).

Procedure

The participants were asked to stand straight on the WBB, with their bare feet together and at a distance of about 126 cm from a 37-inch monitor. They were asked to observe and evaluate the stimulus images (see Figure 1). First, a fixation point was displayed at the center of the monitor, and the trial began when the participant pressed an assigned key. The fixation point continued for 10 seconds after the key was pressed, and then a face image was presented for 10 seconds. The participants were asked to rate the cuteness of the face on a seven-point scale (1: not cute, 7: very cute) by pressing an assigned key after the face images were presented. Participants responded using a keyboard to their right side. When the key for evaluation was pressed, the screen returned to the initial fixation point. During this fixation point screen, the participant could get off the WBB and sit on a chair to rest. The procedure is shown in Figure 2. Each face image was presented three times in a random order, and there were 60 trials in total.

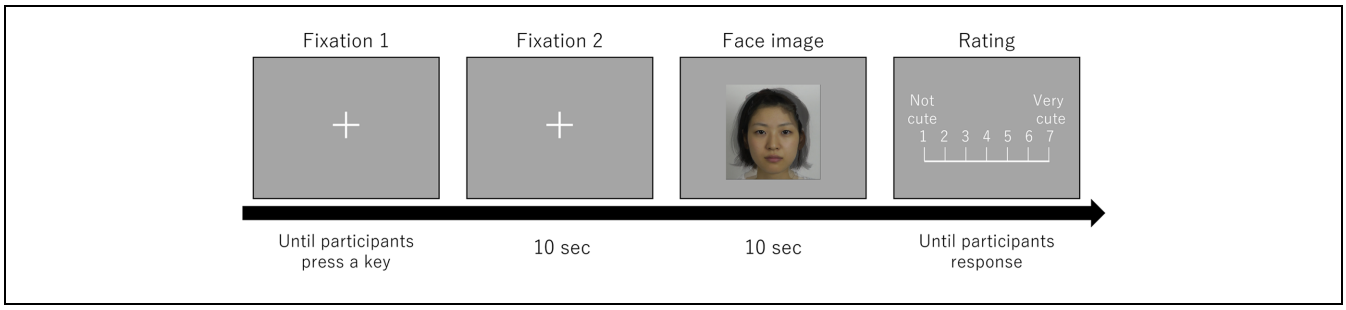

Figure 2. Procedure of Experiment 1. Note that the average face is presented to protect the privacy of those who were photographed, but the original face was used in the actual experiment.

Measurements of Body Sway

Participants' center of foot pressure (CoP) during the image presentation was recorded using a WBB at a sampling rate of up to 100 Hz for each anterior-posterior (A/P) and medio-lateral (M/L) sway. The recording was repeated for all trials. To compensate for noise, non-uniformly sampled signals of the CoP, which is a crucial limitation of the WBB compared with those of other laboratory force platforms, we first resampled the data at 100 Hz to convert the non-uniformly sampled signals into a constant sampling frequency and then smoothed the data using a 10 Hz, fifth order, low-pass Butterworth filter to remove high-frequency artifacts. After the pre-processing, we calculated the mean CoP displacement during the image presentation relative to the initial CoP position of the presentation. In order to investigate whether the postural response evolved or decayed over time, we also divided the CoP data into the first 5 second (early period) and the last 5 second (late period) and averaged them separately. In addition, we calculated the 95% confidence ellipse area of CoP positions using principal component analysis to fit the semi-axes of the ellipse (Oliveira et al., 1996). We computed each CoP area using Matlab code provided by Apthorp et al. (2014), available at the Figshare data repository (http://dx.doi.org/10.6084/m9.figshare.1126648).

Data Analysis

We initially averaged the cuteness rating values for each image and each index of body sway per image, and then calculated Pearson's product–moment correlation coefficients between the mean rating values and each mean CoP using the CORREL function in Microsoft Excel. We also conducted a one-sample *t*-test with the mean CoP in the A/P direction, which indicates approaching or avoiding behavior, using R version 4.0.2. These analyses were conducted per gender. Similar analyses were also performed for the entire observation time and for the first (early period) and second halves (late period).

Results

Experiment 1

We examined the correlations between mean cuteness ratings and each index of body sway in each image. Since there may be gender differences in the perception of cuteness, we examined the results separately for each gender of the participants.

The results of the mean CoP in the A/P direction (A/P CoP), which indicates the degree of approach and avoidance, showed a significant correlation for female participants ($r = -.697$, $p < .001$, $1 - \beta = .954$) but no significant correlation for male participants ($r = -.143$, $p = .549$, $1 - \beta = .092$), as shown in Figure 3. In other words, the higher the cuteness rating, the more avoidant only the female participants tended to be. This tendency was demonstrated regardless of whether the observation time was in the early (female: $r = -.669$, $p = .001$, $1 - \beta = .928$; male: $r = -.083$, $p = .728$, $1 - \beta = .064$) or late period (female: $r = -.642$, $p = .002$, $1 - \beta = .897$; male: $r = -.173$, $p = .465$, $1 - \beta = .112$).

We found no significant correlation in the results of CoP area (female: $r = .038$, $p = .874$, $1 - \beta = .053$; male: $r = -.333$, $p = .151$, $1 - \beta = .306$), which indicates the magnitude of body sway, or mean CoP in the M/L direction (M/L CoP; female: $r = .080$, $p = .739$, $1 - \beta = .063$; male: $r = .358$, $p = .121$, $1 - \beta = .350$), which indicates the body sway in the left-right direction, regardless of the gender of the participant.

We conducted a one-sample *t*-test to determine whether the mean A/P CoP, which indicates approaching or avoiding behavior, was different from zero so that we could verify whether the overall tendency during cuteness perception was approaching or avoiding. For the female participants, the mean A/P CoPs were significantly different from zero, indicating a posterior leaning posture during the observation of adult female facial images ($M = -0.100$, $t(19) = -5.092$, $p < .001$, $d = 1.139$). On the other hand, for the male participants, the mean A/P CoPs were not significantly different from

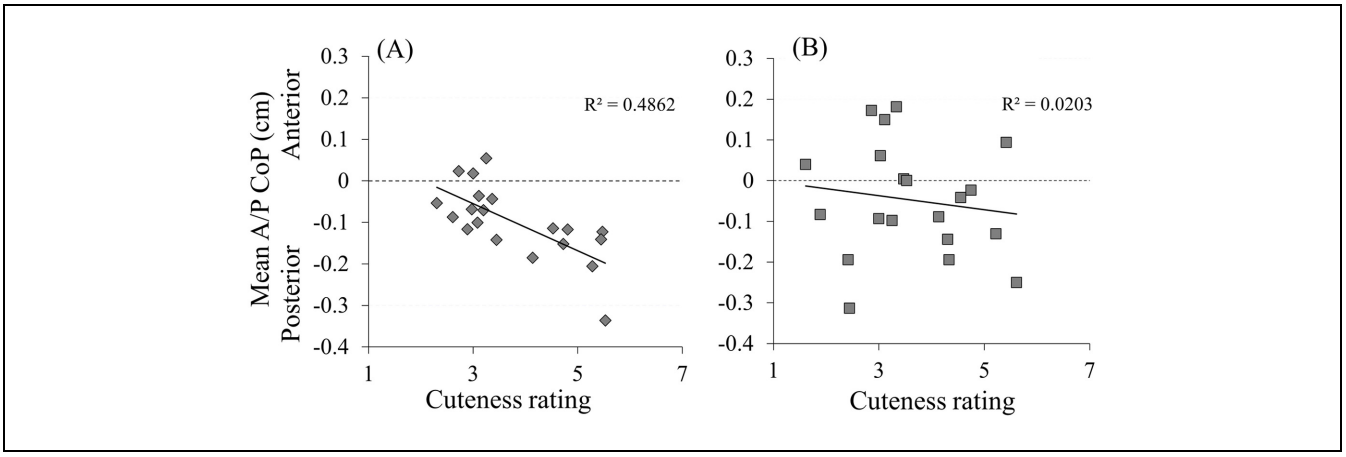

Figure 3. The correlation between the cuteness rating of adult female face images and the mean center of foot pressure in the anterior-posterior direction (A/P CoP). For the mean A/P CoP value, a positive value indicates an anterior leaning posture, and a negative value indicates a posterior leaning posture. Panel (A) shows the data of female participants, and panel (B) shows the data of the male participants. The values in the figure indicate the coefficient of determination.

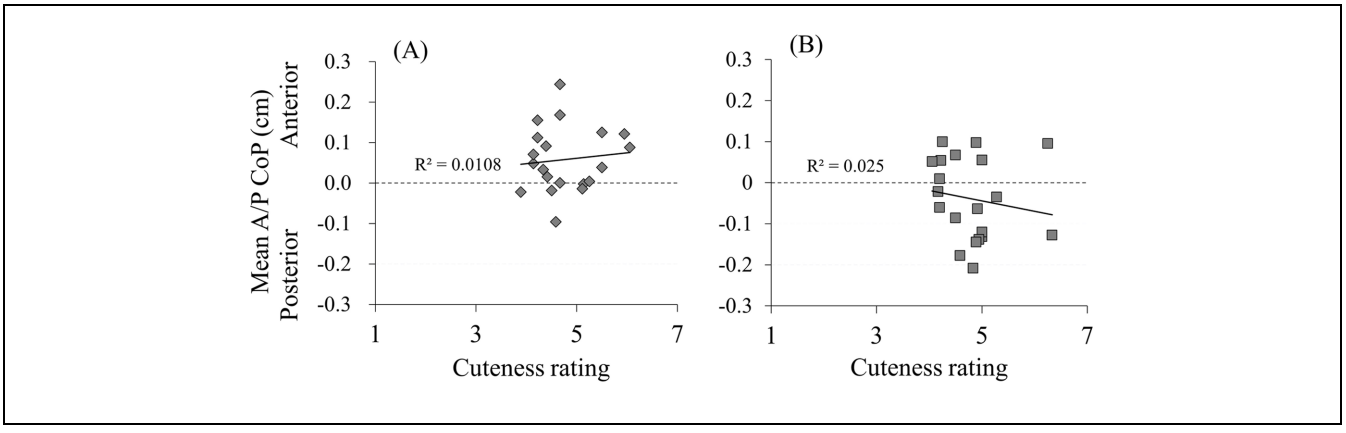

Figure 4. The correlation between the cuteness rating of baby images and the mean center of foot pressure in the anterior-posterior direction (A/P CoP). For the mean A/P CoP, a positive value indicates an anterior leaning posture, and a negative value indicates a posterior leaning posture. Panel (A) shows the data of the female participants, and Panel (B) shows the data of the male participants. The values in the figure indicate the coefficient of determination.

zero ($M = -0.048$, $t(19) = -1.545$, $p = .139$, $d = 0.346$). This trend was consistent even when the observation time was divided into early (female: $M = -0.073$, $t(19) = -4.218$, $p < .001$, $d = 0.943$; male: $M = -0.043$, $t(19) = -1.851$, $p = .080$, $d = 0.414$) and late periods (female: $M = -0.126$, $t(19) = -4.933$, $p < .001$, $d = 1.103$; male: $M = -0.052$, $t(19) = -1.198$, $p = .246$, $d = 0.268$).

Experiment 2

We examined the correlations between cuteness ratings and each index of body sway separately for each gender of the participants, as in Experiment 1. However, no significant correlations were found between the rating values and each index for either gender: mean A/P CoP (female: $r = .104$, $p = .663$, $1 - \beta = .072$; male: $r = -.158$, $p = .505$, $1 - \beta = .101$, Figure 4), mean M/L CoP (female: $r = -.093$, $p = .696$, $1 - \beta = .067$; male: $r = -.159$, $p = .504$, $1 - \beta = .102$), and CoP area (female: $r = .042$, $p = .862$, $1 - \beta = .053$; male: $r = -.364$, $p = .115$, $1 - \beta = .361$).

We conducted a one-sample t-test to determine the mean A/P CoP to verify whether the overall tendency during cuteness perception was approaching or avoiding in the same way as Experiment 1. For the female participants, mean A/P CoPs were significantly different from zero, indicating that they were leaning forward when observing the baby images ($M = 0.058$, $t(19) = 3.226$, $p = .004$, $d = 0.721$). On the other hand, for the male

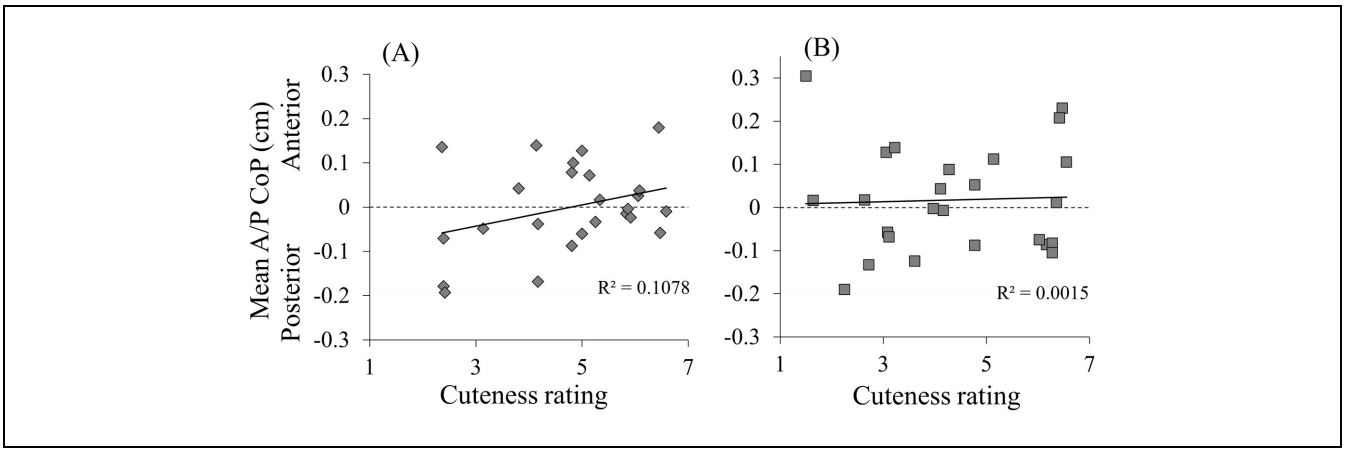

Figure 5. The correlation between the cuteness rating of images, such as animals, plants, and food and the mean center of foot pressure in the anterior-posterior direction (A/P CoP). For the mean A/P CoP, a positive value indicates an anterior leaning posture, and a negative value indicates a posterior leaning posture. Panel (A) shows the data of the female participants, and Panel (B) shows the data of the male participants. The values in the figure indicate the coefficient of determination.

participants, the mean A/P CoPs were not significantly different from zero ($M = -0.039$, $t(19) = -1.746$, $p = .097$, $d = 0.382$). This trend was consistent even when the observation time was divided into early (female: $M = 0.050$, $t(19) = 3.298$, $p = .003$, $d = 0.737$; male: $M = -0.027$, $t(19) = -1.652$, $p = .115$, $d = 0.369$) and late periods (female: $M = 0.066$, $t(19) = 2.906$, $p = .009$, $d = 0.650$; male: $M = -0.054$, $t(19) = -1.576$, $p = .132$, $d = 0.352$).

Experiment 3

We examined the correlations between cuteness ratings and each index of body sway separately for each gender of the participants, as in Experiments 1 and 2. The results of the mean A/P CoP, which indicates the degree of approach and avoidance, showed a significant correlation only during the first half of the observation time for the female participants (total observation time: $r = .328$, $p = .109$, $1 - \beta = .368$; first half: $r = .422$, $p = .035$, $1 - \beta = .576$; second half: $r = .238$, $p = .252$, $1 - \beta = .210$; Figure 5) and no significant correlation for the male participants (total: $r = .039$, $p = .853$, $1-\beta = .054$; first half: $r = -.103$, $p = .623$, $1-\beta = .078$; second half: $r = .124$, $p = .554$, $1 - \beta = .090$). In other words, for the female participants, the higher the evaluation of cute, the more they approached, but this was temporary.

The CoP area results showed significant correlations only for the female participants ($r = .411$, $p = .041$, $1 - \beta = .551$), and no significant correlations for the male participants were found ($r = .309$, $p = .760$, $1 - \beta = .330$). The mean M/L CoP results showed no significant correlation, regardless of gender (female: $r = -.306$, $p = .137$, $1 - \beta = .325$; male: $r = .308$, $p = .134$, $1 - \beta = .328$).

We conducted a one-sample t-test to determine the mean A/P CoP to verify whether the overall tendency during cuteness perception was approaching or avoiding in the same way as Experiments 1 and 2. There was no significant difference from zero, regardless of gender (female: $M = -0.001$, $t(19) = -0.065$, $p = .948$, $d = 0.013$; male: $M = 0.017$, $t(19) = 0.700$, $p = .491$, $d = 0.140$). This trend was consistent even when the observation time was divided into early (female: $M = 0.027$, $t(19) = 1.665$, $p = .109$, $d = 0.333$; male: $M = 0.023$, $t(19) = 1.200$, $p = .242$, $d = 0.240$) and late periods (female: $M = -0.027$, $t(19) = -1.064$, $p = .298$, $d = 0.213$; male: $M = 0.015$, $t(19) = 0.421$, $p = .677$, $d = 0.084$).

General Discussion

In this study, we examined body sway when judging cuteness and examined whether the approach and avoidance responses differed depending on the degree of cuteness. We also examined whether this tendency occurred regardless of the gender of the observer and the object type. The results of the experiments showed that cuteness perception and unconscious approach/avoidance reactions were related only in the female participants, as indicated by the correlation between the index of body sway in the forward-backward direction (mean A/P CoP) and cuteness ratings. As expected, the responses to cuteness perception differed depending on the evaluation target. For adult female faces, the cuter the face was evaluated to be, the more backward the tilt of the body sway, and avoidance responses continued during image observation. For baby faces, there was no correlation with the cuteness rating, but there was an overall forward tilt of the body sway, and approach reactions were continuously observed. For the non-human images, the cuter the

image was evaluated to be, the more forward the tilt of the body sway but only during the early period of the observation time, and a temporary approach response was observed. In other words, although the approach response was generally more likely to occur in female participants, the response to the perception of cuteness was qualitatively different depending on the object, suggesting that different physical responses were unconsciously expressed according to these differences.

Reaction to Adult Female Faces: Why Adult Female Faces Elicit Avoidance for Female Participants

In this study, it is noteworthy that the avoidance response occurred as cuteness increased only when female participants observed adult female faces. This result is inconsistent with the general view that cuteness perception evokes approach motivation. Unlike infant images, adult images might be unlikely to evoke nurturing motivation. The avoiding responses to cute females might originate from negative evaluations due to female rivals to attractive mates. In previous studies, it has been shown that women tend to focus on the physical attractiveness of the same gender and experience jealousy (Buunk & Dijkstra, 2001; Dijkstra & Buunk, 1998) and that avoidance reactions occur to negative stimuli (De Carli et al., 2017; Hillman et al., 2004). In the present study, we used photographs of women, so it is likely that judgments were made mainly regarding external attractiveness, and this experimental process may have caused avoidance reactions in female participants. In other words, there is a possibility that the adult female faces contained value judgments that were not included in the cuteness judgments of babies and non-human images. On the other hand, another interpretation can be discussed by comparing the results with a previous study that examined pupil response (Kuraguchi & Kanari, 2021). In this previous study, the correlation between the pupil change rate and the cuteness rating was examined, and it was found that the cuteness rating and the pupil change rate were negatively correlated for the adult female faces but positively correlated for the other images. It is generally known that the pupils constrict when looking at close objects. Considering the results of body swaying and pupil response in perceiving the cuteness of adult female faces together, cute adult female faces may have been perceived as being closer to the participant than faces that were not cute. Therefore, it is possible that the participants unconsciously attempted to keep their distance from the cute adult female faces due to feeling they were closer to them, which caused them to lean backward. This point is still a matter of speculation and needs to be verified in the future.

Reaction to Baby Faces: Why Baby Faces Elicit Approach for Female Participants

We found that baby faces elicited an approach response in female participants and that baby faces were more likely to elicit an approach response than adult faces. This finding is important because it shows that the cuteness of baby faces evokes unconscious body movements. Additionally, the approach response can be thought of as a response directed at the baby itself, beyond the difference in cuteness. The degree of cuteness of the baby could not correlate with the observer's response (e.g., zygomaticus major muscle; Hildebrandt & Fitzgerald, 1978), suggesting that some of the responses related to nurturing behavior toward the baby may occur independently of the degree of cuteness. On the other hand, the results of the present study are not consistent with the results of a previous study that showed that approach behavior to infant faces was not generated (Hillman et al., 2004). The reason for this could be the difference in the way the stimulus images were presented. In the previous study, various types of images were presented, while in the present study, only the babies face images were presented. In other words, the paradigm of the present study could have measured the approach behavior to the infant faces, which are moderately positive stimuli, because our participants did not compare baby faces with stimuli that evoke stronger emotions.

Reaction to Non-Human Images: Difference from Face Images

For the non-human images, only for the female participants, the cuter the object was, the more forward tilt of the body sway during the first half of the observation time. This may be because motivation to approach the cute object was aroused. However, unlike the observation of the baby images, Experiment 3 observed only a temporary correlation between cuteness ratings and anterior body sway. This may be related to the fact that the face images were the more attention-capturing stimuli (Brosch et al., 2007; Hahn et al., 2013, 2015; Hildebrandt & Fitzgerald, 1978; Leder et al., 2010, 2016; Mitrovic et al., 2016; Parsons et al., 2011; Shimojo et al., 2003; Sprengelmeyer et al., 2013; Sui & Liu, 2009). Thus, it is thought that facial stimuli attract the observer's attention more strongly, resulting in the generation of approach or avoidance responses during the entire observation time in the experiments using face images. On the other hand, the non-human images did not attract such attention as strongly and thus might have caused only a temporary approach response.

Limitation

This study has three limitations as follows. First, this study is a correlational analysis, which did not enable us

to control for other potential causes of the observed relationships. The relationship between cuteness and body sway requires further direct testing in future research. Second, this study was conducted in a single geographic context, such that the Japanese participants were asked to observe Japanese faces. Therefore, to extend the results, further study should be conducted in a wide range of regions and with consideration of variations in the model. Third, the current study has a small sample size. In particular, this study employs correlation analysis and would benefit from revalidation using a larger sample size.

Conclusion

The present study clarified that the approach response is likely to occur when women perceive cuteness but that the occurrence of the approach response differs depending on the object of cuteness using body sway as an indicator. This revealed three points:

- The possibility that cuteness automatically alters the unconscious bodily reactions of the observer
- The possibility that the perception of cuteness is not one-dimensional
- The high sensitivity of women to the perception of cuteness, which has been pointed out in previous studies, is also manifested in their body movements

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Author Contributions

KK and KT conceptualized this study. KK and KF designed the experiments. KF conducted the experiments and collected all data. KK, KF, and KT analyzed the data. KK wrote the draft of this manuscript. All authors commented on the draft manuscript and approved the final version of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Statement

This study was approved by the ethics committee of Otemon Gakuin University (Approved Number: 2019-15) and was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). We obtained written informed consent from all participants before beginning the experiment and paid a reward according to the standard of Otemon Gakuin University.

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Data Availability Statement

The data supporting the findings of this study are available upon request from the corresponding author.

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