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The 'Aww' Factor: Robot Cuteness as a Catalyst for Emotional Responses and Caretaking Tendencies

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Abstract

Cuteness is a key factor in human-human interaction. Infant cuteness, described by Lorenz's baby schema, is thought to promote infant survival by eliciting caregiving behaviors and positive emotions. Despite evidence that people prefer to interact with cute robots, the specific mechanisms through which cuteness influences human–robot interaction remain poorly understood. This research investigated the relationship between perceived robot cuteness, emotional responses, and caretaking tendencies. In two online surveys, participants rated all robots from the ABOT database. In survey 1, 156 participants evaluated robots' perceived cuteness and the extent to which they evoked positive and negative emotions. In survey 2, a separate pool of 152 participants rated the caretaking tendencies elicited by the robots. Results showed that cuteness was positively correlated with positive emotions and caretaking tendencies, and negatively correlated with negative emotions. Path analysis revealed that the effect of cuteness on caretaking tendencies was partially mediated by participants' emotional responses. Consistent with the baby-schema hypothesis, cuteness was negatively associated with perceived robot age and positively with the presence of facial features. Interestingly, participants' individual characteristics, most notably their tendency to anthropomorphize, influenced the responses. Our findings confirm the importance of robot cuteness for HRI and extend theories of baby schema to artificial agents. They also raise ethical considerations: while cuteness is a powerful design feature that facilitates affective bonding with robots, its persuasive potential should not be used lightly. Cute robots may foster care and trust, but these same mechanisms could be exploited to manipulate users in harmful ways.

CCS Concepts

• **Human-centered computing** → **User studies**; *HCI theory, concepts and models*; • **Social and professional topics** → User characteristics; • **Computer systems organization** → *Robotics*.

Keywords

Social Robots, Cuteness, Emotional Responses, Caretaking

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1 Introduction

Our reaction to cute babies is well documented in the scientific literature [1, 16, 22, 30]. Infant cuteness is thought to derive from a set of physical traits – e.g., a large head, a protruding forehead, large eyes, chubby cheeks, and short and thick extremities – known as the baby schema (kindchenschema) [34]. This schema is hypothesized to function as a survival mechanism, eliciting positive emotional and bodily responses that motivate parents to care for their offspring, a reaction sometimes called the "Aww" factor [8].

Baby-schema features are not unique to human infants. They also appear in domesticated animals, fostering both intra- and interspecies affiliation [8]. The modern dog, for example, is the product of a progressive 'puppification' of the wolf, culminating in the selection of brachycephalic (short-faced) features that evoke cuteness [44]. Similarly, kittens, bunnies, and other animals with baby-like traits readily elicit cuteness, often attracting more affection than their less 'cute' relatives (e.g., compare dogs vs. wolves) [19].

Cuteness has likewise been exploited in cultural products [38]. Lorenz highlighted its use in toys and product design [34]. Mickey Mouse and the teddy bear are emblematic cases of neotenic transformation [18, 26]. Their early versions had low foreheads and long muzzles, their late versions large foreheads and short snouts. Even car fronts, adjusted toward the baby schema through enlarged headlights resembling eyes, evoke more positive affect [40].

Robotics has followed this trend. Designers increasingly imbue robots with cute physical features, voices, and mannerisms to improve user experience [17, 37]. The exploitation of the cuteness

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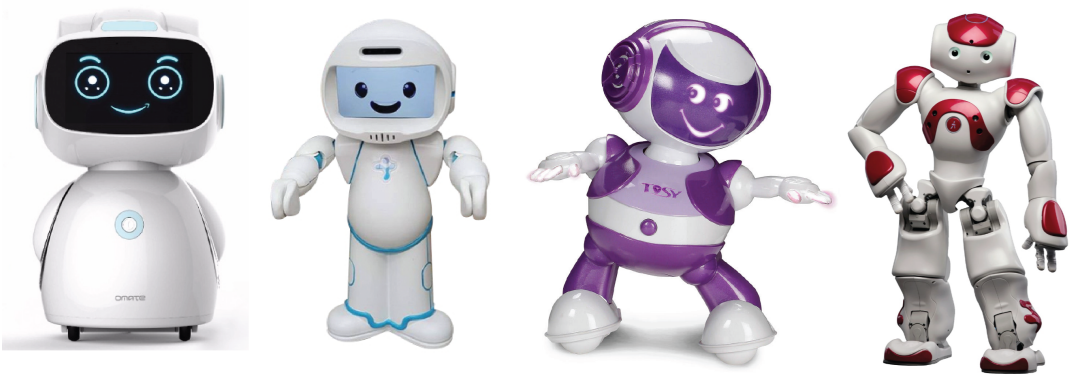

Figure 1: From left to right: Yumi true smart, QT, discorobo, and NAO. The robots perceived as cutest in the Aww-ROBO dataset.

response by roboticists is all but unintentional. Breazeal and Foerst acknowledge how much Human-Robot Interaction (HRI) borrows from infant–caregiver interactions, both in appearance and in social dynamics [5]. Cute robots succeed in attracting engagement, as illustrated by online reactions to the launch video of the baby-like robot Eilik: "*I don't need it, I don't need it, I definitely don't need it, I NEED IIIIIIIIIIT*"; "*I'M CRYING I WANT 10 OF THEM RIGHT NOW*"; "*Aww I'm dyingggg from cutenesss so cuteeeeeee*." As Turkle [57] put it, these robots "push our Darwinian buttons," prompting strong impulses to nurture and protect.

Yet, while cuteness offers advantages, it also carries risks. Scholars caution that cute robots may exploit users' affective responses [6, 31]. They might entice users to interact out of impulse not allowing proper reflection on the terms of service [31]. They might conceal data collection behind baby-like design features (e.g., robots' big eyes often hide recording cameras) [31]. Finally, they might give users the illusion of sovereignty and control through the pretense of robot's vulnerability [31]. Beyond these ethical reflection, the HRI literature has focused primarily on cuteness in terms of kawaii design [51–53], with only a few studies examining how robot cuteness influences trustworthiness [7], caregiving [13] or willingness to interact [21]. As a result, the mechanisms underlying cuteness perception in robots and its effects are still poorly understood.

In this paper, we present a systematic assessment of the cuteness, emotional responses (positive and negative), and caretaking tendencies elicited by the 251 robots of the Anthropomorphic robot (ABOT) database (see Fig. 1 for a teaser). This research aims at investigating (i) the relationship between robot cuteness, emotional responses, and caretaking tendencies; (ii) the relationship between cuteness, and robot's appearance features, perceived age and gender; and (iii) the influence of participants' individual characteristics on cuteness, emotional responses, and caretaking tendencies.

Our findings reveal the powerful impact of cuteness on our emotions, and support the hypothesis that cute robots strongly elicit protective responses. Moreover, they ground the perception of cuteness to the baby schema and suggest that certain individual traits (e.g., tendency to anthropomorphize) might affect our reactions to cute robots. Through these results, we establish a theoretical basis for studying cuteness in social robots. To support further research, we make the Aww-ROBO dataset publicly available. The dataset contains means and standard deviations of the cuteness, positive emotional responses, negative emotional responses, and caretaking tendencies ratings for each robot in the ABOT database.

2 Related Work

Cuteness in Human-Human Interaction. The human-human interaction literature has devoted considerable time to testing Lorenz's hypothesis that baby schema features elicit emotional responses and caregiving behaviors, yielding largely supportive findings. Research has indeed shown that pictures of infant faces are preferred to pictures of adult faces or non-social stimuli [2, 15]. Such pictures are viewed for longer and induce more smiling [23, 24], have strong implicit associations with positive words [48], and are associated with more positive and fewer negative emotional responses [1]. Zhang and Zhou [60] also showed that cute stimuli can evoke "moral emotions" in people, and increase their empathic concern.

Building on these emotional and behavioral outcomes, scholars like Almanza-Sépulveda et al. [1] examined which facial features are associated with perceived cuteness in infants, confirming that a wider forehead, small chin, big smile, round head, chubby cheeks, and long asymmetrical gestures are more likely to elicit cuteness. Hwang et al. complemented this perspective by showing that body proportions integrate facial information to form a holistic perception of cuteness, although facial features tend to have priority in shaping these judgments [28]. These findings help explain why research on the baby schema has gradually shifted from a focus on the whole body to a focus on facial features [29].

Direct evidence of the effects of baby-schema features on caretaking motivation was provided by Glocker et al. [16]. The authors tested the effects of baby-schema features by manipulating pictures of infants to be either high or low in baby schema, and asked participants to rate both manipulated and unmanipulated images on cuteness and caretaking motivation. Results showed that high baby-schema faces were rated higher in both cuteness and caretaking motivation, while low baby-schema faces were rated lower. Interestingly, no overall differences were found between men and women in these ratings, although the influence of cuteness on caretaking motivation was stronger for women.

Overall, these findings consistently demonstrate that baby-schema features reliably elicit positive emotional responses and increase

motivation for caretaking, highlighting the strong social and affective impact of cuteness in human interactions.

Cuteness in Human-Animal Interaction and Product Design. The effect of baby schema in infants is thus widely supported by research. However, baby schema goes further than humans. Lehmann et al. [33] found that the effect is also present in animals, with puppies eliciting the same cuteness responses as human babies. In line with this, Steinnes et al. [56] showed that exposure to cute animal stimuli can induce the feeling of *kama muta* [14], a positive, heartwarming feeling, or being moved or touched, evoked by a sudden intensification of communal sharing. Meta-analytic studies [61] found a significant correlation between the feeling of kama muta and feelings of empathic concern.

As mentioned in the introduction, a cuteness effect has also been observed with objects, particularly cars [40]. In this context, the Japanese notion of *kawaii* becomes central. Kawaii has multiple definitions and can refer to both people and objects. According to Nittono [41], kawaii is "a positive emotion related to the social motivation of watching for and staying with preferable persons and objects, which is typically observed in affection towards babies and infants, but not limited to them." Kawaii stimuli thus evoke positive feelings and can also influence behavior. For example, Nittono et al. [42] found that viewing images of kawaii items (pictures of baby and adult animals) made people more careful and, consequently, more successful in tasks requiring focused attention.

Continuing this line of research, Nittono and Ihara [43] further examined kawaii images with baby-schema (human babies/animals) and without baby-schema features (objects such as desserts and dress accessories), collecting ratings of pleasantness as well as measures of viewing time and physiological activity. Both types of kawaii images were perceived as more pleasant than neutral images, elicited greater willingness to approach, longer viewing times, and higher arousal levels. However, zygomaticus (smiling) activity was greater when participants viewed images with baby-schema features than kawaii images without them. The authors conclude that kawaii reflects a motivation to approach desirable objects, suggesting that the concept of kawaii, and possibly cuteness more broadly, extends beyond responses to baby-schema features.

Together, these findings demonstrate that the effects of cuteness extend beyond human infants, influencing emotional responses and approach behaviors toward animals and objects. This highlights the broader psychological and social significance of baby-schema and kawaii features.

Cuteness in Human-Robot Interaction Despite the ample evidence that baby schema and cuteness are powerful drivers of positive responses toward humans and animals, and the prevalence in social robotics of robots designed following the baby schema [50, 58], relatively little empirical HRI research has examined how people perceive cuteness in robots and its effects.

In terms of design, the impressions of kawaii and cuteness seem to be greater for more animal-like, rounder, shorter, and smaller robot designs [3], as well as for round and colorful virtual robots [4], and for robots with a higher head-to-body ratio and lower body size [20]. In this context, findings suggest that an excessive use of baby-/puppy-like features in extremely humanlike or animallike robots might trigger an effect similar to the "uncanny valley" [7].

Research manipulating the baby schema in robots and assessing its effects on human perceptions is limited. Berque et al. [3] asked participants to create virtual robot prototypes and found that robots designed with baby schema features were judged as cuter, less intimidating, more approachable, more beautiful, and more comfortable, but did not elicit differences in trustworthiness. Laohajangvalvit et al. [32] found that, across cultures (i.e., the US and Japan) and genders, people preferred to be around robots designed to be cute more than other robots. Chen and Jia [7] manipulated the baby schema of five robots and found that robots with high baby schema features elicited significantly higher ratings of cuteness and trustworthiness compared to controls and robots with low baby schema features. Song et al. [54] investigated the perception of a robot's facial trustworthiness by manipulating baby-schema facial features and found that robots with baby schema features were perceived as more trustworthy. Maeiro et al. [35] revealed that cuteness influences initial interest but does not translate into acceptance, whereas perceived usefulness and performance expectancy drive both interest and long-term acceptance.

While the baby schema hypothesis and the emotional effects of cuteness on affiliative behavior have been widely studied in human–human and human–animal interaction, evidence in human–robot interaction remains scarce. To our knowledge, only two studies have addressed this topic. Guo et al. [21] conducted a series of experiments examining how service robot cuteness affects consumers' willingness to interact. They found that cute robots generally increased willingness to interact, with this effect mediated by perceived service pleasure and moderated by service type. Specifically, cuteness enhanced willingness to interact for hedonic services, such as entertainment or friendly conversation, but had no effect for functional services, like financial advice or car repairs. Feng et al. [13] investigated the effects of baby-like form and a childlike voice on caretaking behavior toward faceless robotic plushies. In their experiment, participants interacted with five robotic plushies for one minute each while being filmed, and the number of caregiving and non-caregiving behaviors was recorded. The results showed that the robots' childlike morphology and infantile voice significantly increased caregiving behaviors and reduced non-supporting behaviors, but the effect was not linear. Beyond a certain point, further increases in realism produced smaller additional gains.

Overall, most HRI research on cuteness has focused on how baby-schema features shape perceptions of cuteness on crucial HRI dimensions such as likability, trustworthiness, and acceptance. Far less attention has been paid to the emotional implications of robot cuteness (with [21] addressing this only tangentially) or to its role in fostering caretaking tendencies (with only one direct study [13]). To address these gaps, we ask:

RQ1 To what extent does robot cuteness influence people's positive and negative emotional responses?

RQ2 To what extent does robot cuteness affect caretaking tendencies, and are these effects mediated by emotional responses?

While prior work has manipulated baby-schema features to influence cuteness perceptions, we aim to expand this line of research by

testing a large set of robots (i.e., 251) with varying levels of humanlikeness and multiple appearance features. We also examine how social categories attributed to robots shape cuteness perceptions. Thus, we ask:

RQ3 What role do appearance features (i.e., humanlikeness, body manipulators, surface look, and facial features) and social categories (i.e., robot's perceived age, femininity, masculinity, and gender neutrality) play in the perception of robot cuteness?"

Finally, research in human–human and human–animal interaction highlights individual traits as important moderators of cuteness perception (e.g., empathic concern). Building on this, we ask:

RQ4 To what extent do individual characteristics (e.g., gender, age, familiarity with technology, tendency to anthropomorphize, and empathic concern) influence perceptions of robot cuteness, emotional responses and caretaking tendencies?

3 Methods

To determine people's perceptions of robots' cuteness and their caretaking tendencies and emotional responses to them, we performed two online surveys on LimeSurvey. For both surveys, we leveraged the ABOT database [46], which includes 251 standardized pictures of robots, with respective scores of humanlikeness, presence of body manipulators, surface look features, and facial features. For both surveys, the 251 pictures of robots were randomly divided into 5 groups of 50-51 robots (similar to [45, 46]). Participants were randomly assigned to one of the robot groups, and evaluated the robots' cuteness and their emotional responses to them (survey 1), or their caretaking tendencies towards the same robots (survey 2). We divided the questions into two separate surveys to reduce the length of the questionnaire, participants' fatigue, and the likelihood of participants guessing the purpose of our research. The study was approved by the ethical review board of the Human-Technology Interaction group at Eindhoven University of Technology.

3.1 Participants

We recruited 156 participants (62 women, 94 men; M_{age} = 34.1, SD_{age} = 12.3) for the survey on cuteness and emotional responses, and 152 participants (85 women, 67 men; M_{age} = 33.5, SD_{age} = 11.8) for the survey on caretaking tendencies. Hence, a total of 306 participants representing 37 nationalities took part in the study. Prolific was used for participant recruitment for both surveys. Based on previous research [45, 46], we deemed 25 participants per group enough to achieve stable average perceptual ratings. Final group sizes varied from 28 to 36 participants. Participants in the first survey (lasting ca. 30 minutes) were compensated with £ 3.73, participants in the second survey (lasting ca. 15 minutes) with £ 1.94.

3.2 Measures and Procedure

Upon accessing the surveys on LimeSurvey, participants encountered a short explanation of the study. Once they provided their consent to participate, they started rating the robots. They saw the images of 50-51 robots in random order, and were asked to answer either 10 or 3 questions, depending on whether they were allocated to the first or second survey.

In the first survey, participants were asked to rate the perceived cuteness of each robot responding to the question "How cute is this robot?" on a 7-point Likert scale (1= not cute at all; 7= extremely cute [1, 16, 25]), and rate their emotional response to the robot on a 7-point Likert scale using the items in the emotional response scale (positive, sympathetic, alert, distressed, disturbed, irritated, calm, delighted, and interested; 1= not at all; 7= extremely) [1].

In the second survey, for each robot, participants were asked "How much would you like to take care of this robot?" on a 7-point Likert scale (1= I would not like to take care of this robot at all; 7= I would very much like to take care of this robot) [16]. Moreover, they were asked to gauge their active facilitation tendencies [39] responding to the questions "How likely would you be to <*help* / *protect*> this robot?") on a 7-point Likert scale (1= not likely at all; 7= very likely).

Half-way into the completion of both surveys (after 25 robots were rated), participants were given the opportunity to take a short break. Once they had evaluated all 50-51 robots in their group, they were asked to indicate their age in numbers, and their gender by ticking one or more boxes between woman, men, non-binary, prefer not to say, prefer to specify (followed by a blank field) [55]. Moreover, they were asked to rate their familiarity with technology (AI, robots, and science fiction) on a 7-point Likert scale (1= not familiar at all; 7= very familiar [45]), their tendency to anthropomorphize (3 questions from the Individual Differences in Anthropomorphism Questionnaire (IDAQ) [59]: (1) To what extent does the average robot have consciousness? (2) To what extent does the average computer have a mind of its own? (3) To what extent does technology have intentions?) on a 7-point Likert scale (1= not at all; 7= very much), and their Empathic Concern (using the homonymous subscale from the Interpersonal Reactivity Index (IRI) [10]) on a 7-point Likert scale (1= strongly disagree; 7= strongly agree).

For our analyses, we used additional ratings from the ABOT database [46] and the Humanoid ROBOts - Gender and Age Perception (ROBO-GAP) dataset [45]. From the ABOT database, we took the ratings of humanlikeness (0= not humanlike at all to 100= just like a human) and the scores related to the robots' appearance (0 to 1). These latter gauged the presence in the robots of body manipulators (e.g., torso, legs, arms), surface look features (e.g., headhair, skin, nose), and facial features (i.e., head, face, eyes). From the ROBO-GAP database, we took the scores of age, femininity, masculinity, and gender neutrality for all robots in the ABOT database.

4 Results

4.1 Data Screening and Inter-rater Reliability

4.1.1 Differences across groups. We conducted separate one-way ANOVAs to assess if participants' individual characteristics differed across groups. Gender differences were addressed with a Chi-squared test. Gender distribution did not differ across groups of raters (survey 1: $X^2(4) = 2.16$, $p = .707$; survey 2: $X^2(4) = 4.91$, $p = .296$;), nor did all other individual characteristics (see Table 1).

4.1.2 Measures Reliability. We assessed the inter-rater reliability of the cuteness ratings using two Intra-Class Correlation (ICC) coefficients – $ICC(2,1)$ and $ICC(2,k)$ – each averaged across the 5 groups of raters. The former gauges the reliability of the ratings at

Table 1: Group differences in individual characteristics

	survey 1		survey 2	
Characteristic	$f(4, 151)$	p	$f(4, 147)$	p
Age	0.27	.899	0.91	.458
familiarity with tech.	0.67	.613	0.08	.988
Tendency to anthropomo.	1.88	.118	0.07	.990
Empathic Concern	0.55	.697	2.32	.060

the individual participant's level. The latter measures the reliability of the ratings given by a k panel of raters. The results showed poor reliability at the level of the individual ratings, with a mean $ICC(2, 1) = .225$. However, they showed excellent reliability at the level of the aggregated ratings, with a mean $ICC(2, k) = .899$. This result is not problematic per se, as we use the average ratings of cuteness for our analyses, and only resort to individual ratings to appraise the effects of participants' individual characteristics.

Table 2: Scales reliability (α refers to Crobach's α)

Scale	α survey 1	α survey 2
Positive Emotional responses (PE)	.87	-
Negative Emotional responses (NE)	.81	-
Caretaking tendencies	-	.96
Familiarity with AI, robots and sci-fi	.77	.80
Tendency to anthropomorphize	.88	.87
Empathic Concern	.82	.83

We calculated Cronbach's α to measure the internal consistency of all other scales: the *emotional response sub-scales* – Positive Emotional responses (PE) and Negative Emotional responses (NE) – the *caretaking tendency scale* – including both caretaking and active facilitation tendencies – and the individual characteristics' scales – *familiarity with technology*; *tendency to anthropomorphize* (IDAQ); and *empathic concern*. PE included the items positive, sympathetic, calm, delighted, and interested; NE the items alert, distressed, disturbed, and irritated. As shown in Table 2, reliability was good to excellent for all the scales. Hence, we averaged the ratings for the items in each scale and used them in the remainder of the paper.

4.2 Influence of Cuteness and Emotional Responses on Caretaking Tendencies

As a first step towards gaining an understanding of the relation between cuteness, emotional responses, and caretaking tendencies, we performed a series of Pearson's product-moment correlations. We used the average ratings of all the robots to perform these analyses. Our results disclose a strong positive correlation between cuteness and PE ($r = 0.94, p < .001$; see Fig. 2.B), a strong positive correlation between cuteness and caretaking tendencies ($r = .77, p < .001$; see figure 2.C), and a strong negative correlation between cuteness and NE ($r = -0.77, p < .001$; see Fig. 2.A). Moreover, they show that PE were strongly positively correlated with caretaking tendencies ($r = 0.78, p < .001$), NE strongly negatively correlated with caretaking tendencies ($r = -0.71, p < .001$), and PE and NE were strongly negatively correlated with each other ($r = -0.81, p < .001$).

To follow-up on these promising results, we conducted a path analysis on the aggregated ratings of cuteness, PE, NE, and caretaking tendencies of all the 251 robots, fitting a parallel mediation model (Fig. 3). We used maximum likelihood to estimate path coefficients and bootstrapping ($N = 1000$) to estimate the standard errors of the direct and indirect effect. The model was saturated ($df = 0$), therefore global fit indices are not informative and are not reported. Path coefficients showed that PE positively predicted caretaking tendencies ($\beta = 0.49, SE = 0.16, p = .003$), and NE negatively predicted them ($\beta = -0.32, SE = 0.10, p = .001$). Cuteness had a significant direct effect on PE ($\beta = 0.56, SE = 0.01, p < .001$), NE ($\beta = -0.43, SE = 0.02, p < .001$), and caretaking tendencies ($\beta = 0.21, SE = 0.09, p = .003$). Moreover, the effect of cuteness on caretaking tendencies was partially mediated by PE ($\beta = 0.27, SE = 0.09, p = .003$) and NE ($\beta = 0.14, SE = 0.04, p = .001$). The total effect of cuteness on caretaking tendencies was significant ($\beta = 0.62, SE = 0.03, p < .001$). Together the predictors explained 64% of the variance in caretaking ratings, 88% in PE and 59% in NE.

4.3 The Role of Appearance Features and Social Categories on Cuteness Perception

To appraise whether appearance features and social categories played a role in the perception of cuteness, we performed a series of Pearson's product-moment correlations between the average ratings of cuteness of the 251 robots in this study, the ratings of humanlikeness, body manipulators, surface look features, and facial features collected for the same robots in the ABOT database [46], and the ratings of femininity, masculinity, gender neutrality, and age collected for the same robots in the ROBO-GAP dataset [45]. The results disclose that a robot's humanlikeness is not significantly correlated with cuteness ($r = -0.10, p > .999$), nor is the robot's perceived gender (femininity: $r = 0.13, p = .492$; masculinity: $r = -0.06, p > .999$; gender neutrality: $r = 0.01, p > .999$), or the presence in the robot of body manipulators ($r = -0.03, p > .999$) and surface look features ($r = -0.18, p = .125$). The only appearance features showing a significant (albeit low) correlation with the perception of cuteness were facial features ($r = 0.21, p = .030$), and the only social category with a significant correlation with cuteness was age ($r = -0.64, p < .001$). When looking into which specific facial feature had a significant relation with cuteness, we discovered that the presence of a face – operationalized by Phillips et al. [46] as "the front part of the head, which may contain features such as eyes, nose or mouth" – was significantly positively correlated with cuteness ($r = 0.24, p = .024$), while head ($r = 0.11, p > .999$), eyes ($r = 0.20, p = .247$), and mouth ($r = 0.00, p > .999$) were not.

4.4 Influence of Individual Characteristics on Cuteness, Emotional Responses, and Caretaking Tendencies

To assess the effects of participants' individual characteristics on cuteness, PE, NE, and caretaking tendencies, we included participants' gender, age, familiarity with technology, tendency to anthropomorphize, and empathic concern as predictors in four linear multilevel regression models (LMM), each focusing on one of the dependent variables. In the models focusing on emotional responses, we included two additional predictors in further iterations of the

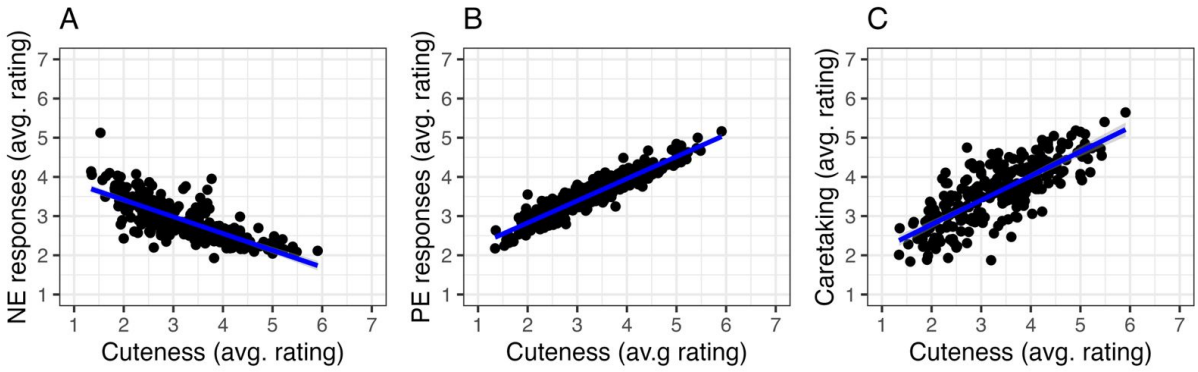

Figure 2: Scatterplots of the correlations between (2.A) cuteness and negative emotional (NE) responses, (2.B) cuteness and positive emotional (PE) responses, and (2.C) cuteness and caretaking tendencies.

model: (i) cuteness, and (ii.a) the interaction between cuteness and empathic concern, or (ii.b) the interaction between cuteness and tendency to anthropomorphize. We could not include these predictors in the model of caretaking tendencies as cuteness was only measured in survey 1. In all models, the participant and the robot were included as random effects (intercepts), and the predictors were centered on the mean. Due to the complexity of the models, the tables including all parameters are provided in the Supplementary Materials. Here, we only focus on the significant predictors.

Our results disclosed that familiarity with technology ($\beta = 0.13, p = .001$) and tendency to anthropomorphize ($\beta = 0.22, p < .001$) were significant positive predictors of cuteness perceptions. Moreover, they showed that tendency to anthropomorphize was a significant positive predictor of NE ($\beta = 0.25, p < .001$). Finally, they disclosed that all the individual characteristics except gender and familiarity with technology were significant positive predictors of caretaking tendencies (participants' age: $\beta = 0.16, p = .001$; tendency to anthropomorphize: $\beta = 0.22, p < .001$; empathic concern: $\beta = 0.14, p = .004$). Participants' age also had a significant negative effect on negative emotions ($\beta = -0.11, p = .023$)

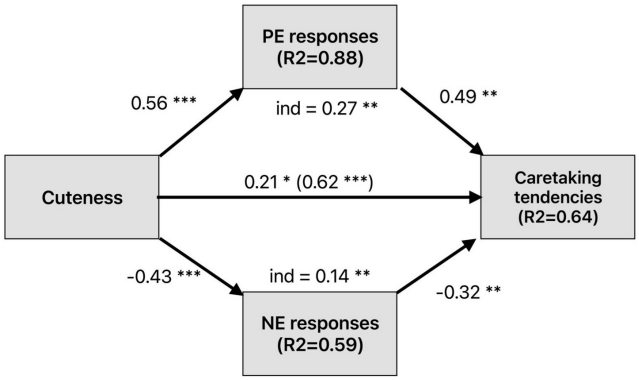

Figure 3: Parallel mediation model featuring cuteness as exogenous variable, positive emotional (PE) responses and negative emotional (NE) responses as mediators, and caretaking tendency as outcome variable.

In line with the results in Section 4.2, cuteness was a significant positive predictor of PE ($\beta = 0.67, p < .001$) and a significant negative predictor of NE ($\beta = -0.36, p < .001$). This is important as the multilevel models reported in this section were performed on participants' individual ratings of cuteness, PE and NE, and not on their aggregated scores as in Section 4.2. Empathic concern significantly moderated the relationship between cuteness and both PE ($\beta = 0.13, p < .001$) and NE ($\beta = -0.07, p < .001$). As visible in Fig. 4 (A-B), which shows the plots of the effect of cuteness on PE and NE at different levels of empathic concern, the positive effect of cuteness on PE is slightly stronger for participants with higher levels of empathic concern than for participants with lower levels of empathic concern. Similarly, the negative effect of cuteness on NE is slightly stronger for participants with higher levels of empathic concern than for participants with lower levels of empathic concern.

The tendency to anthropomorphize also interacted significantly with cuteness in the prediction of both PE ($\beta = -0.04, p < .001$) and NE ($\beta = 0.04, p < .001$). When plotting the interaction effects (Fig. 4 C-D), we discovered a slight, mostly negligible, moderating effect of the tendency to anthropomorphize on the relationship between robot cuteness and PE and NE.

5 Discussion

The Power of Cuteness. Our results confirm that, like cute infants [1, 16, 22, 30], animals [8, 44], and objects [40], *cute social robots can elicit the "Aww" factor, triggering more positive emotional responses and less negative responses than their less cute counterparts* (**RQ1**). Consistent with Lorenz [34], our findings further indicate that *cuteness enhances caretaking tendencies, an effect partially mediated by emotional responses* (**RQ2**). Future research should examine the causal mechanisms underlying this influence by experimentally manipulating robot cuteness and testing if its effects on caretaking tendencies vary across different levels of emotional response.

Beyond their design implications, these findings raise important ethical concerns. The strong associations we observed between cuteness, positive emotional responses, and caretaking tendencies

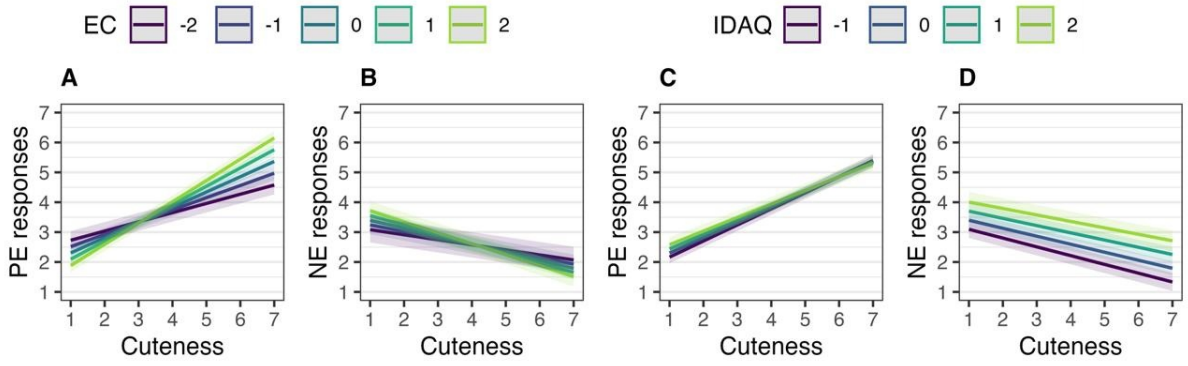

Figure 4: Effects of cuteness on positive emotional (PE) responses (A, C) and negative emotional (NE) responses (B, D) as a function of individual levels of Empathic Concern (EC; 4.A-B) and tendency to anthropomorphize (IDAQ; 4.C-D).

(with the correlation between cuteness and positive emotional response being extremely high; $r = 0.94$) underscore the "power of cute" [38] in social robotics and appear to substantiate the concerns raised by Lacey and Caudwell [31]. Indeed, if cute robots can evoke such strong reactions, they may possess unprecedented persuasive power, potentially making users more vulnerable to manipulative or exploitative practices. This calls for more research investigating the persuasive power of cute robots, and examining the effects of a cute design on the perception of robotic and human norm violations (e.g., data leaks, misuse of participant data, deceptive practices).

The Role of Robot's Features and Social Categories. Our study sheds light on the role of robot characteristics in cuteness perception. *We found a strong association between a robot's perceived age and cuteness, with robots perceived as younger being rated as cuter* (**RQ3**). We further discovered that *facial features, and particularly the presence of a face, are positively related to the attribution of cuteness* (**RQ3**). Since previous research had already established the relationship between facial features and perceived age using the same ratings from the ABOT and ROBO-GAP datasets employed here [45], these results further substantiate the effect of the baby schema, especially in relation to facial appearance cues, on the perception of cuteness in robots, and seem to confirm the dominance of facial features in shaping cuteness judgments [60]. An important specification should be made here, one that might explain why the correlation between cuteness and facial features is weak in our study. When it comes to cuteness, the characteristics of the face are much more important than its mere presence. Indeed, it is not just the presence of a face that elicits cuteness, but the qualities of such a face: e.g., a protruding and wide forhead, a small chin, a round head, chubby cheeks (see [1]). This means that without an enrichment of the ABOT database with ratings that capture the qualities of the appearance features, we cannot properly understand what exactly in a robot's face elicits the perception of cuteness.

Our findings also suggest that the robot's humanlikeness and perceived gender are unrelated to cuteness perception. This result, particularly noteworthy given that the ABOT dataset includes only anthropomorphic robots, aligns with Gn's hypothesis that cute robots cannot be fully realistic, as their bodies must be strategically deformed to elicit cuteness [17]. As Gn argues, "Cute design contributes to the humanization of social robots, but at the same time it presents simple and stylized bodies that are sanitized of human features and behaviors that may invoke rejection, disgust, or terror" [17]. The absence of associations with categories such as femininity, masculinity, and neutrality, may reflect the weak relation between humanlikeness and cuteness, but it may also stem from the fact that childlike, cute robots are often regarded as genderless.

The Influence of Participant's Characteristics. Finally, our study highlights the role of individual traits in shaping responses to cute robots. A noteworthy finding is the absence of gender effects on caretaking tendencies. This contrasts with Glocker et al. [16], who reported that the influence of cuteness on caretaking was stronger for women than for men. An interpretation of this difference could be that robot images are not equally as relevant for women as infant images in terms of offspring survival. Interestingly, earlier iterations of our multilevel regression model, using only participants' age and gender as predictors, revealed a significant gender effect on cuteness ($\beta = -0.23, p < .01$), with women rating robots as cuter than men. However, once empathic concern was included in the model, this gender effect disappeared, suggesting that women's stronger empathic concern (women: $M = 5.78, SD = 1.01$; men: $M = 4.87, SD = 0.98, p < .01$) accounted for the observed difference.

Familiarity with technology was positively associated with both cuteness perception and caretaking tendencies (**RQ4**), possibly reflecting the more favorable attitudes toward robots held by individuals with greater technological literacy. *Empathic concern*, meanwhile, *was linked to stronger willingness to take care of robots* (**RQ4**), which is unsurprising given the established link between cuteness, nurturing, and affiliative tendencies [49, 56]. Notably, empathic concern also moderated the effect of cuteness on emotional responses, strengthening this relationship. This suggests that future iterations of the cuteness model in Fig. 3 should also include empathic concern as a predictor variable of caretaking tendencies.

Beyond empathic concern, also *tendency to anthropomorphize positively influenced cuteness perception, negative emotional reactions, and caretaking tendencies* (**RQ4**). Sherman and Haidt [49] propose that "given the relationship between sociality motivation

and mentalizing [11, 12], cuteness should activate processes related to the attribution of mental states to agents." Our results support this view. We argue that people inclined to anthropomorphize are more likely to attribute richer mental lives to those non-human entities they are more motivated to interact with socially, such as cute robots. This calls for further enrichment of the model in Fig. 3 with the individual trait tendency to anthropomorphize.

Following this line of thought, cuteness may hold particular power over individuals with certain characteristics and could be exploited to target them. Children and individuals with dementia, for example, are more prone to anthropomorphize while also being less aware of a robot's true capabilities. For these users, cuteness could become a problematic design feature, drawing them into interactions whose implications they cannot fully grasp and creating fertile ground for malicious practices. In the case of people with dementia, following the three-factor theory of anthropomorphism [12], an increased *sociality motivation* may further amplify the tendency to anthropomorphize, thereby intensifying the emotional and caretaking effects of cuteness. Because most individuals with dementia are older adults, this concern is compounded by the additional influence of age on negative emotional responses and caretaking tendencies we found in this study.

According to Danaher [9], hidden-state deception occurs when "the robot uses a deceptive signal to conceal or obscure the presence of some capacity or internal state that it actually has," such as looking away while secretly recording through cameras embedded in its eyes. He argues that this form of deception is especially problematic because it constitutes a "form of betrayal." We suggest that cuteness could operate as a form of hidden-state deception if deployed with ulterior motives. A systematic study of the deceptive power of cuteness is therefore both timely and urgently needed.

Taken together, these findings advance our understanding of how cuteness operates in social robotics, highlighting its design potential, its ethical risks, and the roles of robot characteristics and individual differences in shaping responses.

5.1 Limitations

While we consider our findings noteworthy, we need to acknowledge some limitations to our studies. To begin with, the robots in our studies were presented only through static images and viewed briefly. As such, our results primarily address how cuteness is elicited by appearance and operates at the level of first impressions. The addition of multimodal cues could either strengthen or weaken appearance-based perceptions of cuteness. Seaborn et al. [47] and Mandai et al. [36] developed a model of kawaii vocalics that enables the manipulation of cuteness in artificial voices, while Mara and Appel [37] demonstrated how lateral head tilts affect perceived cuteness in robots. Future research should build on these insights and combine appearance cues with cues from other modalities to explore how they jointly shape cuteness perception.

Second, beyond multimodal aspects, other relevant appearance characteristics, such as the size of the robot, might only become evident when encountering a robot face-to-face and fully appreciating its corporeality. Prospective research should thus examine whether cuteness exerts comparable effects during real interactions with robots. In addition, as bonding builds up over time, the immediate emotional responses towards cute robots we found in our study might not necessarily translate into long-term attachment [6] (see the commercial failure of cute robots such as Jibo, Anki, and Kuri [27]). Thus, more research is needed to investigate how cuteness influences attachment and bonding over extended periods of time.

Third, while the ABOT database we used in this study is extremely comprehensive in terms of featured robots, it primarily focuses on anthropomorphic designs. The extent to which our findings extend to zoomorphic robots remains to be determined. Based on existing literature on animal cuteness and the research on canine robots by Voysey et al. [58], we postulate that our findings with anthropomorphic robots can be replicated with zoomorphic robots. However, this grants additional research. Beyond the anthropomorphic focus of the ABOT database, another limitation of the dataset is the considerable variability in the pose and postures of robots. Since asymmetric gestures in static images can affect the perception of cuteness [1], the lack of standardization in the positions of the robots may have partially influenced our results.

Finally, although the sample of participants in our study was particularly heterogeneous in terms of represented nationalities and ages, it lacked gender diversity, featuring only women and men. Future iterations of this research should compensate for this limitation by involving a more gender diverse group of participants.

6 Conclusions

The present paper described the results of a survey study aimed at investigating the relationship between robot cuteness and people's emotional responses and caretaking tendencies. Our results confirm that robot cuteness is reliably associated with "Aww" factor responses, fostering more positive and fewer negative emotions toward robots, and shaping people's willingness to care for them. They also show that the influence of robot cuteness on caretaking behavior is partly mediated by people's emotional reactions. In addition, they point to a relationship between perceptions of cuteness and both a robot's facial features and its perceived age. Finally, they demonstrate that individual traits, most notably the tendency to anthropomorphize, affect not only judgments of cuteness but also emotional responses and caregiving tendencies. While our work demonstrates the advantages of cuteness as a design strategy in HRI, it also highlights its ethical pitfalls. We call for further research into the persuasive power of cute robots, and the role of cuteness in shaping responses to human and robotic norm violations. Overall, our study carries both theoretical and practical implications. On the one hand, it establishes a theoretical basis for studying cuteness in social robots. On the other hand, it offers design insights for creating cute robots and supports further exploration of cuteness in the HRI community through the Aww-ROBO dataset.

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