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# Manipulation of Infant-Like Traits Affects Perceived Cuteness of Infant, Adult and Cat Faces

Anthony C. Little

School of Natural Sciences, University of Stirling, Stirling, UK

**Correspondence**
Dr. Anthony C. Little, School of Natural Sciences, University of Stirling, Stirling, FK9 4LA, UK.
E-mail: anthony.little@stir.ac.uk

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## Abstract

Physical traits that are characteristic of human infants are referred to as baby-schema, and the notion that these affect perception of cuteness and elicit care giving from adults has a long history. In this study, infant-similarity was experimentally manipulated using the difference between adult and infant faces. Human infant, human adult and cat faces were manipulated to look more (human) infant-like or adult-like. The results from the current study demonstrate the impact of infant-similarity on human adults' perception of cuteness across the three different types of face. The type of face had a large impact on perceived cuteness in line with the expected infant-similarity of the images. Infants and cats were cutest while adults were less cute. The manipulations of infant-similarity, however, had similar effects on the perception of cuteness across all three types of face. Faces manipulated to have infant-like traits were rated as cuter than their equivalents manipulated to have adult-like traits. These data demonstrate that baby-like traits have a powerful hold over human perceptions and that these effects are not simply limited to infant faces.

## Introduction

Physical traits that are characteristic of human infants are referred to as 'baby-schema' (e.g. Lorenz 1943), and there is a long history to the notion that such traits might influence the perception of cuteness and elicit care giving from adults. Darwin (1872) noted that something about infants prompts adults to care for them and that this is likely adaptive. Lorenz (1943) proposed seven characteristics that all human infants possess that elicit a particular set of behaviours from human adults (such as care giving). Three of the seven are related to infant facial appearance, with infants typically possessing predominance of the brain capsule (a large forehead), large and low lying eyes, and a bulging cheek region (Lorenz 1943). Human infants are entirely dependent on adults, and it is important to their survival that we recognise infants and that infantile characteristics promote nurturing, care giving responses and suppress aggressive responses. Individuals recognising and acting on cues to infanthood would be likely to enhance their own offspring's survival (Bowlby 1969; Eibl-Eibesfeldt 1989), and the elicitation of care giving has an obvious advantage to the infant. Indeed, Struhsaker (1971) noted in non-human primates that the loss of infant-like characteristics as offspring age often coincides with the subsiding of parental and protective responses.

Images of infants certainly have powerful effects on our behaviour and perception. For example, individuals often initially smile in reaction to infants (Hildebrandt & Fitzgerald 1978; Schleidt et al. 1980). There is also a general preference for infant over adult images (Berman et al. 1975; Fullard & Reiling 1976), and both adults and teenagers show preferences for infants of more baby-like appearance (Gardner & Wallach 1965; Fullard & Reiling 1976; Ritter et al. 1991). Other research has further shown that observers do respond to infant-like cues (Todd et al. 1980). For example, Alley (1981) has shown that more infantile facial profiles and more infantile body builds were judged to be cuter, more cuddly, and more defence provoking than

more mature stimuli. Sternglanz et al. (1977) found that in schematic faces, increased eye and forehead size and smaller chin sizes were perceived as cuter than the more mature looking reverses. Hildebrandt & Fitzgerald (1979) showed adults pictures of real infants and found that cuteness was related to short and narrow noses, short and wide ears, and a narrow face below the eyes.

While much research has been conducted on baby-schema, many studies have employed only simplified line drawings and schematic faces (Hueckstedt 1965; Sternglanz et al. 1977; Todd et al. 1980; Alley 1981; McKelvie 1993). Other studies have examined natural variation amongst infants, for example, using photographs of infants and correlating facial feature size with cuteness ratings (Hildebrandt & Fitzgerald 1979). While both approaches have their merits, both also have drawbacks. Schematic stimuli sacrifice ecological validity for experimental control whereas real variation is prone to the presence of uncontrolled artefacts that may vary across stimuli. One recent study has re-examined these issues using computer graphic techniques to manipulate specific aspects of the baby-schema in colour photographs of infants using a manipulation based on anthropometric measurements to ensure realistic levels of transform. Manipulating faces to possess high (round face, high forehead, large eyes, small nose and mouth) and low (narrow face, low forehead, small eyes, large nose and mouth) baby-schema, Glocker et al. (2009) found that the high baby-schema images were seen as more cute and more likely to elicit care giving than low baby-schema images, providing the first experimental evidence for baby-schema eliciting such perceptions in photo-realistic stimuli.

While not explicitly testing the effects of baby-schema, recent work has also examined the perception of cuteness on responses to infant face images. Using computer manipulation to manipulate cuteness based on high and low scoring infant faces, it has been shown that young women are more sensitive to differences in infant cuteness than men or older women, at a post-menopausal age (Sprengelmeyer et al. 2009). Women's sensitivity to cuteness has been further demonstrated in studies in which women are able to discriminate cues to cuteness in infant faces better than men despite women and men being equally capable of discriminating age and facial expression (Lobmaier et al. 2010).

Infant-like features hold sway over our perceptions in domains beyond just infants. For example, several studies have addressed the impact on baby-like facial traits on the perception of older children and adults. Adults have been found to rate images of children up to 4.5 yr of age as more likeable and attractive if they possess baby-like features (Luo et al. 2011). The effects of infant-like facial features have been found to extend into adulthood, however. Adults with infant-like face traits are perceived in line with what might be expected of infants. There exists a 'baby-face' stereotype (Berry & McArthur 1986) by which adult individuals whose faces most resemble infants are seen as warmer, less likely to exhibit antisocial behaviour, more submissive, naive and irresponsible than those with more mature faces (Zebrowitz & Montepare 1992). Beyond humans, the impact of baby-like features on preferences is apparent in the appearance of pets, cartoon characters or even our preference for products such as teddy bears. For example, it has been noted that Walt Disney's Mickey Mouse has become increasingly more baby-like (Gould 1979) and that teddy bears have changed in appearance from a long-snouted long-limbed bear to become more baby-like in appearance (Hinde & Barden 1985). Hinde & Barden (1985) have suggested that the teddy bear has evolved in this way by means of artificial selection because of customer preference: People prefer baby-like characteristics and the bear makers cater to the tastes of their customers. Pets are another example of how baby-like appearance can generally impact on human perceptions. Lorenz (1950/1971) noted that that some breeds of dogs (*Canis familiaris*) have retained infant-like features into adulthood and several authors have noted the selection for neotenous features in many breeds of pet cats (*Felis catus*) and dogs (Tuan 1984; Serpell 1986). Like Mickey Mouse and teddy bears, artificial selection based on human preference for baby-like traits could have directly resulted in a change in appearance of these pets.

One study has examined how infant-like traits influence the perception of attractiveness in cat and dog images. Faces of both cats and dogs containing infant features were rated as more attractive than the faces that did not (Archer & Monton 2011). This study, however, used a limited number of stimuli (two high and two low for each type of pet), and these were selected by the authors, with one of the images being actively manipulated while others were left unchanged. The images were measured after selection and differed on one aspect of infant schema – the ratio of the forehead to the middle of the eyes to the middle of the eyes to the base of the chin – indicating that the images did indeed differ in infant-like appearance. However, subjective selection could have led the selection of attractive vs. unattractive images by the

authors. Furthermore, alongside the difference in measured ratio, it is clear the images were unmatched in other ways such as pose, expression and colour traits.

The question asked of judges is likely to be important. Some studies address perceived cuteness while others address attractiveness, and often the two terms are treated as if they are equivalent. Attractiveness, however, is likely to be derived from complex processes encompassing category typicality, general aesthetics and mate choice. Cuteness, on the other hand, is more specifically related to infant-like behavioural traits and may or may not be stable across stimuli types. We might then expect the relationship between attractiveness and cuteness to change between sexually mature vs. immature stimuli or between human and non-human stimuli.

Only one study has directly experimentally manipulated infant schema in photographs of infant faces (Glocker et al. 2009). The current study extended the results of previous studies by directly manipulating infant-like appearance. Rather than specifying particular infant traits, here infant-like shape was computed empirically, based on the global differences between adult and infant face shape. In this way, using computer graphic techniques, all differences between infant and adult face shapes were manipulated, objectively capturing traits that define infant-similarity. The difference between adult and infant face shape can be applied to different types of face to examine the effects of an identical transform across face type. The transform was applied to human infant faces, human adult faces and cat faces (representing non-human animal faces). Prior research has indicated that baby-schema affect the perception of attractiveness in all of these types of image and here the impact of infant vs. adult-like appearance is examined to address whether the traits of human infant faces influence perception in a specific (only affecting human infant faces) or general way (affecting non-infant faces).

## Methods

### Participants

Participants were 101 individuals (72 women, 29 men, aged between 16 and 60 yr, $\bar{x} = 27.4$, SD = 10.0) who were selected for being older than 16 and <61 yr of age. Participants were recruited for the study online via a research-based website linked to from a variety of other websites and the study was conducted online.

### Stimuli

*Original images*

Adult human images were eight photographs (four women, four men) of white individuals (aged between 18 and 25 yr) without spectacles or obvious facial hair randomly selected from a larger database. Adult photographs were taken under standardised lighting conditions and with participants posing with a neutral expression. Infant images were eight photographs (four male and four female) of white individuals (aged between 5 and 24 mo). Infant images were scanned in from magazines and were selected based on reporting of both sex and age and that the infant was looking directly at the camera with a relatively neutral expression. Cat images were eight photographs (unspecified sex) that were downloaded from the internet following a Google image search. Cat images were selected for the cat looking directly at the camera with a relatively neutral expression. To equate size, all images were aligned to standardise the position of the pupils in the image.

*Manipulating infant-similarity*

To measure the impact of infant-like features on perception, the difference between infant and adult face shape was used to transform each of the above-mentioned faces to appear more infant-like or more adult-like. A composite image of an adult face was made using 50 male and 50 female (using the same eight images as described earlier plus an additional 92 images from the pre-existing database) images (aged between 18 and 25 yr) to create an androgynous average adult face. A composite image of an infant face was made using eight male and eight female (using the same eight images as described earlier plus an additional eight images collected in the same way as mentioned earlier) images to create an androgynous average infant face (aged between 5 and 24 mo, mean age = 10.3 mo, SD = 5.4). While the ages range above 12 mo, the mean age justifies the use of 'infant-like'. The composite images, composed of multiple images of different individuals, were made by creating an average image using individual facial photographs. The composite faces were created using specially designed software (Tiddeman et al. 2001). Key locations (174 points) were manually marked around the main features (e.g. points outline, eyes, nose and mouth) and the outline of each face (e.g. jawline, hairline). The average location of each point in the faces for each composite was then calculated. The features of the individual faces were then morphed to

the relevant average shape before superimposing the images to produce a photographic quality result. For more information on this technique see Tiddeman et al. (2001). All composite images were made perfectly symmetric prior to transform so that transforms did not manipulate symmetry. While the number of constituent images differs between composites, composite faces do not appear significantly more average after around six faces (Little & Hancock 2002).

Each original face image was transformed on an infant-similarity dimension using the linear difference between the composite of adults and the composite of infant faces (following the technique reported in Perrett et al. 1998 for transforming based on the difference between male and female faces). Transforms represented ±30% the difference between these two composites (100% would represent the complete transform and so starting from an adult face +100% towards infant would make the face into a perceptually infant shape). This meant that the face was transformed along an infant-similarity axis, either increasing infant-like or increasing adult-like appearance, with the face retaining its identity and perceived sex (i.e. male faces remained male in appearance). Images varied on infant-like traits based on the transform. For example, an infant face can be transformed along the continuum towards infant-like, decreasing jaw size and increasing forehead height or towards adult-like, increasing jaw size and decreasing forehead height. The cat images are described as infant-like/adult-like because the transform is derived from the difference between adult humans and infant humans. Final images were eight infant-like/adult-like pairs for each type of face (see Fig. 1).

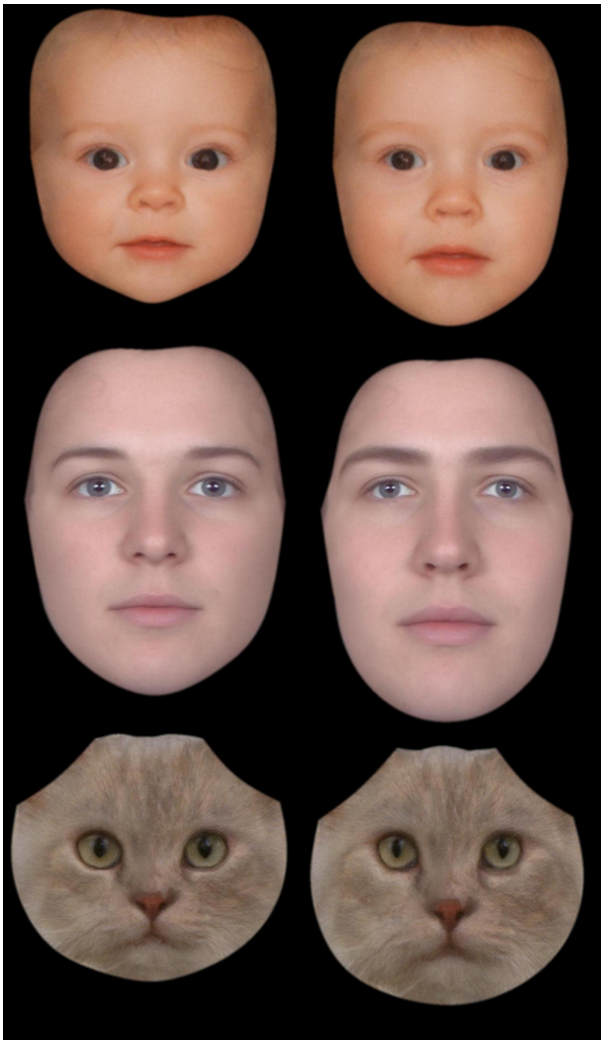

**Fig. 1:** Examples of transformed composite faces based on the difference between infant and adult shape for infant, adult and cat faces. Composite images are shown here for privacy/copyright reasons but participants saw individual images in the experiment.

### Procedure

Participants were administered a short questionnaire assessing age and sex followed by the face test. Participants were told 'In this study you will see human adult and infant faces as well as animal faces and asked to rate the images for cuteness'. The 48 images were then presented individually in a random order with participants asked to 'Rate the image for CUTENESS' using a 7-point Likert scale anchored with Low (1) and High (7). Pressing a button moved the participant onto the next trial and images remained onscreen until a button was a pressed.

### Analysis

Examining mean scores for infant, cat and adult faces, Kolmogorov–Smirnov tests revealed ratings were normally distributed (all $z < 1.17$, all $p > 0.132$) and so parametric tests are used throughout. All significant paired-samples *t*-tests remain significant using non-parametric Wilcoxon signed ranks tests.

## Results

For each participant, I calculated the mean cuteness score given to the different face types (adults, infants and cats) separately for transformed infant-like and adult-like versions to give six mean scores for each participant.

A 2 × 3 × 2 mixed model ANCOVA was carried out with mean cuteness as the dependent variable,

*infant-similarity* (infant-like vs. adult-like) and *face type* (adult vs. infant vs. cat) as within-participant factors, and *sex of participant* (female vs. male) as a between-participant factor. Age was entered as a covariate. This analysis revealed a significant main effect of *infant-similarity* ($F_{1,\ 98} = 20.24$, $p < 0.001$, $\eta_p^2 = 0.171$) and a significant main effect of *face type* ($F_{2,\ 196} = 17.32$, $p < 0.001$, $\eta_p^2 = 0.150$). There was a close to significant effect of *sex of participant* ($F_{1,\ 98} = 3.84$, $p = 0.053$, $\eta_p^2 = 0.038$). *Sex of participant* did not significantly interact with either *infant-similarity* ($F_{1,\ 98} = 0.55$, $p = 0.462$, $\eta_p^2 = 0.006$) or *face type* ($F_{2,\ 196} = 1.49$, $p = 0.229$, $\eta_p^2 = 0.015$), and there was no three-way interaction amongst these variables ($F_{2,\ 196} = 0.53$, $p = 0.591$, $\eta_p^2 = 0.005$). No other effects or interactions were significant (all $F < 1.91$, $p < 0.151$, $\eta_p^2 < 0.019$).

To examine the difference between face types, an average score was computed collapsing across transform for each face type and paired-sample *t*-tests conducted. Participants rated the infant faces as significantly cuter than adult faces ($t_{100} = 13.20$, $p < 0.001$) but not the cat faces ($t_{100} = 0.08$, $p = 0.937$). Cat images were rated as cuter than adult images ($t_{100} = 11.15$, $p < 0.001$).

To examine the difference between infant-like and adult-like transforms for each face type, paired-sample *t*-tests were conducted. Participants rated the infant-like faces as significantly cuter than the adult-like faces in the infant images ($t_{100} = 8.08$, $p < 0.001$), cat images ($t_{100} = 8.62$, $p < 0.001$) and adult images ($t_{100} = 9.08$, $p < 0.001$).

Together these analyses demonstrate that infant and cat faces are rated as cuter than adult faces and that infant and cat faces did not differ in rated cuteness. Furthermore, transforms of infant-similarity had similar effects on each type of face: infant-like faces were rated as cuter than adult-like faces. No effects of sex of participant were seen (although there was a close to significant effect suggesting that women rated faces as cuter than men, $p = 0.053$), indicating that men and women rated the different types of face and the transforms of infant-similarity in similar ways. Mean cuteness scores by infant-similarity and face type can be seen in Fig. 2.

Finally, because male and female adult faces differ, the effects of transform on perceived cuteness was addressed for these two image types. A 2 × 2 repeated measures ANOVA was carried out with mean cuteness as the dependent variable, *infant-similarity* (infant-like vs. adult-like) and *face sex* (female vs. male) as within-participant factors. This analysis revealed a significant main effect of *infant-similarity* ($F_{1,\ 98} = 82.48$, $p < 0.001$, $\eta_p^2 = 0.452$), a significant main effect of *face sex* ($F_{2,\ 196} = 88.57$, $p < 0.001$, $\eta_p^2 = 0.470$), and a significant interaction between *infant-similarity* and *face sex* ($F_{1,\ 98} = 7.29$, $p = 0.008$, $\eta_p^2 = 0.068$). Follow-up paired-samples *t*-tests revealed that infant-like faces were significantly cuter than the adult-like faces for both adult female ($t_{100} = 8.21$, $p < 0.001$) and adult male images ($t_{100} = 5.98$, $p < 0.001$), although the effect was weaker for male images. Collapsing across transform, female faces were rated as cuter than male faces ($t_{100} = 9.41$, $p < 0.001$).

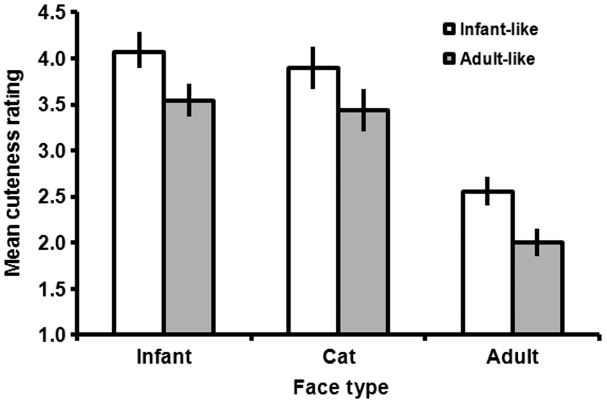


**Fig. 2:** Mean ratings (± 1 SEM) of infant-like and adult-like transformed faces by type of face (infant, adult, and cat). Note: SEM represents between-participant variance but analysis is within-participant.

For the nine follow-up paired-samples *t*-tests presented earlier, all of the significant tests would remain significant correcting alpha for multiple tests using the conservative Bonferonni method (0.05/9 = corrected α of 0.0056).

## Discussion

The current study demonstrates the impact of infant-similarity on adult perception of cuteness across a range of different types of face. The type of face had a large impact on perceived cuteness in line with the expected infant-similarity of the images: Infants and cats were cutest while adults were less cute. Of course, because image sets differed in various factors such as colour and pose, no firm conclusions can be drawn from such comparisons. The manipulations of infant-similarity, however, had very similar effects on the perception of cuteness across all three types of face. Faces with infant-like traits were rated as cuter than faces with adult-like traits. While across category images differed in factors such as colour and pose, such differences should not influence perception across transforms as each infant-like image had an equivalent adult-like image.

These data are consistent with previous studies, the majority of which have employed only simplified line drawings and schematic faces (Hueckstedt 1965; Sternglanz et al. 1977; Todd et al. 1980; Alley 1981; McKelvie 1993). Only one study has directly experimentally manipulated baby-schema in photographs of infant faces (Glocker et al. 2009), and this study focused on the subjectively assigned cues to infant appearance proposed by Lorenz (1943). The current study extended results of previous studies by directly manipulating infant-like appearance in a global way. In this way, all differences between infant and adult face shapes were manipulated capturing the traits that define infant-similarity. This represents an objective method of experimentally manipulating infant-like vs. adult-like shape to address effects on perception. In this sense, infant-like traits are 'baby schema', reflect properties of faces and refer to the actual objective difference between infant and adult faces while 'cuteness' is an observer's subjective perception based on cues associated with cuteness. The two concepts are clearly linked, but it cannot be assumed that they are the same. For example, a woman may rate an adult male face as cute, and this may mean it possesses traits similar to infants but cute in this context may also include other traits that are not characteristic of infants (e.g. dark eyes, chiselled jaw, etc.). Studies using unmanipulated images and examining natural variation between stimuli, particularly if selected by the researchers, are prone to such co-variation errors, meaning that factors other than those intended or measured can influence the perception of the stimuli. In the current study, a greater number of images used to define the infant composite on which the transform was based may have produced more robust effects through a truer representation of the average infant, although it should be noted that the transform did elicit the predicted changes in cuteness. Likewise, the age range was large and perhaps a narrower range of younger ages would have produced a correspondingly larger difference between adult and infant composites.

As well as infant faces, the current study examined how infant- vs. adult-like shape influenced cuteness perception across adult faces. The transform had a similar effect on the perception of cuteness in human adult faces as it did on human infant faces. Adults with infant-like face traits are perceived in line with what might be expected of infants being seen as warmer, less likely to exhibit antisocial behaviour, and more naïve irresponsible than those with more mature faces (Zebrowitz & Montepare 1992). The results here demonstrated infant-like traits increase the cuteness of adult faces using more sophisticated computer graphic techniques.

Alongside human infant and adult faces, the current study demonstrated that infant-like features affected the cuteness of cat faces. One study has shown that the faces of both cats and dogs containing infant features were rated as more attractive than the faces that did not (Archer & Monton 2011). As noted earlier, this study used only a limited number of stimuli and these were selected by the authors, which could bias the results. The objective manipulation presented here supports the conclusions of this previous work. Prior work, and other work addressing the influence of infant-like features in preferences in cartoons and for toy products (Gould 1979; Hinde & Barden 1985), highlights that infant-like features have a general effect of increasing human perceptions of cuteness across different face types. Where traits associated with cuteness are valued, we might expect humans to express preferences and so exert artificial selection pressures increasing infant-like features in certain types of pets and products. Potentially, effects of facial appearance on cuteness across type and species are tied to human interest in pet species (Archer & Monton 2011) and may even impact on interspecific adoption in other related species whereby an animal takes care of an infant of another species (see e.g. Hrdy 2009).

One previous study has shown that human infants capture attention relative to adult faces, and this was not true for puppies vs. dogs or cats vs. kittens (Brosch et al. 2007). The results here, however, suggest more infant-like versions of images are perceived as cuter irrespective of image type. The two findings may not necessarily conflict as attention and cuteness perception may reflect different processes. Alternatively, the difference in neotony between adult and infant forms may not be equivalent across species with a larger difference seen between human adult and infant faces than between cat and kitten faces. Such a difference would predict stronger effects comparing adult human and infant faces than cat and kitten faces in Brosch et al.'s study.

In the current study, no strong effects of sex of participant were seen, indicating that men and women rated the different types of face and the transforms of infant-similarity in similar ways. Some previous studies show that women may be more sensitive to variation in cuteness in infant faces than men because of an increased interest in infants and caretaking activities over men (Berman et al. 1975). It has been shown that young women are more sensitive to differences in infant cuteness than men (Sprengelmeyer

et al. 2009; Lobmaier et al. 2010). In contrast, two other recent studies addressing baby schema rather than cuteness found no significant main effects of gender and no significant interaction between gender and baby schema (Glocker et al. 2009) and no sex effect on ratings of human infants (Archer & Monton 2011). While data here suggest a lack of sex difference in ratings, the small male sample is not ideal for the test and the mixed results from previous studies suggest that individual differences in discrimination of infant-like traits remains a fruitful area for future research.

Cuteness, based on infant-like traits, is an important concept. Individuals recognising and acting on cues to infanthood would be likely to enhance their own offspring's survival (Bowlby 1969; Eibl-Eibesfeldt 1989), and the elicitation of care giving has an obvious advantage to the infant. It appears cuteness is somewhat different to attractiveness. As noted, adults rate images of children up to 4.5 yr of age as more likeable and attractive if they possess baby-like features (Luo et al. 2011) and yet the current study and others show impact of infant-like features on cuteness in adult faces. Potentially, this discrepancy arises because of attractiveness referring to both general aesthetics and mate choice. While cuteness may be valued in an actual mate, it is likely representative of sexual immaturity. Then, it may not be surprising if the link between attractiveness and cuteness changes when the subject being judged reaches puberty. In this way, the infant-like face traits can be related to cuteness and related judgements across infant, child and adult humans, as well as other types of face, but these traits may be more or less related to other rated traits such as attractiveness that can have different meaning for different age of target or type of stimuli. Cuteness may have important consequences for infants too as cute infants are rated as most adoptable (Volk & Quinsey 2002), and mothers with more attractive infants have been found to be more affectionate (Langlois et al. 1995). While exactly how infant-like features lead to responses such as nurturing remains to be fully investigated, it is clear that infant-like traits have a powerful hold over human perceptions and that these effects are not simply limited to infant faces.

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