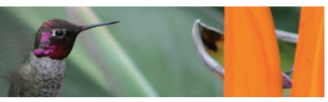
ethology international journal of behavioural biology



Preferences for Infant Facial Features in Pet Dogs and Cats

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Received: December 4, 2009
Initial acceptance: August 17, 2010
Final acceptance: November 7, 2010
(J. Kotiaho)

doi: 10.1111/j.1439-0310.2010.01863.x

Abstract

A set of infant features (large forehead, large and low-lying eyes, and bulging cheeks), were described in classical ethology as *social releasers*, simple stimuli that evoke a stereotyped response, in this case nurturing. We assessed the attractiveness of such features in the faces of dogs or cats (adults and young) or teddy bears or human infants, and also related these preferences to the degree of attachment to a pet. Overall, faces with the infant features were rated as more attractive than those without. Human infant faces were no more attractive than those of kittens or puppies. Pet faces were rated as more attractive by pet owners than non-pet owners, regardless of whether the faces had infant features. A preference was also found for infant features in teddy bear faces. Women showed higher ratings than men for pets with infant features, but not for human infants or pets without infant features. Parents found human infants' faces more attractive than did non-parents, but there were no differences for other faces with infant features. Preferences were to some extent specific to the participant's preferred pet species. Owners who were more strongly attached to their pets showed stronger preferences for photographs with infant features. The findings are discussed in terms of the concept of social releaser, and its part in the development of attachment to a pet species.

Introduction

The concept of 'social releaser' has its origins in classical ethology (Lorenz 1950/1971; Tinbergen 1951), where it referred to simple features that selectively elicited specific and stereotyped actions in another animal. Lorenz (1943, 1950/1971) applied it to human behavior, suggesting that adult nurturance is elicited by a specific configuration of facial and bodily features found not only in human infants but also in the young of other birds and mammals (kinchenschema or baby-schema). The facial features involve a large forehead, large and low-lying eyes, and bulging cheeks. A number of experimental studies have demonstrated the appeal of such features (e.g., Sternglanz et al. 1977; Alley 1983; Zebrowitz 1997, pp. 64–82; Brosch et al. 2007), and have shown a greater preference for them among women than men (Archer 1992, pp. 82–90; see also Lobmaier et al. 2010). Other analyses have shown a change over time in the direction of greater conformity to these infant features in cartoon characters such as Mickey Mouse (Gould 1980), and in teddy bears from a historical collection (Hinde & Barden 1985). These cultural artifacts have been gradually selected to conform to the infant features configuration. Lorenz (1950/1971) noted that that breeds of dogs (*Canis familiaris*) such as the Pekinese have retained the infant features into adulthood. Since then, several authors have noted the selection for neotenous features in many breeds of pet cats (*Felis catus*) and dogs (Serpell 1986; Tuan 1984).

Although Lorenz (1950/1971) described these responses as being 'innate', this was based on a classical ethological formulation that was later replaced in relation to motivation and development (see Lehrman 1953, 1970; Hinde 1970, 1982). Nevertheless, it remains the case that there are mechanisms

through which human adults become attracted to infants of their own species, and that they involve a response to a simple stimulus configuration also found in the young of most other mammals and birds. Such a phylogenetically ancient and general mechanism leads to the same initial attraction being shown to other faces that also incorporate these infant features.

This study is an assessment of the attractiveness of infant features in the context of the most common two pet species, dogs and cats, comparing adults with and without such features, and with puppies and kittens. For comparison, photographs of human infants were also presented to the participants, and so too were those of teddy bears with and without the infant features (following Hinde & Barden 1985). Overall, we would expect a general preference for faces with the infant features over those without.

There are a number of variables that are likely to moderate preferences for infant features. We would expect pet owners to show greater preferences than non-pet-owners, as this response forms the basis of the initial attraction to a potential pet (Archer 1997). We would expect women to show greater preferences than men, and parents to show greater preferences than non-parents, following earlier findings with infant faces (Alley 1983; Cann, 1953, cited in Hess 1970; Fullard & Reiling 1976; see also Lobmaier et al. 2010). The differences involving parenthood are likely to apply specifically to infant features in human infant faces. Owning a cat or dog may be associated with higher preferences for cat or dog faces with infant features, and for cat or faces in general. We therefore compared the relative preferences for faces with and without infant features in these different contexts between pet owners and non-pet owners, men and women, and dog and cat owners.

Preference for pet species with infant features, either in the young or the adult individuals or both, could form a major part of the initial attraction to the pet. This would lead over time to the formation of an attachment bond with the animal (Archer 1997). We also measured the strength of attachment pet owners had to their pet dog or cat, using a questionnaire previously validated on two samples of dog owners (Archer & Ireland in press). From this, we established whether higher ratings for infant features in general, or those in pet faces, were associated with stronger attachment to their particular pet. The measure of attachment also enabled us to assess whether there were sex differences in the strength of attachment (Herzog 2007) and between dog and cat owners (Zasloff 1996).

In summary, we predicted the following: (1) that faces with infant features would be rated as more attractive than similar faces without these features; (2) that when the features occur in dog or cat faces, there would be rated as attractive as when they occur in human infant faces; (3) that the preference for infant features would generalize to an inanimate object, a teddy bear; (4) that pet owners would show stronger preferences for infant features than would non-pet owners; (5) that women would show stronger preferences for infant features than men would; (6) that parents would show a greater preference for infant features occurring in a human infant's face than non-parents; (7) that dog or cat owners would prefer the infant features when they are in their chosen pet species and show higher overall preferences for faces of these species; and (8) that among pet owners, the degree of attachment to the pet would be positively associated with the attractiveness of infant features overall and in particular in their preferred pet species.

Methods

Participants

Participants were a convenience sample of 200, from whom 163 questionnaires were returned (completion rate of 81.5%). The questionnaires were distributed through several sources: a veterinary surgery where they were displayed on reception, and returned at the point of distribution; a leisure center where questionnaires were distributed and returned at several classes; and through groups of friends and family of the second author, who distributed them to further participants and returned them to this author. Participants' mean age was 37.12 yr (median 38 yr, range 17–71 yr); 116 were women (71.2%) and 46 were men (28.2%). There were 122 dog and cat owners (hitherto referred to as 'pet owners') and 41 'non-owners'. Of the pet owners, 74 owned dogs, 32 owned cats and 16 owned both dogs and cats.

As the comparisons involved owners vs. non-owners, men vs. women, parents vs. non-parents, and cat owners vs. dog owners, cross-tabulations were computed to assess the extent to which these categories would be confounded in the analyses. For owners vs. non-owners, owners were more likely to be women than were non-owners (82% vs. 65%), and owners were less likely to have children than were

non-owners (45% vs. 61%). For men vs. women, similar proportions were owners (70% vs. 78%) and parents (52% vs. 48%), although men were less likely to own only a cat rather than only a dog (14% vs. 36%). For parents vs. non-parents, fewer of those with children were owners (69% vs. 92%), although similar proportions were men or women (30% vs. 27%), and dog-only rather than a cat-only owners (72% vs. 68%). For cat owners vs. dog-owners, cat owners were more likely to be women than were dog owners (87% vs. 68%), although similar proportions had children (45% vs. 40%).

Materials

Participants were asked to complete a booklet consisting of three sections: (1) a series of photographs designed to measure preference for the infant features; (2) a questionnaire designed to measure strength of attachment to the pet owner's dog or cat; and (3) a personal details section, comprising information on sex, age, children, present pets and childhood pets. Pet owners were instructed to complete all three sections, and non-owners sections 1 and 3.

Photographs

There were 18 colour photographs in section 1 of the booklet. They were taken from existing images of forward-facing head shots of dogs, cats, babies and teddy bears, and they were reduced or enlarged to produce a uniform size which was easily viewable. The images were chosen to portray either infant features, as described by Lorenz (1943, 1950/1971) and subsequently by Sternglanz et al. (1977), or alternatively an absence of infant features. They comprised two each of the following: (1) puppy, (2) adult dog with baby features, (3) adult dog with no baby features, (4) kitten, (5) adult cat with baby features, (6) adult cat with no baby features, (7) teddy bear with baby features, (8) teddy bear with no baby features and (9) a human infant. Those with infant features had large centrally positioned eyes, a high forehead and a small chin, with a relatively high measurement of the centre of the eye to the crown of the head divided by the centre of the eye to the base of the chin. Most photographs conformed to these specifications but in one case of an adult cat, it was digitally manipulated to ensure that it clearly did not possess infant features. This ratio was retrospectively measured in all the photographs, to provide a readily obtainable measure of one aspect of the infant features. Participants were asked to rate the photographs for attractiveness, using a 7-point Likert scale (1 = very unattractive to 7 = very attractive). The photographs are shown in Fig. 1, grouped by category. These were not the order presented in the study, where the categories were mixed with one another. We restricted the numbers of photographs to two in each case as it was not the purpose of this study to investigate individual differences between faces in the various categories use. We did, however, analyze each photograph separately so that within-category variability can be assessed, so that it can be taken into consideration in future studies.

Pet Attachment Questionnaire

The second section of the booklet comprised 35 questions based on those in the Dog Attachment Questionnaire (DAQ: Archer & Ireland in press). This was designed to measure the strength of attachment to a pet dog and was based on the characteristics of human attachment. It included questions about the importance of the pet in the owners' life, the impact of separation, the use of the pet as a secure base, and nurturing feelings and behaviour directed to it. It therefore covers what has been termed 'attachment' (Bowlby 1980, pp. 39–41; Weiss 1988, 1991), used in the sense of the strength of the bond, rather than as a specific motivational system (either caregiving or care-taking). The DAQ was shown to have good internal consistency (α = 0.88 and 0.95). In the present Pet Attachment Questionnaire (PAQ), references to dog or dogs in the DAQ were replaced by reference to pet or pets. Questions 1, 5, 6, 19, 27, 31, and 32 were negatively phrased and therefore reverse scored so that higher scores indicated greater attachment to the pet. Cronbach's α for the 35-item scale was 0.94. As this is the first time the scale has been applied to both dog and cat owners, individual items and their means and standard deviations are shown (Table 2).

Data Analysis

As the study involved a specific set of hypotheses, which generally involved comparing either particular classes of photographs, or preferences shown by different categories of participants, the data analysis mostly involved paired and independent t-tests. Where continuous variables were involved, for example in relation to the attachment measure, Pearson correlations were used.

Fig. 1: Photographs used: (in order): 1–2) human infants; (3–4) puppies; (5–6) kittens; (7–8) adult dogs with infant features; (9–10) adult cats with infant features; (11–12) adult dogs without infant features; (13–13) adult cats without infant features; (15–16) teddy bears with infant features; (17–18) teddy bears without infant features.

Results

Descriptive Statistics

Table 1 shows the means, standard deviations, and ranges of the attractiveness ratings for the various categories and subcategories. Nearly all of the subcategories were above the midpoint (4) indicating that the photographs were generally regarded as more attractive than unattractive. The two that were below the midpoint were adult cats without infant features and teddy bears without infant features. Puppies and human infants were rated most highly, near to 6 ('attractive'). Table 1 also shows the ratio of the top of the head to the centre of the eyes over the centre of the eyes to the base of the chin, which

Table 1: Means and standard deviations for attractiveness ratings for various categories and subcategories of faces (on a scale from 1 to 7), together with the values for the Facial index (top of head to middle of the eyes divided by middle of the eyes to base of the chin); N = 163

		Facial index	
	$\bar{X}$ (SD)	1	2
Infants (humans, dogs & cats, n = 6)	5.58 (0.82)		
Adult dogs and cats with infant features (n = 4)	4.90 (1.28)		
Adult dogs and cats without infant features (n = 4)	4.14 (1.33)		
Puppies (n = 2)	5.66 (1.03)	0.82	1.00
Human infants (n = 2)	5.64 (1.15)	1.66	1.35
Kittens (n = 2)	5.41 (1.34)	1.08	1.40
Dogs with infant features (n = 2)	5.16 (1.14)	1.00	0.91
Dogs without infant features (n = 2)	4.91 (1.23)	0.65	0.37
Cats with infant features (n = 2)	4.64 (1.42)	0.81	0.68
Teddy bears with infant features (n = 2)	4.24 (1.18)	1.37	1.04
Teddy bears without infant features (n = 2)	3.93 (1.19)	0.73	0.45
Cats without infant features (n = 2)	3.37 (1.42)	0.57	0.51

(as indicated in the Methods) provides an objective index of one aspect of the infant features identified by Lorenz (1950/1971). This is labeled as the 'facial index'. Most photographs conform to the expectation that values will be higher in faces of infants and of adults with baby features. One of the adult cats selected as having baby features had a low value (0.68), although it clearly possessed a second feature, large eyes, which this index does not measure. An independent samples t-test showed that the face ratio was significantly higher ($t_{16} = 4.34$; $p < 0.001$) in the 12 faces regarded as having infant features ($\bar{X} = 0.86$; SD = 0.27) than in the six regarded as not having these features ($\bar{X} = 0.43$; SD = 0.12).

Table 2 shows the means, standard deviations, and ranges for the items on the PAQ. The overall mean value was higher than the midpoint (3) at 3.61, indicating a general tendency toward the 'attachment' end of the scale. This value is similar to the previous ones obtained from two samples of dog owners, which were 3.74 and 3.67 (Archer & Ireland in press). Individual items were also similar to those obtained from these samples of dog owners.

Are Faces with Infant Features Rated as More Attractive than those Without?

The mean of the 12 faces with infant features produced higher attractiveness ratings than the mean of the six faces without infant features: $\bar{X}$ values were

Table 2: Questionnaire items from the Pet Attachment Questionnaire, showing the means and standard deviations (SDs, in brackets)

Item	$\bar{X}$ (SDs)
1. People are more important to me than my pet is (R)	2.72 (1.23)
2. I spend a lot of time stroking and petting my pet	4.01 (1.00)
3. I spend a lot of time talking to my pet	3.80 (1.12)
4. I find it easier to talk to my pet than to people	2.53 (1.26)
5. I receive more companionship from friends or family than from my pet (R)	3.04 (1.11)
6. If I am on holiday without my pet I hardly ever think about him or her (R)	3.71 (1.31)
7. Extra care is taken to ensure my pet is well taken care of whilst on holiday	4.43 (1.04)
8. Having a pet is a source of contact and comfort	4.25 (0.97)
9. What I like about my pet is its acceptance, love and loyalty	4.26 (0.89)
10. When I think of losing my pet I become very upset	4.29 (1.01)
11. There was an increase in happiness after getting my pet	4.16 (0.86)
12. My pet is treated like a family member	4.40 (0.90)
13. Life without my pet would be unbearable, as though a vital part were missing	3.47 (1.23)
14. When I'm alone, I often think about my pet	3.04 (1.20)
15. When talking to my pet I often use endearing terms or baby talk	3.60 (1.31)
16. I feel more relaxed in company when my pet is present	3.15 (1.20)
17. I feel very close to my pet	4.04 (1.02)
18. I often find myself talking about my pet when in company	3.35 (1.17)
19. Having a pet means you cannot do what you want to (R)	3.45 (1.14)
20. I feel a strong companionship with my pet	4.06 (0.94)
21. I enjoy feeling my pet sitting close to me	4.03 (0.88)
22. Having a pet increased my self-esteem and self-worth	2.78 (1.14)
23. Having to deal with the death of my pet would be very hard	4.13 (1.09)
24. The loss of my pet would mean as much to me as the loss of a family member or friend.	3.27 (1.42)
25. When upset or anxious I turn to my pet for comfort	3.22 (1.19)
26. My pet is an important part of my life	4.09 (0.96)
27. I/we do not celebrate my pet's birthday (R)	3.18 (1.44)
28. I hate going home when my pet is not there to greet me	3.22 (1.18)
29. Its hard to express to others what the loss of my pet would mean to me	3.39 (1.26)
30. He/she is encouraged to sleep on my bed at night	2.28 (1.41)
31. When people let me down I don't find that I rely more upon my pet for companionship and solace (R)	3.06 (1.16)
32. Having a pet means you are tied down (R)	3.41 (1.24)
33. Extra care is taken to ensure my pet does not escape or get lost	4.16 (1.00)
34. If my pet became lost I would not give up until I found him or her	4.23 (0.94)
35. A reward would be offered for their return	4.13 (1.01)
Overall mean (SD)	3.61 (0.63)

(R) indicates reverse-scored item.

5.12 (SD = 0.77) and 4.07 (SD = 0.91) respectively (t_{162} = 18.8; p < 0.0001). When analyzed separately, both sets of faces showed comparable differences (t_{162} = 13.99 and 17.23 respectively). The objective measure of infant features, the facial index, was significantly positively correlated with the attractiveness ratings across the 18 photographs used (r = 0.60; p = 0.009).

Are Infant Features Rated as more Attractive in Human than in Non-Human Faces?

We compared the two human infant faces (n = 2) with each of the following: puppies (n = 2), kittens (n = 2), adult dogs with infant features (n = 2), and adult cats with infant features (n = 2). To accommodate the multiple comparisons, we set the α level at 0.01. Values for the two human infant faces did not differ from either puppies (t_{162} = −0.136; p = 0.89) or kittens (t_{162} = 1.85; p = 0.067), using aggregate values, although for one of the two kitten faces, the corresponding infant face was rated as significantly higher than the kitten face (t_{162} = 2.59; p = 0.001). Infant faces were rated as more attractive than both adult dogs with infant features (t_{162} = 4.35; p < 0.0001), and adult cats with infant features (t_{162} = 7.33; p < 0.0001), using aggregate values, although for one of the adult dogs with infant features, there was no significant difference with the corresponding infant face (t_{162} = −1.63; p = 0.10). Table 1 shows the means and standard deviations for the aggregate comparisons.

Are Infant Features Rated as more Attractive in a Teddy Bear's Face?

We compared the teddy bear faces, with (n = 2) and without (n = 2) infant features. As predicted, those with infant features were rated as more attractive than those without (t_{162} = 3.76; p < 0.0001). This difference was entirely because of a significant difference for one pair of faces (t_{162} = 5.68; p < 0.0001), but not the other (t_{162} = 0.15; p = 0.88). Table 1 shows the means and standard deviations for the aggregate comparisons.

Are Infant Features Rated as more Attractive by Pet-Owners than Non-Pet Owners?

Table 3 shows that pet-owners showed significantly higher ratings than non-owners for the faces with infant features combined. However, they also showed higher ratings for the faces without baby features, leading to no significant difference between the two categories in the extent to which ratings for the faces with infant features exceeded those without. Likewise, pet owners showed significantly higher ratings than non-owners for faces of pets both with and without infant features (Table 3). Thus, owners' preferences were characterized by higher ratings than non-owners for pet and other faces irrespective of whether they had infant features (along with a preference for faces with infant features that they shared with non-owners).

Table 3: Comparisons between attractiveness ratings of faces by pet owners (N = 122) and non-owners (N = 41)

	Pet owners	Non-owners	t	p
Faces with infant features (n = 12)	5.28 (0.71)	4.66 (0.76)	4.76	<0.0001
Faces without infant features (n = 6)	4.27 (0.85)	3.48 (0.85)	5.09	<0.0001
Pets' faces with infant features (n = 8)	5.42 (0.84)	4.60 (0.96)	5.23	<0.0001
Pets' faces without infant features (n = 4)	4.37 (0.99)	3.45 (1.00)	5.17	<0.0001

Are Infant Features Rated as more Attractive by Women than by Men?

For all 12 faces with infant features combined, women ($\bar{X}$ = 5.25, SD = 0.77) showed significantly (t_{160} = 3.12; p = 0.002) higher ratings than men ($\bar{X}$ = 4.84, SD = 0.69). This difference was attributable to significantly (t_{160} = 2.91; p = 0.004) higher female ($\bar{X}$ = 5.36, SD = 0.93) than male ($\bar{X}$ = 4.89, SD = 0.88) scores for the eight pet faces with infant features. There were no sex differences for the two human infant faces (women: $\bar{X}$ = 5.73, SD = 1.13; men: $\bar{X}$ = 5.41, SD = 1.18; t_{160} = 1.60) or the two teddy bears with infant faces (women: $\bar{X}$ = 4.31, SD = 1.25; men: $\bar{X}$ = 4.04, SD = 0.97; t_{160} = 1.33). There were no sex differences for the six faces without infant features combined (women: $\bar{X}$ = 4.07, SD = 0.96; men: $\bar{X}$ = 4.06, SD = 0.81; t_{160} = 0.94). The degree to which ratings for faces with infant features exceeded those for the faces without infant features was significantly greater (t_{160} = 3.28; p < 0.001) for women ($\bar{X}$ = 1.17, SD = 0.72) than for men ($\bar{X}$ = 0.78, SD = 0.62), indicating that infant features had more impact on women's than men's ratings.

Are Infant Features rated as more Attractive by Parents than by Non-Parents?

As expected, parents ($\bar{X}$ = 5.98, SD = 0.97, N = 80) found human infants' faces significantly more attrac-

tive (t_{160} = 3.99; p < 0.0001) than non-parents did ($\bar{X}$ = 5.29, SD = 1.12; N = 82). This difference remained significant when age was entered as a covariate in a one-way Analysis of Covariance ($F_{1,158}$ = 7.03; p = 0.009). There were no significant differences between parents and non-parents for: (1) all 12 faces with infant features combined; (2) all six faces without infant features combined; (3) all 8 pet faces with infant features; and, (4) all four pet faces without infant features. Non-parents showed higher attractiveness ratings ($\bar{X}$ = 4.50, SD = 1.23) than parents ($\bar{X}$ = 3.99, SD = 1.02), for the two teddy-bear faces with infant features (t_{160} = 2.84; p = 0.005), although an analysis of covariance showed that this was because of the younger mean age of the non-parents ($\bar{X}$ = 29.2 vs. 45.3 yr): age was a marginally significant covariate ($F_{1,158}$ = 3.75; p = 0.055), which reduced the effect of parental status to a non-significant level ($F_{1,158}$ = 1.66).

Do Dog or Cat Owners Prefer the Infant Features in their Chosen Pet Species?

We compared dog owners (N = 74) and cat owners (N = 32) on their preferences for adult dogs and cats with and without infant features, and for puppies and kittens. The only significant differences were (1) that cat owners showed a significantly stronger preference than dog owners did for kittens (cat owners: $\bar{X}$ = 5.25, SD = 0.77; dog owners: $\bar{X}$ = 4.84, SD = 0.69; t_{104} = 3.46; p < 0.001), and for adult cats with infant features (cat owners: $\bar{X}$ = 5.53, SD = 1.19; dog owners: $\bar{X}$ = 4.53, SD = 1.12; t_{104} = 4.11; p < 0.0001). We should note that these findings are different from those for the two sexes, and are therefore not attributable to cat owners being more likely to be female.

Is the Degree of Attachment to a Pet Associated with Ratings of Infant Features?

The PAQ measures the degree of attachment to the pet (Archer & Ireland in press). The mean score was positively correlated with ratings of all 12 faces with infant features combined (r = 0.31; p < 0.001; N = 116). Table 4 shows the correlations between the PAQ and subcategories of faces. There were slightly higher correlations than the overall ones, for the puppies' and kittens' faces combined, and for those of adult dogs and cats with infant features combined. There was a lower value for the correlation with the combined scores for adult dogs and cats without infant features.

Table 4: Correlations between mean score on the Pet Attachment Questionnaire and attractiveness ratings of sub-categories of photos, with and without infant features (N = 116)

	r	p
Puppies and kittens (n = 4)	0.35	<0.0001
Adult pets with infant features (n = 4)	0.33	<0.0001
Adult pets without infant features (n = 4)	0.21	0.024
Kittens (n = 2)	0.33	<0.0001
Adult dogs with infant features (n = 2)	0.28	0.003
Puppies (n = 2)	0.25	0.008
Adult dogs without infant features (n = 2)	0.23	0.012
Teddy bears without infant features (n = 2)	0.20	0.03
Teddy bears with infant features (n = 2)	0.19	0.04
Adult cats with infant features (n = 2)	0.14	0.14
Adult cats without infant features (n = 2)	0.11	0.22
Human infants (n = 2)	0.05	0.60

Correlations with kitten or puppies, and with adult dogs with infant features, were similar to that for the combined faces with infant features (Table 4). Correlations with adult dogs without infant features, and with adult cats with infant features, were anomalous: the first was higher than expected for faces without infant features and the second lower than expected for faces with infant features. There was a weak association with the photographs of teddy bears, irrespective of whether they had infant features, and there was no association with attractiveness ratings of human infants.

To assess the possibility of species-specific preferences by owners, correlations were computed separately for (1) participants who only owned cats (N = 31) and (2) those who only owned dogs (N = 69). Table 5 shows that there were some species-specific associations. Dog owners showed similar correlations between the PAQ and faces of adult dogs, irrespective of whether these had infant features, and they showed higher correlations

Table 5: Correlations between mean score on the Pet Attachment Questionnaire and attractiveness ratings of photos of pet species, with and without infant features, for dog owners (N = 69) and cat-owners (N = 31)

	Dog owners	Cat owners
Puppies (n = 2)	0.37**	0.30
Adult dogs with infant features (n = 2)	0.27*	0.41*
Adult dogs without infant features (n = 2)	0.29*	0.24
Kittens (n = 2)	0.33**	0.60***
Adult cats with infant features (n = 2)	0.20	0.40*
Adult cats without infant features (n = 2)	0.06	0.48**

*p < 0.05; **p < 0.01; ***p < 0.0001.

($r = 0.37$) with faces of puppies, but also a slightly smaller correlation with the faces of kittens. Cat owners showed a clearer species difference, with higher correlations for all three cat photographs, especially those of kittens; they also showed a moderate correlation with photographs of adult dogs with baby features.

Discussion

We tested a number of predictions derived from the theory that humans respond with nurturing feelings and behavior to a specific set of infantile facial features, which our species shares with most other birds and mammals (Lorenz 1943; 1950/1971). These involve a large forehead, large and low-lying eyes, and bulging cheeks. They have previously been found to operate in the context of human infants (e.g., Sternglanz et al. 1977; Alley 1983), in teddy bears (Hinde & Barden 1985) and in cartoon characters (Gould 1980). We measured the rated attractiveness of 18 facial photographs, primarily of pet species, with or without infant schema.

Overall, faces containing the infant features were rated as more attractive than the faces that did not contain them. An objective measure of one important 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, was considerably greater in the photographs chosen as having baby features than those chosen to be without. The ratio was also highly positively correlated with attractiveness ratings across all 18 photographs.

The finding that facial photographs of puppies and kittens were viewed as being as attractive as those of human infants is not surprising if the infant features represent a set of 'social releasers' that are consistent throughout birds and mammals, as Lorenz (1943; 1950/1971) argued. Such releasers would have evolved for a specific signaling function (Hinde 1982), and represent a phylogenetically ancient mechanism whereby young are attractive to adults, primarily their parents. Classical ethological studies show a range of circumstances where social releasers, which are adaptive in their original context, can give rise to non-adaptive or maladaptive responses (Tinbergen 1951). Nurturant reactions to the infant features in the context of a pet species or to a teddy bear are clearly non-adaptive (Archer 1997), indicating one of the features of social releasers, their generalizability. In the current study, there was some moderation of the response according to the context of the infant features, because human infant faces (and those of puppies and kittens) were rated as more attractive than those of adult pet species with the infant features.

We found an overall higher preference for the photographs containing infant features among pet owners than among those who did not own a pet. This was predicted from the suggestion that infant features in the face of a potential pet contribute to its initial choice, and aid the subsequent bonding process (Archer 1997). There were two qualifications to this finding. First, the greater preference only applied to pet species and not to human infants. Second, pet owners' ratings of dog and cat faces without baby features were also higher than those on non-pet owners. Thus, pet owners preferred pet faces whether or not they had infant features, although their preferences for pet faces with infant features were higher than those for pet faces without these features (as they were in non-pet owners).

There is some evidence from studies involving infant features in the context of human infants that women show a greater preference for these features than men do (see Introduction for citations). We found no sex difference in the ratings of human infant faces, although we did find higher female ratings for infant features in the faces of pet species, which was not present when such faces lacked the infant features. Thus, the sex difference involved a specific response to infant features embedded in the faces of pet species. This cannot be attributed to more of the women than the men being owners or having children, as these categories were similarly represented among men and women (see Methods), nor to the higher proportion of cat owners among women, as differences between these categories were mostly species specific.

As expected, the faces of human infants were more attractive to parents than to non-parents, a difference that was not attributable to the age or other differences between the two categories. Non-parents did show higher ratings of teddy bear faces with infant features than parents did, although this was mainly because of the lower ages of the non-parents. Thus, the attraction of teddy bears with infant features lessened with age, and parental effects were specific to infant features in the context of a human infant.

Although most of the pet owners in our sample owned dogs, we were able to compare dog and cat owners to assess their specific preferences. Cat owners showed a stronger preference for kittens and adult cats with infant features than did dog owners. But they did not show a lower preference than dog

owners for infant features in dog faces. Dog owners' lower preferences for cat faces were responsible for the lower ratings for cat faces overall (Table 1).

Participants who were pet owners also completed a measure of the extent to which they had formed an emotional bond with their own pet, the PAQ. This was based on a previous scale designed for measuring attachment to a pet dog (Archer & Ireland in press). The current version was altered slightly to apply to cats as well as dogs, and there was no difference in the strength of attachment shown by dog and cat owners. As predicted, the degree of attachment owners reported to their pets was associated with their overall attractiveness ratings of facial photographs with infant features. This was largely due to associations with the rated attractiveness of puppies and kittens and with adult dogs with infant features, there being no association with rated attractiveness of human infants. The PAQ scores also showed a smaller but significant association with preferences for those pet faces without infant features. Thus, participants with stronger attachments to their pets found the faces of dogs and cats to be more attractive, and this occurred irrespective of whether these contained infant features. Among the cat owners, this association was much higher, especially for kittens, but also for adult cats with or without the infant features.

The adaptive context of the preferences investigated in this study is the initial attraction by a parent or other adult to the young of their own species. In a parent, this forms the beginning of a process leading to the development of an emotional bond, or attachment, to the infant. Lorenz (1943; 1950/1971) conceptualized this initial reaction in relation to the concept of social releasers, but as mentioned in the Introduction, the theory of motivation behind this concept has long been discarded, and contemporary studies now involve concepts such as selective attentional capture of biologically significant stimuli (e.g., Brosch et al. 2007). There have also been many further conceptual developments in the understanding of the attachment process, from Bowlby's writings (e.g., Bowlby 1958, 1969) onwards. These mainly concentrated on the infant's attachment to the parent, although the parent's attachment to the infant was also included in his later writings (Bowlby 1980, pp. 39–41). Daly & Wilson (1980, 1988) incorporated an initial assessment of the quality of the offspring and the maternal circumstances, into a three-stage attachment process out of which an attachment bond develops. Although they emphasized cues indicating the quality and survival chances of the offspring, the social releasers identified by Lorenz are part of this process, and their absence would indicate defects or deformities in the infant (Zebrowitz 1997, pp. 75–76). What we have seen in the present study is the operation of this general and phylogenetically ancient mechanism in a non-adaptive or maladaptive context (Archer 1997, in press). Owing to its generalized nature, this evolved parenting response can also provide the first step in the development of an attachment bond with a member of another species. This process involves not only the initial attraction to the pet but also a range of other mechanisms that together facilitates the development of the human-pet bond (Archer in press). These include anthropomorphism, the use of motherese or infant-directed speech to the pet, and the ability to regard attachments to pets more favorably than those to humans.

The present study is the first to systematically investigate the attractiveness of infant facial features in the context of pet dogs and cats. Further studies could readily improve on the present design, first by using a more systematic factorial design, and second by manipulating separately the three aspects of infant schema, the eyes, cheeks and facial ratio. We began investigating the last of these by taking measurements of the forehead in relation to the remainder of the face, finding that overall this ratio was highly correlated with rated attractiveness across all the photographs. In future, this index could be systematically altered by digital manipulation, to assess its contribution to ratings of attractiveness of faces in relation to manipulations of the other two features comprising infant schema.

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