

## Research Report

## The Cutest Little Baby Face

## A Hormonal Link to Sensitivity to Cuteness in Infant Faces

R. Sprengelmeyer,<sup>1</sup> D.I. Perrett,<sup>1</sup> E.C. Fagan,<sup>1</sup> R.E. Cornwell,<sup>1</sup> J.S. Lobmaier,<sup>1</sup> A. Sprengelmeyer,<sup>2</sup> H.B.M. Aasheim,<sup>1</sup> I.M. Black,<sup>1</sup> L.M. Cameron,<sup>1</sup> S. Crow,<sup>1</sup> N. Milne,<sup>1</sup> E.C. Rhodes,<sup>1</sup> and A.W. Young<sup>3</sup>

<sup>1</sup>University of St. Andrews, <sup>2</sup>Universität Bielefeld, and <sup>3</sup>University of York

**ABSTRACT**—We used computer image manipulation to develop a test of perception of subtle gradations in cuteness between infant faces. We found that young women (19–26 years old) were more sensitive to differences in infant cuteness than were men (19–26 and 53–60 years old). Women aged 45 to 51 years performed at the level of the young women, whereas cuteness sensitivity in women aged 53 to 60 years was not different from that of men (19–26 and 53–60 years old). Because average age at menopause is 51 years in Britain, these findings suggest the possible involvement of reproductive hormones in cuteness sensitivity. Therefore, we compared cuteness discrimination in pre- and postmenopausal women matched for age and in women taking and not taking oral contraceptives (progestogen and estrogen). Premenopausal women and young women taking oral contraceptives (which raise hormone levels artificially) were more sensitive to variations of cuteness than their respective comparison groups. We suggest that cuteness sensitivity is modulated by female reproductive hormones.

More than half a century ago, Konrad Lorenz proposed the *Kindchenschema* as an innate releasing mechanism for caretaking behavior and affective orientation toward infants, triggered by features such as protruding cheeks, a large forehead, and large eyes below the horizontal midline of the skull (Lorenz, 1943). Baby faces having these features are commonly described as cute, and although cuteness has been shown to modulate mother-infant interaction (Langlois, Ritter, Casey, & Sawin, 1995), there are only a few psychophysical studies investigating responses of men and women to variations of physical properties of baby faces (Alley, 1981; Brooks & Hochberg, 1960; Gardner & Wallach, 1965; Hückstedt, 1965; Sternglanz, Gray, & Murakami, 1977). Overall, findings from these studies

are not conclusive but suggest a possible difference between men and women in perceiving cuteness. However, a question not addressed in previous studies concerns what might underlie any sex differences in adults' ability to perceive infant cuteness. An obvious cause might be differential interest in babies, but there are other explanations. Given that Lorenz had conceived the *Kindchenschema* as a biological mechanism, we decided to investigate the possibility of a link to female reproductive hormones.

## STUDY 1

Study 1 aimed to explore the idea of a possible link between cuteness perception and female reproductive hormones by looking at groups of younger women, younger and older men, and women aged slightly below and above the average age at menopause in Britain.

## Method

## Participants

Twenty-four younger women (mean age = 22.0 years, *SD* = 1.8 years, range = 19–26 years), 24 younger men (mean age = 21.5 years, *SD* = 1.5 years, range = 19–26 years), and 24 older women (mean age = 53.2 years, *SD* = 4.1 years, range = 45–60 years) were investigated. Bearing in mind that reproductive hormones might possibly modulate sensitivity to infant facial cuteness, we used the older women's median age of 52 years (which is near the average age at menopause in Britain) to subdivide the latter group into a group of women aged 51 years and younger (mean age = 49.8 years, *SD* = 2.1 years, range = 45–51 years), and a group of women aged 53 years and older (mean age = 56.6 years, *SD* = 2.5 years, range = 53–60 years). No participant was taking hormone-replacement therapy or had undergone hysterectomy. At a later stage of the study, a group of 11 older men (mean age = 56.5 years, *SD* = 2.3 years, range = 53–60 years) was added to provide a point of comparison to the women aged 53 through 60 and to the younger men.

Address correspondence to R. Sprengelmeyer, School of Psychology, University of St. Andrews, St. Andrews KY16 9JU, Scotland, e-mail: rhs3@st-and.ac.uk.

The 48 younger participants reported not having children, whereas all 35 older participants had children.

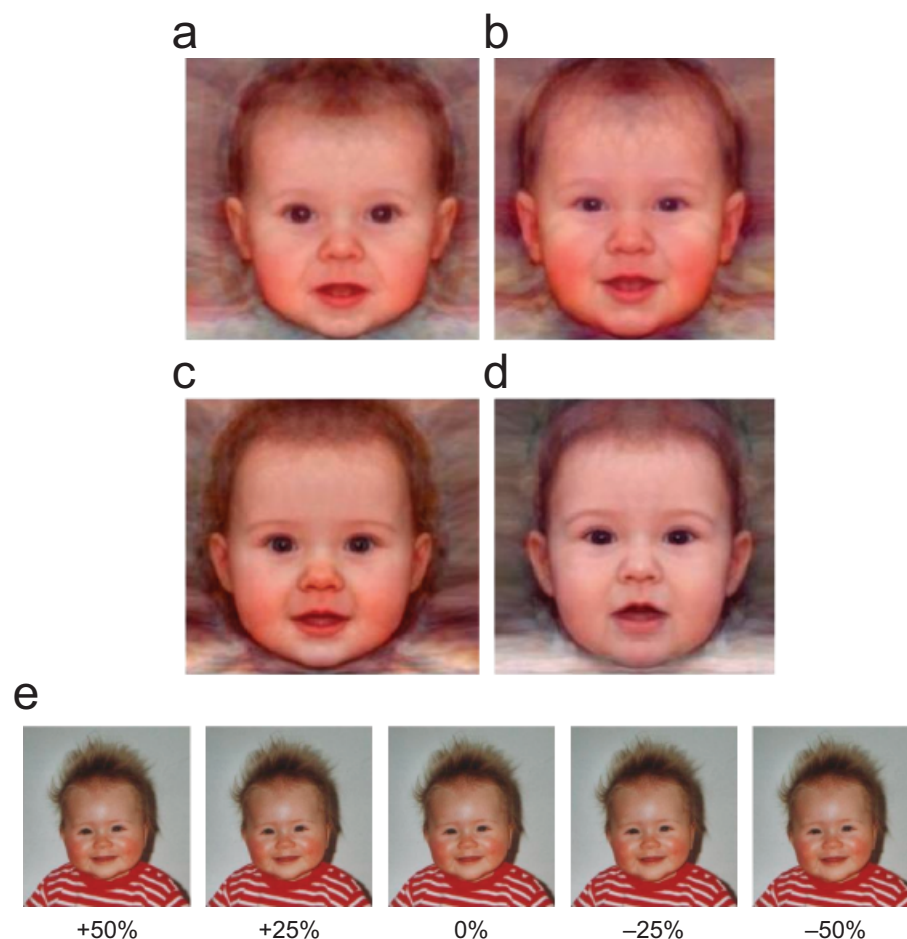
#### Cuteness Discrimination

Facial images of 130 female and 72 male Caucasian European babies were collected. From these sets, we choose 28 pictures of female and 30 pictures of male faces considered to be of a sufficient quality for further computer processing. The female baby faces were rated for cuteness on a 7-point scale (1 = *not cute*, 7 = *very cute*) by 10 younger women (mean age = 22.9 years,  $SD = 3.6$  years, range = 20–30 years), 10 younger men (mean age = 24.2 years,  $SD = 4.1$  years, range = 20–29 years), and 10 older women (54.1 years,  $SD = 4.1$  years, range = 45–59 years). The male baby faces were rated in the same way by groups of 10 younger women (22.8 years,  $SD = 3.3$  years, range = 20–29 years), 10 younger men (23.2 years,  $SD = 3.7$  years, range = 19–29 years), and 10 older women (54.0 years,  $SD = 4.4$  years, range = 45–59 years). Ratings for female faces

correlated significantly between groups, Spearman's  $\rho \geq .76$ , Cronbach's  $\alpha \geq .82$ . Similar results were obtained for the male faces, Spearman's  $\rho \geq .73$ , Cronbach's  $\alpha \geq .82$ . This finding indicates that all participants had similar opinions concerning what they considered cute and less cute baby faces.

On the basis of these ratings, we compiled four sets of pictures: 10 female infant faces rated as cute (mean rating = 4.4,  $SD = 0.8$ ), 10 female infant faces rated as less cute (mean rating = 3.3,  $SD = 0.6$ ), 10 male infant faces rated as cute (mean rating = 4.8,  $SD = 0.8$ ), and 10 male infant faces rated as less cute (mean rating = 3.2,  $SD = 0.7$ ).

We took the pictures from these four sets and defined the shape of each face with 174 manually marked facial landmark points using the computer program Psychomorph (Burt & Perrett, 1995). The average face shapes (Fig. 1) were then calculated for each set. Next, we randomly chose five different faces of female babies from the set of 28 pictures, and five different faces of male babies from the set of 30 pictures. The average



**Fig. 1.** Creation of the experimental stimuli. First, four sets of baby faces were used to obtain averaged cute male (a) and female (c) baby faces and averaged less cute male (b) and female (d) baby faces. Next, these averages were used to apply the cuteness continuum to an individual baby's face, as illustrated in (e). The cuteness continuum ranged from +50% (image altered to make the face more cute) to -50% (image altered to make the face less cute). The baby shown in (e) is 6 months old, and transformations were performed using the shape information from the faces shown in (a) and (b).

cuteness rating of these pictures was 4.5. The individual shapes of these faces were also defined.

The photographs of the five female faces were shape-transformed using the differences between the corresponding landmark points of the cute and the less cute female averages. To make the five individual female faces 25% or 50% cuter, we added 25% or 50% of the differences to the values of the individual's face original landmark points. To make the individual face 25% or 50% less cute, we subtracted 25% or 50% of the differences from the individual's face original landmark points. The same procedure was applied to the photographs of the male faces. This resulted in five pictures differing in cuteness for each individual infant (50%, 25%, 0%, -25%, -50%). Details of the transformation procedure can be found elsewhere (Tiddeman, Burt, & Perrett, 2001).

In each of the 200 pseudorandomized trials of the cuteness task, two pictures of the same baby were shown, one each on the left and right side of the screen. Participants had to decide which of the two faces was cuter. In half of the trials, both faces were presented in an upright orientation; in the remaining 100 trials, faces were inverted. For each of the babies, there were two upright and two inverted pairs of faces at each of five levels of difference in cuteness (pairings used are in parentheses): 100% (+50% vs. -50%), 75% (+50% vs. -25%, or +25% vs. -50%), 50% (+50% vs. 0%, or 0% vs. -50%), 25% (+50% vs. +25%, or -25% vs. -50%), and 0% (identical images). The 0% difference condition was included only to balance the design, and was not used for analysis. The inverted stimuli were intended to investigate the extent to which the pattern of findings might be orientation-specific. However, they led to near-chance performance in all conditions, and the data for inverted faces are therefore not presented here.

#### Size Discrimination

A size-discrimination task was included for comparison to the cuteness-discrimination data. In each of 50 trials, two squares of different sizes were presented at random locations, one each on the left and on the right side of the screen. A square with a side length of 100 mm was paired with squares with side lengths of 99 to 95 mm. Participants had to point to the smaller square.

#### Results

We performed a repeated measures analysis of variance (ANOVA) of the cuteness-discrimination data with task difficulty (25%, 50%, 75%, 100% difference) as a within-subjects factor and group (women aged 19–26 years, men aged 19–26 years, women aged 45–51 years, women aged 53–60 years, and men aged 53–60 years) as a between-groups factor. The analysis showed a significant effect of difficulty and group,  $F_s \geq 14.54$ ,  $p < .001$ , as well as a significant interaction between these variables,  $F(12, 234) = 2.00$ ,  $p < .05$ . As shown in Figure 2a, the two groups of younger women were more accurate than the older

women and the two groups of men. This was true at all levels of difficulty, but the group differences were greater at the easier levels (i.e., when faces differed in cuteness by 75% and 100%). To explore the group effect in more detail, Scheffé tests ( $p < .05$ ) were performed. These tests revealed no significant differences among the following three groups: men aged 53 to 60 years, women aged 53 to 60 years, and men aged 19 to 26 years. There was also no difference in performance between women aged 19 to 26 years and women aged 45 to 51 years. However, the former three groups differed significantly from the latter two groups.

To establish whether basic visuo-perceptual differences might contribute to the observed pattern of results, we administered a control task involving discriminating differences in the size of two squares. Overall performance was 83% ( $SD = 6.7\%$ ). An ANOVA showed that performance declined with task difficulty,  $F(3, 312) = 85.40$ ,  $p < .001$ , but neither the group effect nor the Difficulty  $\times$  Group interaction was significant,  $F_s \leq 1.53$ ,  $p \geq .09$ . These results show that basic visuo-perceptual processing did not differ among groups.

#### STUDY 2

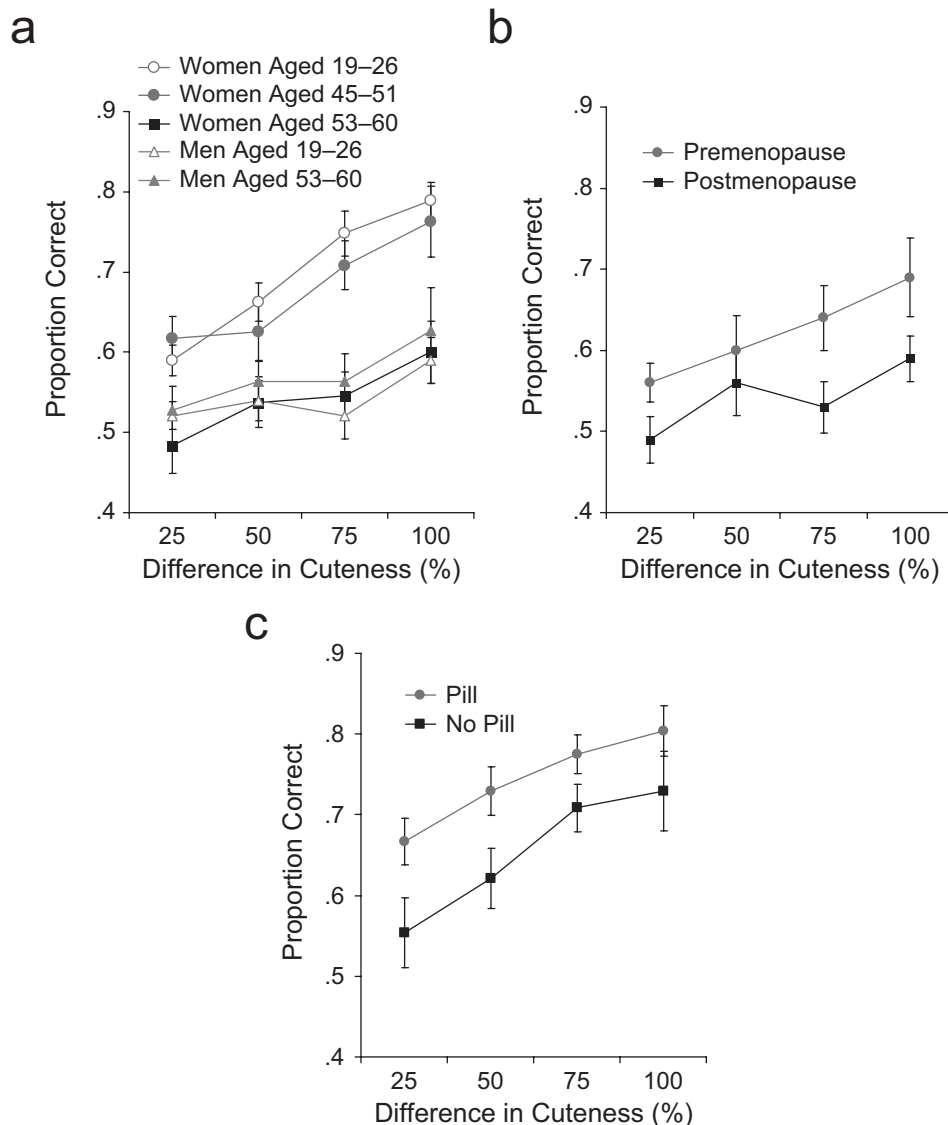
In Study 1, we found a difference in cuteness discrimination between women aged 45 to 51 and 53 to 60 years. Given an average age at menopause of 51 years in Britain, these findings suggest that reproductive hormone status might be linked to cuteness discrimination. To explore this possibility, we looked at cuteness and size discrimination across pre- and postmenopausal women matched for age. In this study, only the upright faces were presented. Otherwise, the procedures were identical to Study 1.

#### Participants

This study included 20 healthy women, 10 of whom reported having passed menopause at least 2 years before the study (mean age = 55.0 years,  $SD = 1.9$  years), and 10 who were premenopausal (mean age = 54.4 years,  $SD = 1.8$  years). No participant was taking hormone replacement therapy or had undergone a hysterectomy. The groups did not differ in age, mean number of children, mean age of the youngest child, and mean age of all children,  $t_s \leq 1.13$ ,  $p \geq .27$ , or in how much they liked children, Mann-Whitney  $z = -0.35$ ,  $p = .73$ . The latter was rated on a 7-point scale (1 = *not at all*, 7 = *very much*). We also asked whether participants had contact with children several times per week, several times per month, or rarely. Most participants reported contact with children several times per week. No statistical group difference was found,  $\chi^2(2, N = 20) = 1.29$ ,  $p = .52$ .

#### Results

An ANOVA for the cuteness-discrimination data showed a significant effect of difficulty,  $F(3, 54) = 3.99$ ,  $p < .05$ , and no



**Fig. 2.** Mean accuracy ( $\pm 1 SE$ ) in the cuteness-discrimination task as a function of the difference in cuteness between the faces. Results are shown for (a) men and women of different age groups (Study 1), (b) age-matched pre- and postmenopausal women (Study 2), and (c) women taking and not taking oral contraceptives (Study 3). Chance performance on this task was .5.

Difficulty  $\times$  Group interaction,  $F(3, 54) = 0.50, p = .68$ . A significant group effect,  $F(1, 18) = 5.42, p < .05$ , indicated reduced ability to discriminate cuteness in the postmenopausal group (Fig. 2b).

An ANOVA showed that size discrimination declined with task difficulty,  $F(3, 312) = 85.40, p < .001$ , but neither the group effect nor the Difficulty  $\times$  Group interaction was significant,  $F_s \leq 0.84, p \geq .37$ . Overall performance was 86% ( $SD = 6.0\%$ ).

### STUDY 3

Results from Study 2 suggest the involvement of female reproductive hormones in modulating cuteness sensitivity, with es-

trogen and progesterone as the most likely candidate hormones. Therefore, we decided to address this possibility more directly by comparing cuteness sensitivity in young women taking and not taking oral contraceptives (combined pill containing estrogen and progesterone). Procedures used were identical to those in Study 1.

### Participants

We investigated 24 women, of whom 12 (mean age = 21.4 years,  $SD = 0.5$  years) were taking oral contraceptives (tested outside the 7-day pill-free interval) and 12 (mean age = 21.2 years,  $SD = 0.4$  years) were not (tested at day 12.7 of the cycle,  $SD = 7.6$ ).

There was no significant age difference between groups,  $t < 1$ . All participants reported not having children. Participants had

to rate how much they wished to have children of their own on a 7-point scale (1 = *not at all*, 7 = *very strong*). The groups did not differ on this measure, Mann-Whitney  $z = 0.59$ ,  $p = .63$ . As in Study 2, we also asked about the frequency of contact participants had with children; no group difference was found,  $\chi^2(2, N = 24) = 0.00$ ,  $p = 1$ .

## Results

The ANOVA for the cuteness-discrimination data showed a significant effect of difficulty,  $F(3, 66) = 17.58$ ,  $p < .001$ ; no Difficulty  $\times$  Group interaction,  $F(3, 66) = 0.47$ ,  $p = .70$ ; and a significant group effect,  $F(1, 22) = 5.10$ ,  $p < .05$ . Women taking oral contraceptives judged cuteness more accurately than women not taking oral contraceptives (Fig. 2c).

An ANOVA showed that size discrimination declined with task difficulty,  $F(4, 88) = 21.58$ ,  $p < .001$ , but the group effect and the Difficulty  $\times$  Group interaction were nonsignificant,  $F_s \leq 0.35$ ,  $p_s \geq .56$ . Overall performance was 84% ( $SD = 5.1\%$ ).

## DISCUSSION

Study 1 showed that women aged 19 to 26 were more sensitive to small variations of cuteness than same-aged men. Women aged 19 to 26 and 45 to 51 did not differ in performance, whereas sensitivity to cuteness in women aged 53 to 60 was at the level of the young men and a group of older men aged 53 to 60. Study 2 found differences in cuteness discrimination between age-matched premenopausal and postmenopausal women, and Study 3 revealed increased cuteness sensitivity in women with artificially raised levels of progesterone and estrogen from the contraceptive pill.

What might cause these differences? Study 1 could suggest a cohort effect as a possible explanation for the difference between women aged 45 to 51 and 53 to 60, or alternatively, age-related role transitions that might impact on experience with infant faces and hence affect related perceptual skills. For these reasons, the groups who participated in Studies 2 and 3 were matched for age and for a range of variables related to experience with and fondness for children. Despite this, differences in cuteness discrimination were found, ruling out cohort and social role effects as likely causes.

We now turn to more biological explanations. The average age of menopause in Britain (51 years) is near to the group separation criterion of 52 years used in Study 1. Findings from Study 1 therefore suggested that reproductive hormones could be important for processing cuteness. This idea would also explain the difference between women aged 19 to 26 and men (whether aged 19–26 or 53–60). The possibility of a hormonal link to cuteness discrimination was followed up in Study 2, where we found that premenopausal women discriminated cuteness significantly better than same-aged and similarly experienced postmenopausal women. Levels of progesterone and estrogen both drop

sharply after menopause and are candidate hormones that may mediate the group differences. We explored the potential role of these hormones in Study 3 by comparing cuteness sensitivity in young women who were and who were not taking the combined oral contraceptive pill. Because women taking this particular form of oral contraception have artificially raised levels of estrogen and progesterone, we expected them to discriminate infant cuteness better than women not taking the pill. Our results fit this prediction.

At the moment, we do not know how hormones (directly or indirectly) influence judgment of cuteness. However, basic visuo-perceptual processing did not differ between groups, making it more likely that hormones impact on postperceptual processes.

Given that the concept of cuteness not only encompasses the processing of specific physical properties of a baby face, but also involves an affectionate, “heart warming” (Lorenz, 1943) orientation toward the baby, it may be that hormones alter the emotional response to a cute baby face. Neural substrates involved in reward processing and maternal behavior are possible candidate structures linked to these processes (Panksepp, 1998).

We also have to consider the potential functional value of being able to discriminate small variations in cuteness. Although caring for a baby involves an investment of time and resources, it is rewarding to be with cute babies. They are rated as more friendly, cheerful, and likeable (Karraker & Stern, 1990), and a female’s willingness to adopt a baby (Volk & Quinsey, 2002) and a mother’s sensitivity toward the baby (Langlois et al., 1995) depend on its cuteness. Heightened cuteness sensitivity may therefore help the mother to focus on the newborn and modulate attachment.

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