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Are average and symmetric faces attractive to infants? Discrimination and looking preferences

Gillian Rhodes, Keren Geddes, Linda Jeffery, Suzanne Dziurawiec§, Alison Clark
Department of Psychology, University of Western Australia, Nedlands, Perth, WA 6907, Australia; e-mail: gill@psy.uwa.edu.au; § Department of Psychology, Murdoch University, Murdoch, WA 6150, Australia
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Abstract. Young infants prefer to look at faces that adults find attractive, suggesting a biological basis for some face preferences. However, the basis for infant preferences is not known. Adults find average and symmetric faces attractive. We examined whether 5 – 8-month-old infants discriminate between different levels of averageness and symmetry in faces, and whether they prefer to look at faces with higher levels of these traits. Each infant saw 24 pairs of female faces. Each pair consisted of two versions of the same face differing either in averageness (12 pairs) or symmetry (12 pairs). Data from the mothers confirmed that adults preferred the more average and more symmetric versions in each pair. The infants were sensitive to differences in both averageness and symmetry, but showed no looking preference for the more average or more symmetric versions. On the contrary, longest looks were significantly longer for the less average versions, and both longest looks and first looks were marginally longer for the less symmetric versions. Mean looking times were also longer for the less average and less symmetric versions, but those differences were not significant. We suggest that the infant looking behaviour may reflect a novelty preference rather than an aesthetic preference.

1 Introduction

Preferences for attractive faces emerge early in development (Geldart et al 1999; Langlois et al 1987, 1991; Rubenstein et al 2002; Samuels et al 1994; Samuels and Ewy 1985; Slater et al 1998, 2000). By two months of age, infants look longer at faces that adults judge to be attractive than at unattractive faces (Langlois et al 1987). Early emergence of preferences strongly suggests that not all preferences are learned from the surrounding culture. Instead, some may be part of our biological heritage. Converging evidence for this view comes from high levels of cross-cultural agreement among adults on facial attractiveness (for a recent meta-analysis see Langlois et al 2000).

Although infants prefer to look at attractive faces, we do not know exactly on which aspects of these faces they base their preferences. Attractive facial traits for adults include averageness (similarity to an average or typical facial configuration), symmetry, pleasant expressions, and certain extremes, such as feminised features and neotonous or youthful features (for recent reviews see Etcoff 1999; Rhodes and Zebrowitz 2002; Zebrowitz 1997). Any of these could be biologically based preferences displayed by infants.

Infants appear to prefer neotonous (babyfaced) features (Geldart et al 1999; Kramer et al 1995; McCall and Kennedy 1980). 4-month-olds looked longer at a schematic face depicting a 6-month-old than one depicting an adult, when the face appeared as a new stimulus in a sequence of faces, although not during an initial familiarisation period (McCall and Kennedy 1980). 4 – 5-month-olds also looked marginally longer at babyfaced than at maturefaced adults (equated on attractiveness) (Kramer et al 1995). Finally, 5-month-olds looked longer at adult faces with neotonous, large eyes than at the same faces with smaller eyes (Geldart et al 1999). Therefore, a preference for neotonous traits could potentially contribute to early preferences for attractive faces. A preference for feminised traits might also contribute, given a preference for neotonous

traits and the fact that female faces are more neotonous than male faces (Zebrowitz 1997), but we know of no studies that have directly examined infant preferences for feminised adult faces.

Infants also appear to prefer positive expressions (D'Entremont and Muir 1997; Kuchuk et al 1986). Kuchuk et al (1986) showed that 3-month-olds preferred a smiling to a neutral face, and D'Entremont and Muir (1997) showed that 5-month-olds smiled more when their mothers posed smiles than sad or neutral expressions. Therefore, a preference for smiling faces could contribute to early preferences for attractive faces, although it cannot account for preferences when all the faces have neutral expressions (eg Langlois et al 1987, 1991).

Average and symmetric faces are attractive to adults in both Western and non-Western cultures (Langlois and Roggman 1990; Mealey et al 1999; Perrett et al 1999; Rhodes et al 1998, 1999b, 2001, 2002).[1] Such cross-cultural agreement suggests that these may be biologically based preferences, and such preferences could emerge early in development.[2] Little is known, however, about whether infants find averageness and/or symmetry attractive in faces.

We know of only one published study on infant preferences for average faces. Rubenstein et al (1999) reported that 6-month-olds looked significantly longer at an averaged composite of 32 female faces than at an unattractive female face. This result suggests that, like adults, infants may find average faces attractive, but caution is warranted because only 4 face pairs were used and the looking preference was found with only 3 of the 4 unattractive comparison faces.

Infant preferences for symmetric faces were examined by Samuels et al (1994), who showed normal faces paired with symmetric versions of those faces to 4 – 5-month-old infants, but found no preference for symmetric faces. Unfortunately, however, their symmetric faces were made by reflecting each half of the face about the vertical midline, which produces chimeras that can contain structural abnormalities (eg abnormal height : width ratios, abnormally wide or narrow midline features, abnormally spaced eyes) and are unattractive to adults (Kowner 1996; Langlois et al 1994; Rhodes et al 1999a). Given that 4-month-olds can discriminate vertical symmetry from other forms of symmetry and from asymmetric patterns (Bornstein et al 1981; Bornstein and Krinsky 1985; Fisher et al 1981; Humphrey and Humphrey 1989), they may well be able to discriminate symmetric from asymmetric faces, and may prefer symmetric ones, when those images do not contain structural abnormalities (see below and Rhodes et al 1999a).

The aims of the present study were to determine, first, whether 5 – 8-month-old infants can discriminate faces with different levels of averageness and symmetry, and, second, whether they prefer more average and more symmetric versions of faces. We also sought to confirm that adults would prefer the more average and symmetric faces, by asking the mothers to indicate which versions they found more attractive. We manipulated the averageness of individual faces using a morphing technique, as in previous studies with adults (Rhodes et al 1999b). This technique alters averageness of the spatial configuration or shape, while keeping skin texture constant. Symmetry was manipulated by blending each face with its mirror image, which produces natural-looking symmetric faces that are attractive to adults (eg Perrett et al 1999; Rhodes et al 1998, 1999b).[3] Both techniques are described below.

[1] Averageness and symmetry are usually correlated in faces, but both contribute independently to adult perceptions of attractiveness (Rhodes et al 1999b).

[2] Of course, not all biologically based preferences need emerge early in development. Some, for example, could emerge at puberty, triggered by high levels of sex hormones.

[3] The symmetric blends are more attractive than the original faces even when differences in skin texture are controlled.

2 Method

2.1 *Participants*

Twenty-seven full-term, Caucasian infants with a mean age of 6 months and 28 days (from 5 months 28 days to 8 months 13 days) were included in the analyses (eighteen males, nine females). No current health problems were reported, except for three babies, one with excema, one with allergies, and one with kidney problems. Eight additional infants were tested but had to be eliminated from the sample owing to fussiness ($N = 5$) or technical problems with the recordings ($N = 3$). Twenty-eight mothers also participated. The remaining mothers were either not tested or their data were lost because of computer or experimenter error. Mothers and babies were recruited from participants in an earlier study on antenatal expectations, postnatal outcomes, and the transition to parenthood, or from an advertisement in a local Perth newspaper.

2.2 *Stimuli*

The stimuli were taken from Rhodes et al (1999b). Black-and-white, full-face, digitised images of 24 young adult female faces with neutral expressions were used to create a low-average, high-average, low-symmetric, and perfectly symmetric version of each face, with the use of Gryphon's Morph™. Full details can be found in Rhodes et al (1999b), but, briefly, a set of 120 landmark points was found on each face. An averaged composite was created by warping (distorting) all the faces onto a configuration with the average landmark locations, and then averaging (across faces) grey-levels in corresponding regions. A high-average version of each face was created by moving all landmark points on that face 50% closer to their corresponding landmark points on the averaged composite, and remapping grey-levels from the face into this new configuration. A low-average version was created by moving the landmark points 50% further away from their corresponding points on the averaged composite. This procedure alters the spatial configuration of the face, without changing the skin texture.

Perfectly symmetric versions were created by blending each face with its mirror image. Blemishes were removed prior to blending, with Photoshop's cloning tool. Briefly, a symmetric configuration was created by averaging the locations of corresponding landmark points on the two sides of the face, then warping both the original face and its mirror image onto this new configuration, and averaging the grey-level values in corresponding pixel locations across the two images. Low-symmetry versions were created by exaggerating all the differences between the original face and the perfectly symmetric version by 50%. This was done by moving each landmark point 50% further away from its corresponding point on the symmetric version, and then warping the face into this new asymmetric configuration.

All faces were presented in oval masks that hid the outer hairline, but not the inner hairline or face outline. A full set of images for one face is shown in figure 1. Each image measured approximately 12 cm × 15 cm when displayed on the computer monitor. Pairs of faces were displayed, one on the left and the other on the right side of the screen, with their inner edges separated by 4.5 cm.

2.3 *Apparatus*

The images were presented on a Macintosh computer, with a large monitor (30 cm × 40.5 cm) viewed through a rectangular aperture 27 cm wide × 21 cm high. A curtain in plain fabric surrounded the infant and computer screen. Superlab was used to control stimulus presentation. One video camera recorded each baby's looking behaviour and another recorded what the baby saw on the computer screen. A timer was displayed on the first video image to facilitate scoring of looking times to each image. A small inset of what the baby actually saw (dubbed from the second video) was also shown in the top left corner of the screen, but was partially covered so that the scorer could see when each trial began but not which faces were shown.

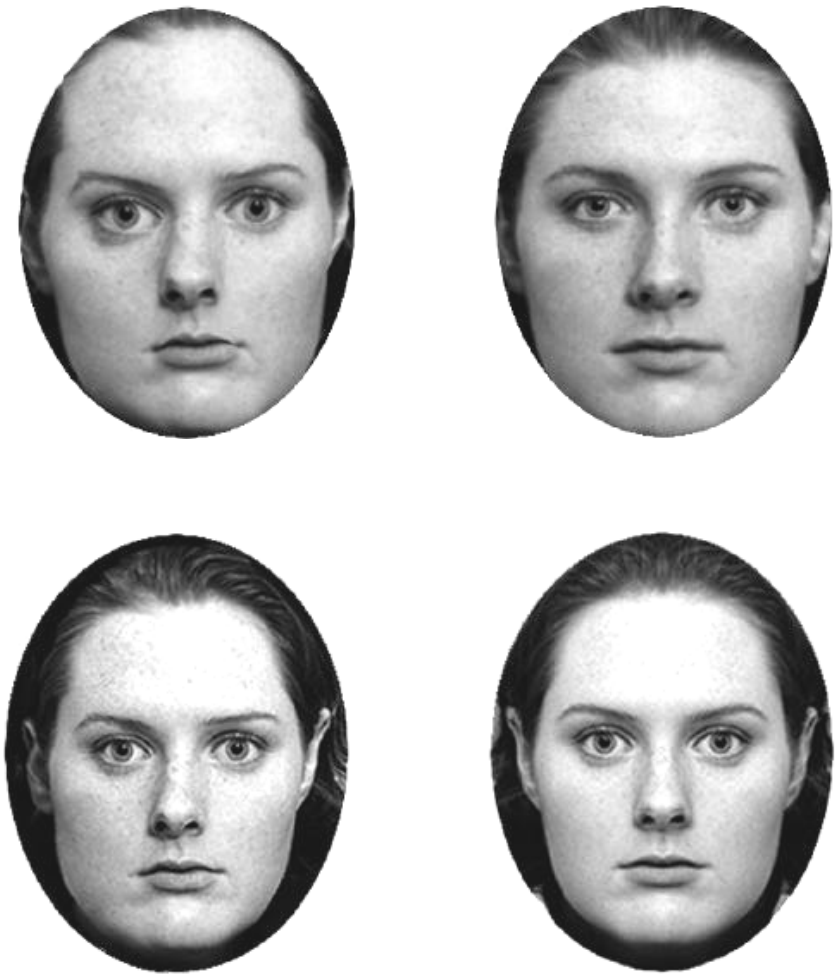

Figure 1. Top row: low-average and high-average versions of one face. Bottom row: low-symmetry and perfect-symmetry versions of the same face.

2.4 *Procedure*

Infants were tested in a preferential-looking procedure. Each baby saw 24 pairs of images. Each pair showed 2 different versions of the same face, side by side (24 different faces seen). 12 pairs showed a low-average and high-average version. The low-average version was on the left for half the faces and on the right for half the faces. The other 12 pairs displayed a low-symmetry and a perfect-symmetry version of 12 different faces (left–right position reversed for half the pairs). The assignment of faces to averageness or symmetry condition, and the left–right position of the images was counterbalanced across subjects. The 24 pairs were presented in a different random order to each baby.

At the beginning of each trial, an engaging toy, animal, or cartoon character appeared in the centre of the screen, and, if necessary, a hand bell was shaken behind the screen to attract the baby's attention to the toy. When the baby fixated the centre of the screen, the toy disappeared and a pair of faces was presented for 10 s, a typical trial duration in infant face preference studies (Langlois et al 1987, 1991; Rubenstein et al 1999; Samuels et al 1994; Samuels and Ewy 1985). During testing, the baby was held on the mother's lap about 70 cm from the monitor. The mother was asked to look down at the baby, not at the computer screen, and was told that she would later

be shown all the pictures shown to the baby. The experimenter watched the mother during testing, to ensure compliance.

After the baby had viewed all 24 pairs of faces, these were presented again to the mother, who was asked to indicate which member of each pair was more attractive.

3 Results

3.1 *Infant looking behaviour*

For each baby, we measured total looking time, length of longest look, and length of first look for each of the two faces shown on each trial. We then averaged across trials to get the mean total looking time, mean length of longest look, and mean length of first look for low-average, high-average, low-symmetry, and perfect-symmetry faces (table 1). Inter-rater reliability was calculated for a random selection of five babies. Reliability for these measures was very good, averaging (across babies) 0.89, 0.92, and 0.89 ($N = 24$) for total looking time, length of longest look, and length of first look, respectively. We also examined whether any babies had a looking side bias, by calculating the proportion of time spent looking at the left face (mean = 0.29, SD = 0.07) and the right face (mean = 0.29, SD = 0.08) on each trial. There were no substantial side biases.

Table 1. Mean looking time, mean length of longest look, and mean length of first look for low-average, high-average, low-symmetry, and perfect-symmetry faces. Standard errors in parentheses.

	Face			
	low-average	high-average	low-symmetry	perfect-symmetry
Mean looking time/s	2.94 (0.11)	2.81 (0.13)	3.03 (0.13)	2.89 (0.11)
Mean length of longest look/s	1.64 (0.08)	1.50 (0.08)	1.76 (0.10)	1.61 (0.09)
Mean length of first look/s	1.19 (0.08)	1.24 (0.08)	1.38 (0.11)	1.24 (0.09)

Mean looking times and mean length of first look did not differ for low-average and high-average faces (both ts < 1, ns), but the longest look was significantly longer for low-average than for high-average faces ($t_{26} = -2.22$, $p < 0.04$, repeated-measures t-tests). These results suggest that infants can discriminate different levels of averageness in faces, but that, contrary to our expectations, they show a weak looking preference for low-average faces.

Mean looking times did not differ for low-symmetry and perfect-symmetry faces ($t_{26} = 1.14$, ns). However, both first looks and longest looks were marginally longer for low-symmetry than for perfect-symmetry faces ($t_{26} = -2.03$, $p < 0.06$; $t_{26} = -1.88$, $p < 0.08$) indicating a weak preference for asymmetric faces.

3.2 *Mothers' preferences*

As expected, the mothers strongly preferred more average and more symmetric faces. High-average versions were chosen as more attractive than low-average versions on 94% of averageness trials (SD = 5%, $N = 28$) and perfect-symmetry versions were chosen as more attractive than low-symmetry versions on 91% of symmetry trials (SD = 14%, $N = 28$). Both percentages were significantly higher than chance performance of 50% (ts > 15.16, ps < 0.0001).

4 Discussion

We found that 5–8-month-old infants could discriminate between different levels of averageness and symmetry in faces. These effects were small and did not reach statistical significance in all the measures, although the direction of difference was generally consistent across measures (see table 1). Nevertheless, they provide preliminary evidence

that infants are sensitive to averageness and asymmetry, traits which make faces attractive to adults.[4] However, they did not show a looking preference for high-average and symmetric versions. Longest books were significantly longer for low-average than for high-average versions, and both longest looks and first looks were marginally longer for low-symmetry than for perfect-symmetry versions. These unexpected results cannot be attributed to a procedure that fails to elicit preferential looking or to inadequate power, because averageness and symmetry did influence looking behaviour, just not in the expected way. Instead, they suggest that previous looking preferences for attractive faces reflect preferences for attractive traits other than averageness or symmetry, such as neotonous features.

There is, however, another possible interpretation of our results. Aesthetic preferences are not the only determinants of infant looking times, and infants show strong looking preferences for unusual or unexpected stimuli (Rochat and Hespos 1996; Spelke 1985). The low-average and low-symmetry faces were created by exaggerating differences from average and symmetric configurations, respectively, and are expected to be unusual. This was confirmed in a follow-up study, in which twenty-five adults (twenty-two females, three males), indicated which face in each pair looked more odd. The mean proportion of face pairs for which the low-average and low-symmetry versions were selected was 0.62 and 0.60, respectively; both significantly higher than 0.50 (chance) (ts > 6.33, ps < 0.0001). It is possible, therefore, than an interest in unusual faces masked infant aesthetic preferences in our study. Future studies, in which average and symmetric versions are paired with normal faces rather than the odd-looking low-average and low-symmetry versions used here, may be better able to detect any infant aesthetic preferences for average and symmetric faces. By showing that infants can discriminate different levels of averageness and symmetry in faces—a necessary condition for having an aesthetic preference—the present study certainly suggests that such further studies are warranted.

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[4] It remains to be seen whether infants are sensitive to each trait independent of the other, given that averageness and symmetry are correlated in faces (Rhodes et al 1999a).

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