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Short communication

Human sex differences in social and non-social looking preferences, at 12 months of age

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Abstract

Twelve-month-old infants ($n = 60$) were presented with a video of cars moving, or a face moving, in a looking preference experimental design. This tested the prediction from our earlier work that attention in males is drawn more to mechanical motion, whilst attention in females is drawn more to biological motion. Results supported this prediction. These findings are discussed in relation to social and biological determinism.

Sociality seems to be sexually dimorphic in humans. The evidence for this comes from several sources: (1) At birth, boys look longer than girls at a mobile, whilst girls look longer than boys at a face (Connellan, Baron-Cohen, Wheelwright, Ba'tki, & Ahluwalia, 2001). (2) At age 12 and 24 months, girls make more eye contact with their mother than boys do, and this amount of eye contact is inversely correlated with level of prenatal testosterone (Lutchmaya, Baron-Cohen, & Raggett, 2002). (3) At age 4, girls pass tests of 'theory of mind' earlier than boys do (Happe, 1995). (4) At ages 7–12, boys lag behind girls by as much as 2 years in terms of the development of social sensitivity to 'faux pas' (Baron-Cohen, O'Riordan, Jones, Stone, & Plaisted, 1999a). (5) In adulthood, women score higher on emotion recognition tasks (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Hall, 1978; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979). (6) Both girls and women have different styles of social interaction, conversation, and degree of intimacy, compared to boys and men (Geary, 1998; Maccoby, 1966).

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Whilst many of these sex differences in sociality may to some extent be the result of socialisation, the first two of the results above (differences at birth, and the correlation with prenatal testosterone) strongly suggest biological (including genetic) factors play a role. The idea that biology may play some part in sex differences in sociality gathers further support from the findings that medical conditions such as autism and Turner's Syndrome affect sociality (Baron-Cohen, Ring, et al., 1999; Skuse et al., 1997).

The present paper reports an experiment that tested if there are sex differences in looking preference for social or non-social stimuli at 12 months of age. Looking preference is widely used in studies of infant development (Fantz, 1963). The stimuli employed were social and non-social video clips (two of each). The social video clips showed human faces. The first clip was of a man and a woman talking in a social context. The second clip consisted of a head and shoulders view of a man reading out loud from a child's storybook. The non-social video clips showed mechanical objects. The first clip was footage from a motor racing event, consisting of cars travelling at high speed. The second clip was of a single stationary vehicle with its windscreen wipers switched on. So within each category (social and non-social) there was one clip containing a single target stimulus and one clip containing a number of target stimuli. The videos had no sound, to avoid introducing this as a potentially confounding variable. Parents were instructed not to direct their child's attention during the testing session.

Subjects were 60, 12-month-old infants (33 boys and 27 girls). None of the subjects had younger siblings. The age of the infants on the day of testing ranged from 357 to 431 days ($M = 387.43$ days, $SD = 18.33$). There was no difference in age, or on any of the background variables listed in Table 1, between the sexes.

Infants were shown the four silent video clips in sequence, which were each 2 min in length. The video clips were presented in a random order, alternating between social and non-social stimuli. The parents were asked not to guide the child's attention, but to react to the child as they normally would if approached. The child was free to move around the testing room, and the parent was asked to encourage them to stay in the field of view of the videocamera. The layout of the laboratory is shown in Appendix A.

The amount of time that the subject spent looking at each video clip was measured using a stopwatch. Looking preference was expressed as the looking preference ratio (LPR)—the ratio of time spent looking at the social stimuli to time spent looking at the non-social stimuli. The greater the value of the ratio, the stronger the preference for the social stimuli. LPR values

Table 1
Descriptive data for boys and girls together

	Both sexes ($n = 60$)			
	n[a]	Range	M	SD
Number of siblings	57	0–3	1.1	1.0
Maternal age at child's birth	60	24.0–43.0	35.5	4.5
Paternal age at child's birth	52	28.0–53.0	37.8	5.7
Level of education attained by parents	51	4.0–10.0	6.6	1.6

[a] Refers to the number of subjects for whom the data was available.

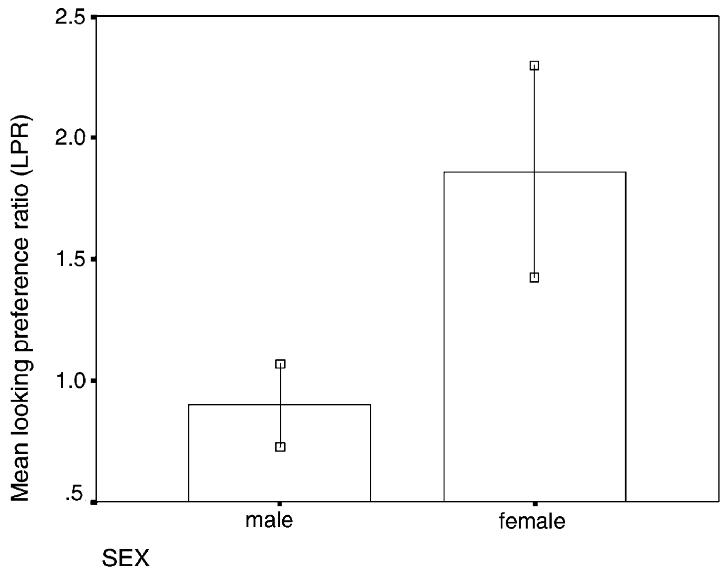

Fig. 1. The distribution of LPR scores for each sex.

can be thought of as lying on a continuum, from strong social looking preference to strong non-social looking preference. A value of 1 means no preference (i.e., equal looking times for both types of stimulus) and lies in the middle of the continuum.

Results indicated that girls had a significantly higher LPR than boys. The mean LPR for girls was greater than 1 (indicating a mean social preference) and the mean LPR for boys was less than 1 (indicating a mean non-social preference). Of the independent variables listed in Table 1, sex was the best predictor of LPR. The mean LPR for girls ($M_{\text{girls}} = 1.86$, SD $= 2.27$) was significantly higher than that for boys ($M_{\text{boys}} = 0.89$, SD $= 0.1$) ($t = -3.10$, df $= 58$, $p < .001$).[1] Looking times were re-measured for 10% of subjects in order to generate a test–retest reliability statistic. The first and second sets of recorded looking times were highly significantly correlated ($r = .99$, $p < .001$). A Mann–Witney U-test correlating LPR and sex revealed $U = 248.5$, $p = .003$. LPR for each sex separately, and showing the overlap between the sexes, is shown in Figs. 1 and 2.

Seventy-nine percent of boys and 37% of girls had LPR scores below 0.9 (non-social preference), and 18% of boys and 56% of girls had LPR scores above 1.1 (social preference). Three percent of boys and 7% of girls had LPR scores between 0.9 and 1.1 (neutral preference). This neutral category was considered here because, if the value of LPR was close to 1 (i.e., between 0.9 and 1.1) the subject could not be said to show a strong preference in either direction. Although most of the boys showed a non-social preference, only about half of the girls showed a social preference. This suggests that the boys as a group showed a strong non-social preference, whilst the girls as a group did not show such a strong preference in either direction.

The following factors were then considered: number of siblings; maternal age; paternal age; sex; and parental education level. A backward stepwise linear regression method (entry criteria,

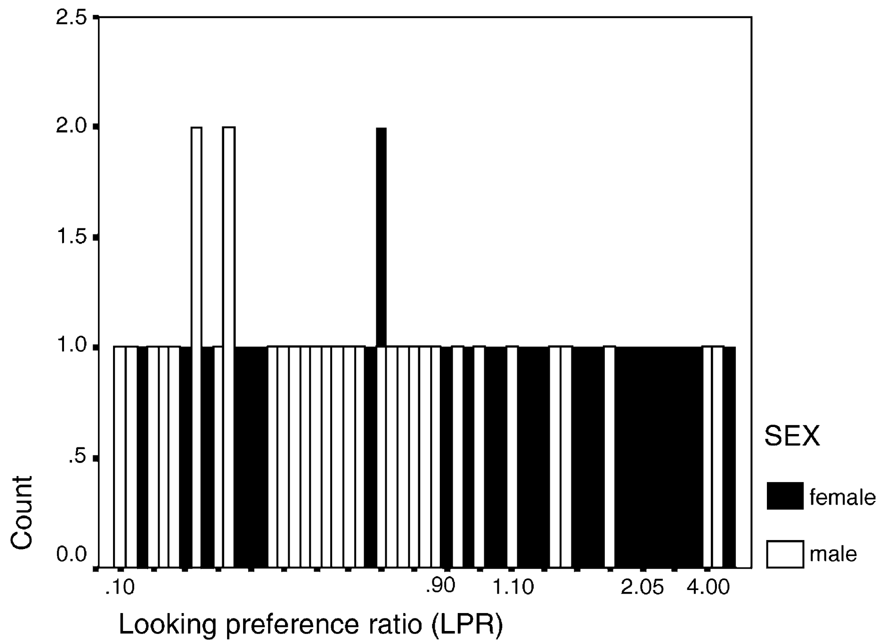

Fig. 2. Graph to show the distribution of LPR scores for each sex.

$p = .05$, removal criteria, $p = .10$) was used to find the best fit for the dependence of LPR. All factors were discarded from the model apart from sex. No unusual data points were identified by regression diagnostic techniques. The residuals were approximately normally distributed and there was no systematic relationship between the residuals and predicted values. The findings

Table 2
Correlation matrix showing relationships between the dependent variable (LPR) and the independent variables (except for sex)

	Spearman's ρ	Looking preference ratio (LPR)
Number of siblings	Correlation coefficient	.06
	Significance (2-tailed)	.63
	n	57
Maternal age	Correlation coefficient	.13
	Significance (2-tailed)	.33
	n	60
Paternal age	Correlation coefficient	.13
	Significance (2-tailed)	.36
	n	52
Parental education level	Correlation coefficient	.11
	Significant (2-tailed)	.46
	n	51

Table 3
Regression model

Model	*B*	SE	Significance
Constant	−1.10	.33	.001
Sex	.67	.21	.001

Dependent variable: ln(LPR); $r^2 = .146$; $F = 9.75$, $p < .001$; power is equal to approximately 0.82.

are not explained by boys and girls spending different amounts of time looking at the television (regardless of stimulus) as there was no sex difference in total looking time (Mann–Whitney $U = 416.50$, $p = .67$).

In summary, this model revealed that sex was a significant predictor of LPR at 12 months of age (such that girls scored higher than boys). Other social factors were not found to have a significant effect on LPR over and above the effect of sex (see Tables 2 and 3).

Allocation of subjects to groups according to whether they showed a social, non-social or neutral looking preference suggested that boys as a group showed a strong preference for the non-social stimuli, whilst the girls showed a less strong preference for either type of stimulus. This observation is consistent with findings that boys develop a preference for sex typical toys sooner than girls do (Servin, Bohlin, & Berlin, 1999).

If the observed sex difference in looking preference is due to social influences such as parenting, these must operate very early. An alternative explanation is that these results in part reflect biological differences in neural development, influencing how attention is deployed by the male and female brain. The present results replicate the pattern seen in our experiment of one-day old neonates (Connellan et al., 2001), in whom socialisation clearly plays no significant role. If boys attend less to faces and more to systems, and if girls show the opposite pattern, partly for biological reasons, this may have some relevance for understanding the neurodevelopmental, genetic condition of autism, where the male pattern of looking preference is seen to an extreme degree (Baron-Cohen, 1999; Swettenham et al., 1998).

Note

1. The LPR data was transformed using a natural logarithm before the *t*-test was carried out.

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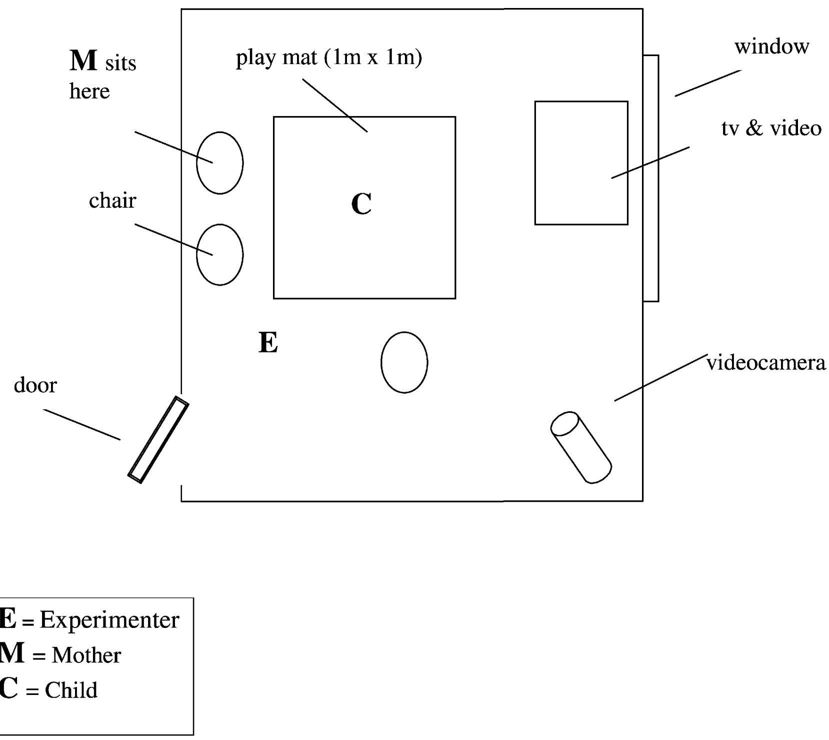
Appendix A. Layout of testing room used for infants at 12 months of age



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