INFANCY, *1*(2), 265–274

Newborn Infants' Preference for Attractive Faces: The Role of Internal and External Facial Features

Alan Slater
School of Psychology
University of Exeter

Gavin Bremner
Department of Psychology
University of Lancaster

Scott P. Johnson
Department of Psychology
Cornell University

Penny Sherwood, Rachel Hayes, and Elizabeth Brown
School of Psychology
University of Exeter

Several previous experiments have found that newborn and young infants will spend more time looking at attractive faces when these are shown paired with faces judged by adults to be unattractive. Two experimental conditions are described with the aim of finding whether the "attractiveness effect" results from attention to internal or external facial features, or both. Pairs of attractive and less attractive faces (as judged by adults) were shown to newborn infants (mean age 2 days, 9 hours), where each pair had either identical internal features (and different external features) or identical external features (and different internal features). In the latter, but not the former, condi-

---

Supplementary materials to this article are available on the World Wide Web at http://www.infancyarchives.com.

Requests for reprints should be sent to Alan Slater, School of Psychology, Washington Singer Laboratories, University of Exeter, Exeter, EX4 4QG, United Kingdom.

tion the infants looked longer at the attractive faces. These findings are clear evidence that newborn infants use information about internal facial features in making preferences based on attractiveness. It is suggested that when newborn (and older) infants are presented with facial stimuli, whether dynamic or static, they are able to attend both to internal and external facial features.

Newborn infants have been found to learn about individual faces very rapidly. Several researchers have reported that the mother's face is discriminated from (and preferred to) female strangers' faces within hours from birth (Bushnell, Sai, & Mullin, 1989; Field, Cohen, Garcia, & Greenberg, 1984; Pascalis, de Schönen, Morton, Dereulle, & Fabre-Grenet, 1995; Walton, Bower, & Bower, 1992). More recently, Walton, Armstrong, and Bower (1998) presented findings suggesting that newborn infants can recognize a face after having seen it for only .8 sec. These findings suggest that learning about faces, and the formation of a representation of a face, can be very rapid in the newborn period.

Other lines of evidence suggest that the newborn infant can come into the world with some innately specified representation of faces. For example, it has been demonstrated on many occasions that newborn (and older) infants will imitate a variety of facial gestures that they see an adult modeling (e.g., Meltzoff & Moore, 1977, 1984; Riessland, 1988). Meltzoff (1995) suggested that newborns "begin life with some grasp of people" (p. 43) and that their ability to recognize when their facial behavior is being copied implies that "there is a representation of their own bodies" (p. 53).

A further line of evidence relating to infants' facial representations is infants' preference for attractive faces. Infants 2 months of age and older will spend more time looking at attractive faces when these are shown paired with less attractive faces (Langlois et al., 1987; Samuels & Ewy, 1985). The attractiveness effect was recently reported with newborn infants, who averaged under 3 days from birth at the time of testing (Slater et al., 1998). The usual interpretation of the attractiveness effect is in terms of prototype formation. When several faces of the same sex, ethnicity, and age are averaged, usually by computer, the consistent finding is that the averaged faces are judged by adults to be attractive (e.g., Young & Bruce, 1998). The interpretation of the attractiveness effect in infants that results from this finding is that attractive faces are seen as more "facelike" because they more closely match the prototype that infants have formed from their experience of seeing faces. Thus, "infants might prefer attractive or prototypical faces because prototypes are easier to classify as a face" (Langlois & Roggman, 1990, p. 119).

Among the unresolved questions concerning infants' attention to faces is what aspects of the face infants attend to in making the discriminations described previously? Several lines of evidence suggest that this issue cannot easily be resolved. In the studies investigating infants' imitation of facial gestures the stimuli presented to infants are dynamic. When newborn infants are presented with faces, and other stimuli, when the internal features are dynamic, it is invariably the case that

they will attend to the internal features. However, it has often been found that when presented with static stimuli newborn infants attend only, or primarily, to the external features of the stimuli, a phenomenon called the externality effect (e.g., Bushnell, 1979; Girton, 1979). Pascalis et al. (1995) presented newborn infants (4-day-olds) with their mother's and a female stranger's static, three-dimensional face, and replicated the effect reported by others; that is, the infants preferred to look at their mother's face. However, in a condition in which the mother and stranger were wearing head scarves, the preference disappeared. This led Pascalis et al. to conclude that "what they have learned has to do with the outer features of the face rather than the inner features" (p. 84). This conclusion seems difficult to reconcile with the finding that newborn infants prefer attractive faces, when these are presented statically: Presumably, much of the information that determines attractiveness lies in the internal, rather than external features of the face.

There would seem to be agreement that when newborn infants are shown dynamic faces they will attend to the internal features of the face. However, when the face stimuli are static, there is some uncertainty as to whether they will attend to both internal and external features, or whether attention is directed primarily to the external features of the face. The experiment described here was designed to establish whether newborn infants' preference for attractive faces is based on internal or external features, or both. Pairs of faces differing in judged attractiveness were shown to infants in conditions in which either the external or the internal features of the faces were identical. The assumption underlying the experiment was that if infants attended more to one aspect of the faces (internal or external features) in making their preferences then this should be apparent from preferential looking scores.

METHOD

Participants

Twenty-nine newborn infants, 18 girls and 11 boys, between the ages of 7 and 135 hr (M = 57 hr, SD = 28.5) were the participants, and throughout testing they remained in the behavioral state of alert inactivity (Ashton, 1973). Fourteen additional infants began the experiment but did not complete testing because of crying and fussing, and their data were not used.

Stimuli and Apparatus

The stimuli were 24 photographs of female faces, which were derived from an original set of 12 photographs of White female faces: Half of the original set were judged by adults to be attractive and half were judged to be unattractive. These

stimuli were used previously by Slater et al. (1998). The 12 faces were put into the six face pairs used by Slater et al. that were matched for facial expression: One pair were smiling with teeth showing, the other faces all displayed a neutral expression. Four of the pairs were black and white, two were color. All photographs were full face and showed the face from the crown of the head to the jaw.

To manipulate the internal and external features of the faces, the photographs were digitally scanned into a personal computer using a videocamera and Corel Photo-Paint software. They were then scaled and the contrast manipulated to ensure that skin color was identical for each member of a pair, and that each had similar style, color, and amount of hair. For each member of a pair the external facial features (i.e., the hair, ears [where visible], jawline, and cheekline) and the internal features (i.e., eyebrows, eyes, nose, mouth, and other internal markings) were switched to produce two additional stimuli: the attractive exterior with the unattractive interior, and the unattractive exterior with the attractive interior. Thus, for each of the six original stimulus pairs there were four facial stimuli: (a) the original attractive stimulus (with attractive exterior and attractive interior; AA); (b) the attractive exterior with the unattractive interior (AU); (c) the unattractive exterior with the attractive interior (UA); and (d) the original unattractive stimulus with unattractive exterior and unattractive interior (UU). To illustrate this procedure, Figure 1 shows the four stimuli (AA, AU, UA, UU) from one of the stimulus pairs.

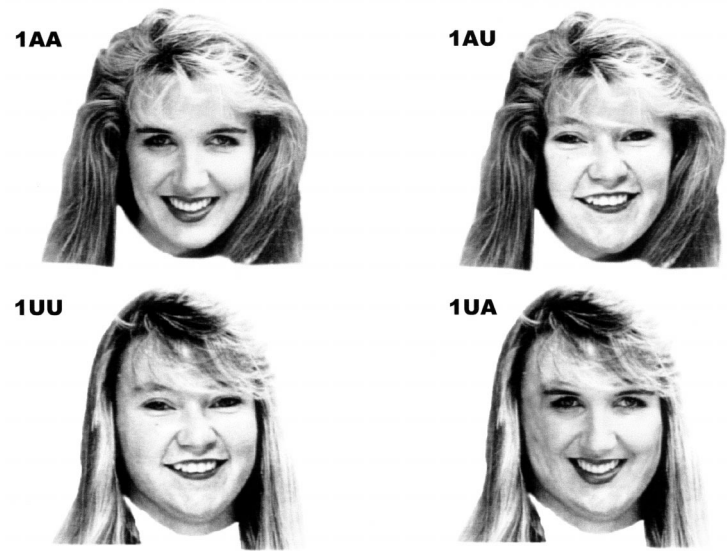

FIGURE 1 The four stimuli from facial pair one. The adult ratings of these stimuli (on a 7-point scale, with 7 being very attractive) are AA, 4.9; AU, 3.1; UA, 2.6; UU, 3.4.

Each facial stimulus was 19 cm (+/– 0.5 cm) in height and 14 cm (+/– 0.5 cm) in width, subtending visual angles of 32° (height) and 25° (width) at the viewing distance of 30 cm. These stimuli were mounted on cards and presented against a matte-white screen that measured 61 × 45 cm, and the sides of the viewing chamber were hung with matte-white curtain material. The stimuli were illuminated by two strip lights placed behind and to both sides of the infant. On each paired stimulus trial (discussed later) the two photographs were equidistant from center and separated by 7.5 cm. After the experiment with newborn infants had been completed 10 adult raters judged all 24 faces on a 7-point scale of attractiveness ranging from 7 (*very attractive*) to 1 (*very unattractive*).

Procedure

Infants were brought to the experimental room in the maternity ward of the hospital and seated upright on one experimenter's knee with the infants' eyes 30 cm (+/– 2 cm) from the center of the stimulus screen. Each infant was tested in one of two conditions: internal same–external different and external same–internal different.

In the internal same–external different condition the 24 photographs were arranged into 12 pairs, in each of which the internal facial features were the same, and the external features different. These pairs were the six photographs of Stimuli AA paired with Stimuli UA, and the six photographs of Stimuli AU paired with Stimuli UU. Thus, for each pair the internal features of the face were identical, and for half of the pairings the attractive interior was present, and for half the unattractive interior was shown. From the adult ratings of the facial pairs (see earlier), the attractive faces of each pair had a mean rating of 4.12 (SD = 1.66, range = 1.7–6.0), and the unattractive faces had a mean rating of 2.43 (SD = 0.81, range = 1.5–4.2). The difference in adults' attractiveness ratings for the attractive and unattractive faces was significant, $t(20) = 2.89$, $p < .01$. For one pair the two facial stimuli were judged to be equal in perceived attractiveness and the infants' looking-time data for this pair were not used (see Results section).

In the external same–internal different condition the 24 photographs were arranged into 12 pairs, in each of which the external facial features were the same, and the internal features different. These pairs were the six photographs of Stimuli AA paired with the six AU stimuli, and the six UA stimuli paired with the six UU stimuli. For these pairings the attractive stimuli had a mean adult rating of 4.14 (SD = 1.34, range = 2.2–6.0), and the unattractive faces had a mean rating of 2.12 (SD = .73, range = 1.5–3.8). The difference in adults' ratings was significant, $t(22) = 4.56$, $p < .001$.

Each infant was given a maximum of six paired-stimulus looking trials, each continuing until 20 sec of looking had accumulated. To minimize participant loss infants were not required to complete all six trials, and for each infant testing continued until the infant began crying or fussing, or until six trials had been completed. Testing

continued until six sets of data had been collected for each stimulus pair, so that in each of the two experimental conditions there were data from 72 trials in all. Stimulus presentation was counterbalanced across infants and stimuli, so that each stimulus was shown an equal number of times to the left and to the right. In the internal same–external different condition 13 infants (9 girls, 4 boys) provided data: 1 infant completed two trials, 1 completed four, and 11 completed six. In the external same–internal different condition 16 infants (9 girls, 7 boys) provided data, 1 for one trial, 2 for two trials, 3 for three trials, 1 for four trials, and 9 for six trials.

Either one or two experienced observers from peepholes behind and to the left and right of the viewing chamber recorded the infants' fixations of the stimuli by pressing buttons linked to a computer. At no time were these observers visible to the infants and on all trials the observers did not know whether the attractive (or unattractive) stimulus was on the right or left of the screen: The observers were unaware of the purpose of the experiment. Two observers recorded looking for 126 of the total of 144 paired trials, and the interobserver agreement, measured as the correlation between the observers' looking times to each paired stimulus on each of the trials, was high (Pearson $r = .80$, $p < .001$).

RESULTS

It is often the case that in paired-stimulus trials infants look only at one stimulus, and on a number of trials in this experiment, infants looked only at one stimulus of the pair shown. It can be argued that on these trials it is not clear that the infants had the opportunity to compare both stimuli, and they are therefore not displaying a preference for the stimulus that is looked at. In the internal same–external different condition there were nine such trials, and in the external same–internal different condition there were five. The results were analyzed with these "noncompared" trials removed. The infants' preferences differed in the two conditions, and the findings are presented separately here.

Internal Same–External Different

The stimuli rated as attractive and unattractive accumulated, respectively, 50.8% (*SD* = 13.58) and 49.2% of the total looking time. From the original set of 72 data points, 9 noncompared trials were removed, and also the data from 5 trials in which the two stimuli of the pair were equal in adults' judgments of attractiveness. This equality of judgment was discovered when the adult ratings were collected, which was after the newborn infants had been tested. Of the 58 remaining trials the infants looked longer at the attractive faces on 30 trials, at the unattractive faces on 27 trials, and on 1 trial looking times to the two stimuli were the same. Of the 13 infants

tested, 6 looked longer, overall, at the attractive faces, and 7 looked longer at the unattractive faces. The infants' percentage preference for each of the facial stimuli was not correlated with the adults' mean rating (Pearson $r = -.13$, *ns*). Clearly, the attractiveness effect reported by several researchers with older infants, and by Slater et al. (1998) with newborn infants, did not replicate in this experimental condition. Given that the preferential looking data were so close to chance (50%) further statistical analyses are not reported.

External Same–Internal Different

The stimuli rated as attractive and unattractive accumulated, respectively, 57.1% (*SD* = 10.8) and 42.9% of the total looking time, and this preference for attractiveness was significant, Matched-pairs *t* test, $t(15) = 2.63$, $p < .01$, one-tailed. From the original data set of 72 data points, 5 noncompared trials were removed. Of the 67 remaining trials the infants looked longer at the attractive faces on 39 trials, at the unattractive faces on 24 trials, and on 4 trials looking times to the two stimuli were the same: This difference is significant, $\chi^2(1, N = 63) = 3.57$, $p < .05$, one-tailed. Of the 16 infants tested, 12 looked longer, overall, at the attractive faces, 2 looked longer at the unattractive faces, and 2 showed no preference (Infants 11 and 16 in Table 1). The data for the individual infants are shown in Table 1, and this difference is sig-

TABLE 1
External Same–Internal Different Condition: Infants' Preferences for Attractive Faces on Paired-Stimulus Trials

Infant	*Sex*	*Age (Hr)*	*Attractiveness Preference (%)*
1	M	60	51.8
2	M	135	59.1
3	M	57	75.5
4	F	87	82.3
5	F	45	62.2
6	M	25	54.8
7	F	65	57.8
8	F	64	54.3
9	M	73	54.5
10	F	46	45.9
11	M	37	49.8
12	F	83	53.0
13	F	110	58.0
14	F	8	67.0
15	F	54	38.0
16	M	60	50.0
M		63.1	57.1

nificant, Sign test, $N = 14$, $x = 2$, $p = .006$. The infants' percentage preference for each of the facial stimuli was positively and significantly correlated with the adults' mean ratings for the faces (Pearson $r = .57$, $p < .01$), a finding that indicates that the newborns tended to look longer at the faces that the adult raters judged to be most attractive.

Comparison Between Conditions

In the internal same–external different condition, 6 infants looked longer, overall, at the attractive faces, and 7 looked longer at the unattractive faces, and in the external same–internal different conditions these numbers are 12 and 2, respectively. A 2×2 chi-square analysis indicates a reliable difference between these two proportions, $\chi^2(1, N = 14) = 7.14$, $p < .01$, two-tailed.

DISCUSSION

The findings from these two conditions are that newborn infants appear not to discriminate between attractive and unattractive faces when the internal features of the paired facial stimuli are the same, but that they do make this discrimination, and confirm earlier findings that newborn infants prefer attractive faces, when the internal facial features differ. It is of interest to consider how to reconcile these findings that newborn infants do attend to, and process, internal features of static faces with the finding reported by Pascalis et al. (1995) that newborns no longer preferred to look longer at their mother's face when she (and a female stranger) were wearing head scarves. It is possible that when infants, from birth on, look at faces they process both external and internal features and that what is perceived represents some sort of gestalt of the whole. If a large part of the face is then hidden, such as by a head scarf, this might disrupt recognition of the mother. Clearly, in Pascalis et al.'s experiment the presence of the external facial features was critical for maternal recognition. However, it is clearly not the case that newborn infants attend only to external facial features when presented static two-dimensional facial stimuli. If this were the case, the significant preference for attractive faces could not have emerged in the condition where the external facial features were held constant for each member of each stimulus pair.

Several of the findings on face perception described earlier appear to be dependent on the newborn infant attending to internal facial features. These findings include a tendency to follow schematic facelike patterns, to imitate facial gestures, and to form facial prototypes from previously seen stimuli. It is usually the case that internal facial features provide more relevant information about attractiveness than external features, and the findings from this experiment are clear evidence

that newborn infants use this information in making preferences based on attractiveness. It is very likely that the attractive faces fit more closely the newborn infants' facial prototype, whether this prototype is innately provided or results from their limited experience of seeing faces in the few hours or days from birth, and it would seem that this prototype, or facial representation, contains information about internal facial features. A reasonable interpretation of these, and other findings, is that when newborn (and older) infants are presented with facial stimuli, whether dynamic or static, they are able to attend both to internal and external facial features.

ACKNOWLEDGMENTS

This research was supported by research grant R000237093 from the Economic and Social Research Council, UK, to Alan Slater, Gavin Bremner, and Scott P. Johnson.

We are indebted to the staff of the Maternity Ward, Royal Devon and Exeter Hospital, Exeter, Devon, for their support, and to the participants' mothers for their help and cooperation.

REFERENCES

Ashton, R. (1973). The state variable in neonatal research: A review. *Merrill-Palmer Quarterly, 19,* 3–20.

Bushnell, I. W. R. (1979). Modification of the externality effect in young infants. *Journal of Experimental Child Psychology, 28,* 211–229.

Bushnell, I. W. R., Sai, F., & Mullin, J. T. (1989). Neonatal recognition of the mother's face. *British Journal of Developmental Psychology, 7,* 3–15.

Field, T. M., Cohen, D., Garcia, R., & Greenberg, R. (1984). Mother–stranger face discrimination by the newborn. *Infant Behavior and Development, 7,* 19–25.

Girton, M. R. (1979). Infants' attention to intrastimulus motion. *Journal of Experimental Child Psychology, 28,* 416–423.

Langlois, J. H., & Roggman, L. A. (1990). Attractive faces are only average. *Psychological Science, 1,* 115–121.

Langlois, J. H., Roggman, L. A., Casey, R. J., Ritter, J. M., Rieser-Danner, L. A., & Jenkins, V. Y. (1987). Infant preferences for attractive faces: Rudiments of a stereotype? *Developmental Psychology, 23,* 363–369.

Meltzoff, A. N. (1995). Infants' understanding of people and things: From body imitation to folk psychology. In J. L. Bermudez, A. Marcel, & N. Eilan (Eds.), *The body and the self* (pp. 43–69). Cambridge, MA: MIT Press.

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science, 198,* 75–78.

Meltzoff, A. N., & Moore, M. K. (1984). Newborn infants imitate adult gestures. *Child Development, 54,* 702–709.

Pascalis, O., de Schönen, S., Morton, J., Deruelle, C., & Fabre-Grenet, M. (1995). Mother's face recognition by neonates: A replication and an extension. *Infant Behavior and Development, 18,* 79–85.

Reissland, N. (1988). Neonatal imitation in the first hour of life: Observations in rural Nepal. *Developmental Psychology, 24,* 464–469.

Samuels, C. A., & Ewy, R. (1985). Aesthetic perception of faces during infancy. *British Journal of Developmental Psychology, 3,* 221–228.

Slater, A., von der Schulenburg, C., Brown, E., Badenoch, M., Butterworth, G., Parsons, S., & Samuels, C. (1998). Newborn infants prefer attractive faces. *Infant Behavior and Development, 21,* 345–354.

Walton, G. E., Armstrong, E. S., & Bower, T. G. R. (1998). Newborns learn to identify a face in eight-tenths of a second? *Developmental Science, 1,* 79–84.

Walton, G. E., Bower, N. J. A., & Bower, T. G. R. (1992). Recognition of familiar faces by newborns. *Infant Behavior and Development, 15,* 265–269.

Young, A., & Bruce, V. (1998). The science of the face. *The Psychologist, 11,* 120–125.