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The Effect of Motion Information on Infants' Recognition of Unfamiliar Faces.

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We examined the role of motion information on infants' recognition of unfamiliar faces. Previous studies suggested that motion information promotes infants' perception (Kellman & Spelke, 1983; Otsuka & Yamaguchi, 2003), and therefore we theorized that motion information should facilitate infants' face recognition. In the present study, we compared infants' recognition memory for unfamiliar faces learned in a moving or a static condition. Infants aged 3- to 5- months (N = 24) were first familiarized with a smiling woman face either in the moving or static condition. After familiarization, infants were tested using a pair of novel and familiar female faces. Both novel and familiar faces in the test phase had static, neutral expressions. Hair was excluded so that only the internal features were visible. We found that the infants in the moving condition showed a significant preference for novel faces, but that the infants in the static condition showed no preference for either of the faces. The present results suggest that learning from moving condition promotes infants' recognition of unfamiliar faces.

Key words: moving face, unfamiliar face, infants

Traditionally, face researchers mainly use static pictures. However, a number of recent studies have attempted to reveal the effect of motion information in face recognition.

There are two hypotheses about the possible role of motion information in the face recognition: the supplemental information hypothesis and the representation enhancement hypothesis (O'Toole, Roark, & Abdi, 2002). The supplemental information hypothesis posits that motion information contribute to face recognition thorough supplying additional identity information to the invariant structure of the face (e.g., facial movements characteristic to the individual such as the way of smiling). This hypothesis predicts that motion information would be more effective for familiar faces than unfamiliar faces. This is because some experience with a face may be needed to learn which movements are characteristic to the individual.

The representation enhancement hypothesis posits that motion information contributes to face recognition by facilitating the perception of facial structure. According to this hypothesis, the effect of motion information depends on the perception of faces rather than the prior experience with a face. Thus, the representation enhancement hypothesis predicts that the effect of motion information would be found for both familiar and unfamiliar faces. As a matter of fact, studies with adult participants reveal a fundamental difference in the effect of motion for familiar and unfamiliar faces (O'Toole et al., 2002). Although a facilitative effect of motion is consistently found for the recognition of familiar faces, this effect is less clear for the recognition of unfamiliar faces.

The aim of the present study was to examine the role of motion information on infants' recognition of unfamiliar faces. Several previous studies have suggested that motion information promotes infants' perception (Kellman & Spelke, 1983; Otsuka & Yamaguchi, 2003). Therefore we theorized that motion information should facilitate infants' face recognition even for the faces unfamiliar to the infants. In the present study, we compared infants' recognition memory for unfamiliar faces learned in a moving or a static condition.

Infants were first familiarized with a smiling woman face either in the moving or static condition. The familiarization phase was fixed at a relatively short duration (30 sec). After familiarization, infants were tested using a pair of novel and familiar female faces. Both novel and familiar faces in the test phase had static, neutral expressions. In such a paradigm, we infer that infants have recognized the familiar face, if they show a novelty preference for the novel female face.

Method

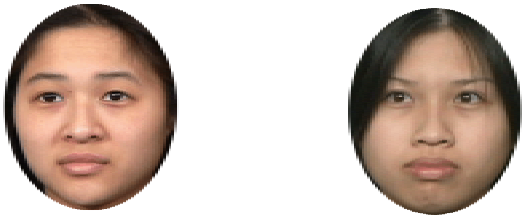
Participants: Twenty-four healthy 3- to 5-month-olds who had a birth weight greater than 250g (mean age = 128.6 days, ranging from 81 to 162 days) participated in this experiment. An additional 12 infants were tested but were excluded from the analysis due to fussiness (3) or side bias greater than 90 % (6), or due to looking times in the familiarization trials that were less than 20s (2).

Apparatus: All stimuli were displayed on a TOTOKU-Calix CDT2141A 21-inch CRT monitor controlled by a computer. The infant and the CRT monitor were located inside an enclosure, which was made of iron poles and covered with cloth. Each infant sat on his/her parent's lap in front of the

CRT monitor. The infant's viewing distance was approximately 40 cm. There were two loudspeakers, one on either side of the CRT monitor. There was a CCD camera just below the monitor screen. Throughout the experiment, the infant's behavior was videotaped through this camera. The experimenter could observe the infant behavior via a TV monitor connected to the CCD camera.

Stimuli: All stimuli were produced from two video recordings of Asian woman faces, which were taken in the University of Texas at Dallas. The familiarization stimuli consisted of a smiling female face seen either in the moving or static condition. Stimuli in the moving condition were composed of 33 frames, which were shown at a rate of 25 frames per seconds. Static stimuli were composed of the last frame of the moving stimulus (shown in Figure1a). The size of the familiarization stimuli was 22deg on each side. Test stimuli consisted of a static female face with a neutral expression (see Figure1b) for all infants. Hair was excluded so that only the internal features were visible. The size of the test stimuli were 16deg ×19deg.

(a) Moving / Static



(b) Static

Figure 1. (a) familiarization stimuli, (b) test stimuli.

Procedure: Infants were first familiarized with a smiling female face seen either in the moving or static condition. The familiarization stimulus was shown on the center of the CRT monitor. The familiarization trial was composed of two 15sec trials. After familiarization, infants were tested using a pair of novel and familiar female faces. The test stimuli were shown in a pair side by side. The test trials were composed of two 10sec trials. The position of the novel and familiar face was reversed across the two trials. The familiarization face differed between the infants so that the novel and familiar relationship of test stimuli was reversed. One observer, unaware of the stimulus identity, measured infants' looking time for each stimulus based on the video recordings. Only the infant's looking behavior was visible in the video.

Table 1. Preference for Novel Face
Mean Preference Scores in Percentages, Standard Deviation, and *t* scores (vs. chance)

	Moving condition	Static condition
M	63.12	45.00
SD	14.21	11.37
t	3.2*	1.52

*p < .01, two-tailed test.

Results and discussion

The mean total looking time from the two-familiarization trials was 25.73 seconds for the moving condition, and 27.03 seconds for the static condition. There was no statistical difference in the total looking time between the two conditions.

We calculated a preference score for each infant. This was done by dividing the infant's looking time to the novel female face during two test trials by the total looking time over the two test trials, and then multiplying this ratio by 100. The mean preference scores of each group, together with their standard deviations and t values (vs. chance), are shown in Table 1. Two-tailed one-sample t-tests (vs. chance level 50%) revealed significant preference in the moving condition (t (11) = 3.2, p < .01, *two-tailed*) but not in the static condition. (t (11) = 1.52, p = .16, *two-tailed*). These results suggest that infants in the moving condition could recognize the familiar female face but that infants in the static condition could not. The present results suggest that learning from the moving condition promotes infants' recognition of unfamiliar faces.

In contrast to the previous studies with adult participants, we found facilitative effect of motion information for the recognition of unfamiliar faces in infants. Our finding suggests that motion information contributes to recognition of unfamiliar face in young infants who are in the course of perceptual development.

References

O'Toole AJ, Roark DA, Abdi H. (2002) *Trends in Cognitive Science*. 6 (6), 261 - 266.

Kellman PJ, Spelke ES. (1983) *Cognitive Psychology*. 15 (4), 483 - 524.

Otsuka Y, Yamaguchi MK. (2003) *Journal of Experimental Child Psychology*. 86 (3), 244 - 51.

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