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Adaptation to differences in 3-d face shape across changes in viewpoint and texture

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◆ **Analytical and configural processing in infants' gaze perception**

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Perceiving gaze direction is important for human adults and infants. Human adults process gaze direction by using the configural information of the face. In face cognitive developmental studies, 7 – 8-month-old infants showed configural processing in upright faces (Schwarzer and Zauner, 2003 *Vision Research* **43** 2783 – 2793), and analytical processing in inverted faces (Choen and Cashon, 2001 *Infant and Child Development* **10** 83 – 92). But until now, there have been no developmental studies about the interaction of gaze perception and configural information processing. We examined whether 6 – 8-month-old infants ($N = 96$) process gaze direction configurally or analytically. We used the face stimuli of schematic faces drawn by Wollaston (1824 *Philosophical Transactions of the Royal Society of London, Series B* **114** 247 – 256). In habituation period, a schematic illusion face was shown. In this face, human adults perceive direct gaze by analytical processing of only the eyes, and averted gaze by configural processing with facial contour. In the test period, two mirror images of this face were shown; one had a mirror image (eye-switch face), and the second had a mirror image except eyes (gaze-switch face). If infants process gaze direction configurally, they show novelty preference to a gaze-switch face. By contrast, if infants process gaze direction analytically, they show novelty preference to an eye-switch face. An upright face was used for experiment 1, and inverted faces were used for experiment 2. Results suggest that only 8-month-old infants could process gaze direction configurally in an upright face, and process gaze direction analytically in an inverted face.

◆ **Adaptation to differences in 3-D face shape across changes in viewpoint and texture**

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Face-adaptation effects can provide clues as to the nature of underlying representations. Two experiments are reported in which an adaptation paradigm was used to test for adaptation to differences in face shape across changes in image properties. All experiments made use of synthesised 3-D face models based on principal components analysis of a database of laser scans of faces drawn from two distinct populations, Japanese and Caucasian. Participants were asked to make an ethnicity judgment. 3-D shape is known to be useful in this task and its variation can be captured by linear discriminant analysis to give a quantifiable variable. For both experiments the point of subjective equality (PSE) was measured before and after adaptation to a set of faces defined in terms of one of the distinct populations. The viewpoint and the texture map used for rendering the adapting faces were varied between subjects. For experiment 1, the pre-adaptation and post-adaptation PSE was measured for faces shown in 15° or 45° views, with adapting stimuli shown in one of these views. Adaptation, that is movement of the PSE in the direction of the adapting population, was found ($F_{1,8} = 20.1$, $p \ll 0.05$) independent of adapting or test view. In experiment 2, pre-test and post-test PSE was measured for 0°, 30°, and 60° views. Adaptation was always to the 30° view but the texture map used at adaptation varied between subjects. The texture used was an ethnicity specific average, either consistent or inconsistent with the shape information. Again, there was adaptation dependent on the shape defined ethnicity of the adapting stimuli ($F_{1,12} = 36.2$, $p \ll 0.05$). This was independent of texture map and test view. The results are interpreted as evidence for the high-level representation of 3-D face shape independent of view and surface reflectance.

◆ **Linear functions of actual head and gaze angles predict the shift of perceived gaze direction for both 2-D and 3-D presentations**

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Perceived gaze direction of another person, the 'looker', can be affected by their head angle and the lighting. In order to measure these effects quantitatively, and to compare the effect of changes between real-life communication and the 2-D images used in telecommunications, we carried