Perception of Glass patterns and texture-defined forms in developing macaque monkeys

Yasmine El-Shamayleh, Lynne Kiorpes and J. Anthony Movshon

Center for Neural Science, New York University

Introduction
Basic spatial vision is established early in the course of visual development. Infant macaques are able to detect “first order” sinusoidal gratings at birth and reach adult levels of acuity and contrast sensitivity by the end of the first postnatal year (Kiorpes, 1992). However, they are unable to extract more “global” form perceptions, such as contour integration and Glass pattern detection, until much later (Kiorpes & Bashin, 2003; Kiorpes and Movshon, 2003). This is due to late development of ventral extrastriate areas that are thought to underlie form vision. Alternatively, it could be ascribed to the necessary spatial integration of the form cues contained within these stimuli. To explore the further, we examined the performance of monkey subjects on a form discrimination task that does not require explicit binding of signals across space. We used a “second order” texture discrimination task, in which the form cue was carried by complementary sinusoidal variation in the amplitude of a vertical and a horizontal noise carrier as shown in Figure 3 (Landy & Orcu, 2002). As such, it was accessible to local analysis of texture orientation and did not require integration over features and space as is true for Glass pattern and contour integration displays.

Methods
We presented monkeys (ages 6wks-3.3yrs) with two families of visual stimuli: Glass patterns and texture-defined forms.

In each case, the animal’s task was to indicate which of two target stimuli contained the correct structure; namely constrict or linear structure in the Glass pattern display and vertical structure in the texture stimulus.

We measured performance on each task by measuring psychometric functions using the method of constant stimuli in a two-alternative forced-choice paradigm. Thresholds and standard errors of estimate were computed using Probit analysis of the log-transformed data sets.

1 Sensitivity to Glass patterns

2 Does “form vision” develop late?

3 Stimulus composition and parameters

4 Detection of texture-defined form

5 Discrimination of texture-defined forms

6 Carrier orientation affects performance

7 Development of texture sensitivity

8 Different aspects of form perception develop at different rates

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