NEURAL CORRELATES OF BOUNDARY AND MEDIAL AXIS REPRESENTATIONS IN PRIMATE STRIATE CORTEX.

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Purpose. Two fundamental descriptors of the shape of an object are its boundary and its medial axis (axis of symmetry). This study investigated the representation of these descriptors in the primate striate cortex. **Methods.** 64 units were isolated in an awake rhesus monkey. These units were convolved with one or more of the following three sets of stimuli along one dimension: (a) a boundary defined by two regions of contrasting texture, (b) a texture strip of 4^o visual angle in width in a background of contrasting texture and (c) a texture square of $4^o \times 4^o$ in size in a background of contrasting texture. The convolution was done at 0.5^o step, spanning a range of 12^o in visual angle. The sequence of the convolution steps was randomized. At each step, the full-screen stimulus was presented for 330 msec while the monkey fixated. **Results.** 15 of these units, all complex cells, exhibited the following characteristics in their spatial-temporal response profiles: 1. Sharp response peaks were observed at the texture-contrast boundaries for all three sets of stimuli. 2. Boundary responses for narrow regions such as the strip and the square figure (4^o in width) emerged and sharpened rapidly at 40 msec after stimulus onset, while the boundary responses for wider regions (width $> 10^o$) emerged later and became sharp at 90 msec, suggesting that boundary detection might be coupled with surface interpolation. 3. A sharp response peak can be observed in the middle of the strip and the figure. It emerged almost simultaneously with the boundary peaks. This middle peak could be interpreted as the representation of the medial axis of the figure/strip. 4. The enhancement modulation profile for the square figure is qualitatively consistent with the psychophysical sensitivity profile discovered by Kovacs and Julesz [PNAS, vol.90, 1993].

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