

S-Cone Filling-in Studied with a Forced-Choice Method

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Abstract

Sampling of the retinal image by the short-wavelength sensitive (S) cones is sparse, and vision mediated by S cones is of poor spatial resolution. When two small rectangles that differ only in S cone excitation are juxtaposed, chromatic discrimination between them is worse than when a visible gap or contour separates the two rectangles (Boynton *et al.*, 1977); in the absence of the contour, a perceptual interpolation or filling-in process may reduce the apparent difference between the two sides. The present study began with the observation that when the top half of a black outline rectangle was filled with an S cone increment (S+, purplish), with the other half being an equiluminant gray, near threshold the purplish color seemed to adhere to the interior of the outline box at the top, as if the S cone signal spreads into the rectangle but is prevented from spreading outside the rectangle by the visible boundary. We used a 2TIFC method to explore this effect in several experiments, by measuring observers' ability to discriminate two stimuli, both of which were contained within a black outline rectangle. In one condition, half of the outline rectangle was filled with an S+ patch, fixed at detection threshold, and the other half was equiluminant gray, with no visible contour between the two halves. The other, variable contrast stimulus was identical but the S+ patch filled only a quarter of the outline rectangle (adjacent to the outer edge), leaving 75% of the rectangle filled with gray. Discrimination threshold for the small and large patches is up to 3-fold higher than the detection

threshold. These and other results suggest these chromatic patches are most visible near the outline rectangle's border, consistent with a spreading of the chromatic signal that is inhibited at visible contours.

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