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Contrast Gain Control: A Bilinear Model for Color Selectivity

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We report the results of psychophysical experiments on color contrast induction. In earlier work (Singer and D'Zmura, Vision Research, 1994, 34, 3111-3126), we showed that modulating the spatial contrast of an annulus in time induces an apparent modulation of the contrast of a central disk, at isoluminance. Here we vary the chromatic properties of disk and annulus systematically in a study of the interactions among the luminance and color opponent channels. Results show that induced contrast depends linearly on both disk and annulus contrast, at low and moderate contrast levels. This dependence leads us to propose a bilinear model for color contrast gain control. The model predicts the magnitude and chromatic properties of induced contrast. In agreement with experimental results, the model displays chromatic selectivity in contrast gain control and a negligible effect of contrast modulation at isoluminance on the appearance of achromatic contrast. We show that the bilinear model for chromatic selectivity may be realized as a feed-forward multiplicative gain control. Data collected at high contrast levels are fit by embellishing the model with saturating nonlinearities in the contrast gain control of each color channel.