

Color Tuning Curves in V4 Do Not Generalize to Natural Images

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Presentation Abstract Summary Tuning curves are conceptual tools that make comprehensible the complex responses of a neuron to stimuli or behavior. An intrinsic assumption of tuning curves is that they capture overall response properties and thus will generalize to stimuli not used to create them. Here, we tested this assumption in macaque V4, an intermediate visual area historically characterized by tuning curves to artificial stimuli such as shapes of a single hue. After characterizing traditional color tuning from neural responses to single hues, we trained a linear model to predict responses to natural images from hue histograms of image portions within fixation-centered receptive fields. We found that the color responses of the two models do not significantly correlate even despite their identical functional form. This is due in part to a nonlinear response to hue, as a nonlinear model fit upon hue histograms shows higher predictive performance than a linear model. Predictions of this nonlinear model to full-field hue also do not correlate with the original tuning curve, however, indicating that hue tuning varies for reasons other than nonlinearity. Color tuning curves in V4 are thus incomplete and misleading accounts of the neural response to natural images.

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