Hue, saturation and brightness scaling of signals from single cones
Brian P. Schmidt, Katharina G. Foote, Alexandra E. Boehm & Austin Roorda

INTRODUCTION
The algorithm used by the visual system to extract hue, saturation and brightness from the ambiguous signals generated by cone photoreceptors is unknown. We investigated this computation by stimulating individual cones in human subjects and recording the associated percepts.

METHODS
An adaptive optics scanning laser ophthalmoscope was used to image and present stimuli to the retina ~1.5° from the fovea. The eye’s optical aberrations were measured with a wavefront sensor (940 nm) and corrected with a deformable mirror. Imaging and eye-tracking was performed with 840 nm light. Cones were targeted using the IR channel and lighting. Light diameter was ~1°. The eye’s optical aberrations were measured with a wavefront sensor (940 nm) and used to image and present stimuli to the retina ~1.5° from the fovea. The subject’s visual angle was fixed at ~1° in the dark.

RESULTS
Subjects rated the brightness of each stimulus on a scale from 0 to 5. Stimuli that received brightness ratings above zero were also rated for hue and saturation (Harris et al. 2012). The background appeared white. The spectral class of targeted cones were identified using densitometry (Sabesan et al. 2015).

CONCLUSIONS
The majority of cones tested mediated desaturated sensations (<0.5) at all intensities, while a smaller group elicited saturated (>0.5) sensations. L- and M-cones produced sensations that were reliably discriminated at all intensities. L-cones tended to generate red, and to a lesser extent yellow, hue reports. M-cones produced predominantly green reports. Hue was largely independent of stimulus intensity and brightness rating. Brightness ratings were positively correlated with stimulus intensity and fit by compressive exponential functions. In summary, over the range of intensities tested, a single cone produced a consistent hue sensation and relatively fixed saturation, but with brightness roughly proportional to stimulus intensity. This is consistent with the interpretation that for percepts associated with single cone stimulation, hue and saturation are independent of photoreceptor isomerization rate.

REFERENCES
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