Adaptation of higher order colour mechanisms

Robert J. Lee[1], John D. Mollon[2], Qasim Zaidi[3], Hannah E. Smithson[1*]

[1] Department of Psychology, Durham University, UK
[2] Department of Experimental Psychology, University of Cambridge, UK
[3] Graduate Program in Vision Science, SUNY College of Optometry, New York, USA
[*] presenting author

Krauskopf, Williams and Heeley (1982, *Vis Res*) used adaptation to sinusoidal modulation along lines in the isoluminant plane of DKL colour space to reveal two cardinal colour mechanisms that exhibit independence – thresholds in one cardinal direction are not elevated following adaptation in the other. All intermediate adaptation directions produced generalised threshold elevation for all test directions. Krauskopf, Williams, Mandler & Brown (1986, *Vis Res*) later showed that intermediate adaptation directions influenced thresholds in a way not predicted by adaptation of only two colour mechanisms, a result that they suggest could be explained by additional desensitization in higher order colour mechanisms that are maximally sensitive in non-cardinal directions. We set out to test explicitly whether it is possible to differentially elevate thresholds with adaptation stimuli that are matched in the modulation presented to early colour mechanisms. A stimulus that is modulated in time around a circular locus in the isoluminant plane of colour space provides sinusoidal modulation to each of the cone classes, and to both cardinal mechanisms. The time-averaged level and the amplitudes of these signals are the same for clockwise (CW) and counterclockwise (CCW) modulations, as is the locus of hues presented. However, at modulation frequencies of around 10 Hz, the modulating stimuli appear different depending on whether the sense of procession is CW or CCW, consistent with a delay in the S-cone pathways that transforms the hue circle modulations to differently oriented elliptical loci at a central site (Stromeyer et al., 1991, *Vis Res*; Lee et al., 2009, *ICVS*). We measured chromatic discrimination thresholds along eight chromatic directions, before and after adaptation to hue circle stimuli. The pattern of threshold elevations was different following adaptation to CW or CCW modulations. By exploiting neural delays we have been able to isolate differential adaptation of higher order colour mechanisms.

Supported by a Durham University Doctoral Fellowship, a Rank Prize Funds Vacation Studentship and NEI grant EY07556.