Color is slow; color contrast is fast

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The visual response to chromatic modulation is often thought to be slow: typically, chromatic modulation thresholds at 10 Hz are about eight times higher than thresholds at 1 Hz. However, a number of studies have shown that the visual system can adapt perfectly well to fast chromatic contrast (>10 Hz) and that neurons in area V1 can respond to fast chromatic contrast modulation. To account for these (and other) findings, Shapiro (2008, Journal of Vision 8/1/8, 1-18) proposed a model that explicitly incorporates separate color and color contrast pathways. At an intuitive level, the model recognizes an observer's ability to perceive both the color of a patch and the color contrast of the patch relative to the surrounding field. In this presentation, I will give further demonstrations that support the existence of a separate rectified color contrast pathway; I will show that some classic temporal sensitivity measurements can be reinterpreted within the dual pathway framework; and I will discuss the dual pathway model in light of some recent physiological findings (Liu and Wandell, 2005, Journal of Neuroscience, 25, 3459-3468; Johnson, Hawken and Shapley, 2008, Journal of Neuroscience, 28, 8096–8106) that indicate at least two separable color responses at the level of the cortex. An important question is whether these separable color responses originate at the cortical level (the slow “color” response being derived from the fast color-contrast response) or whether the two responses originate in the retina, as might be suggested by a rectified chromatic response in the M ganglion cells (Lee and Sun, 2009, Journal of Vision, 9/2/15, 1-18).