



Separating Color From Color Contrast

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***Color Science Building 18, Franc Grum Learning Center**

Abstract

The visual response to equiluminant lights is often thought to be slow (typically, chromatic modulation thresholds at 10 Hz are about eight times higher than at 1 Hz). Recent studies, however, have shown that the visual system can adapt to fast chromatic contrast (>10 Hz) and that cells in cortical area V1 respond to fast chromatic contrast modulation. To investigate this apparent discrepancy, my laboratory has developed a class of stimuli based on shifting the temporal phase of multiple sources of contrast information. This class of stimuli makes it relatively easy to separate the visual response to color (1st-order information) from the visual response to color contrast (2nd-order information). Examples of these stimuli can be seen at www.shapirolab.net.

In this talk, I will show that 1) the response to 2nd-order information can be nulled at orthogonal directions in color space; 2) the response to 2nd-order information is faster than the response to 1st-order information for both equiluminant and achromatic stimuli; and 3) luminance thresholds appear to be determined by 2nd-order information, whereas chromatic thresholds appear to be determined by 1st-order information. These findings are consistent with a model of color vision that contains a separate contrast channel that sums rectified color and luminance responses. I will also show that asynchronous contrast modulation can be used to create efficient measures of equiluminance and can generate compelling illusions that give new insights into many aspects of visual processing (e.g., motion and spatial scale).

Biography

Arthur Shapiro is an associate professor at Bucknell University, where he is in the Department of Psychology and the Neuroscience program. He received his undergraduate degree in Math/Computer Science and Cognitive Science at UC San Diego, and his Ph.D. in Psychology from Columbia University; he did a post-doc in the Department of Ophthalmology and Vision Sciences at the University of Chicago. His research has focused primarily on questions related to chromatic adaptation and low-light-level vision. His most recent work—and the topic of his presentation—stems from questions that arose during a sabbatical leave spent at the University of Cambridge in 2000-2001. Part of this research has led to a new class of visual illusions, generally referred to as contrast asynchronies. One of these illusions was selected as “visual illusion of the year” in an international competition associated with the 2005 European Conference in Visual Perception.