Investigate the Assimilation and Contrast Effects on Color Induction with Color Discrimination Paradigm

Huang, Chih-Hsien (School: Taipei First Girls High School)
Yu, Cheng-Ying (School: Taipei First Girls High School)

It is well known that the perceived color of a neutral stimulus can be altered by the presence of a surround. Here, we aimed to identify the neural mechanism underlying the phenomenon of color induction by a combination of increment threshold measurement and computational modeling. The stimulus consisted of an annulus target embedded in a concentric surround alternating between two colors. We manipulated the chromaticity of each ring of the surround and the color contrast of the target. The observer's task was to decide which interval contained the greater target contrast. An adaptive staircase method measured the observer's increment threshold. The resulting threshold functions enabled us to build a mathematical model to determine the properties of the lateral interactions between underlying mechanisms. The increment threshold significantly decreased when a red target was surrounded by a nearby green ring and a distanced red ring, or a green target surrounded by a nearby red ring and a distanced green ring. The increment threshold significantly increased with opposite color arrangements. Such measurements showed that surrounding ring near the target induced the appearance toward the inducing chromaticity (assimilation), while surrounding ring some distance from the target induced the appearance away from the inducing chromaticity (contrast). The data is best explained by a model with short-range additive and long-range multiplicative lateral interactions. Such lateral interactions share similar computational properties with the interactions among V1 neurons. Thus, color induction is likely resulted from both short-range and long-range interactions among V1 neurons.