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色彩と色覚メカニズム

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Color and Color Vision Mechanism

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Abstract

It is shown in this paper what the nature of color is and how color vision mechanism is realized in the human visual system. Color is not a physical attribute of light, but a human sensation as described by Newton for the first time. Human color vision mechanism has evolved to utilize spectral information of reflected lights from objects in order to detect, discriminate, segregate and identify objects. Three cones, L, M, S with different spectral sensitivities receive lights, and then produce responses depending on their spectral sensitivities. A cone does not discriminate wavelengths of light because of the principle of univariance. The cone-opponent stage in the retina to the LGN consists of the parvocellular, magnocellular and koniocellular paths made from L, M and S cones. They have L-M or M-L, L+M and S-(L+M) responses with center surround receptive fields. Interestingly L-M or M-L responses in the parvocellular path are reorganized in visual cortex to produce chromatic and luminance channels. In the higher order mechanism in the cortex it is likely that multi-color channels exist in V1 and a categorical color mechanism exists somewhere beyond V1.

Key words: color vision, color perception, L, M, S cones, cone opponent, categorical colors.