Simulating monocular vs. binocular perceptions of chromatic images in pathological subjects

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Different pathologies (glaucoma, optic neuritis, diabetes, multiple sclerosis, etc.) alter the relative action spectra of the chromatic and achromatic mechanisms and cause frequency-selective reductions in achromatic and chromatic contrast sensitivity to spatio-temporal stimuli, resulting in alterations of the visual perception of affected subjects. In this work, we have used a modification of the Corresponding Pair Algorithm originally used to simulate the perceptions experimented by dichromatic subjects [Capilla et al. (2004)], including models of spatial and chromatic processing, to simulate how subjects with different pathologies perceive a coloured scene. Simulations evidence a variety of phenomena, including defocus chromatic and achromatic haloes, local contrast reductions, hue and colorfulness changes, etc. Since in most real cases, a pathology does not affect both eyes in the same manner, studying the differences in quality of vision between the eyes of a pathological subject is a matter of interest. We compare the images obtained with monocular and binocular contrast sensitivity functions and show some results demonstrating that the quality of the images simulating the monocular perceptions may differ, in degree (for instance, in both eyes a colorfulness reduction is observed, but not of the same magnitude) or even in nature (for instance, the color palette may be more reduced in one eye, but with small loss of spatial information, whereas in the other eye the situation may be even the inverse). An asymmetry of such magnitude, may cause binocular rivalry problems, and, beyond a certain limit, could lead to the suppression of one of the monocular images.