

Natural scenes statistics account for human cones ratios

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An underlying principle of visual science is that the characteristics of visual systems are determined by evolution to facilitate survival in the environments where these visual systems function. In particular, the number and peak wavelength of the cone photoreceptors in the retina seem to be the product of natural selection [Mollon, 1989 *J. Exp. Biol* **146** 21-38; Párraga et al, 2002 *Curr. Biol* **12**(6) 483-487]. In this work, we explored whether the dissimilarities of densities between the three types of colour photoreceptors, in particular the low density of short wavelength cones, are due to the statistics of natural scenes. We built a colour image representation which allowed us to model and parameterize different cone densities. We then determined the spatial distribution of the parameters which provide power spectrum values near to the ideal one, ie -1 , to which processing in the human visual pathway is optimised [Field, 1987 *JOSA* **4**(12) 2379-2394; Atick and Redlich, 1992 *Neural Comp* **4** 196-210; Párraga et al, 2002 *Curr. Biol* **12**(6) 483-487]. We found a high correlation between this distribution and the cone ratio distribution observed in the human population. Our results show that cone ratios are optimally suited to provide the best value of Fourier amplitude spectrum for natural image statistics.