

Colour vision and illumination noise in primates and birds

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There is considerable evidence that the properties of primate colour vision are optimised to allow foraging for food. The data on which these conclusions are based are the reflectance spectra of fruit and leaves, and measures of the spectral composition of the illumination. However, the 3-D structure of natural scenes containing leaves results in considerable variation in the intensity and chromatic content of light reflected from different elements of each scene. We present data which show that the absorption spectra of cones in primates and passerine birds have an effect on the degree to which this illumination noise is encoded by the visual system. In particular, the close spacing of primate L and M cones results in a greater degree of invariance to shadows and illumination than the equivalent spacing of these cones in passerine birds. The results point to a trade-off between (a) achieving greater chromatic resolution, and (b) immunity from illumination noise. Given that primate vision has a particularly enhanced ability to ignore shadows and changes in the colour of the illumination, we present data to show that human observers are able to ignore such changes when making judgments about the degree of similarity of natural scenes.

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