Categorical colour naming of surfaces in natural scenes under different illuminations

Amano, K[1] and Foster, DH[1]

[1] School of Electrical and Electronic Engineering, University of Manchester, Manchester, UK

Colour naming quantifies colour appearance more directly than colour matching because it requires absolute rather than relative judgements, but it has the disadvantage that a single name may encompass many discriminable colours. This problem is circumvented here by tracking the centroids (foci) of colour categories. Images of natural scenes under daylights of correlated colour temperature either 6500 K or 25000 K were generated on a colour monitor from a set of hyperspectral data to allow the accurate control of illuminant and reflectance spectra. Each scene contained a test surface, a sphere, whose spectral reflectance coincided with that of a sample drawn from approximately 430 Munsell reflectances grouped into eight colour categories, namely, red, green, blue, yellow, pink, purple, brown, and orange (cf. Sturges and Whitfield, 1995, Color Research and Application, 20, 364-376). Each category comprised approximately 60 spectra, but with empirically determined foci the nominal boundaries were not critical. Only one category was tested in each experimental session. Observers, viewing each image for 1 s, named the colour of the test surface by pressing one of nine computer keys corresponding to the eight categorical colour names plus neutral. Focal colours were estimated from the peaks of the smoothed distributions of observers' responses in the CIE 1976 (u', v') space, chosen for ease of comparison with previous reports. To quantify the effect of a change of illuminant, a focal-colour constancy index was calculated with perfect constancy corresponding to 1 and perfect inconstancy to 0. Focal-colour constancy varied with both test surface and scene, but, overall, performance approached that with traditional measures of constancy, with some indices as high as 0.9, obtained with a purple surface. Extending previous findings, these results suggest that for some surfaces, categorical colour perception is sufficiently robust to anchor relative judgements of surface colour in natural images.

Supported by EPSRC grant nos. EP/B000257/1 and EP/F023669/1.