

Colour Constancy of Polychromatic Surfaces
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Natural surfaces tend to have heterogeneous surface reflectances, which are nonuniform in both chromaticity and luminance. This feature of natural surfaces is not captured by traditional studies of colour perception, which typically employ stimuli of uniform colour and brightness. In a computational model, we consider the effect of surface 'polychromaticity' (Beeckmans, *Philosophical Psychology*, 2004) on colour appearance under changing illumination. To quantify and characterise surface chromatic texture, we analysed the surface colour distributions of natural and man-made objects (including fruits, vegetables, foliage, and textiles), imaged under artificial daylight illumination using a tristimulus-calibrated camera system. The distribution of within-surface cone contrasts for a given object forms a distinct signature in three-dimensional cone-contrast space, which transforms predictably under changes in illumination. For many natural surfaces, the distribution is an elongated cluster whose vector direction in cone-contrast space remains roughly constant under illumination changes, provided the contrasts are calculated with respect to the illumination whitepoint. This feature provides a surface descriptor which remains stable under adaptation to the illumination, thereby potentially mediating colour constancy.