Performing a naturalistic visual task when the spatial structure of colour in natural scenes is changed

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A previous study (Párraga et al, 2000 *Current Biology* **10** 35 - 38) demonstrated psychophysically that the human visual system is optimised for processing the spatial information in natural achromatic images. This time we ask whether there is a similar optimisation to the chromatic properties of natural scenes. To do this, a calibrated, 24-bit digital colour morph sequence was produced where the image of a lemon was transformed into the image of a red pepper in small (2.5%) steps on a fixed background of green leaves. Each pixel of the image was then converted to the triplet of L, M, and S human cone responses and transformed into a luminance (L= L+M) and two chromatic [(L - M)/L and (L - S)/L] representations. The luminance and the (L - M)/L chromatic plane were Fourier-transformed and their amplitude slopes were independently modified to either increase (blurring) or decrease (whitening) them in fixed steps. Recombination of the luminance and chromatic representations produced 49 different morph sequences, each one with its characteristic luminance and L - M chromatic amplitude slope. Psychophysical experiments were conducted in each of the 49 sequences, measuring observers' ability to discriminate between a morphed version of the fruit and the original one. A control condition was the same task with only monochrome information. We found that colour information appeared to 'dominate' the results, except that performance was significantly impaired when the colour information in the images was high-pass filtered. This is in keeping with the idea that colour information is most useful at low spatial frequencies, as expected from the contrast sensitivity function for isoluminant gratings.
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