

A simple perceptual model of surface colours in naturalistic scenes: first assessments

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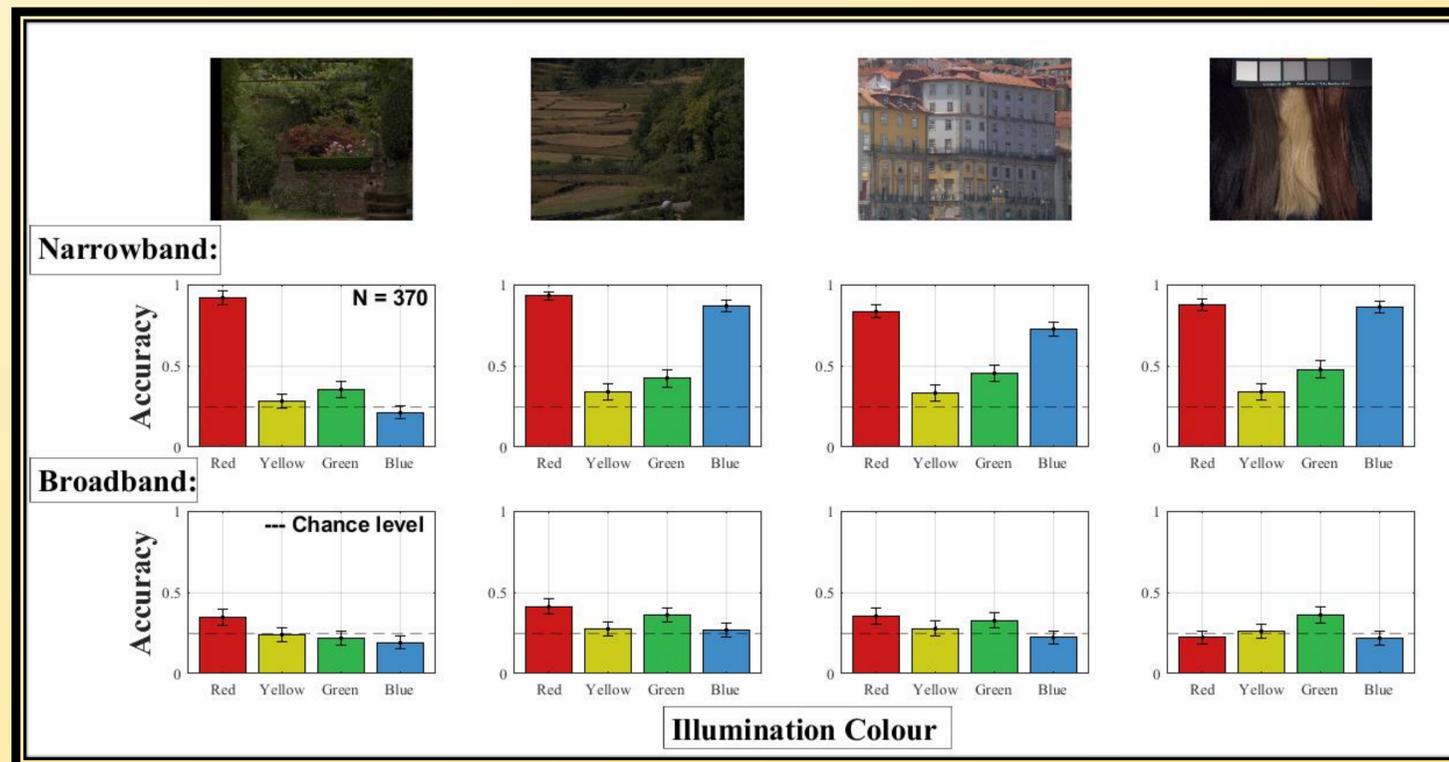
INTRODUCTION

It is of great interest to a wide range of applications in art and industry to characterise the colour of objects and materials (*surface colours*). Surface colours depend on the complex interaction between their spectral reflectance properties and the spectra of the illumination. We propose a simple linear approximation that allows surface colour characterisation with only 9 numbers instead of full spectra (Philipona & O'Regan 2006; Witzel et al 2015). Here, we test whether images of scenes based on our approximation are undistinguishable to human observers from images rendered with full spectral information.



TASK

In each trial, 4 images were presented in a 2x2 grid (left figure). Three of them were the same spectrally rendered images, one was based on our approximation. Observers were asked to spot the different one. Data was collected online.

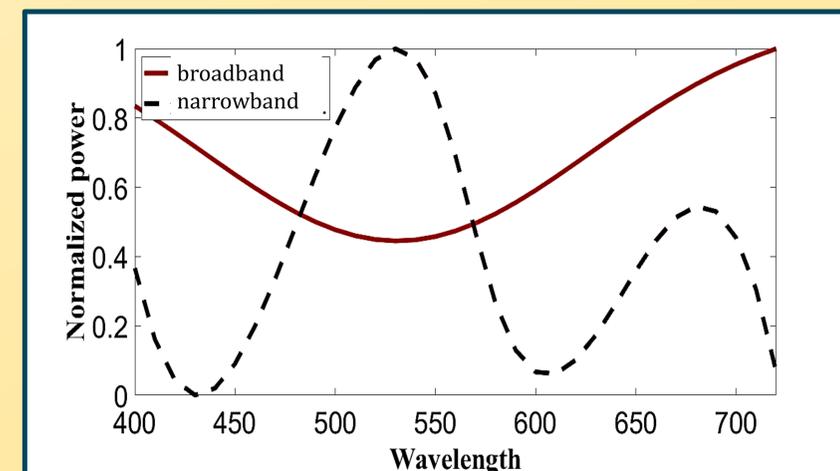


STIMULI

- Hyperspectral images of 4 natural(istic) scenes (Foster et al 2006; Yasuma et al 2008).
- 4 illumination colours along (blue & yellow) and orthogonal to (red & green) the daylight locus.
- 2 kinds of illuminant spectra:
 - (1) **broadband** = comparable to illuminants in natural environment.
 - (2) **narrowband** = unusual, unpredictable lighting properties.

RESULTS

- Participants were able to distinguish our approximation from spectral rendering with blue and red narrow-band illuminants (center row).
- But they responded at chance level when illuminants were broadband (bottom).
- This was similar for all 4 types of scenes and illumination colours.



CONCLUSION

Our approximation is barely distinguishable for broadband illuminants that are comparable to naturalistic illuminants. Further measurements with a larger range of different scenes and illuminants are needed to make sure that these observations are generalizable. If the results hold, our simple approximation will allow characterizing and communicating surface colours under naturalistic illuminants using only 9 numbers.

REFERENCES

- Foster et al (*JOSA* 2006) Frequency of metamerism in natural scenes.
- Philipona & O'Regan (*Vis Neurosci* 2006) Color naming, unique hues, and hue cancellation predicted from singularities in reflection properties.
- Witzel et al (*Jov* 2015) What determines the relationship between color naming, unique hues, and sensory singularities: Illuminations, surfaces, or photoreceptors?
- Yasuma et al (*IEEE Trans Im Proc* 2010) Generalized Assorted Pixel Camera: Postcapture Control of Resolution, Dynamic Range, and Spectrum.