



Chromatic Distribution affects Color Constancy

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1. Abstract

Does chromatic distribution matter in color constancy experiments?

We asked observers to judge color constancy of test patterns varying in average chromaticity and chromatic distribution. Four illuminants were used to simulate illumination of the color patches. Stimuli were presented on a calibrated color monitor.

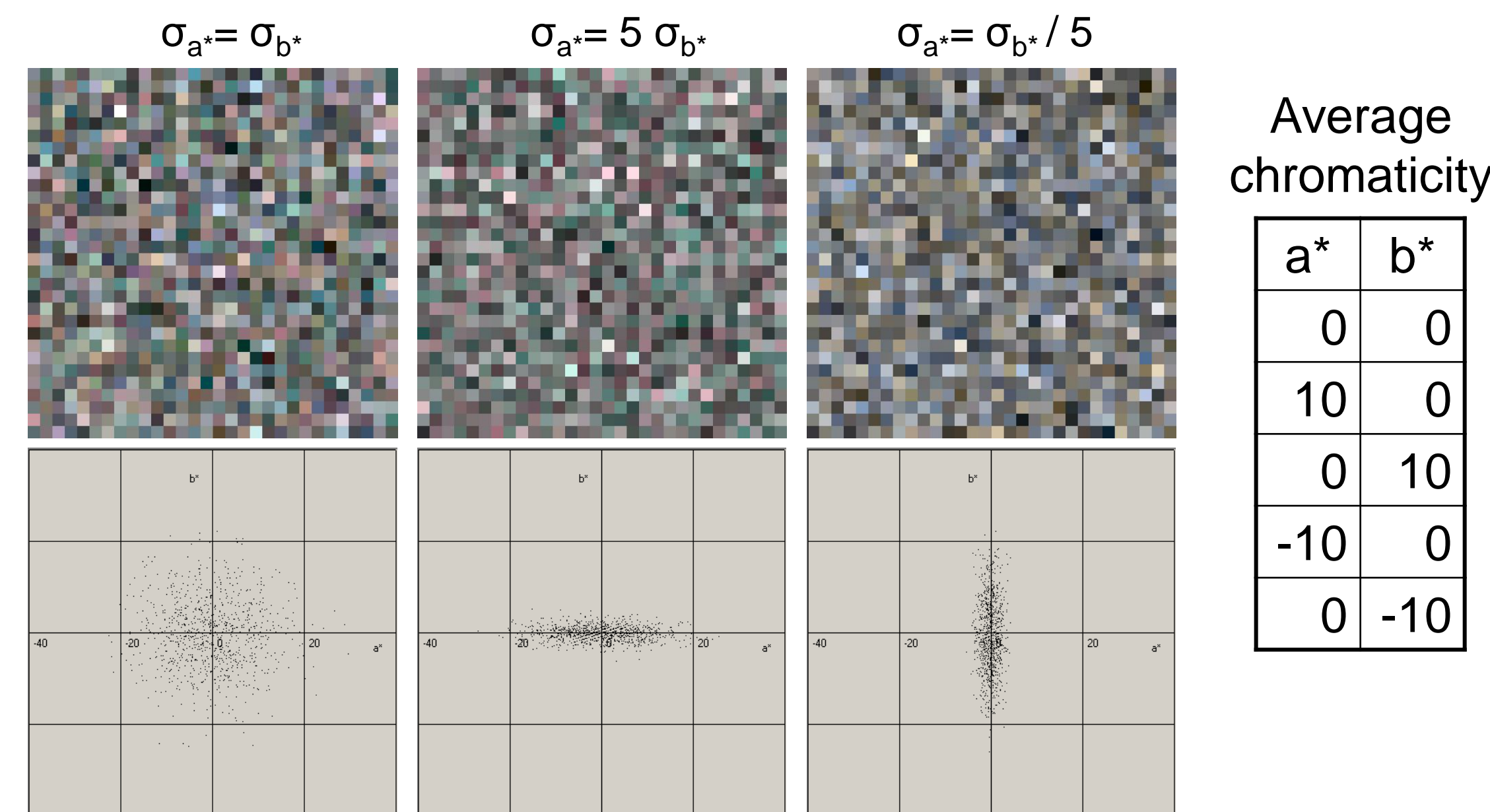
In a paired-comparison, our observers judged the color fidelity of the patterns under two illuminants compared to patterns under neutral reference illumination. They indicated which of the two illuminants showed better color constancy.

Our results show that color constancy is best when the dominant axis of the chromatic distribution is parallel to the direction of the illuminant change.

In conclusion, color constancy depends on the chromatic distribution of the scene.

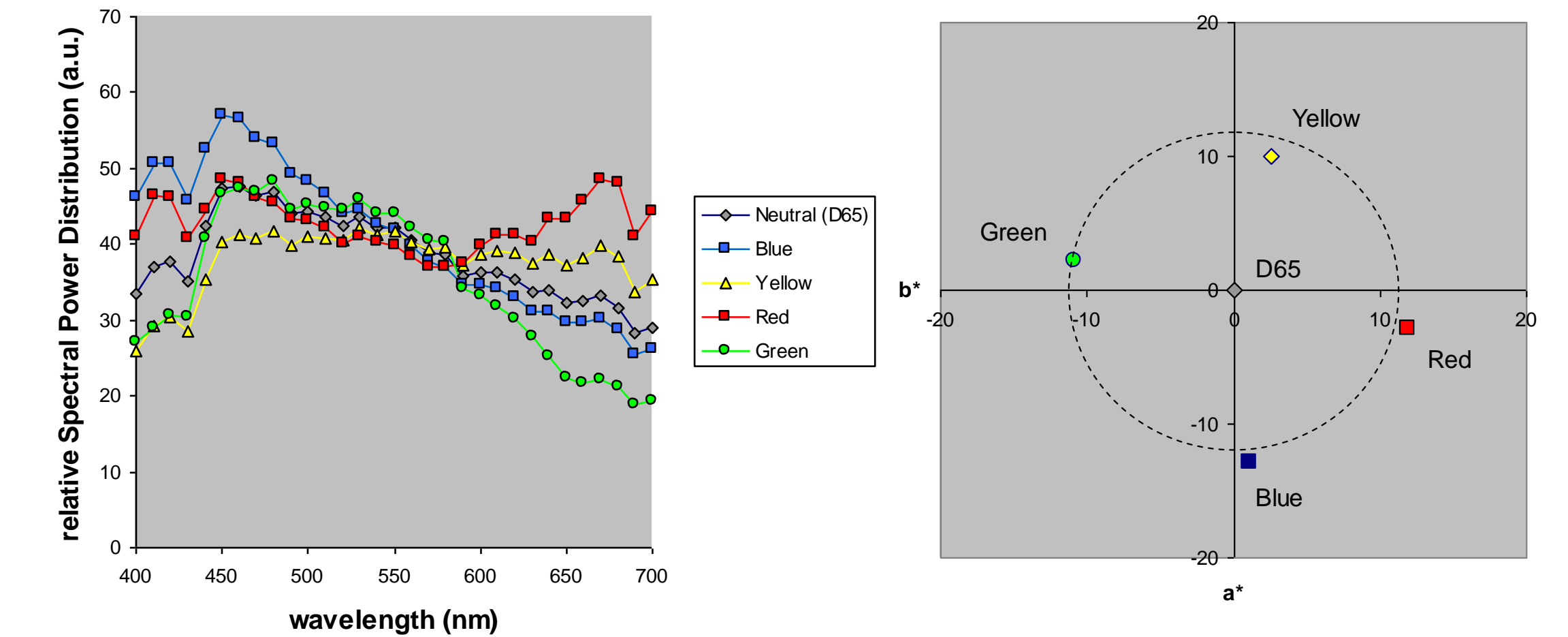
2. Test Patterns

• Images were composed of 900 patches varying in CIE L*a*b* values. Both the average chromaticity and the chromatic distribution were varied. The 2D Gaussian distribution of a*b* values was either circular, or ellipsoid with the variance in a* 5 times that in b*, or vice versa.



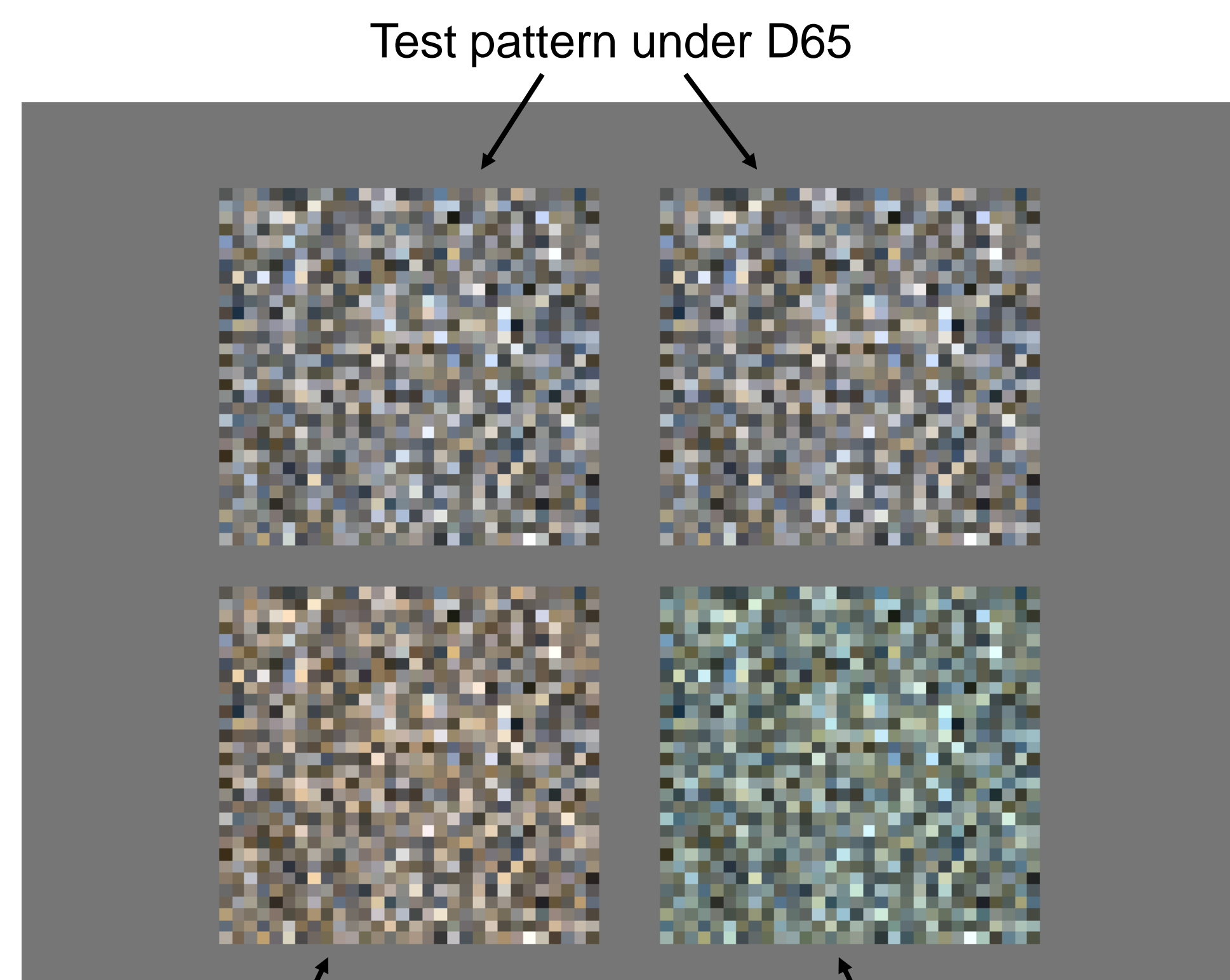
• Smoothest reflectance functions were calculated for each patch

3. Illuminants



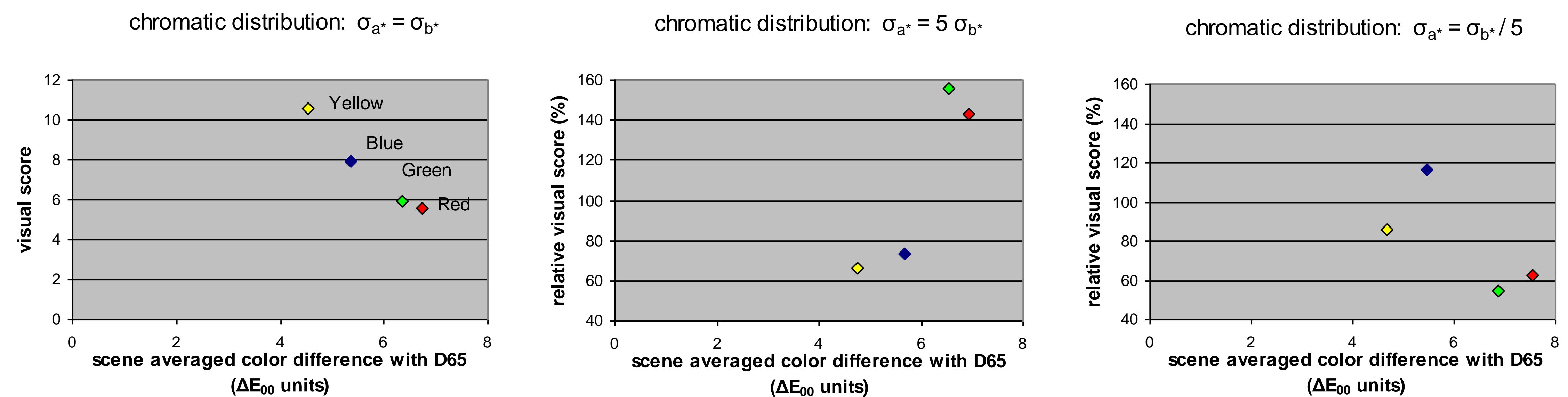
- Illuminants were created with CIE daylight basis functions
- D65 used as reference illuminant
- Red, Green, Yellow, Blue as test illuminants
- Approximately equally distant from the neutral point ($\approx 12 \Delta E_{ab}$)

4. Psychophysical Experiment



- 5 observers indicated which illuminant gives best color constancy (compared to D65)
- Visual score

5. Results



6. Conclusions

Color constancy

- 1) depends on the chromatic distribution of the test pattern;
- 2) is best when the major axis of the chromatic distribution is parallel to the direction of the illuminant change.

7. References

- CIE. Colorimetry, 2nd edition. CIE Publication No. 15.2. Vienna: Central Bureau of the CIE, 1986.
- Delahunt, P.B., Brainard, D.H. (2004). Does human color constancy incorporate the statistical regularity of natural daylight? *Journal of Vision*, 4(2):1, 57-81.
- C. van Trigt (1990). Smoothest reflectance functions I: definition and main results. *J. Opt. Soc. Am. A*, 7, 1891-1904.