

The powers of attraction of chromatic light from LED-spotlights

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PHILIPS
sense and simplicity

TUDelft

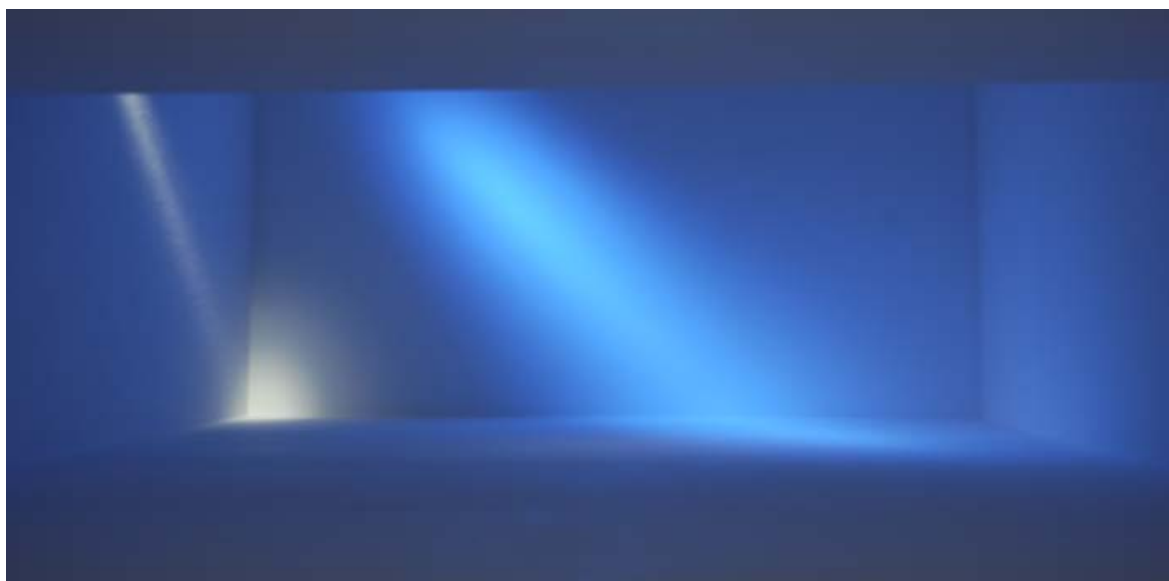


* renderings

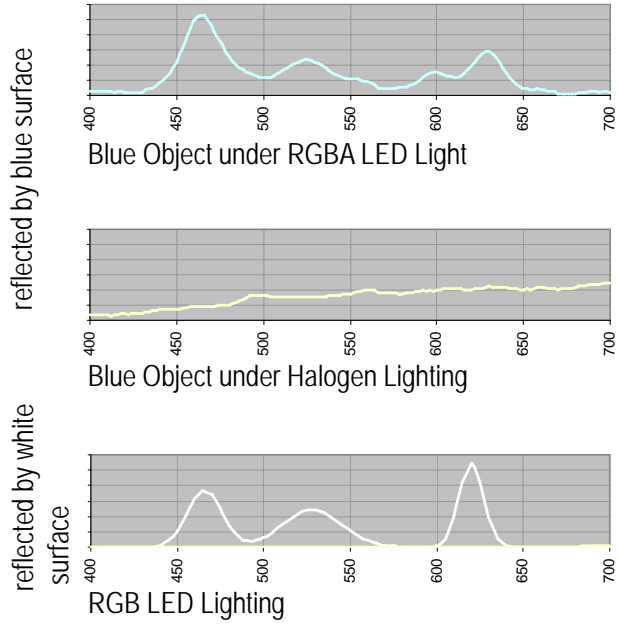
Accent lighting:

Accent lighting is directional lighting to emphasize a particular object or surface feature or to draw attention to a part of field of view.

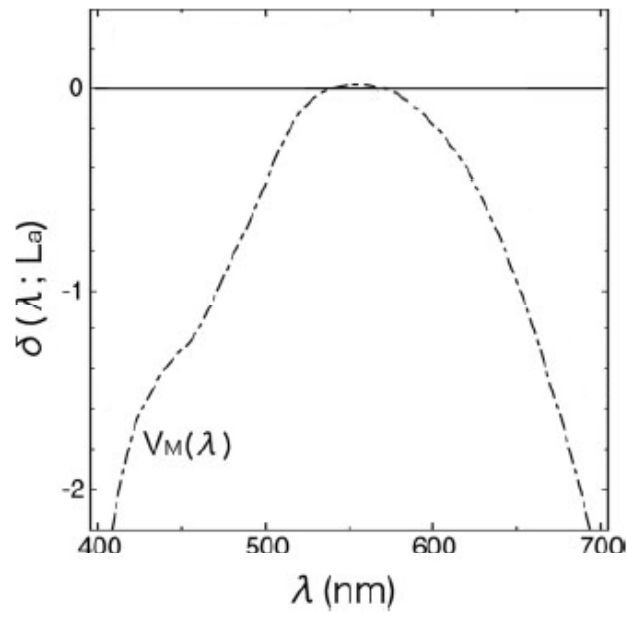
IESNA 2003



Color - spectral power distribution



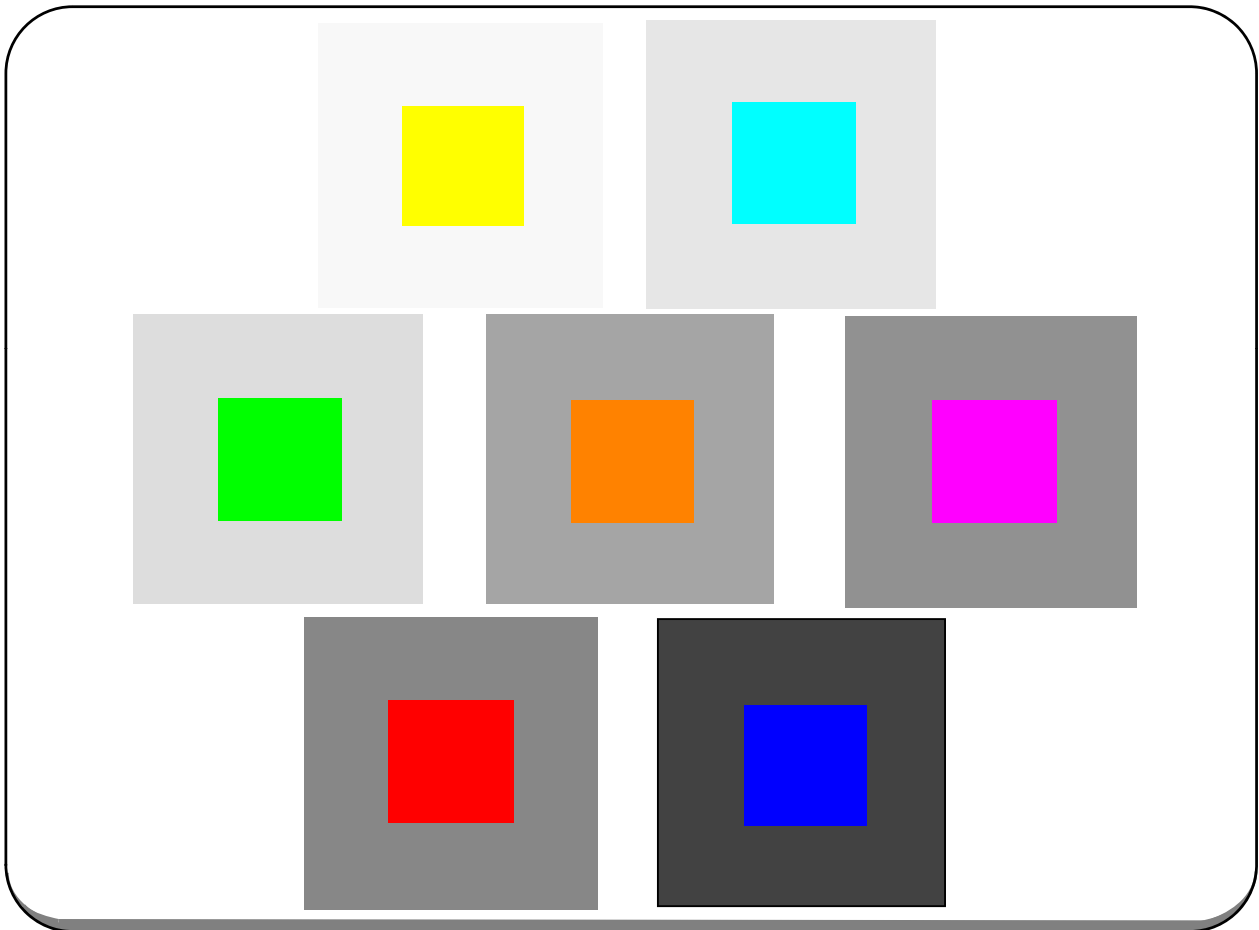
Luminous Efficiency Function



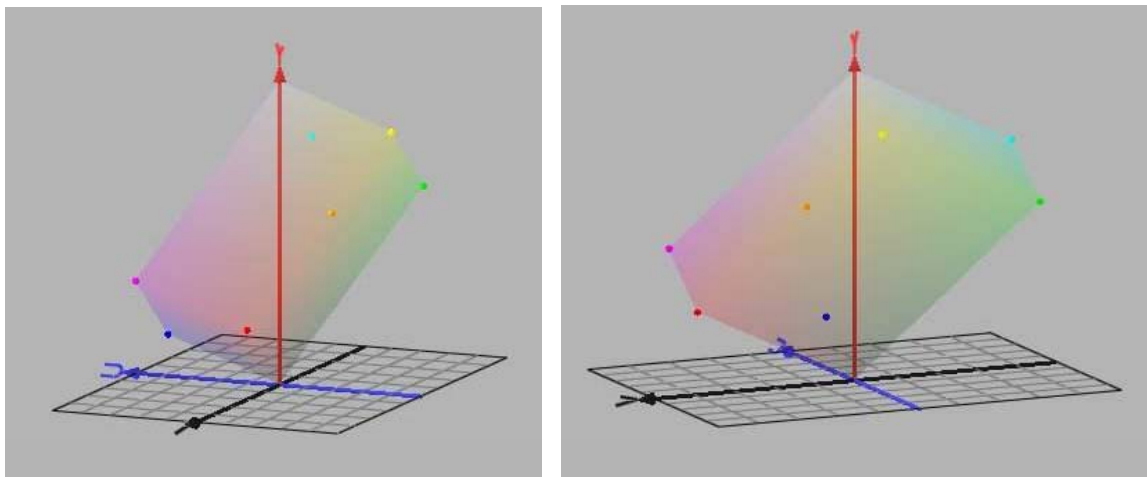
CIE 1988 Spectral Luminous Efficiency Function

Balancing

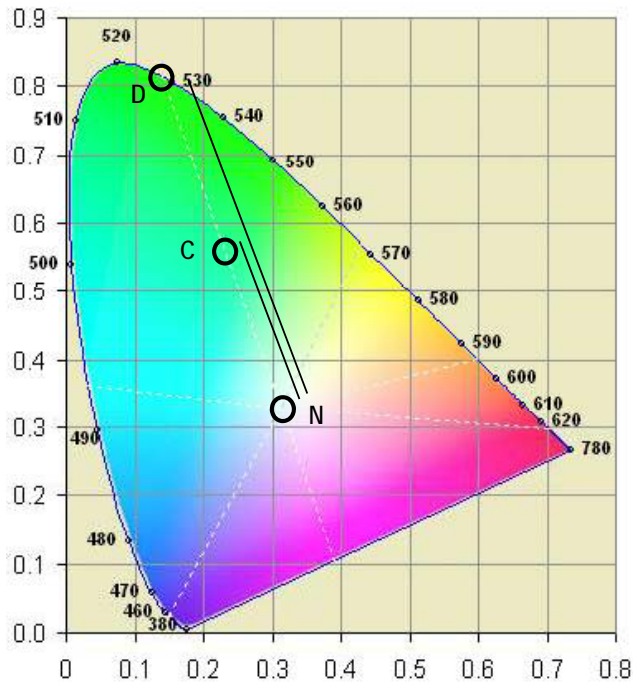




Color points in 3D color space



Chromaticity



Purity:

$$p = NC / ND$$

- N ... achromatic light stimulus
- C ... color stimulus
- D ... dominant wavelength on the spectrum locus

Perceptual terms and Psychophysical measures

Subjective Perceptual Term	Objective Psychophysical Measure
Brightness	Luminance Surround luminance
Hue	Dominant Wavelength
Colorfulness; Saturation	Chromaticity coordinates

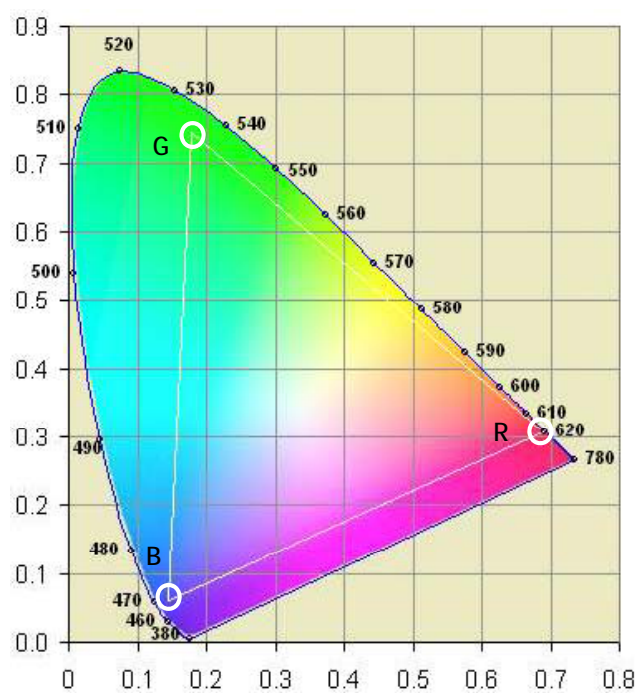
Saturation: The colourfulness of an area relative to its brightness. ($s_{uv} = 13 \times NC$)

Objective:

What luminance is required for LED-spotlights of different chromaticities to provide equal attraction value?

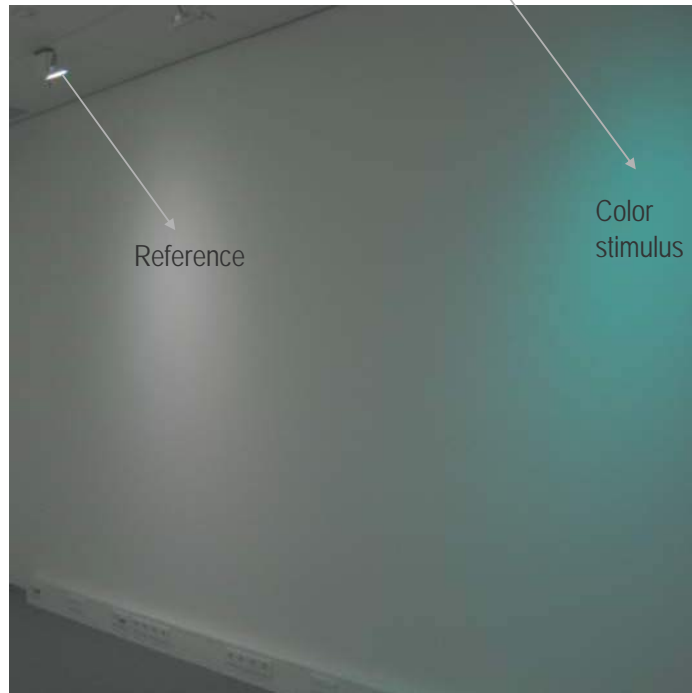
Attraction value is the characteristic that a certain area exhibits to arouse visual interest and attract views.

Trichromatic mixing with red – green – blue LED sources

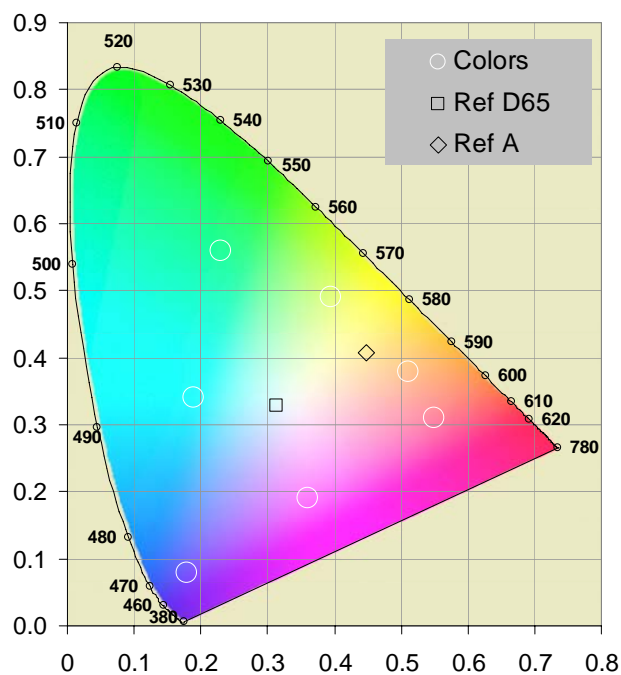


Experimental condition

- Accent lighting condition:
- Achromatic reference luminance approx. 10 cd/m²
- Surrounding luminance 1 cd/m²
- Reference and general light of CCT 6500K



Test stimuli



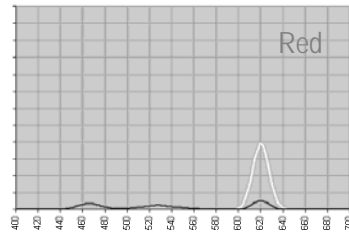
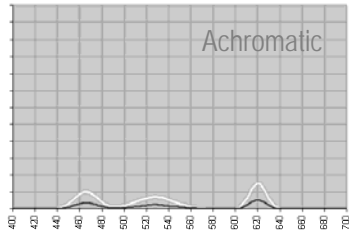
Primaries:

- red
- green
- blue

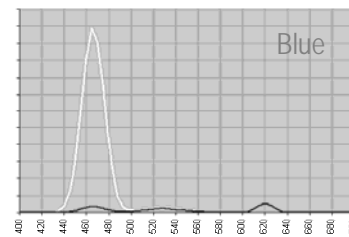
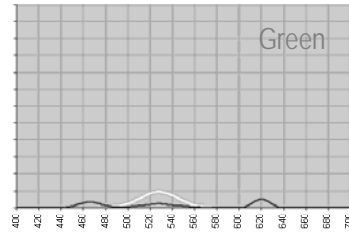
Mixtures:

- orange
- yellow
- cyan
- purple

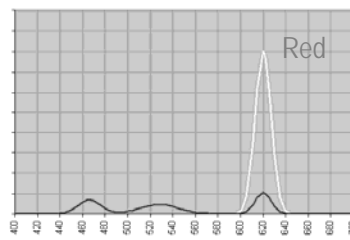
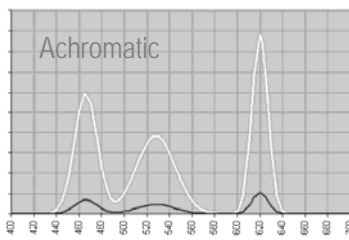
Isoluminant set of stimuli



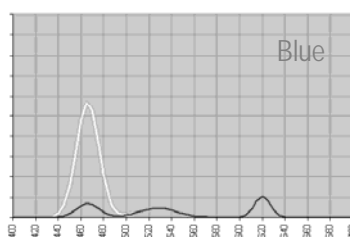
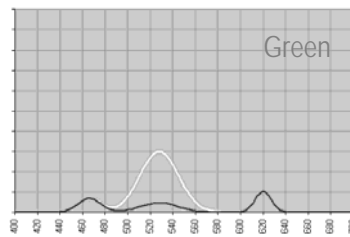
spectral power distributions



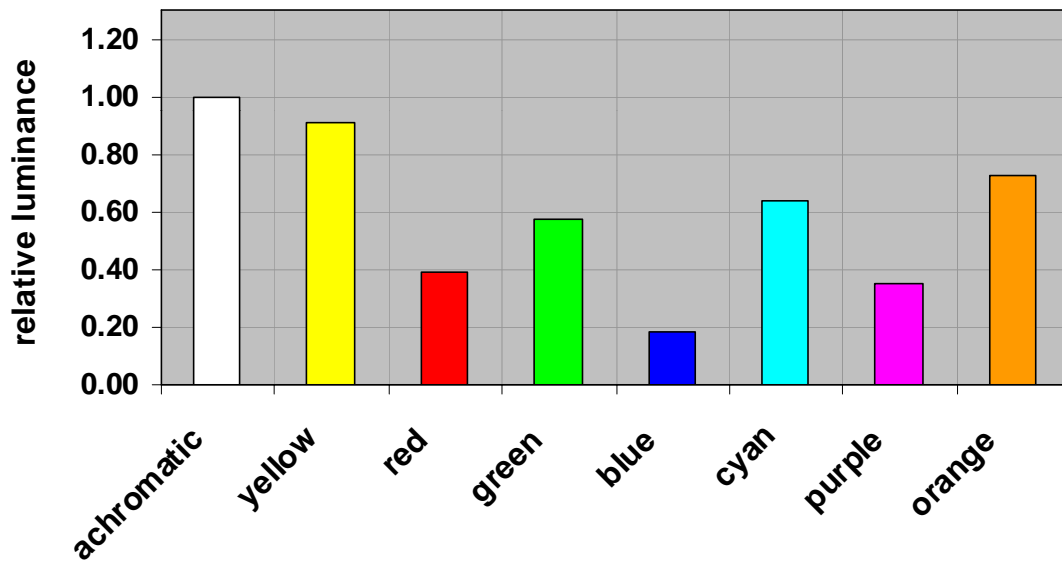
Set of stimuli balanced according attraction value



spectral power distributions



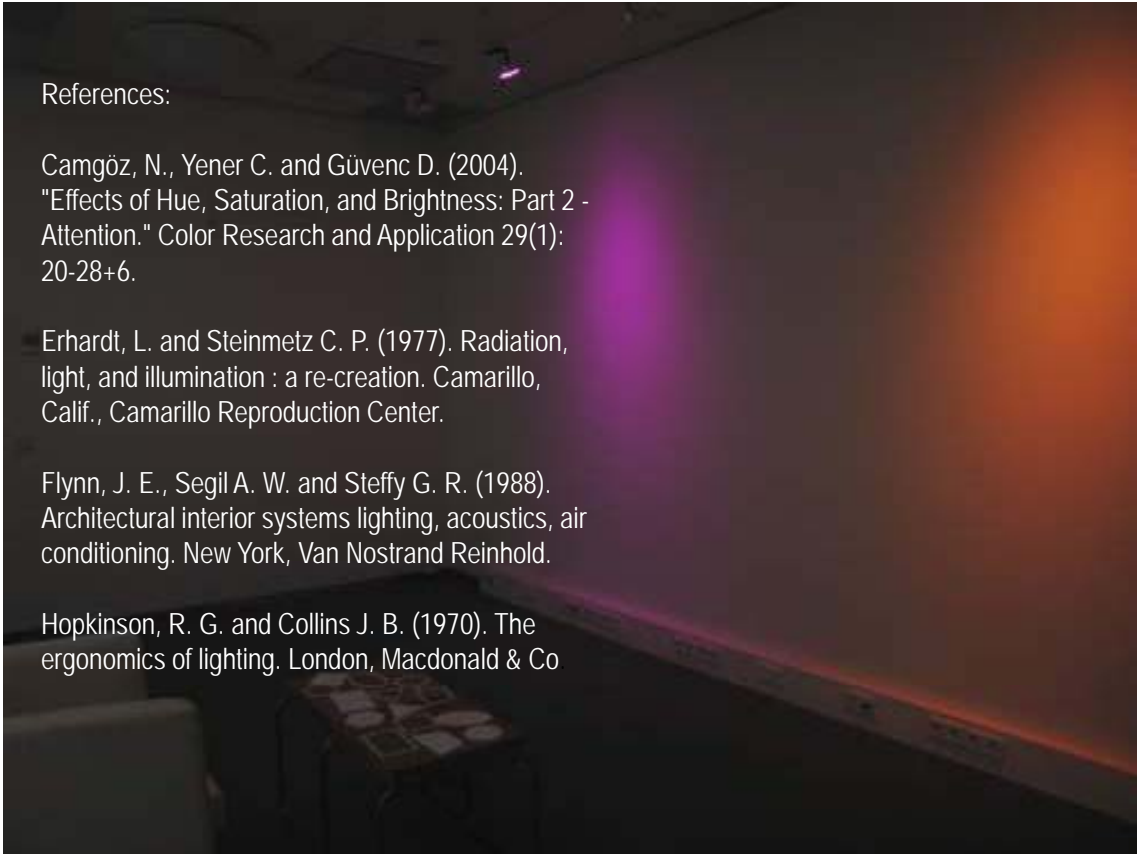
Balanced luminances



Conclusion:

Dependent on hue and saturation the luminances vary that provide same attraction value.

One potential use is to formulate an underlying order to accentuate objects or areas according to attraction value. Another potential application is to determine intensity for chromatic LED illumination to provide the desired emphasis for an object.



References:

Camgöz, N., Yener C. and Güvenc D. (2004).
"Effects of Hue, Saturation, and Brightness: Part 2 -
Attention." *Color Research and Application* 29(1):
20-28+6.

Erhardt, L. and Steinmetz C. P. (1977). *Radiation,
light, and illumination : a re-creation*. Camarillo,
Calif., Camarillo Reproduction Center.

Flynn, J. E., Segil A. W. and Steffy G. R. (1988).
*Architectural interior systems lighting, acoustics, air
conditioning*. New York, Van Nostrand Reinhold.

Hopkinson, R. G. and Collins J. B. (1970). *The
ergonomics of lighting*. London, Macdonald & Co