



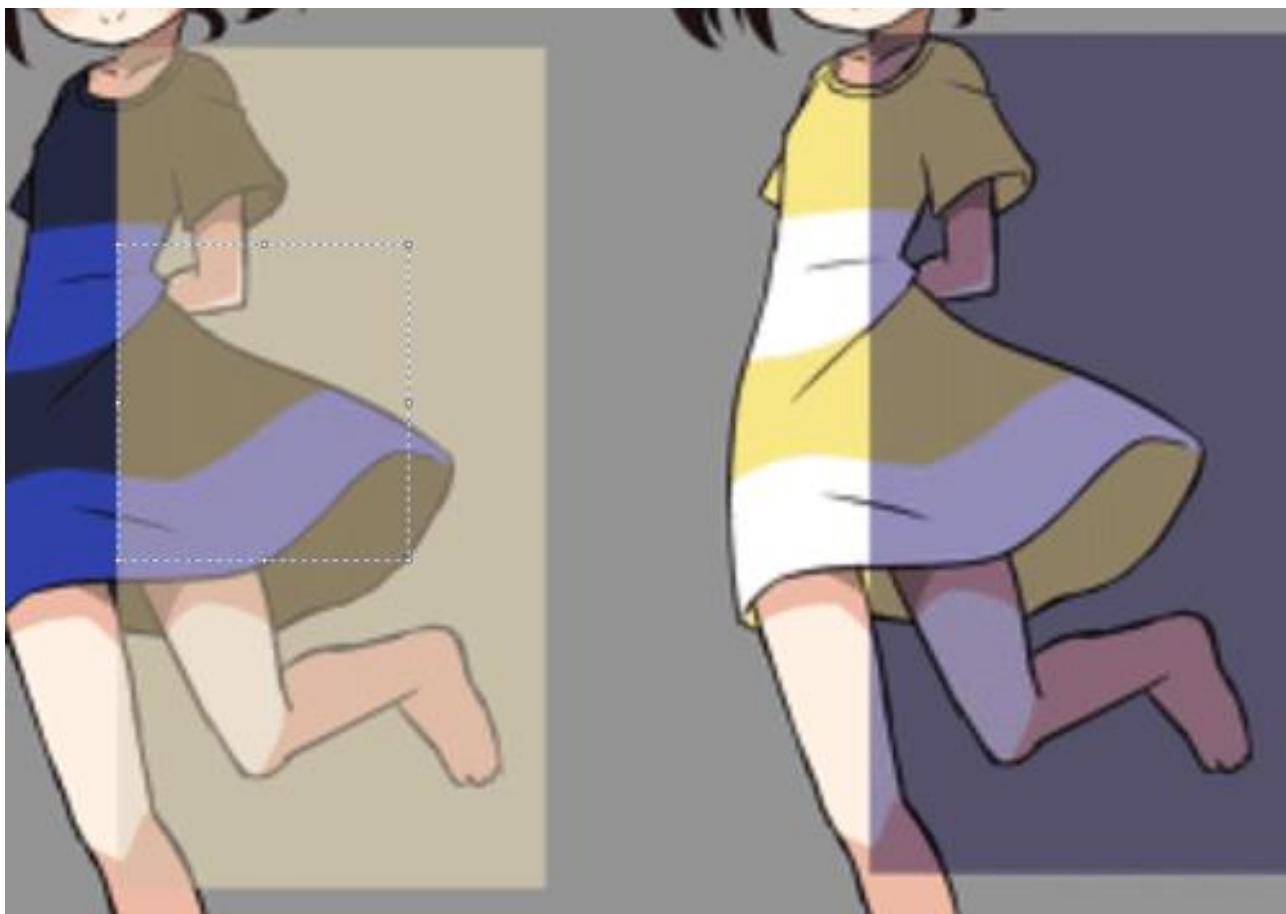


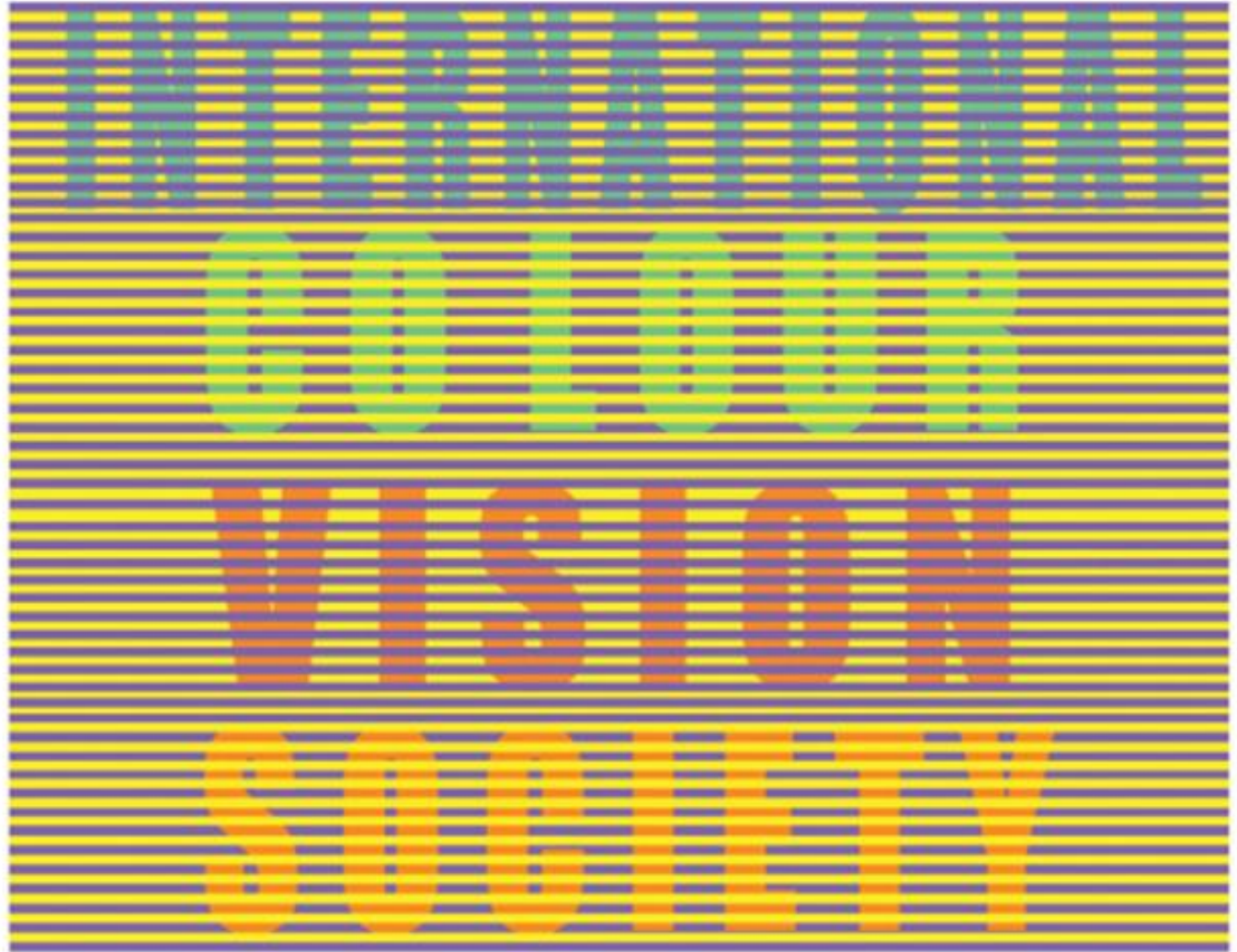
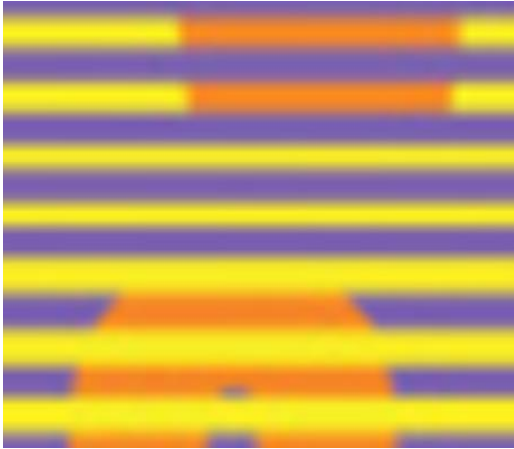
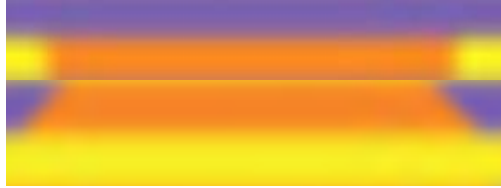


What is white?



What is colour?





Colours for design



Colours for information



Colours for signals





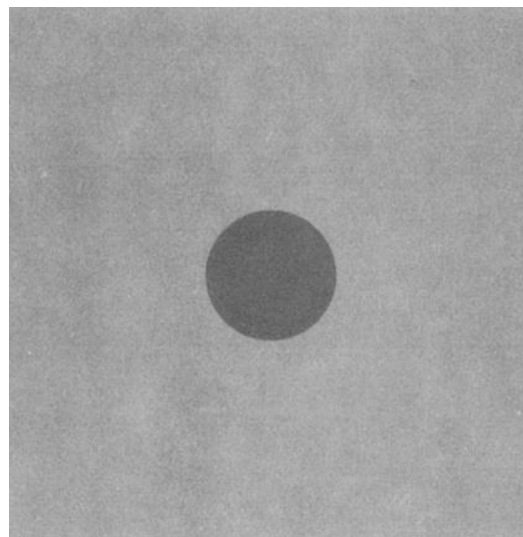
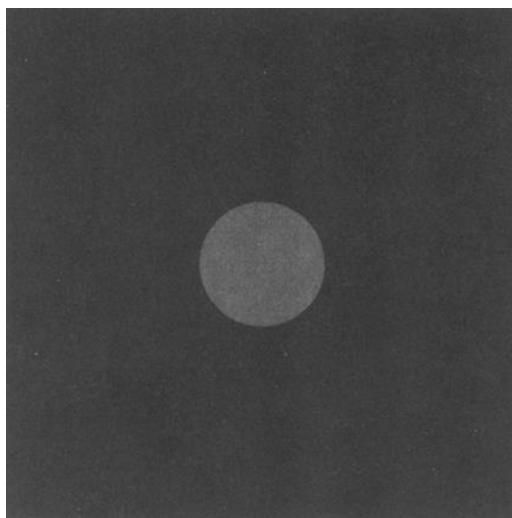
Monet – Rouen Cathedral

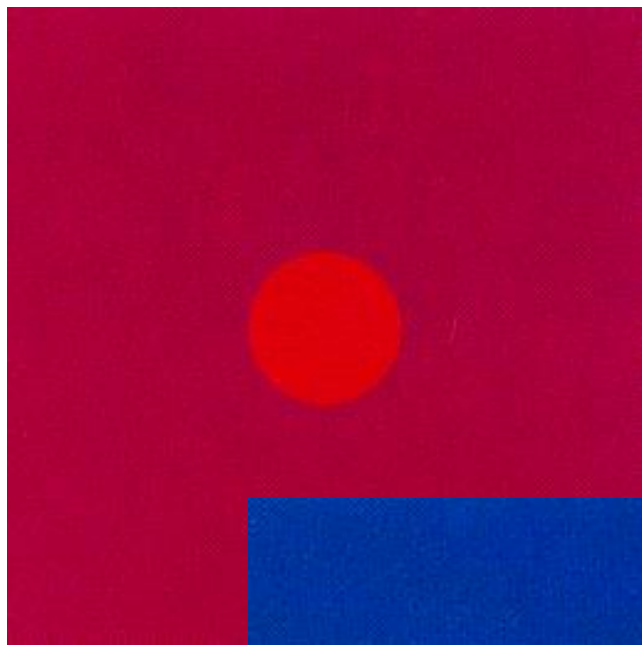
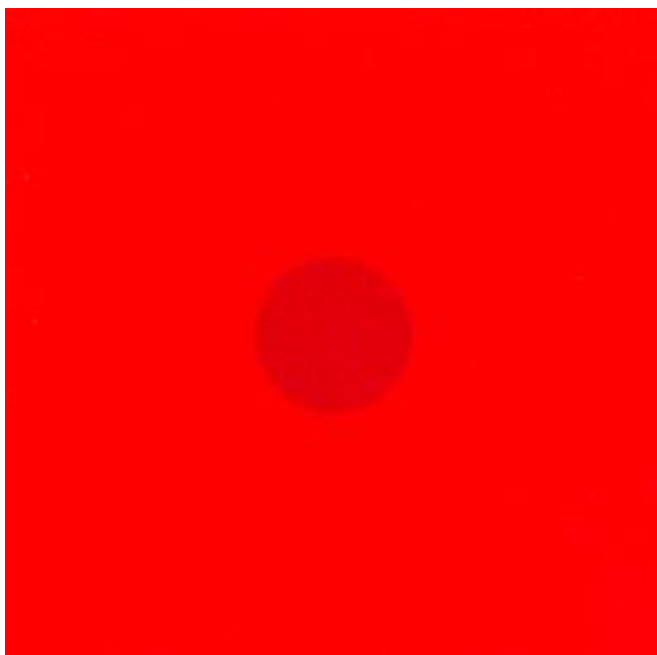
Perception

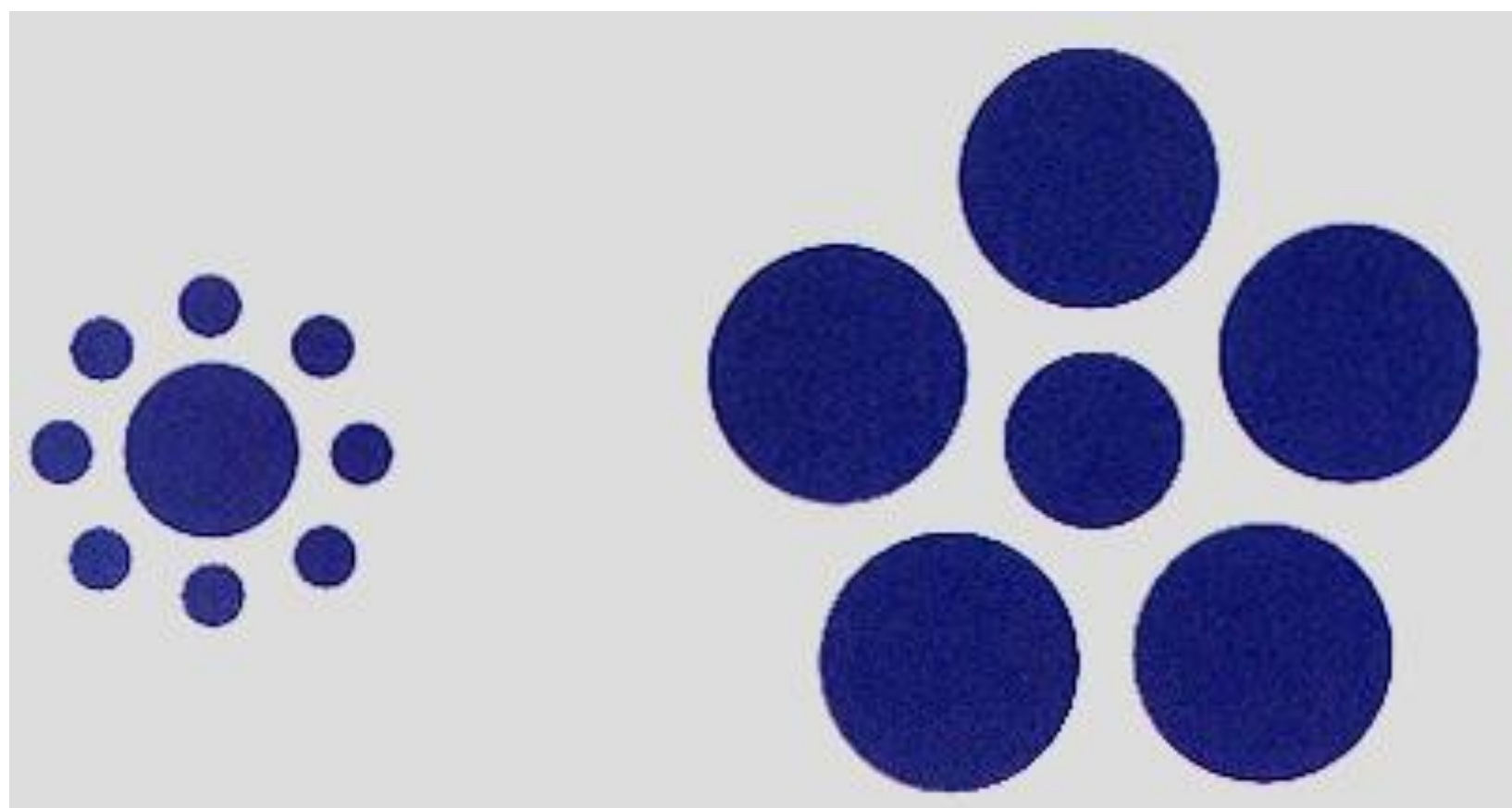


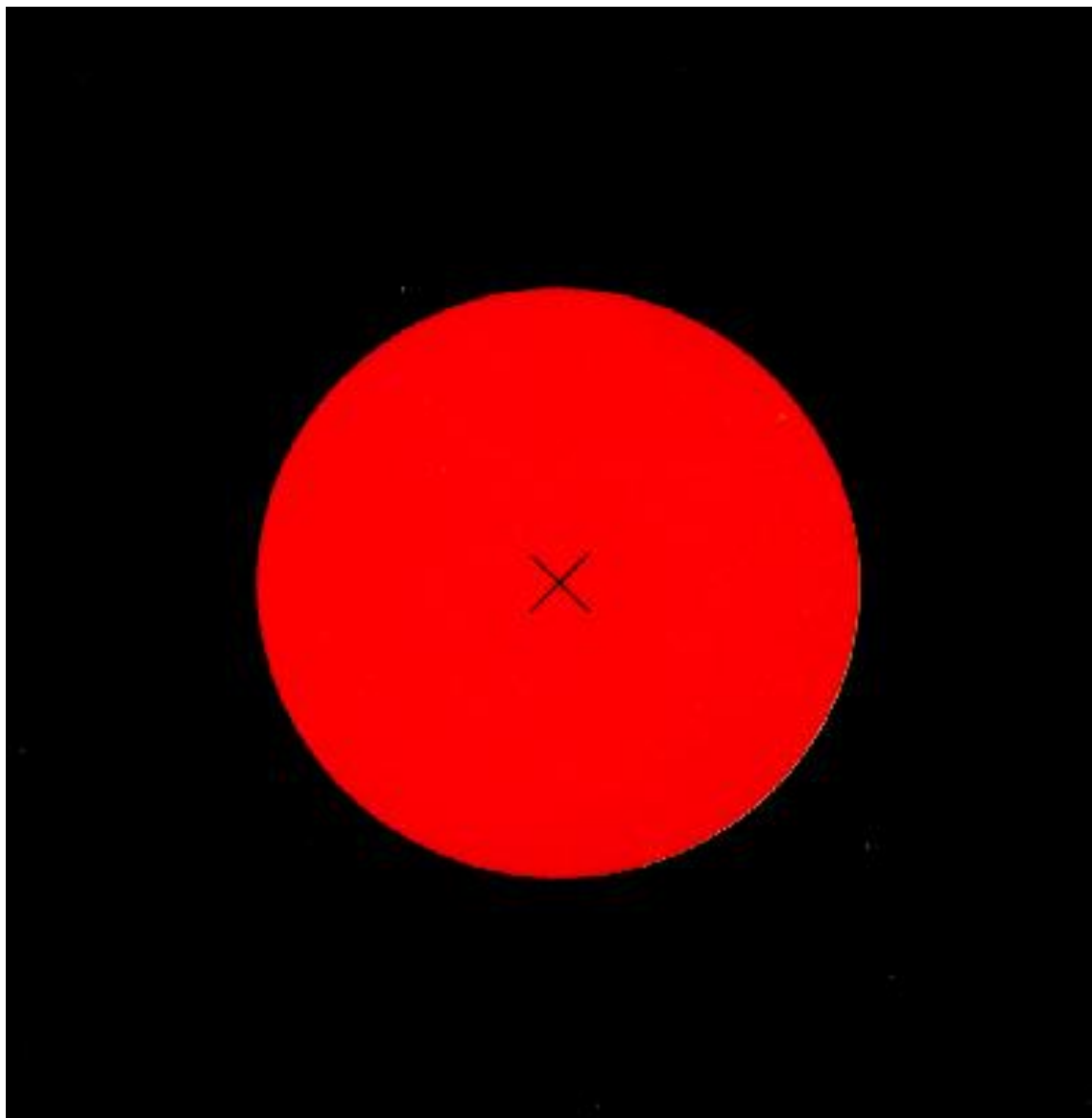
- | | | |
|----|--------|------|
| 1. | Vision | 90 % |
| 2. | Sound | 6 % |
| 3. | Smell | 2 % |
| 4. | Touch | 1 % |
| 5. | Taste | 1 % |





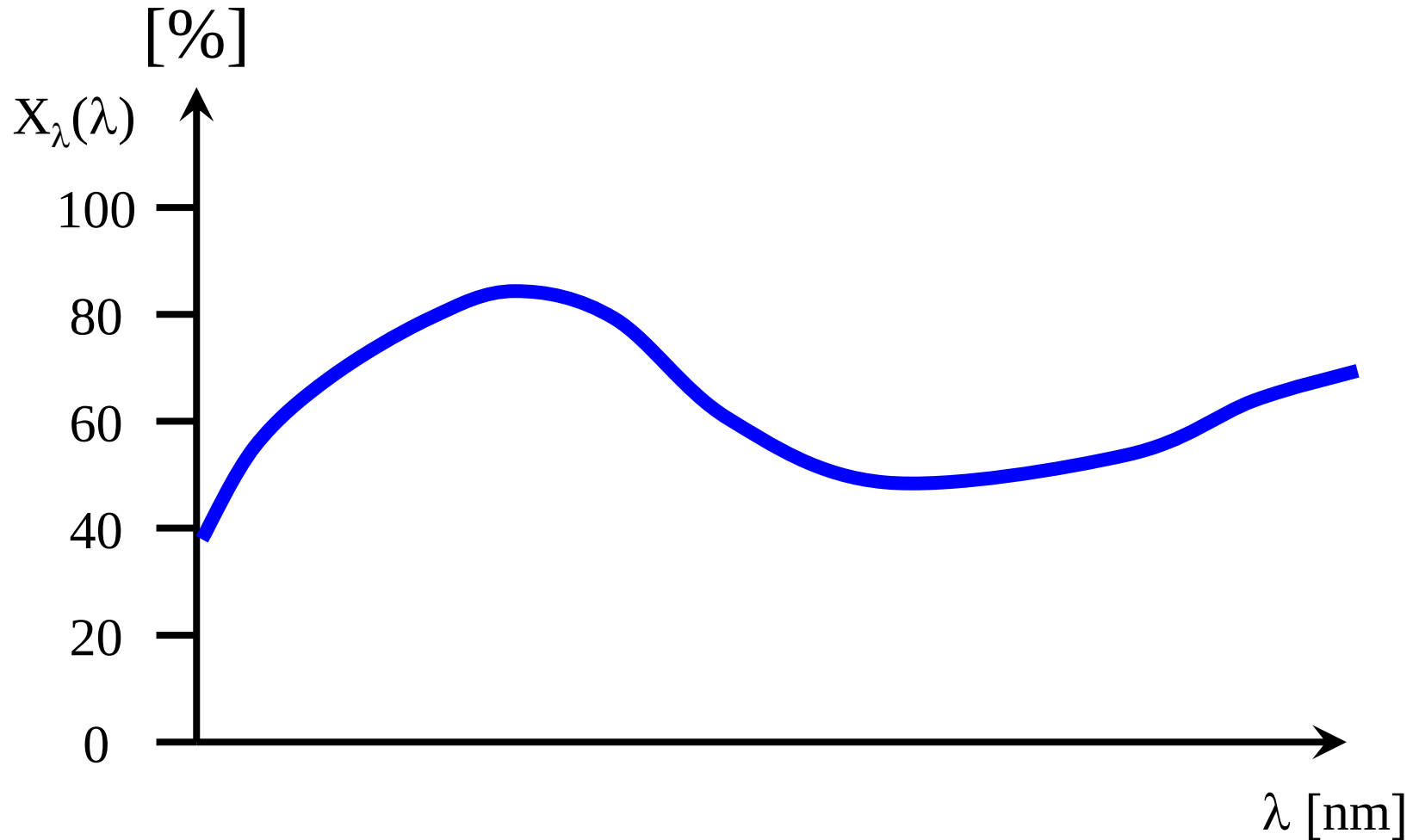




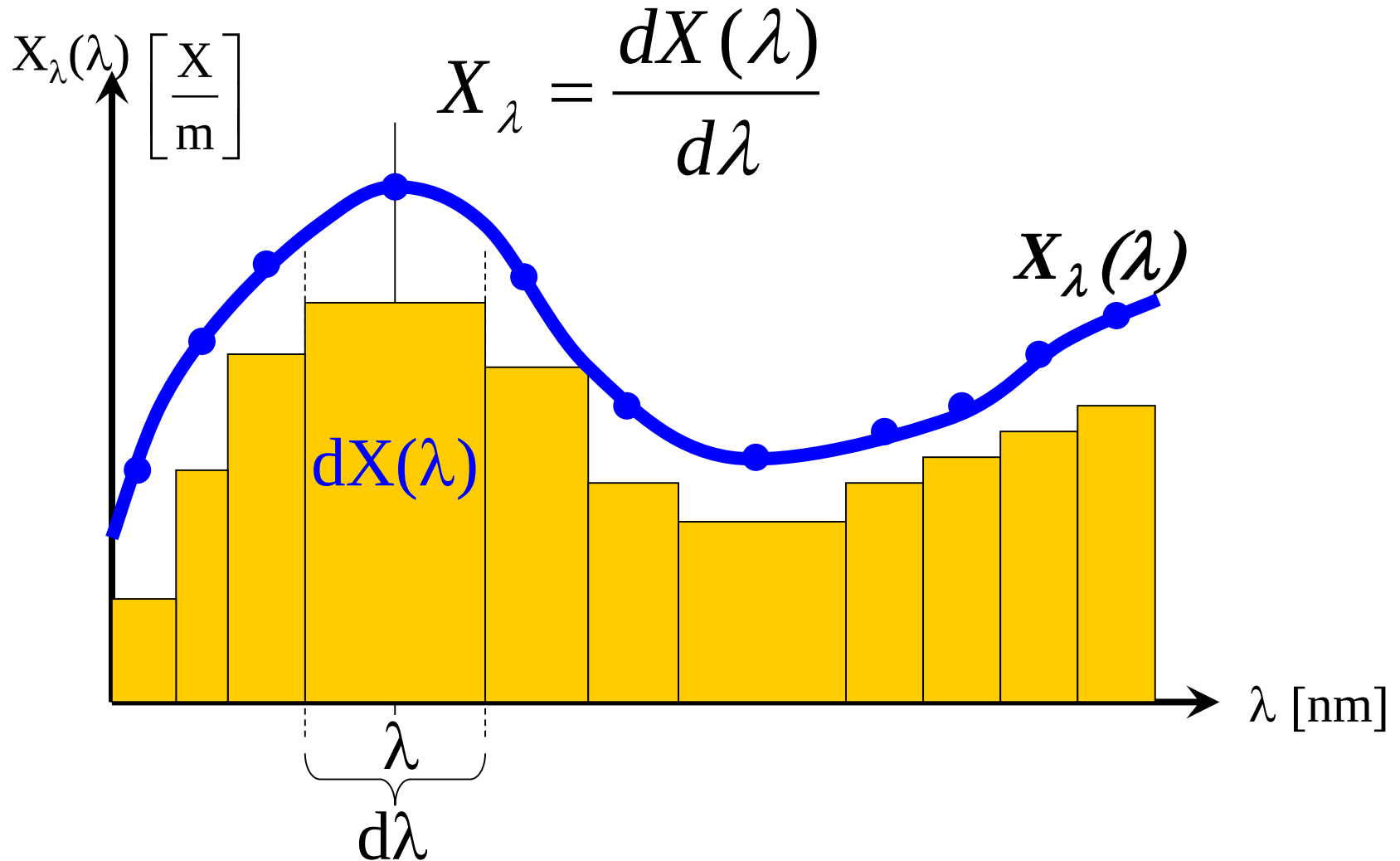




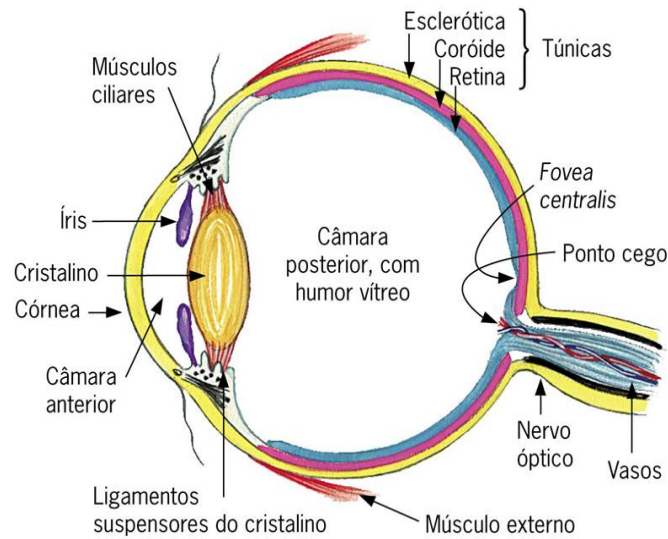
Spectral power distribution



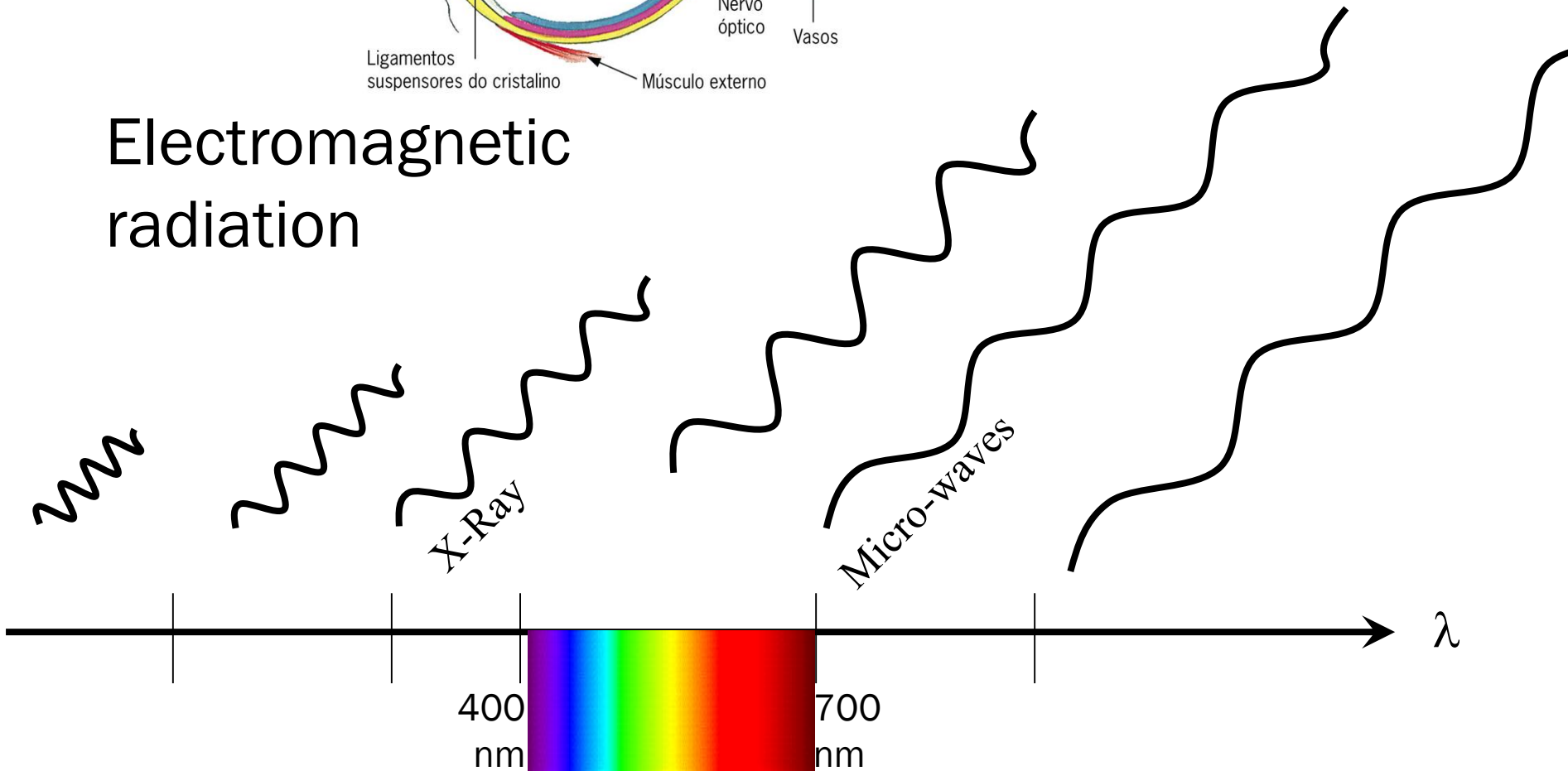
Spectral power distribution



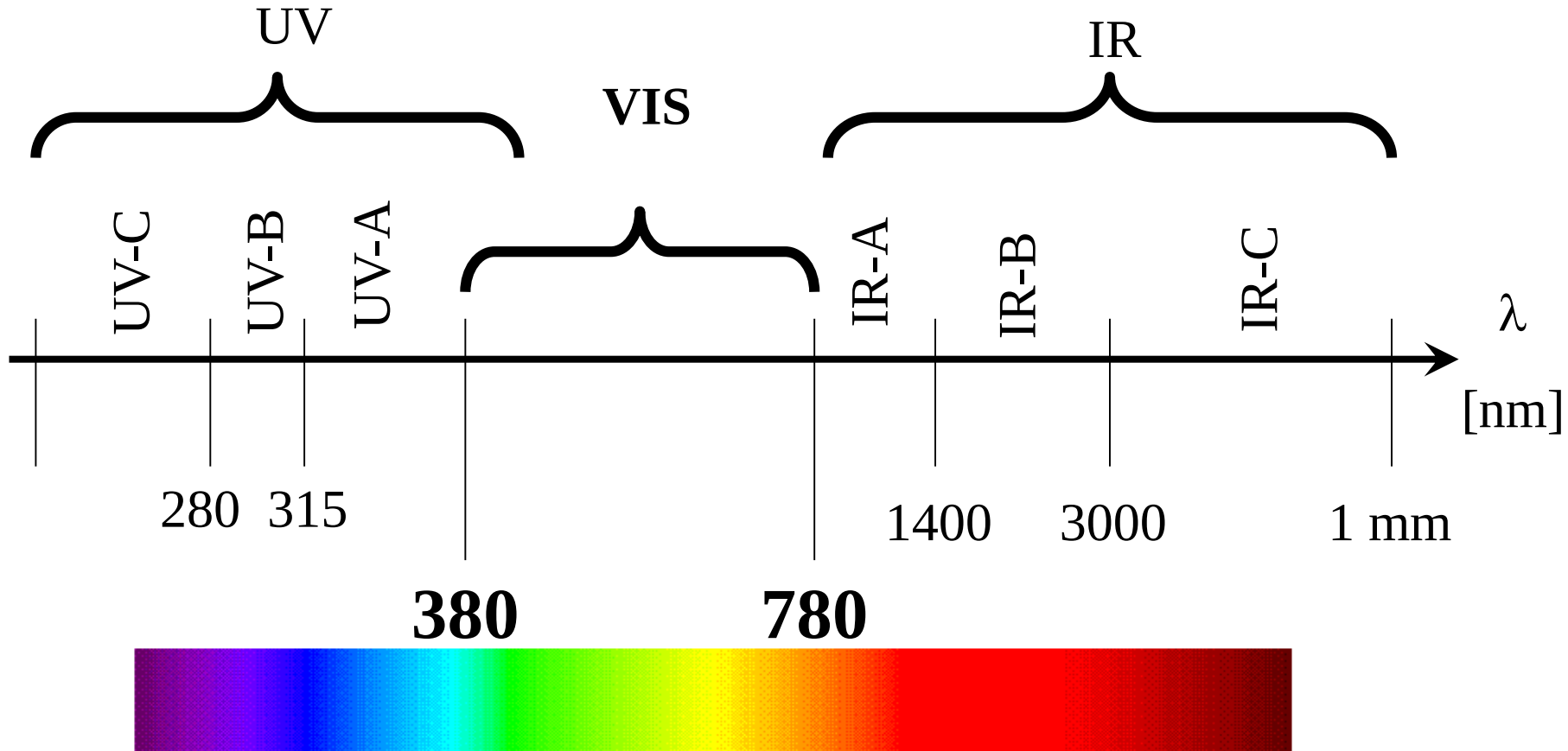
Human vision

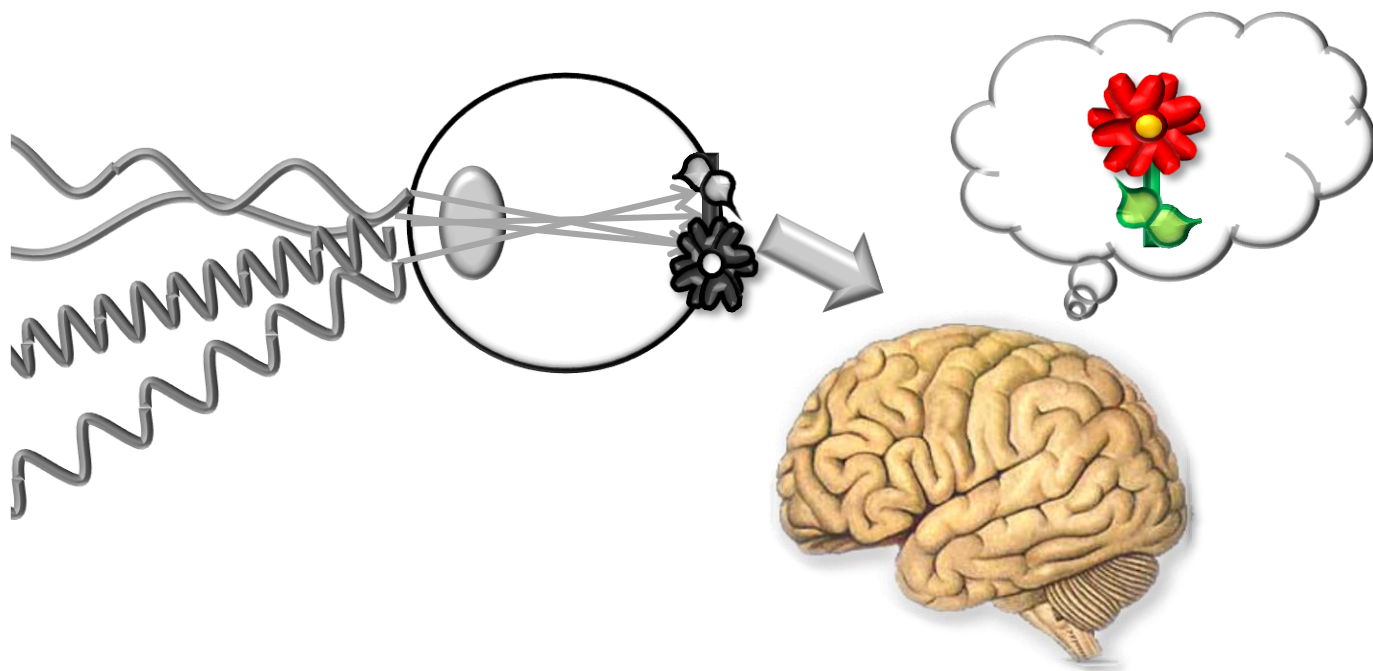


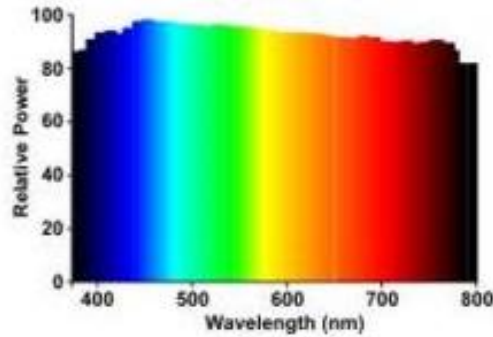
Electromagnetic radiation



Optical radiation



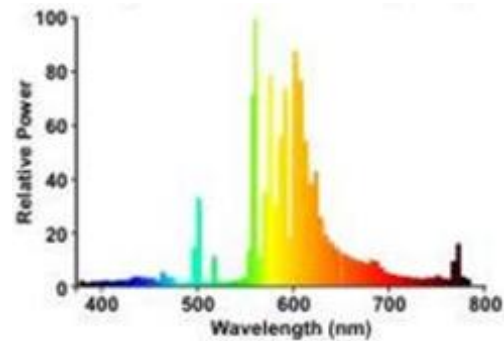


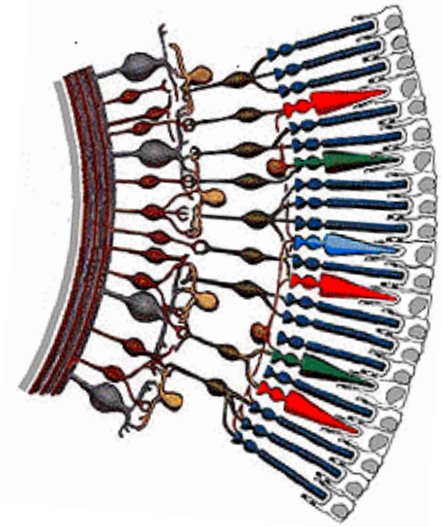
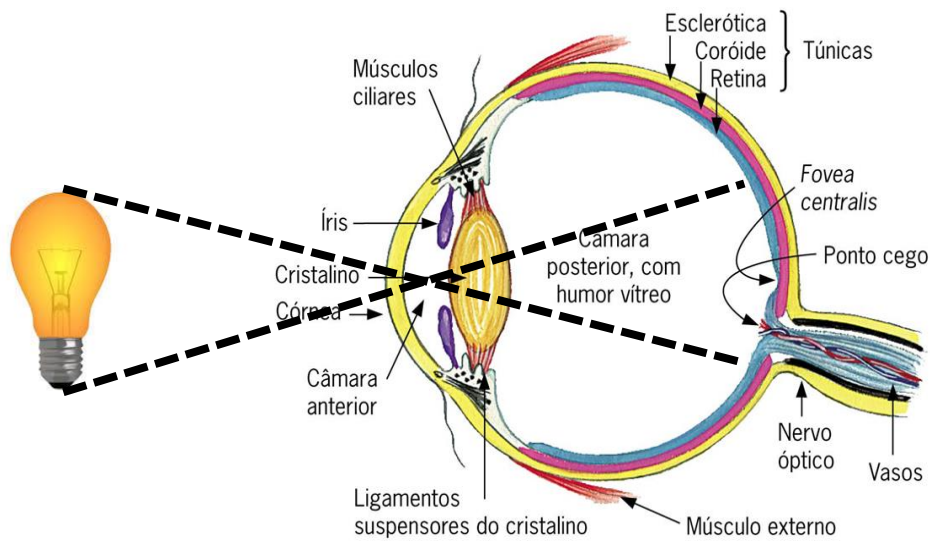


Natural lighting



Artificial lighting



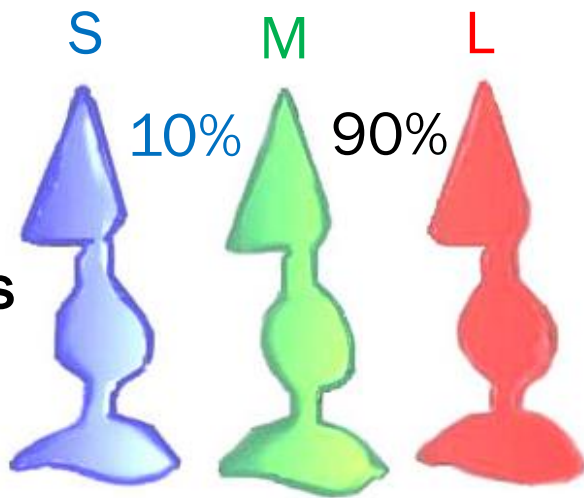


RETINA

Cones/Rods



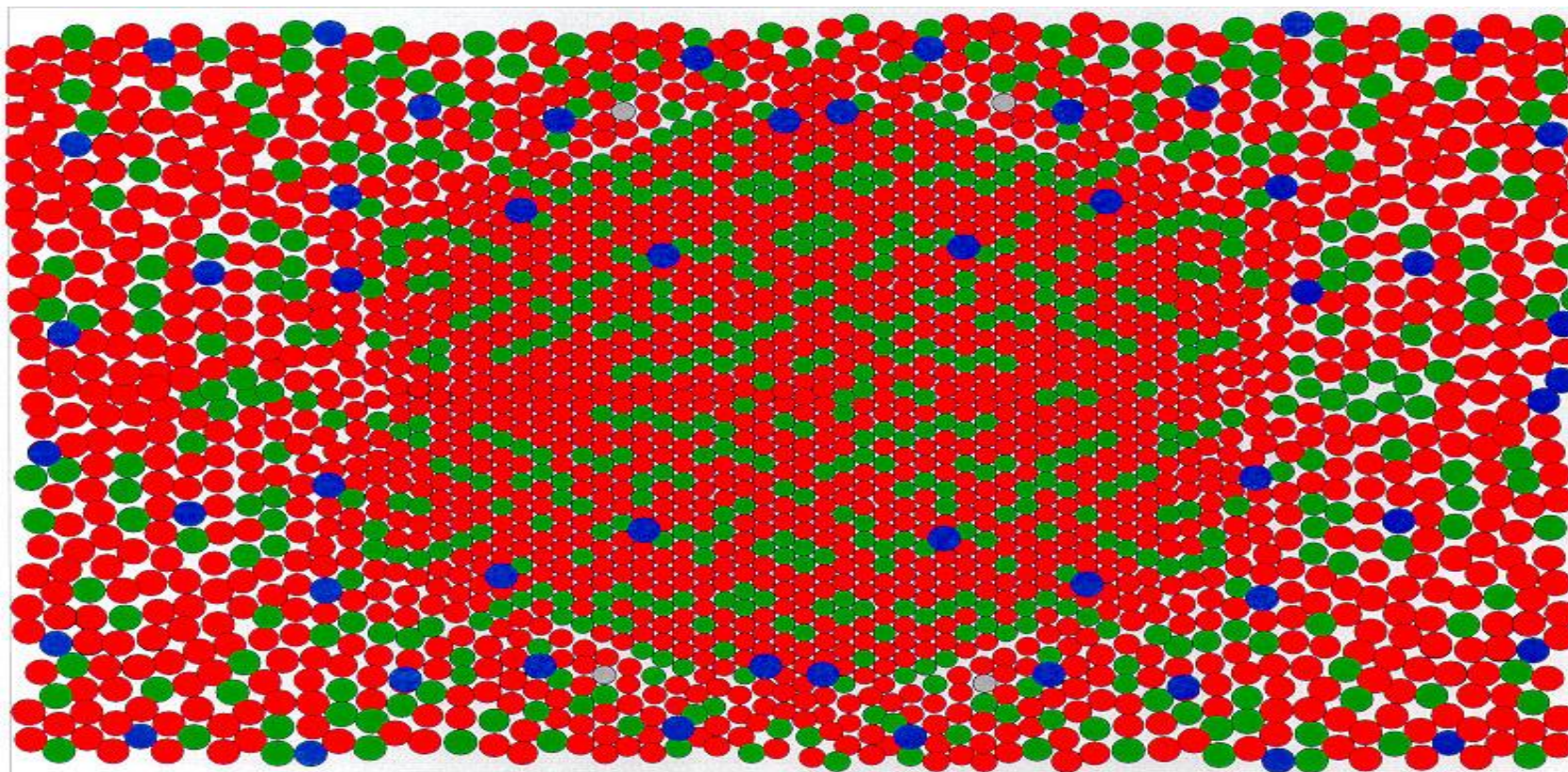
5 - 7 millions
cones

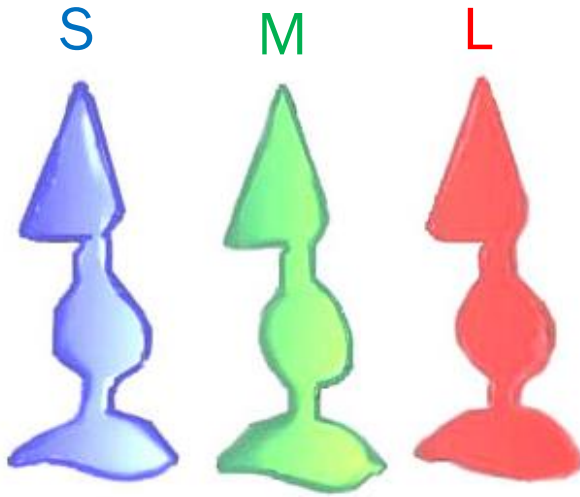


120 millions
rods

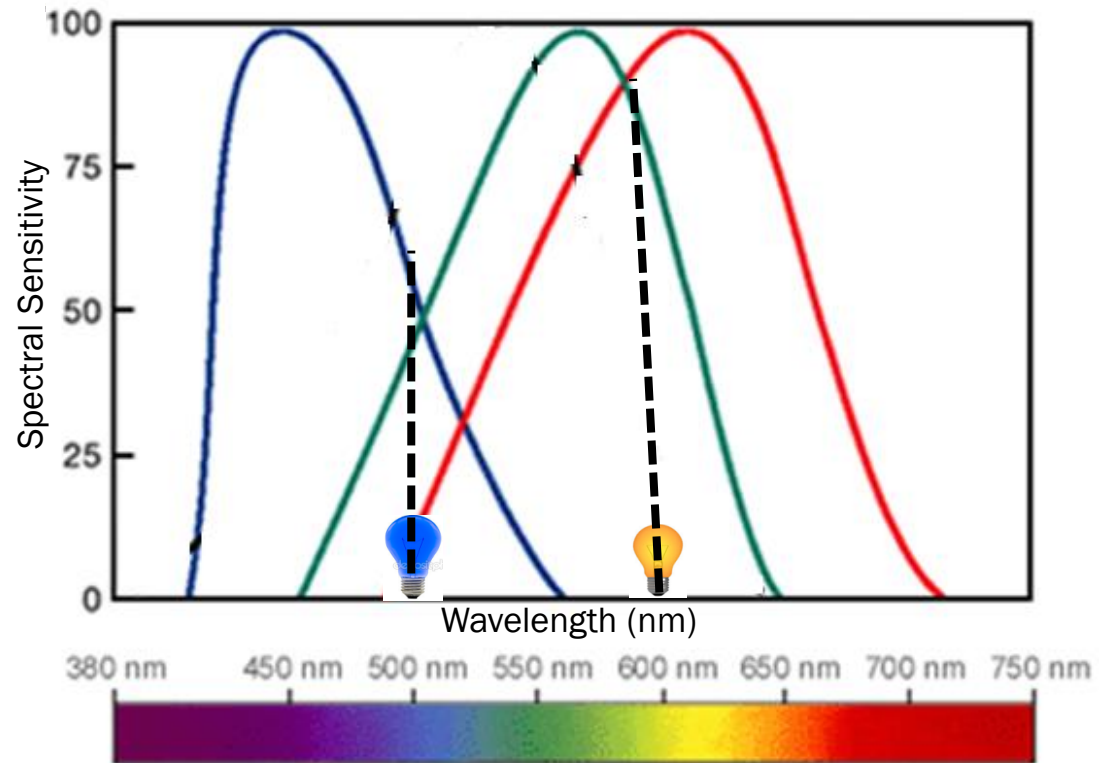
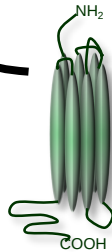


Roorda & Williams (1999)

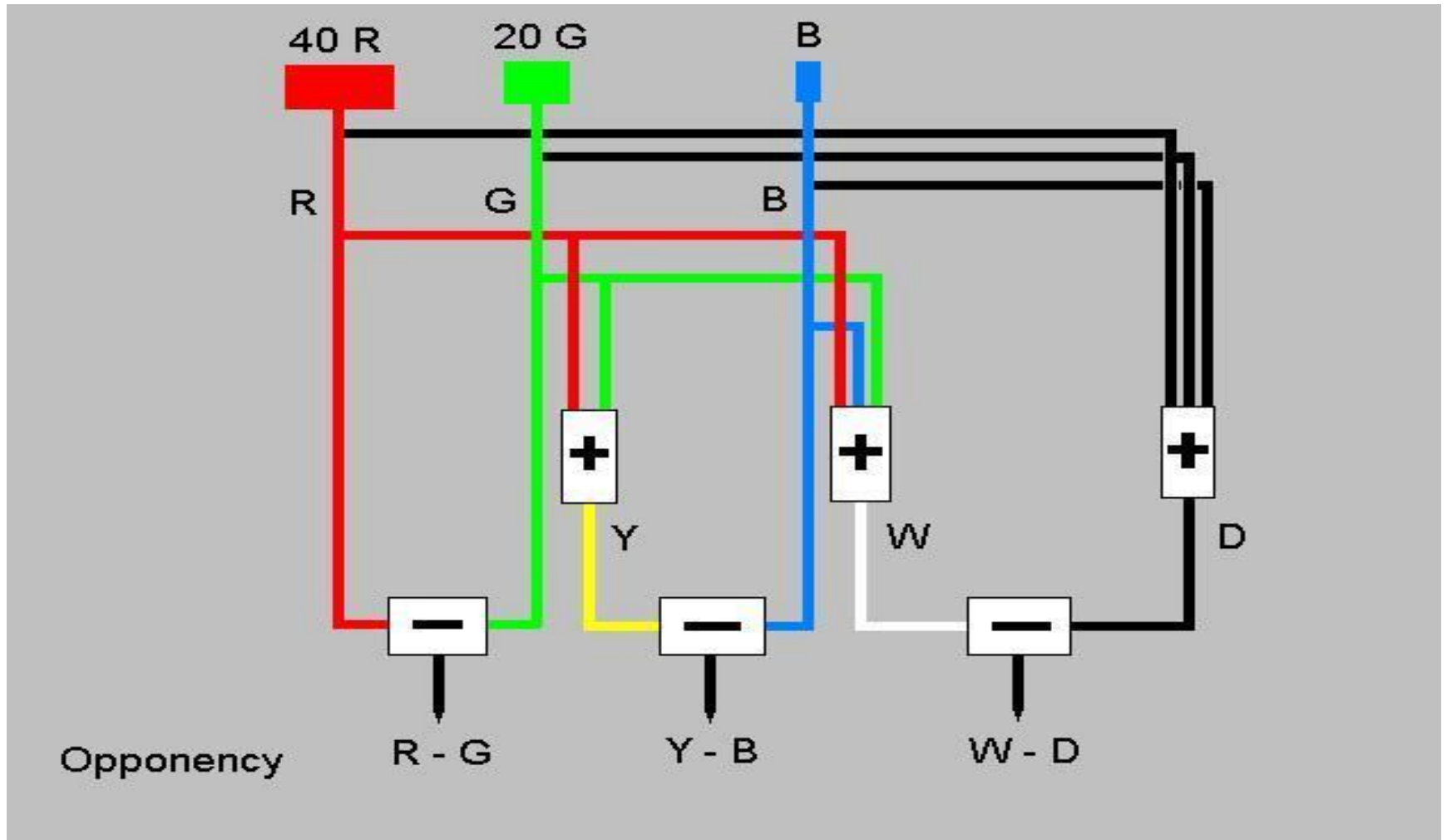




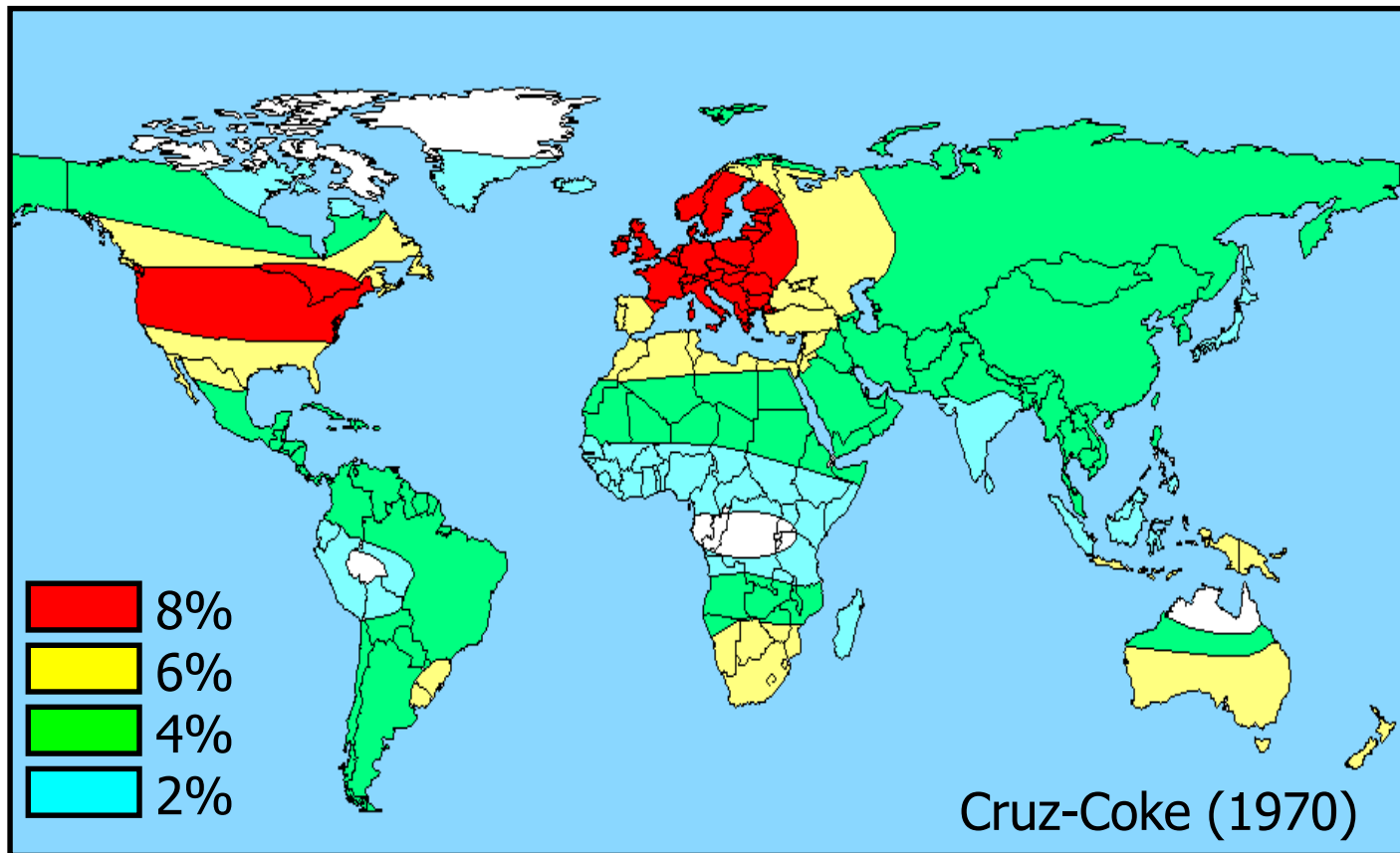
Opsin

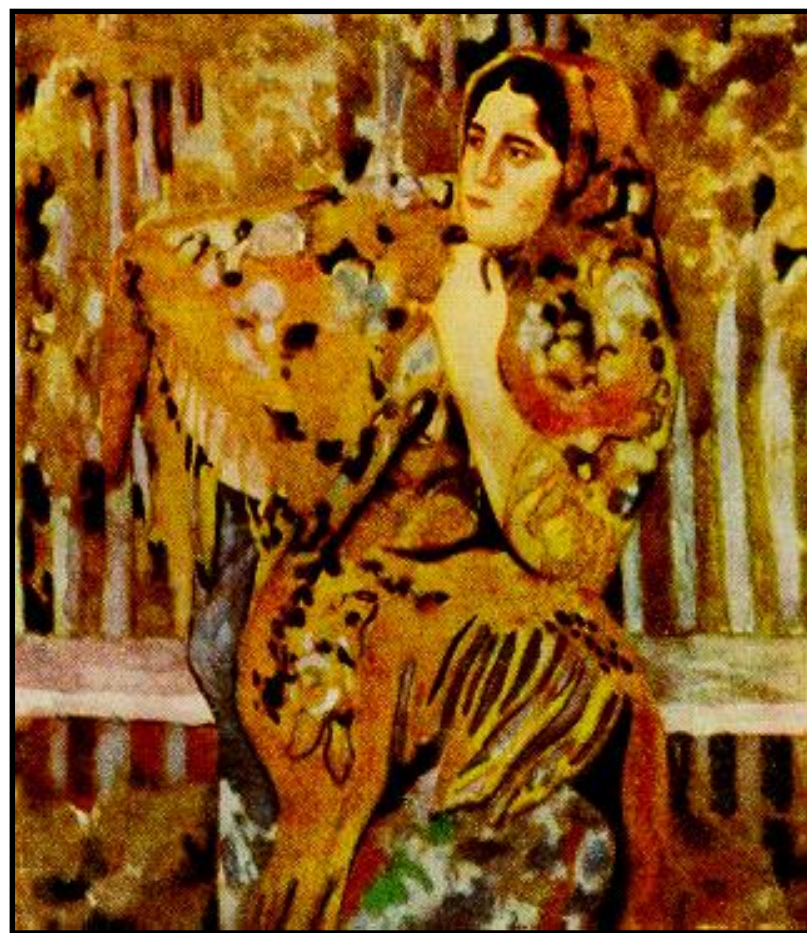
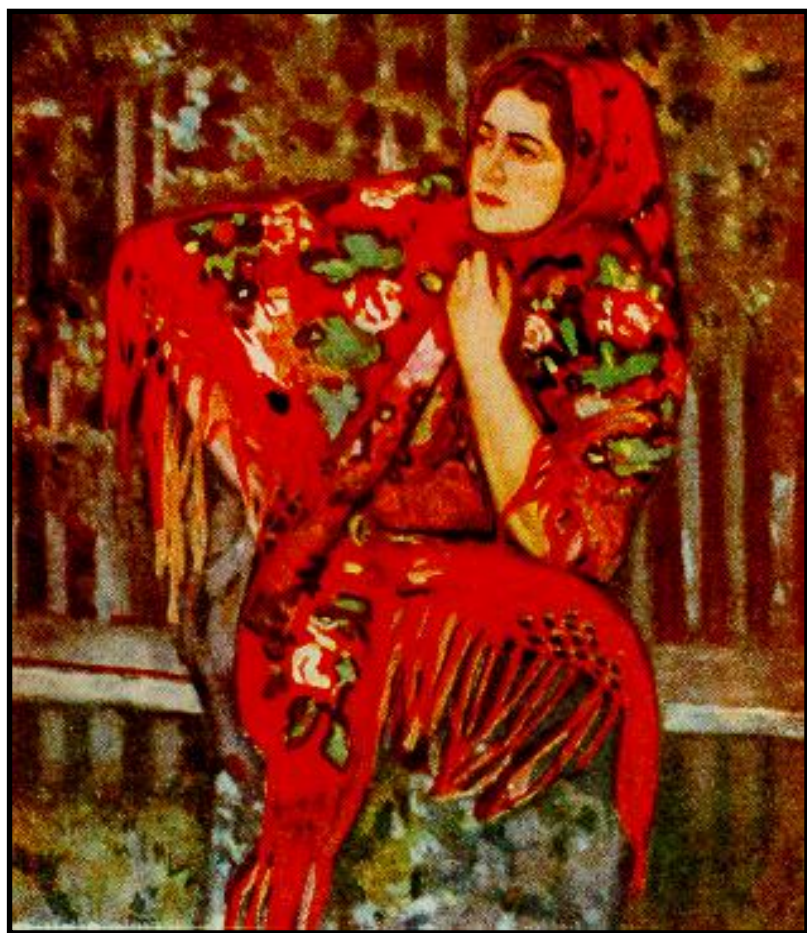


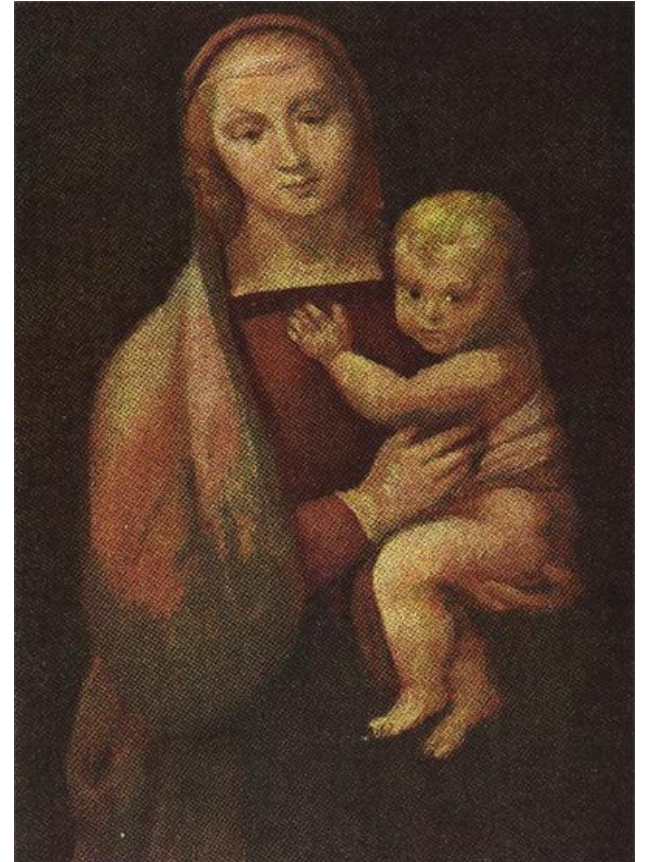
Opponency



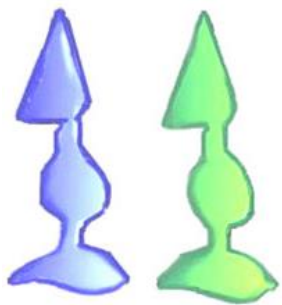
Colour deficiency

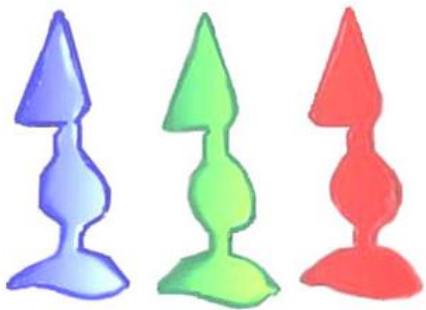


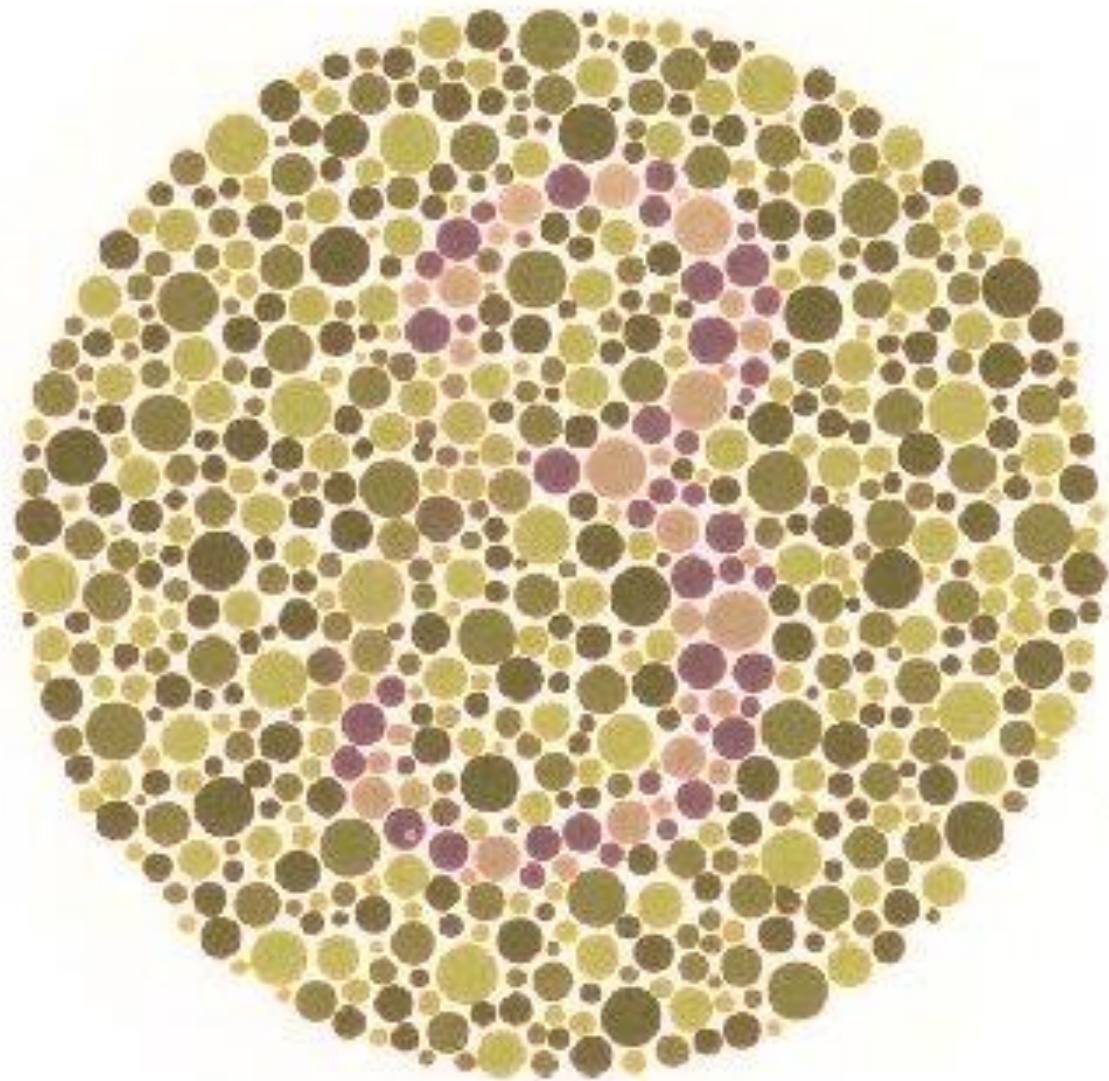








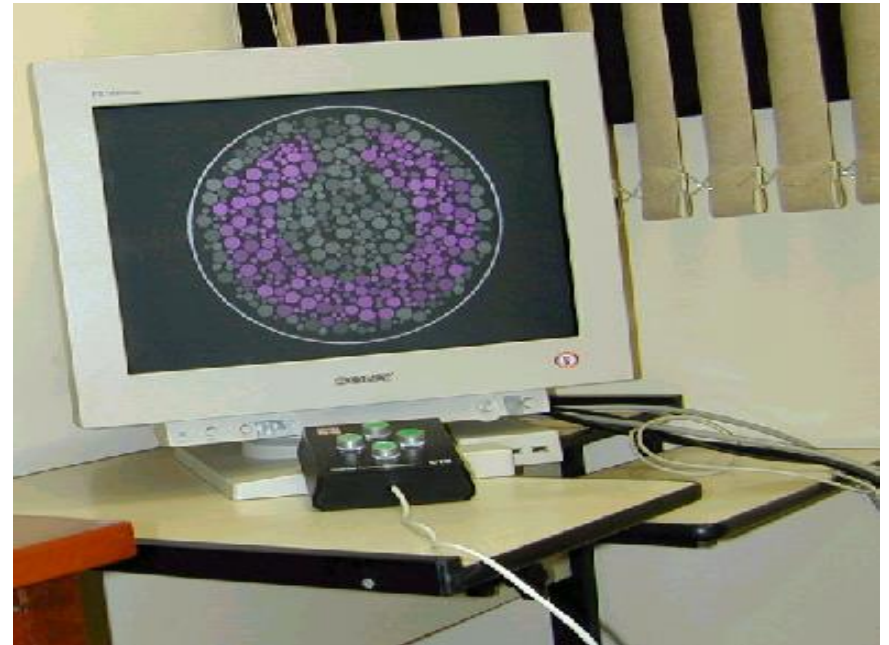


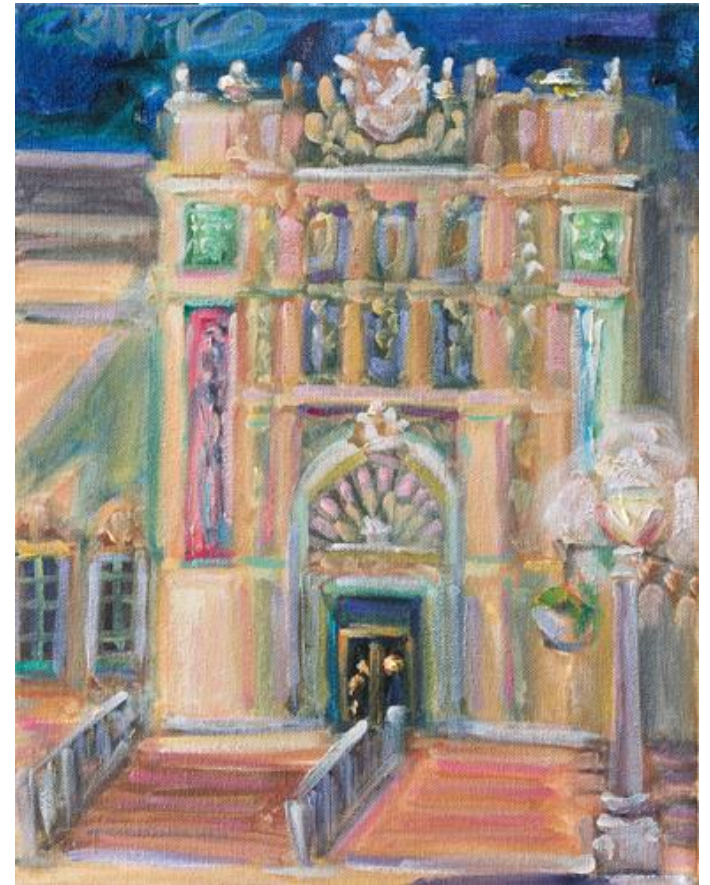


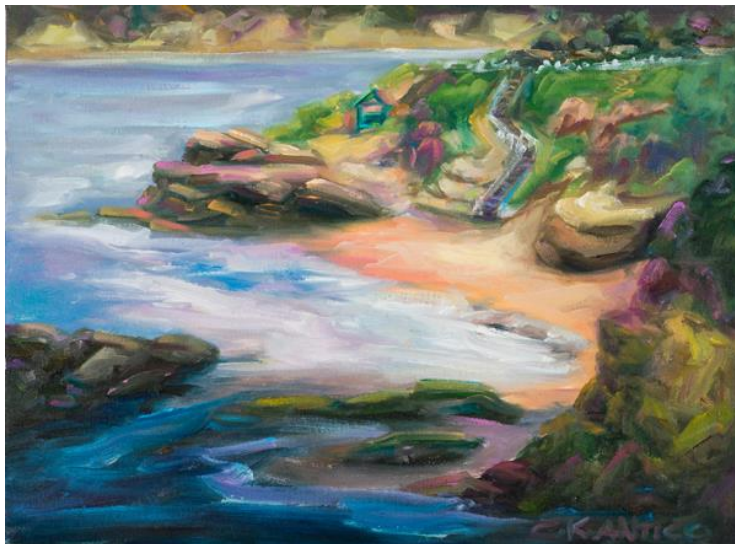
Color matching ANOMALOSCOPE



Cambridge Colour Test CCT



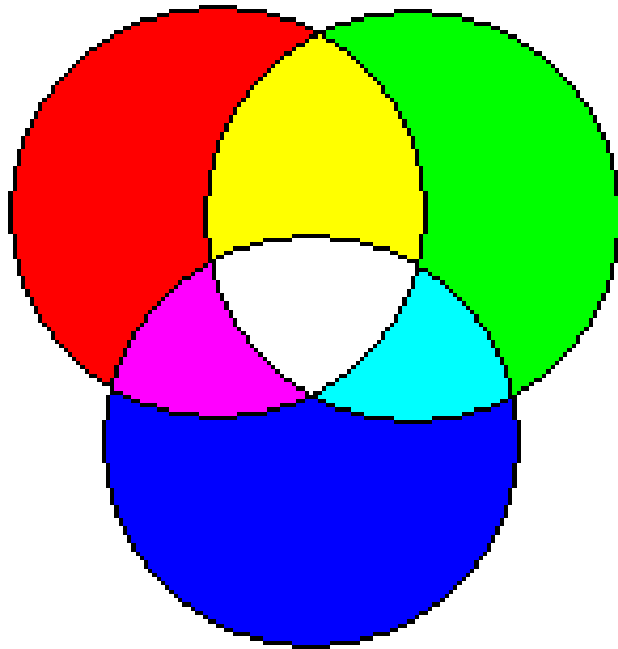




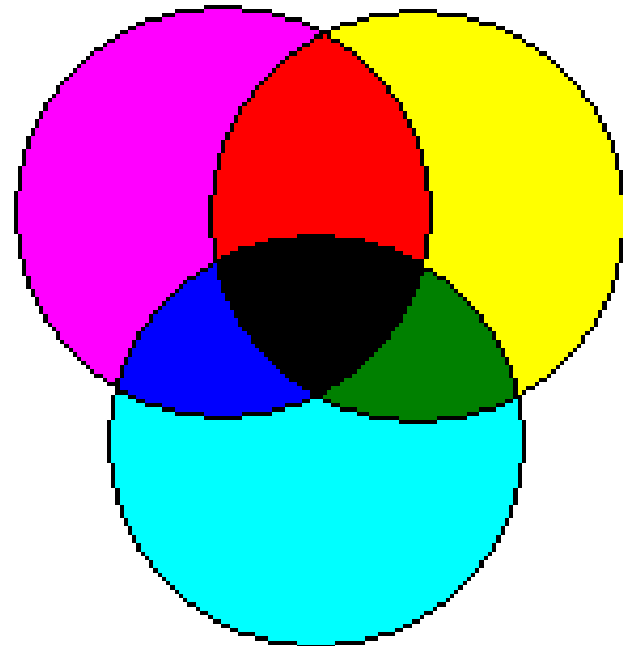


CIE TC1-01

Colour mixing



Additive



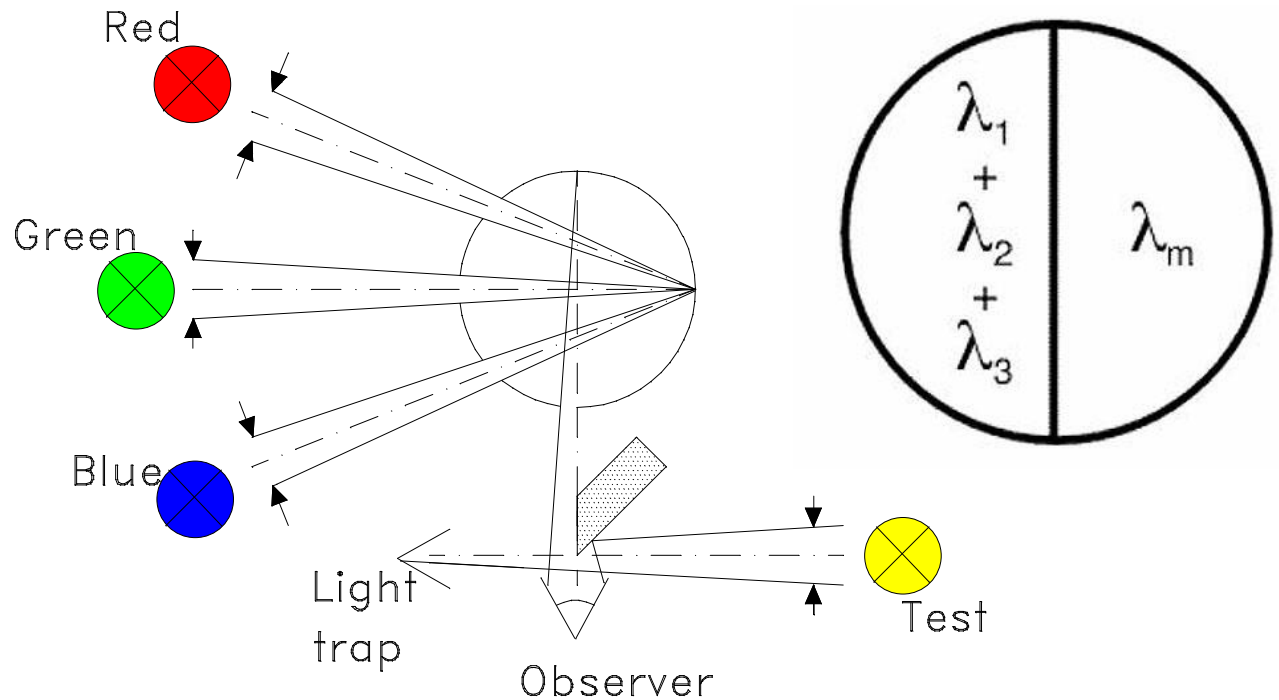
subtractive

colour mixing

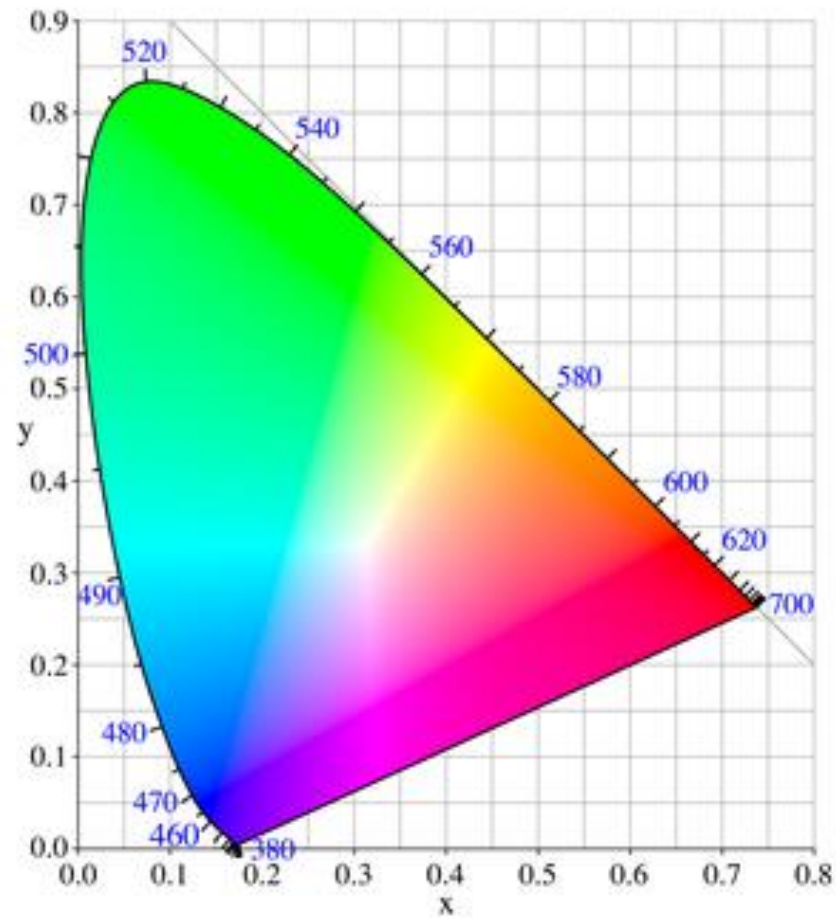
Colour equation

- **Positive additivity**

$$C \equiv R[R] + G[G] + B[B]$$



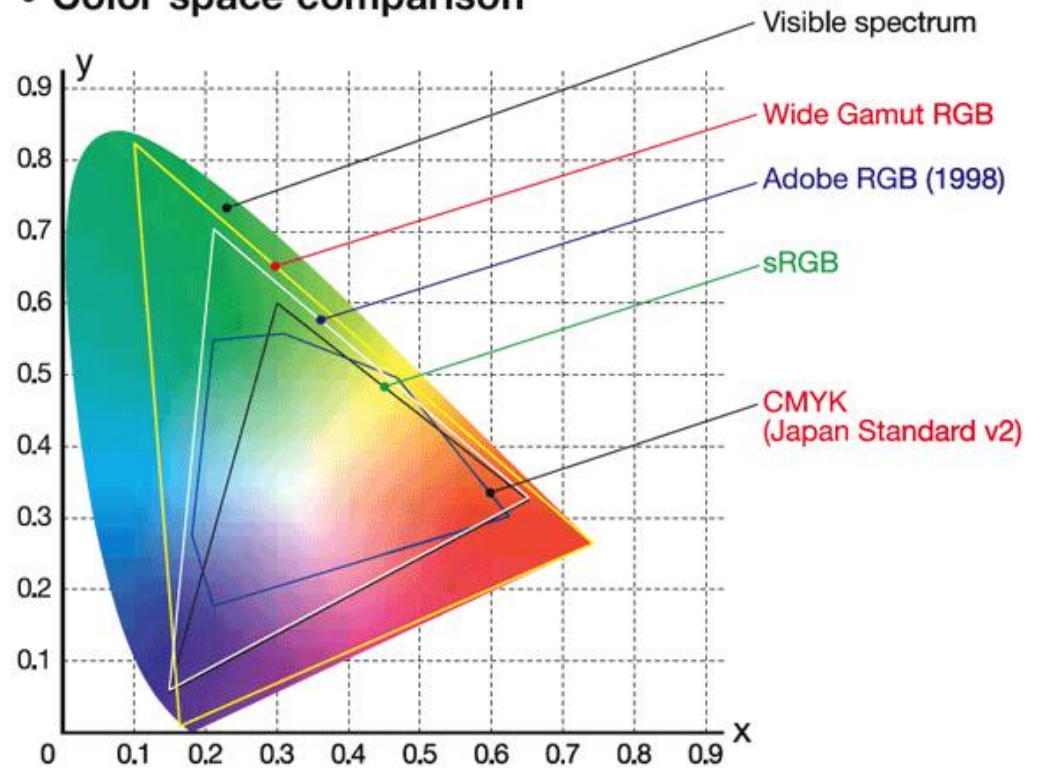
Chromaticity diagram



Colour spaces



• Color space comparison

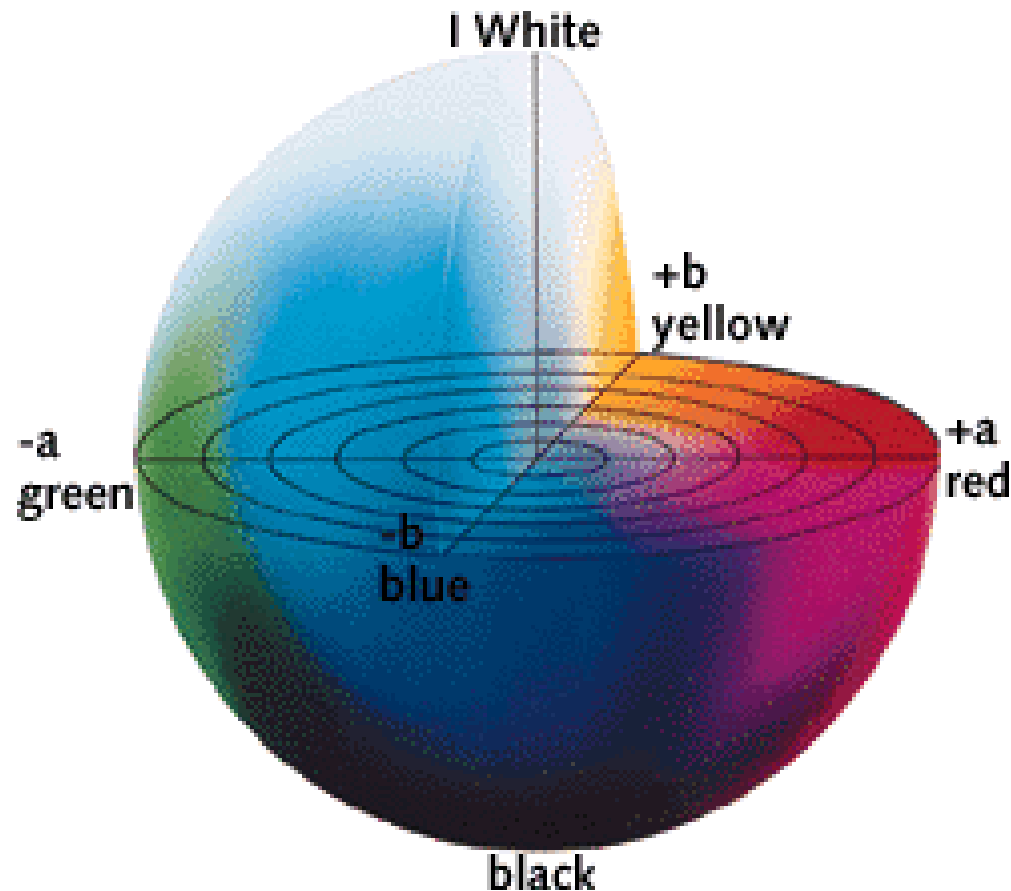


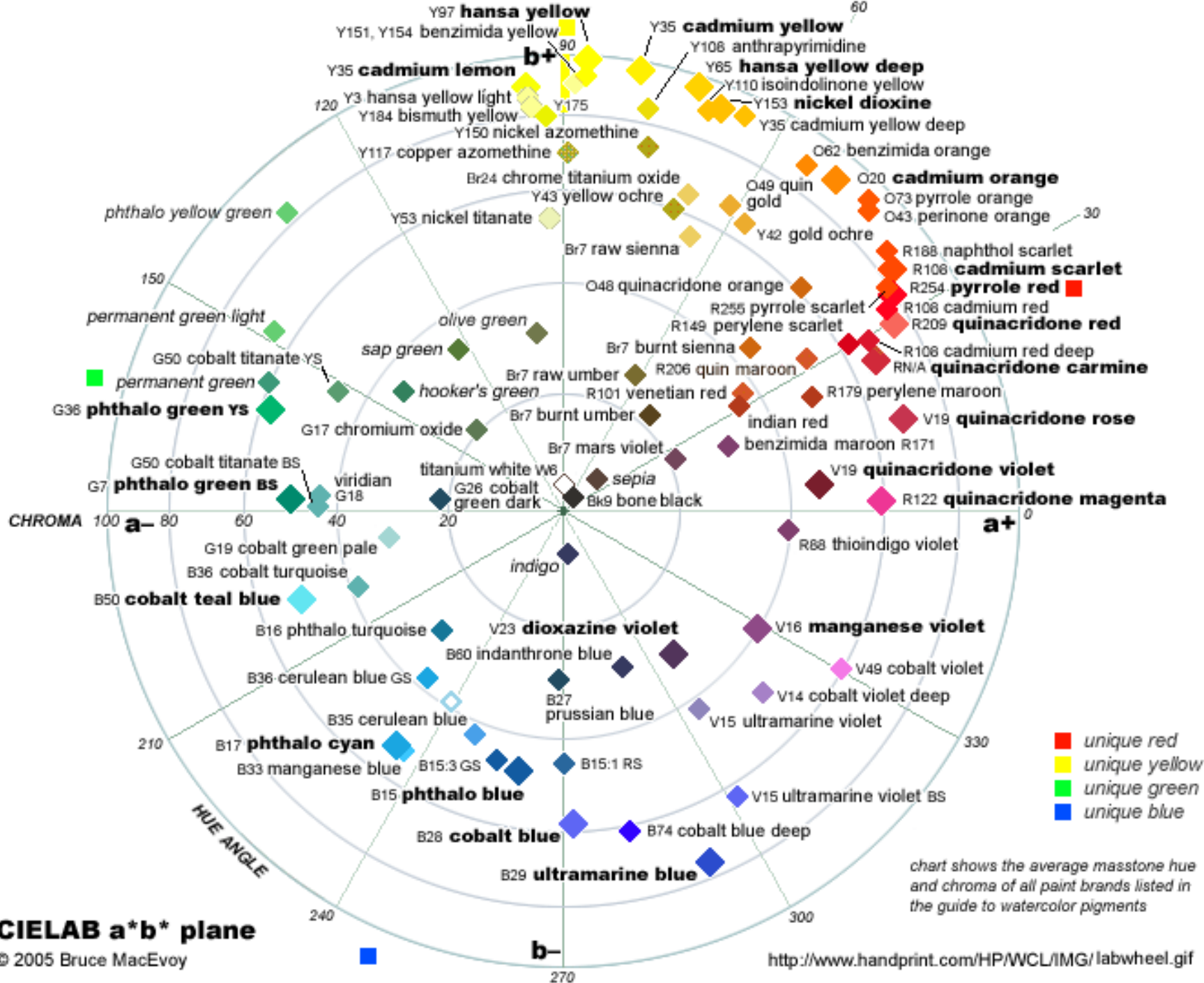
Colour - space



Hungarikum utca
Központi Vásárcsarnok 1093 Budapest, Vámház körút 1-3. (Fővám tér)

CIE 1976 ($L^*a^*b^*$) colour space, CIELAB colour space



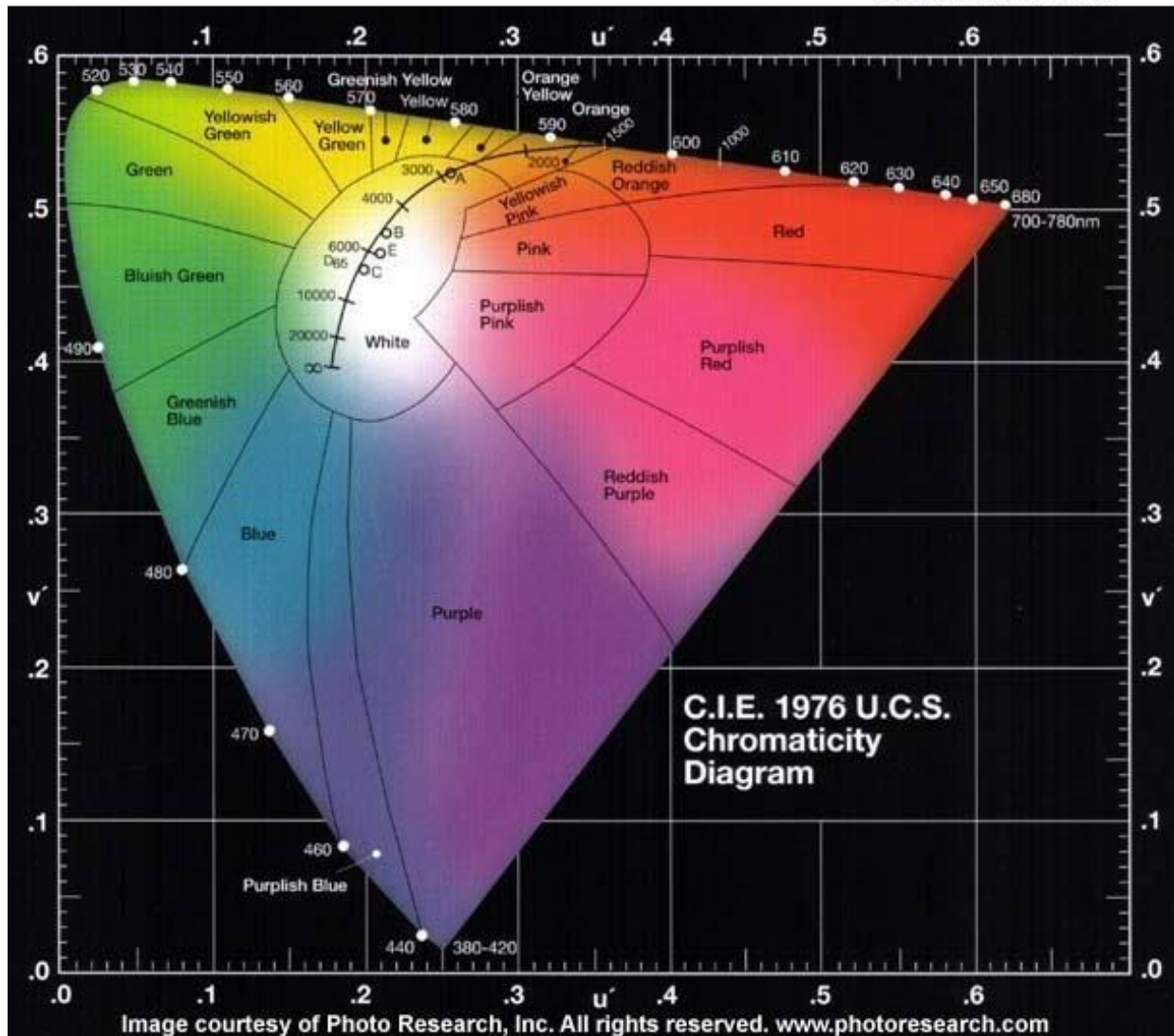


CIELAB a*b* plane

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u', v' chromaticity diagram

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Perceived colour differences

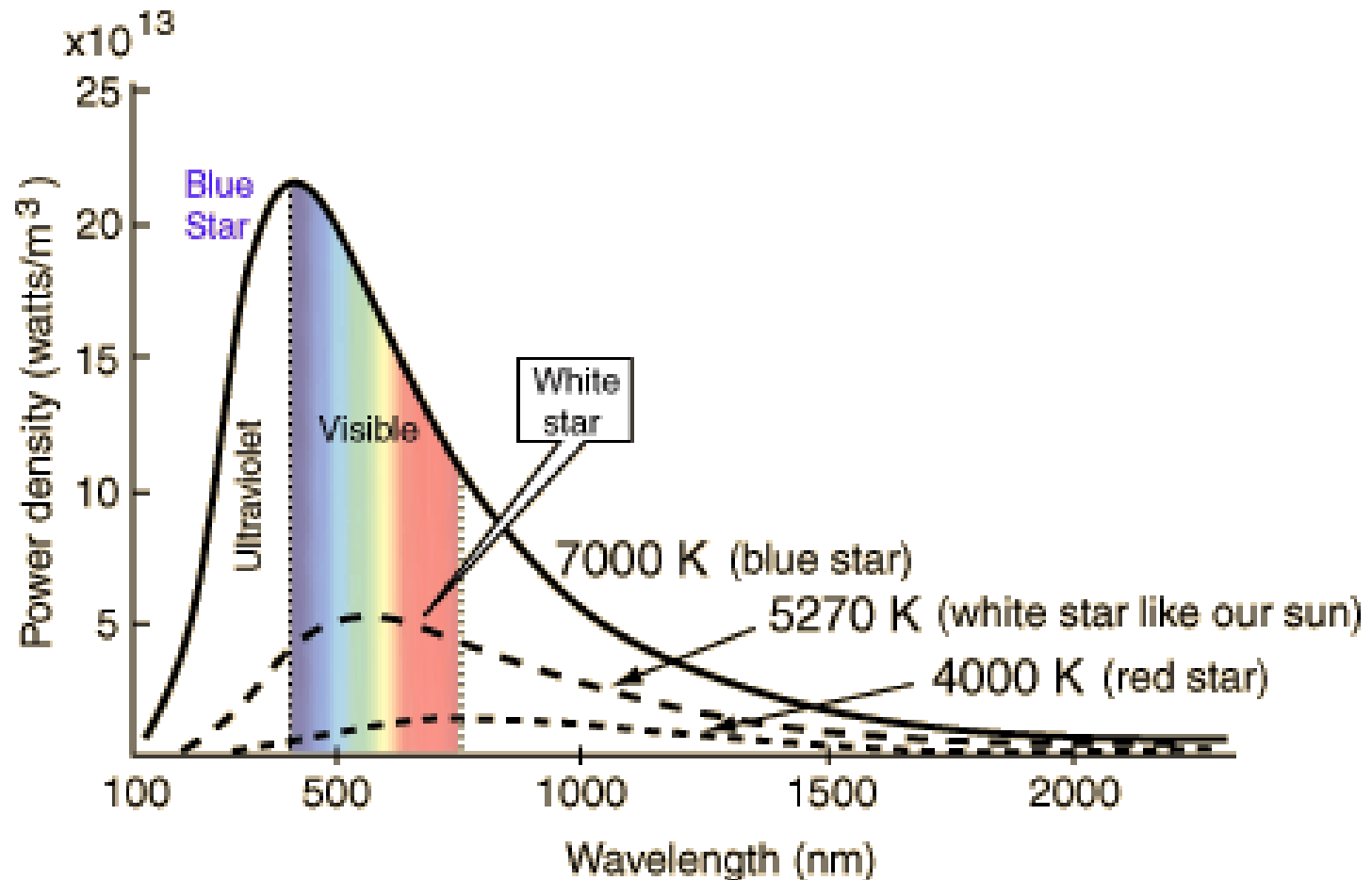
ΔE_{ab}^* experimental values

- 0.....0,5 not perceivable
- 0,5...1,5 slightly perceivable
- 1,5...3,0 perceivable
- 3,0...6,0 well perceivable
- 6,0...12,0 large

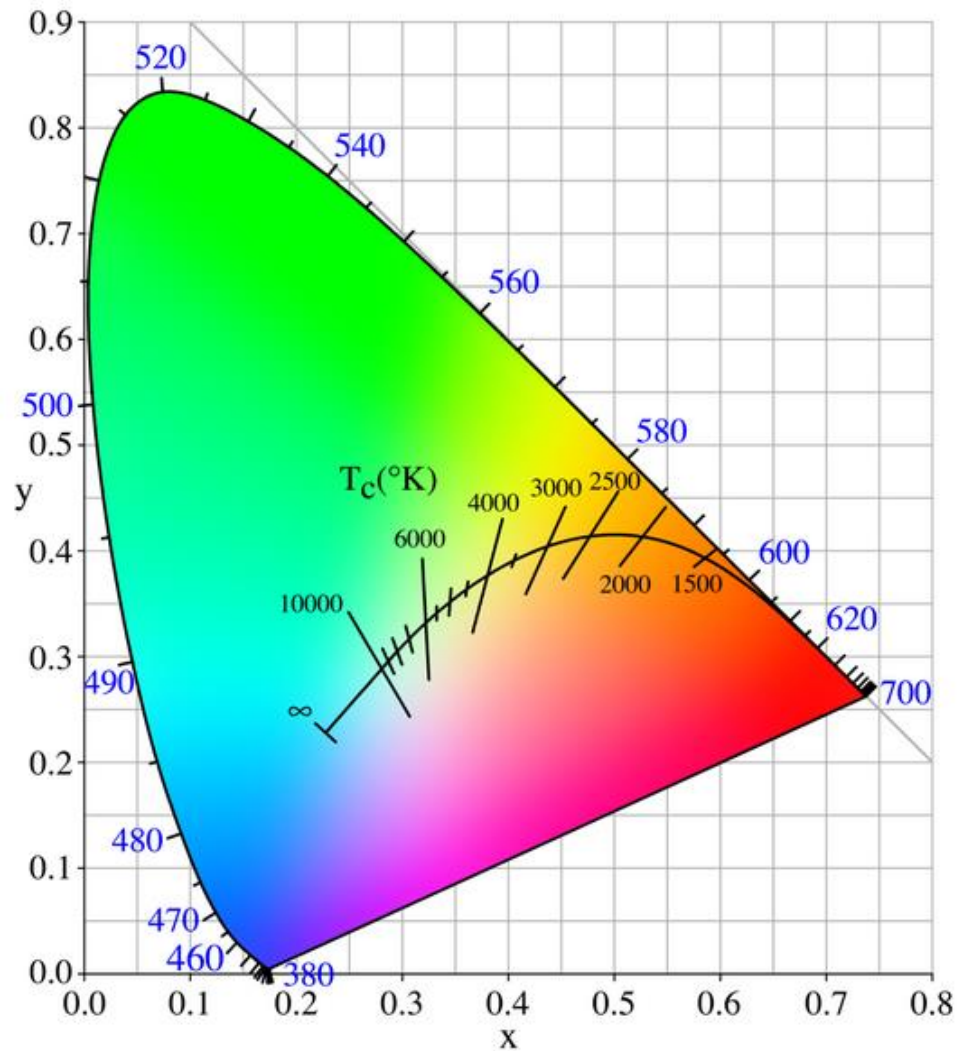


Colour temperature

Thermal radiation



Correlated Colour Temperature - CCT





CCT

- Warm $< 3500\text{K}$
- Neutral $3500\text{K} - 5500\text{K}$
- Cool $> 5500\text{K}$



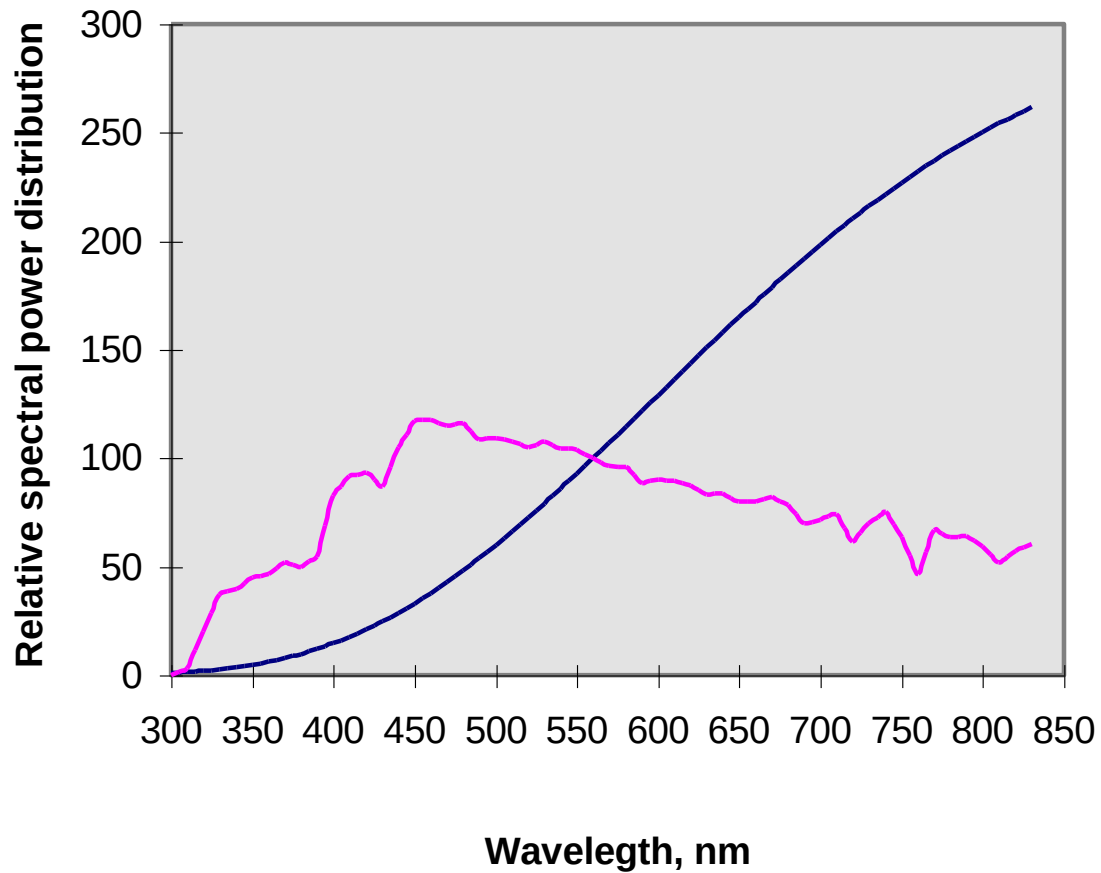
Colour rendering

Colour rendering

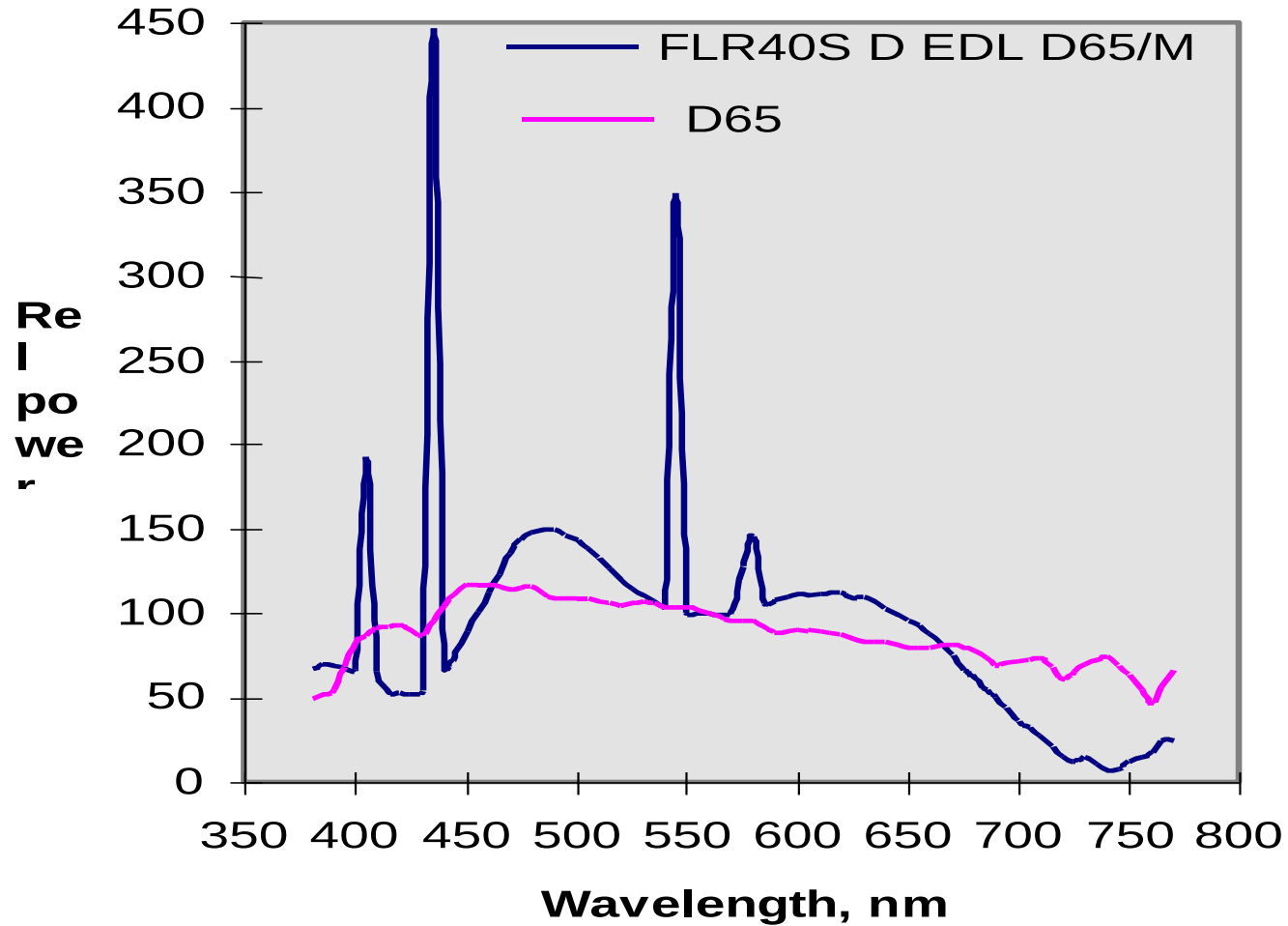




CIE Standard Illuminants



CIE D65 simulator



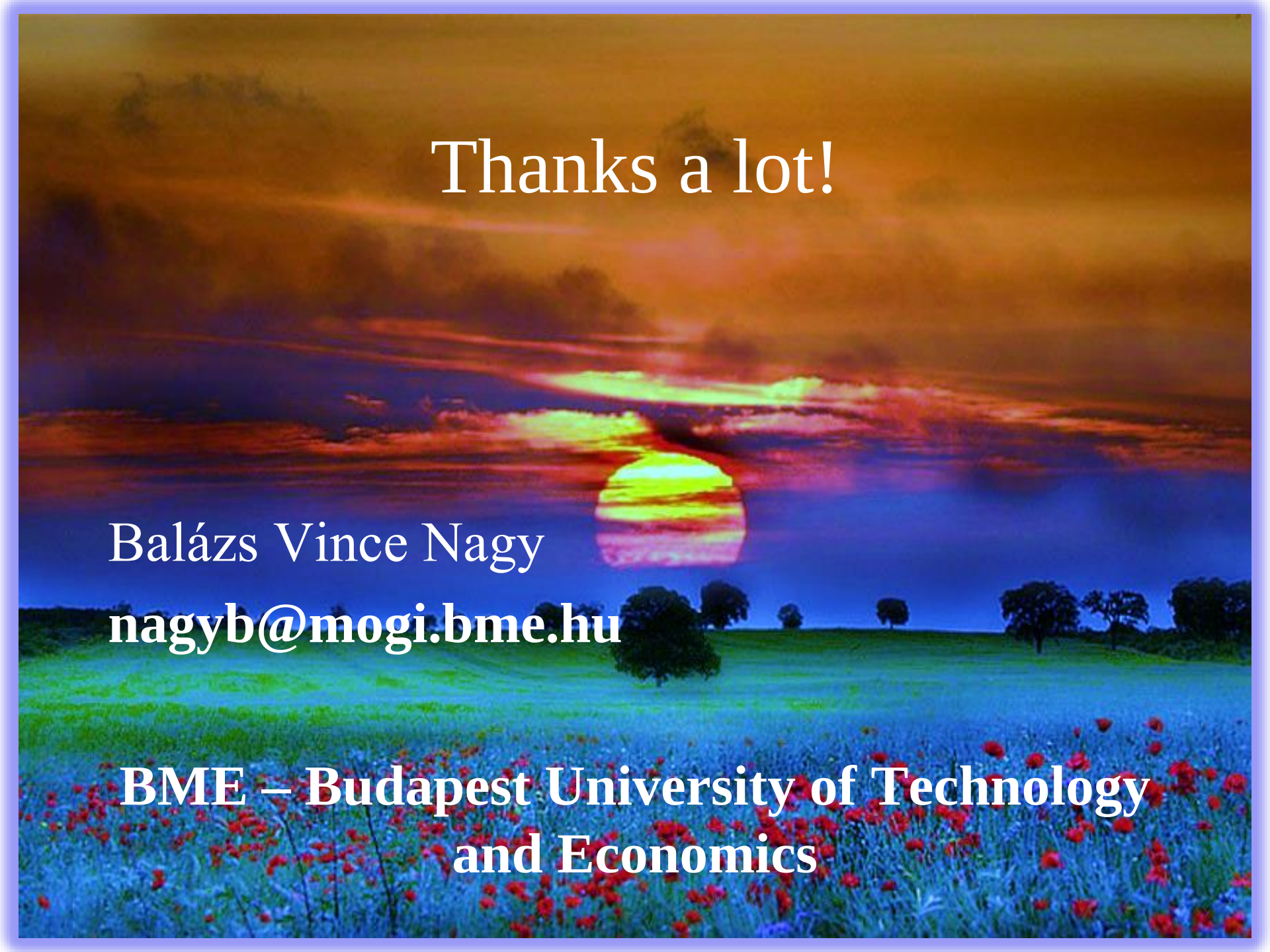


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Thanks a lot!

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and Economics**