LIGHTING ACADEMY

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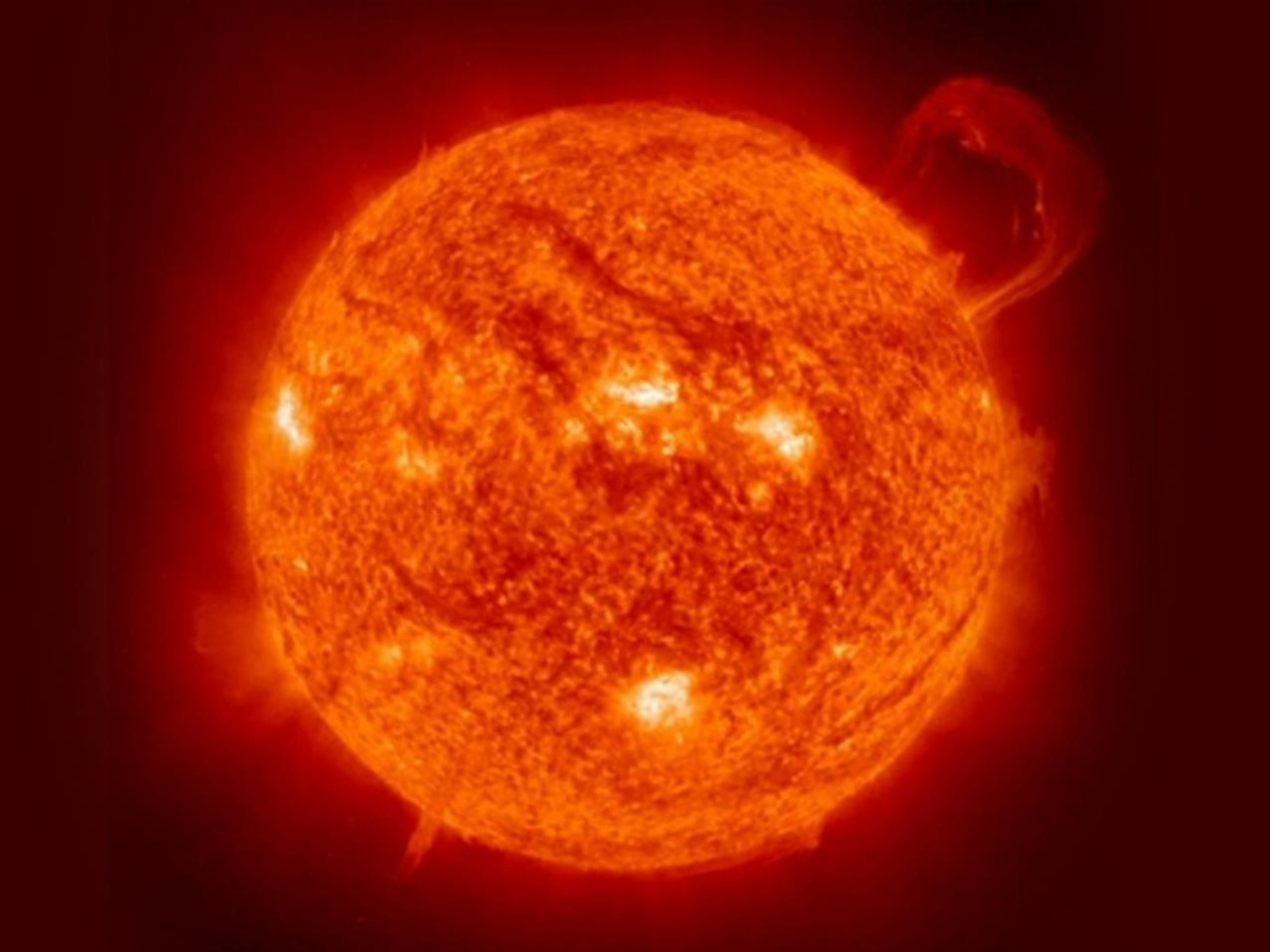
How to combine good Visual Communication and increase Academic Performance



THE ELECTRO MAGNETIC SPECTRUM

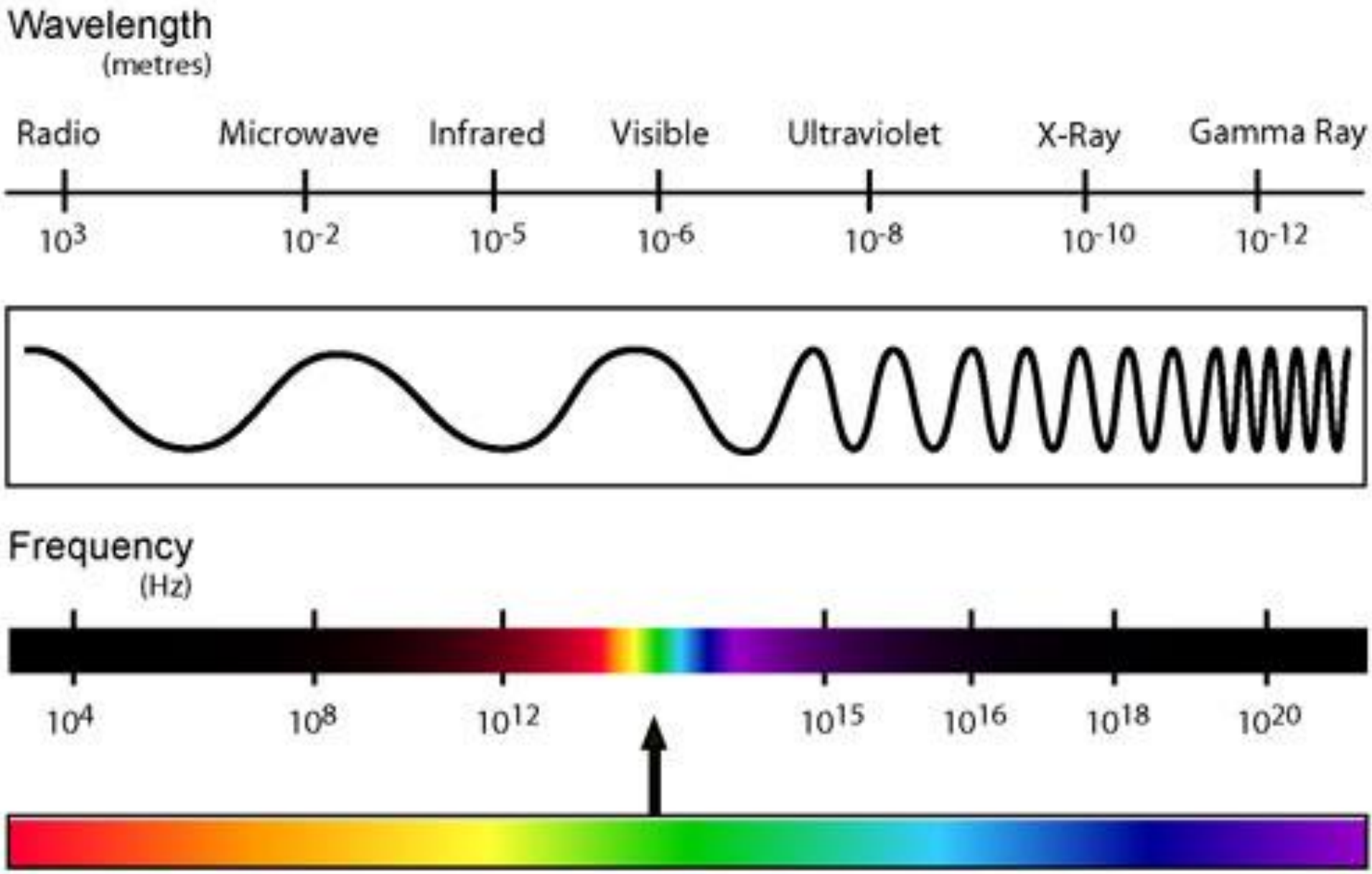


Figure 1a

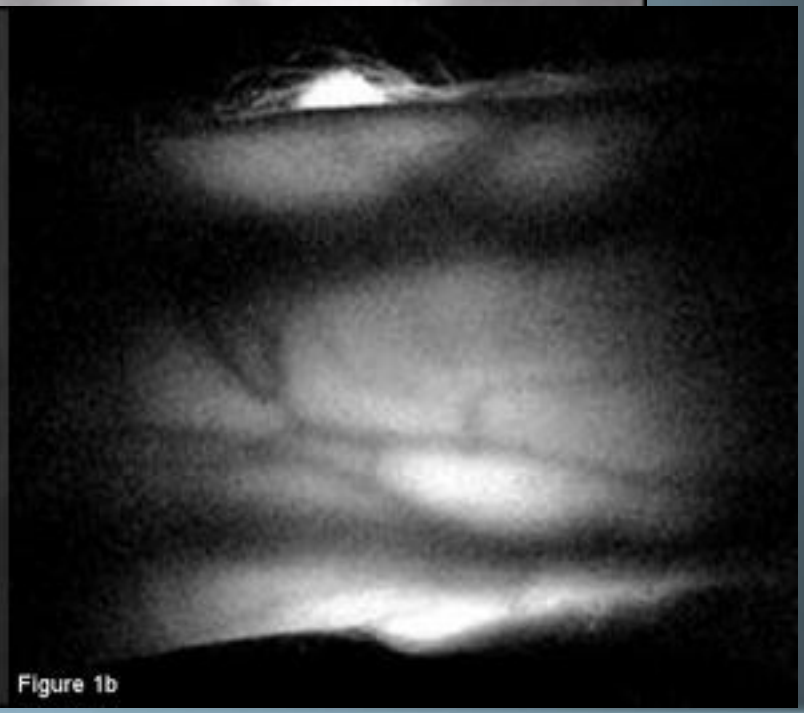


Figure 1b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4.6.2 Mean cylindrical illuminance requirement in the activity space

Good visual communication and recognition of objects within a space require that the volume of space in which people move or work shall be illuminated. This is satisfied by providing adequate mean cylindrical illuminance, $\bar{E}_z$, in the space.

The maintained mean cylindrical illuminance (average vertical plane illuminance) in the activity and interior areas shall be not less than 50 lx with $U_o \geq 0{,}10$, on a horizontal plane at a specified height, for example 1,2 m for sitting people and 1,6 m for standing people above the floor.

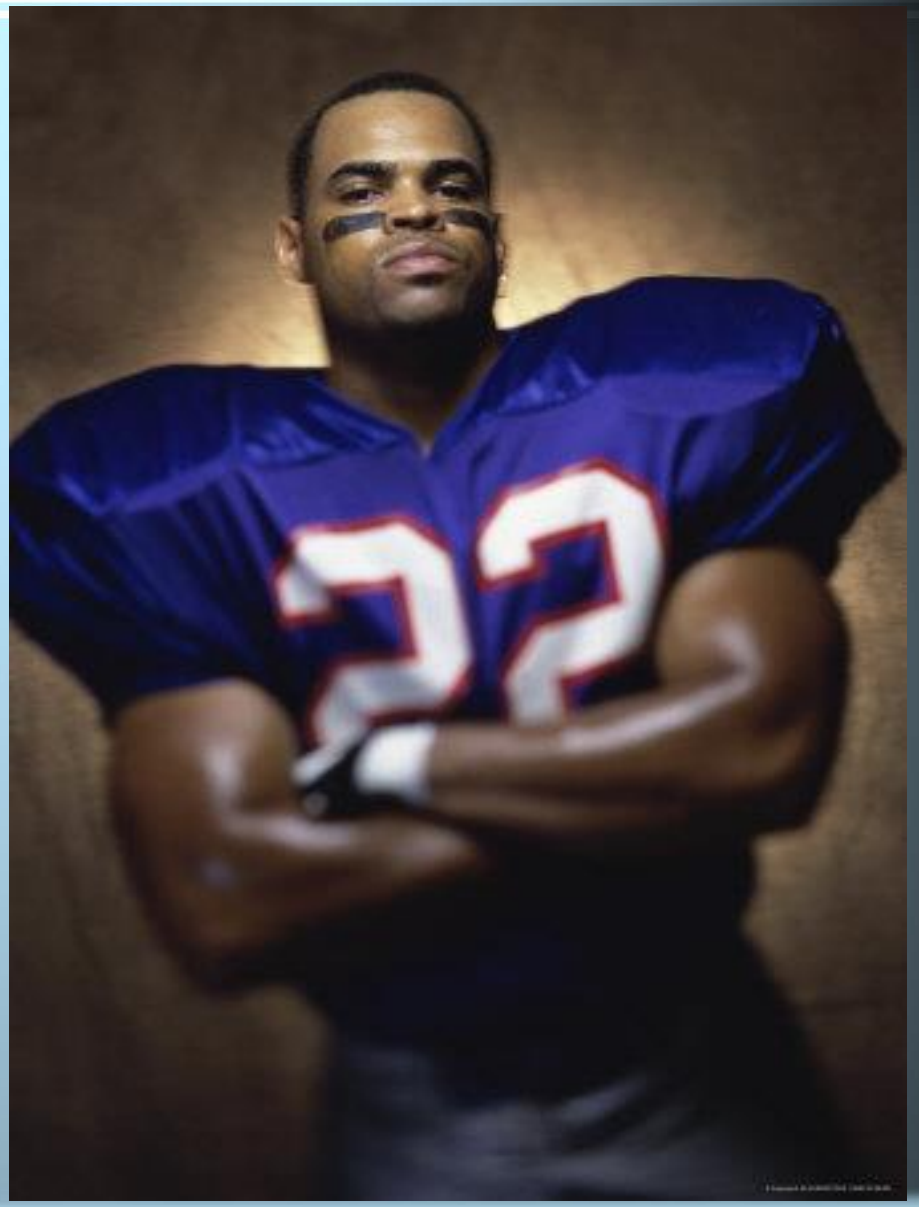
NOTE In areas, where good visual communication is important, especially in offices, meeting and teaching areas, $\bar{E}_z$ should be not less than 150 lx with $U_o \geq 0{,}10$.

4.6.3 Modelling

The general appearance of an interior is enhanced when its structural features, the people and objects within it are lit so that form and texture are revealed clearly and pleasingly.

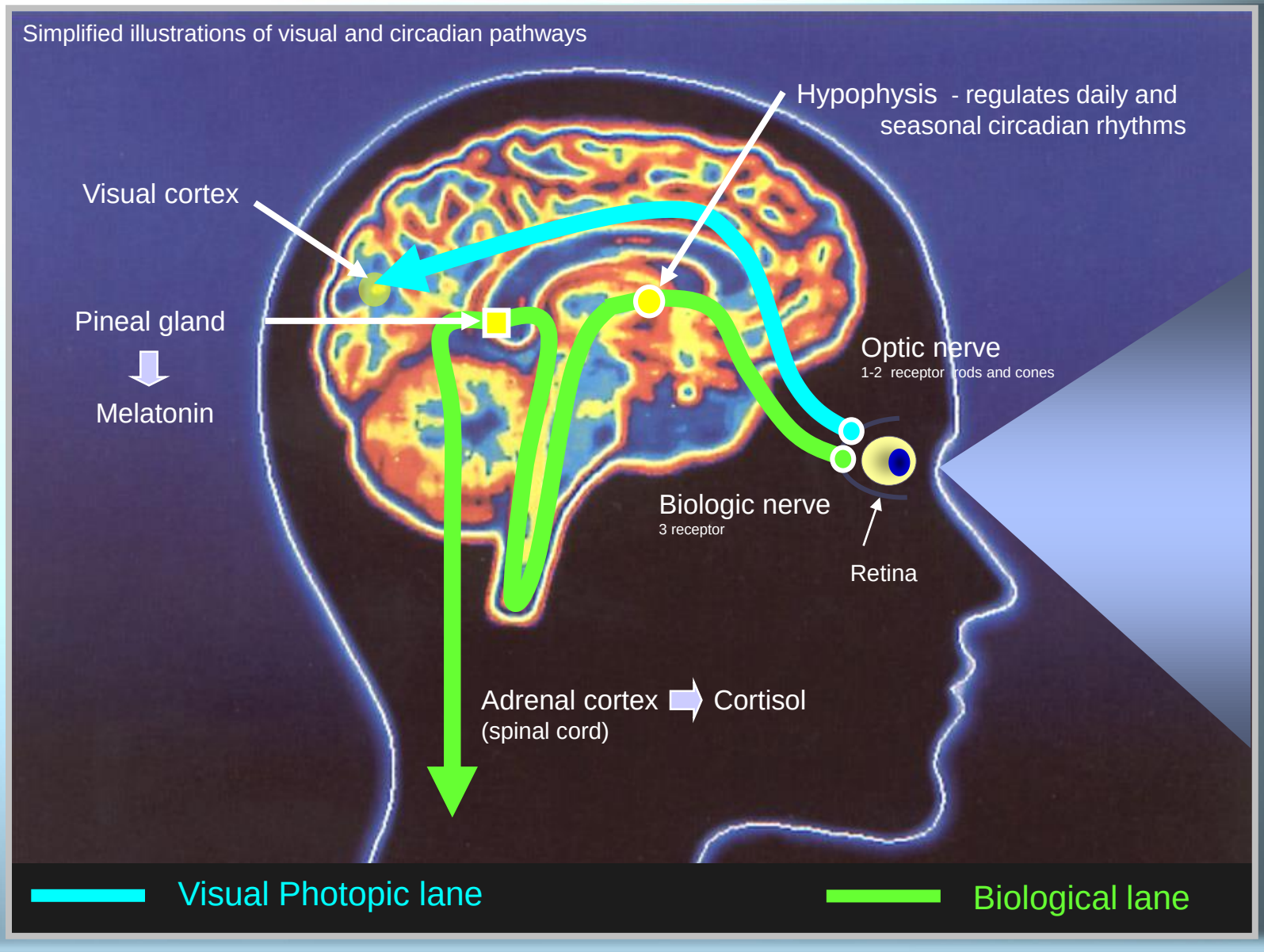
The lighting should not be too directional or it will produce harsh shadows, neither should it be too diffuse or the modelling effect will be lost entirely, resulting in a very dull luminous environment. Multiple shadows caused by directional lighting from more then one position should be avoided as this can result in a confused visual effect.

LIGHTING ACADEMY

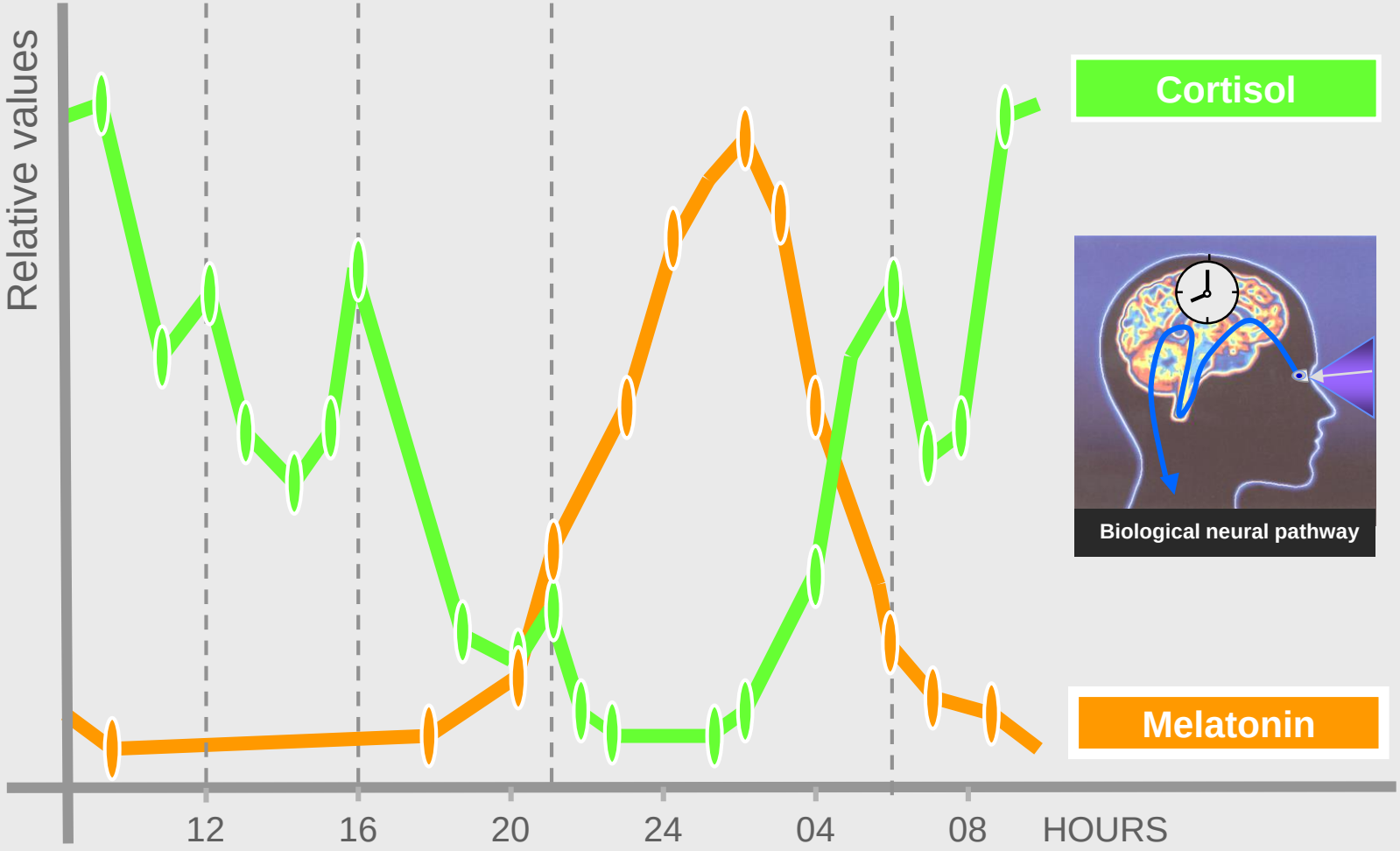


4.7.3 Colour rendering

For visual performance and the feeling of comfort and well being colours in the environment, of objects and of human skin, shall be rendered naturally, correctly and in a way that makes people look attractive and healthy.

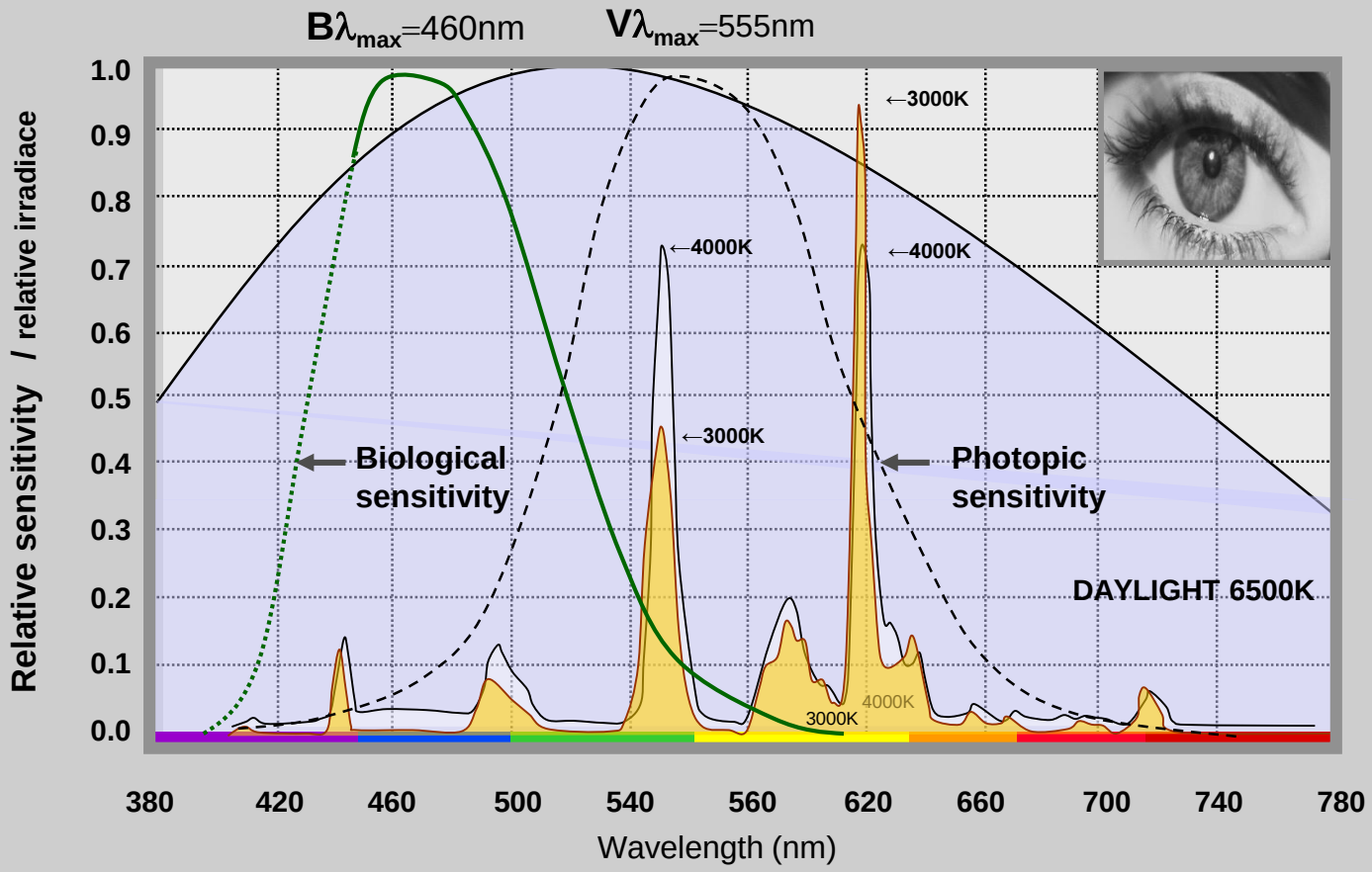

Simplified illustrations of visual and circadian pathways
Hypophysis - regulates daily and seasonal circadian rhythms
Visual cortex
Pineal gland
Melatonin
Optic nerve
1-2 receptor rods and cones
Biologic nerve
3 receptor
Retina
Adrenal cortex
(spinal cord)
Cortisol
Visual Photopic lane
Biological lane

Day and night alertness



Source: Küller, Laike

“Biological” sensitivity curve B_λ vs. **Photopic** sensitivity curve V_λ /CIE/



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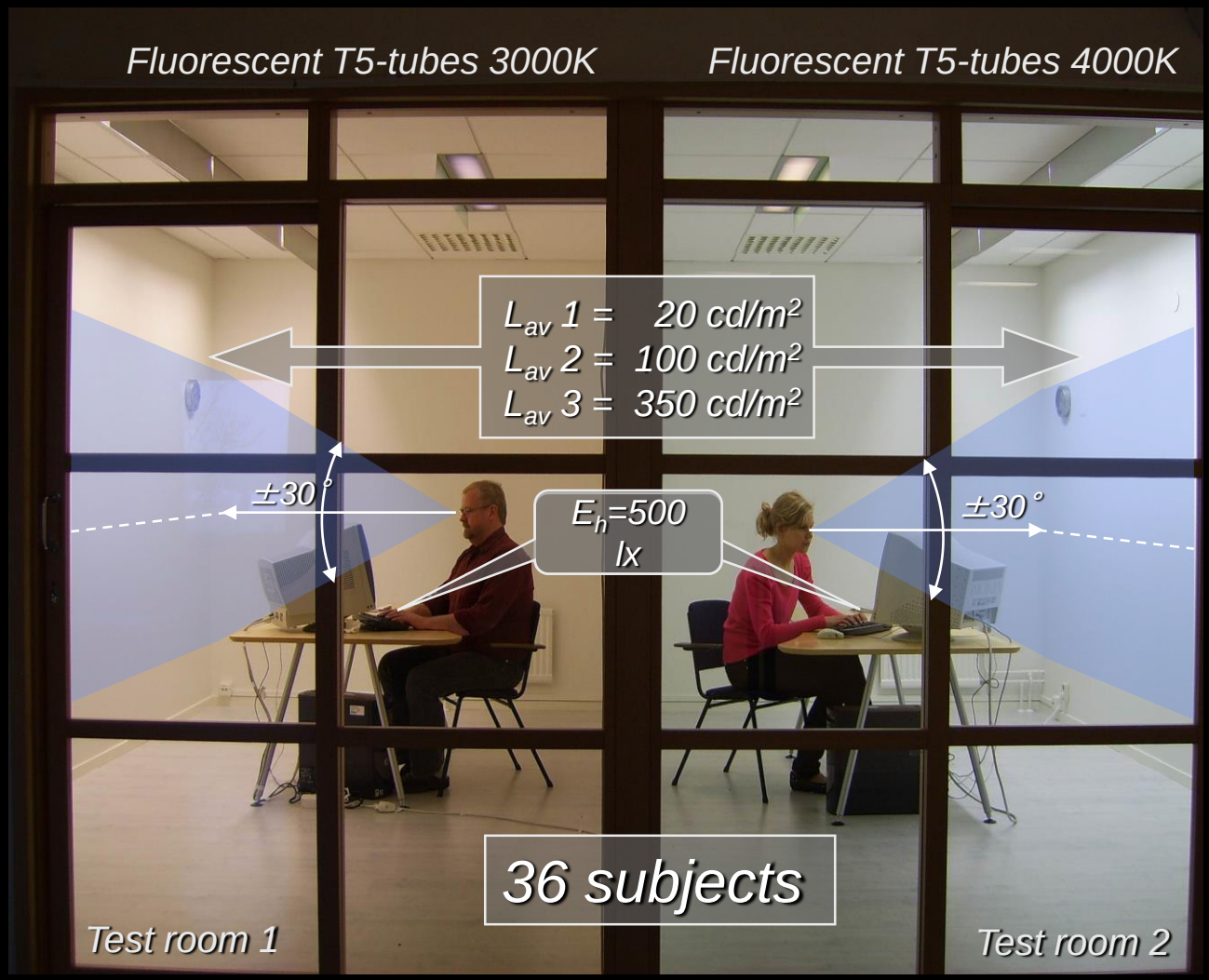
New study - the background luminance and colour temperatures influence on alertness and mental health

Govén, Laike, Pendse, Sjöberg 2006

Purpose

”to lay down the appropriate luminance levels at different colour temperatures for ambient lighting within working areas”

Methodology of the test



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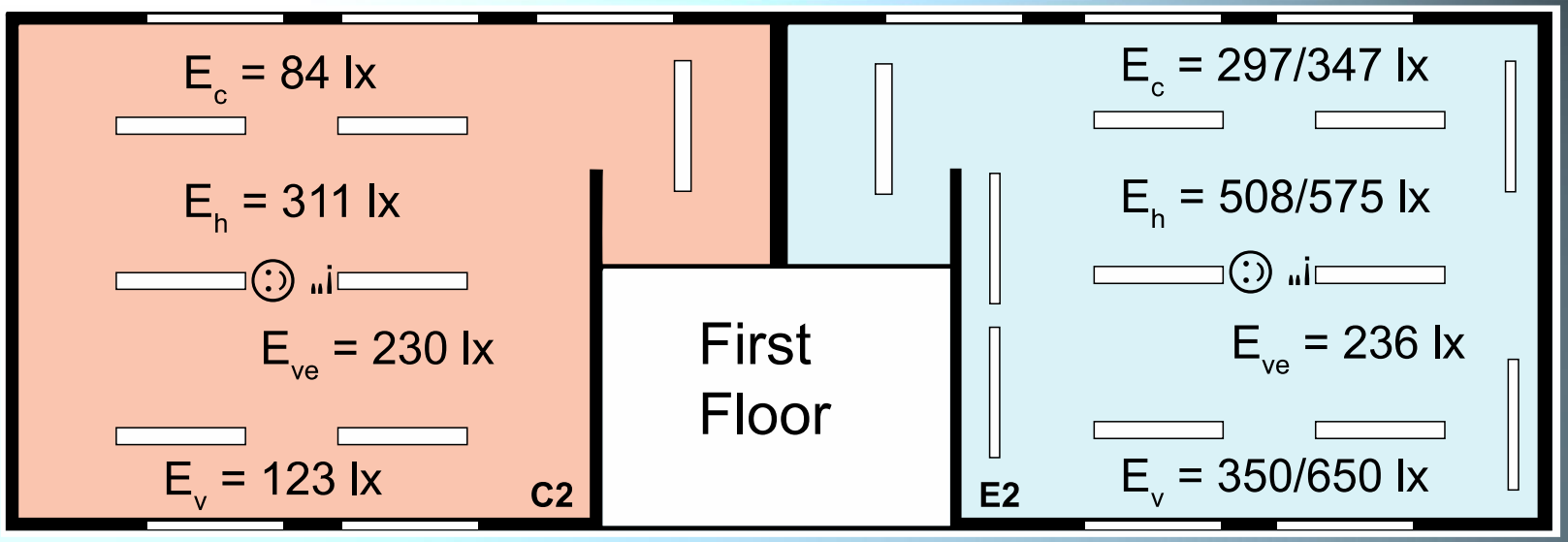
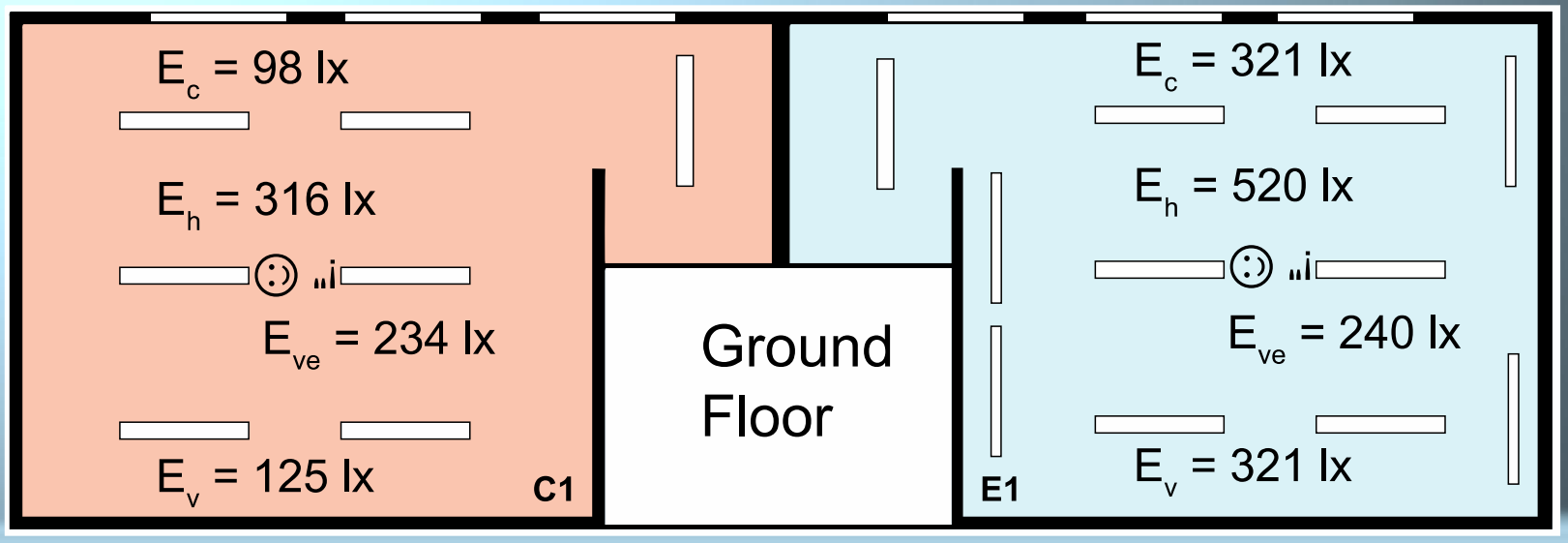
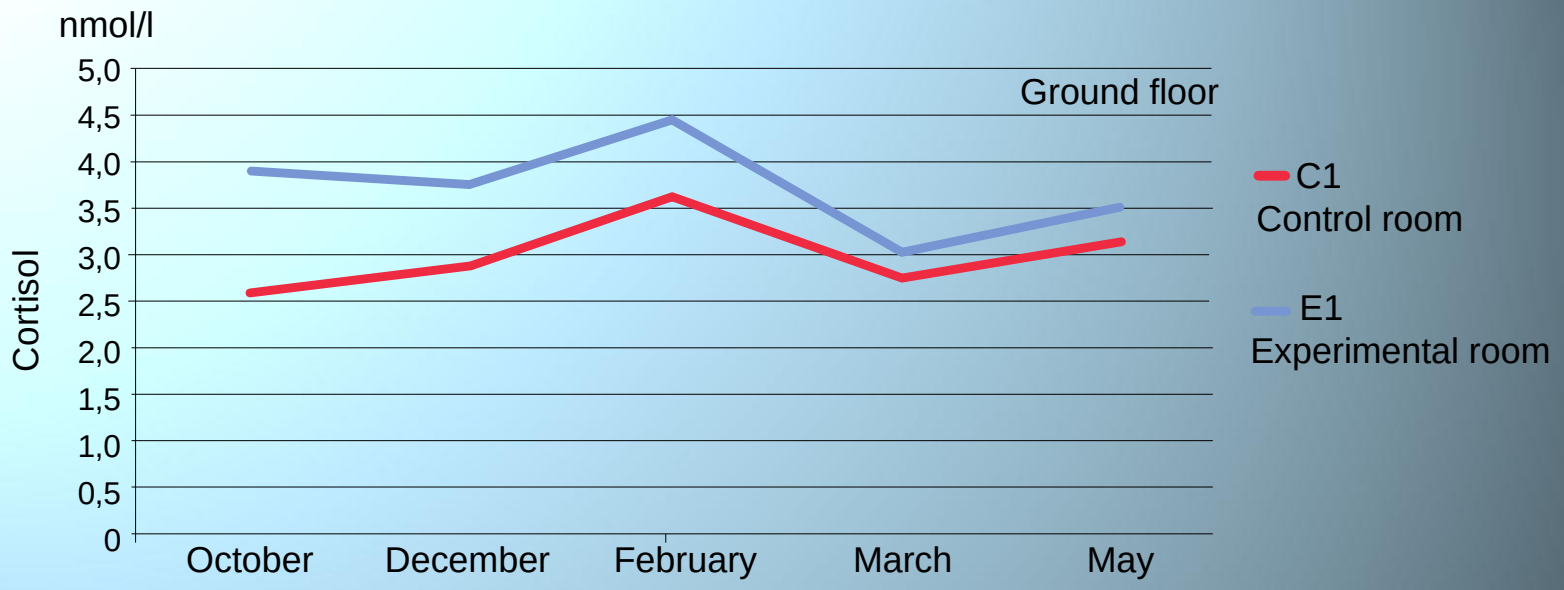
The Pickhurst study


E_c = 84 lx
E_h = 311 lx
E_{ve} = 230 lx
E_v = 123 lx
C2
First Floor
E_c = 297/347 lx
E_h = 508/575 lx
E_{ve} = 236 lx
E_v = 350/650 lx
E2

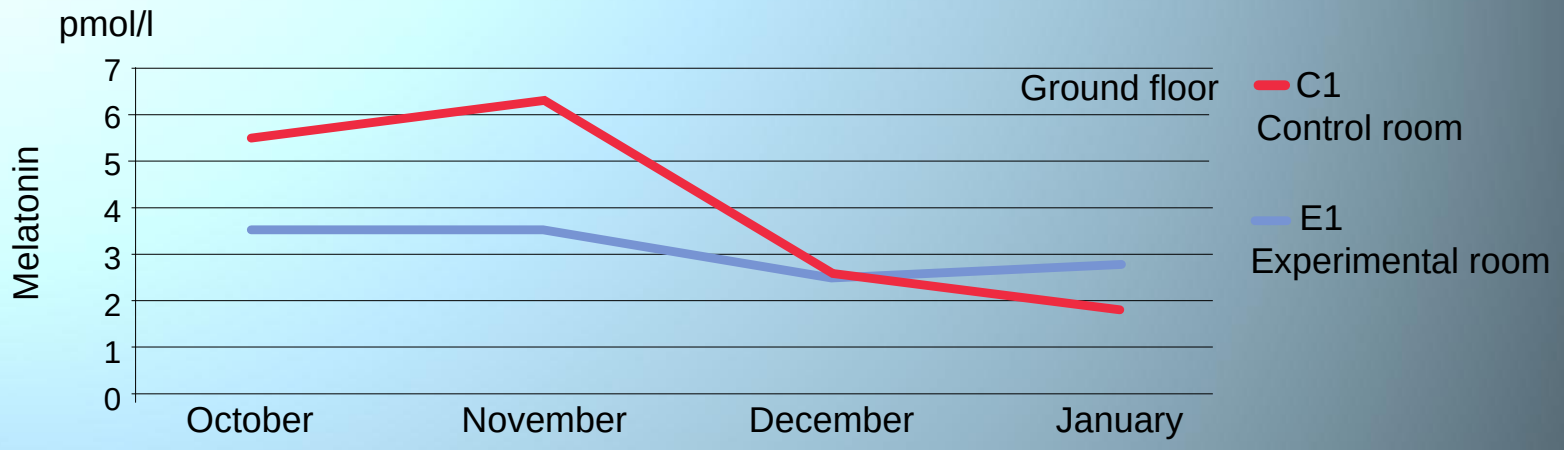

E_c = 98 lx
E_h = 316 lx
E_{ve} = 234 lx
E_v = 125 lx
C1
Ground Floor
E_c = 321 lx
E_h = 520 lx
E_{ve} = 240 lx
E_v = 321 lx
E1

Comparison in Cortisol on ground floor – C1 vs. E1

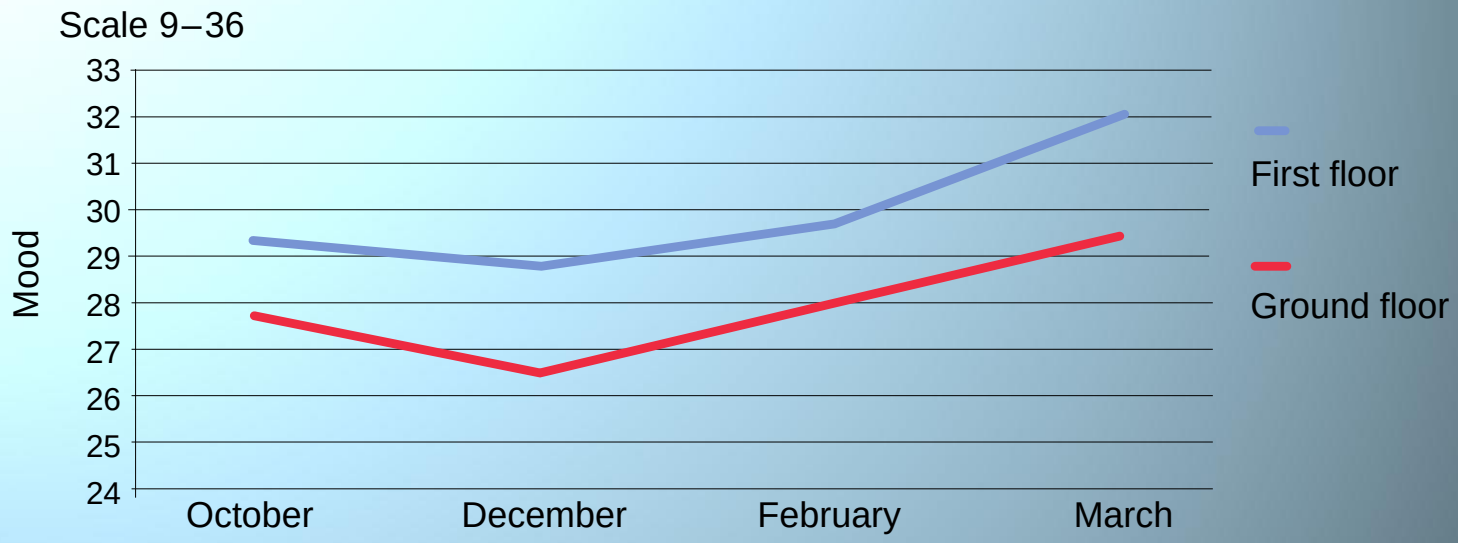


ANOVA Repeated measures

Comparison in Melatonin on ground floor – C1 vs. E1

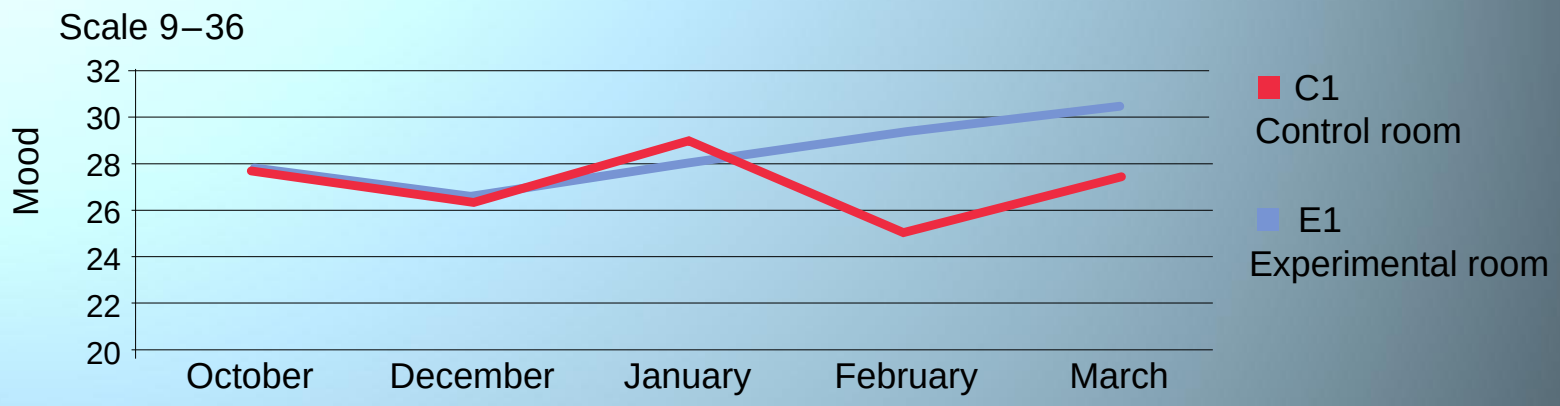


Comparison in Mood – ground floor vs. first floor

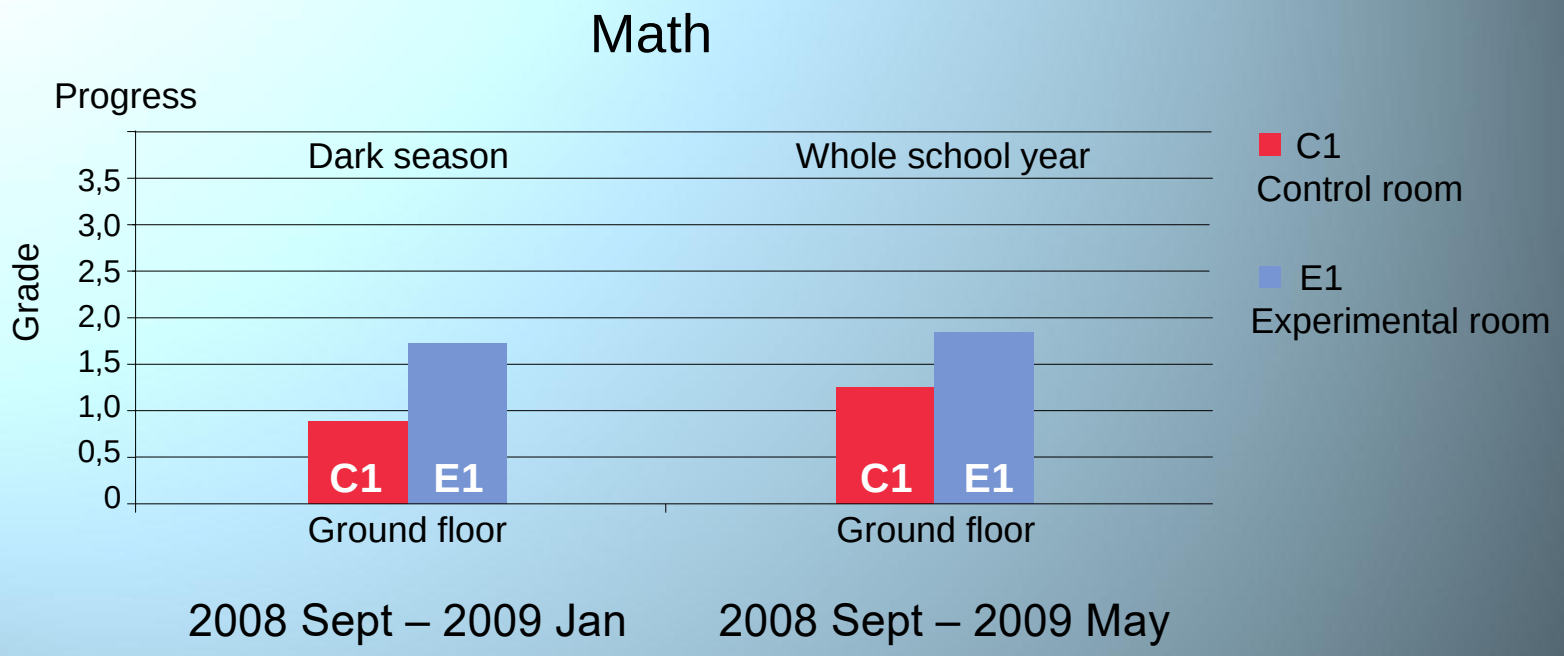


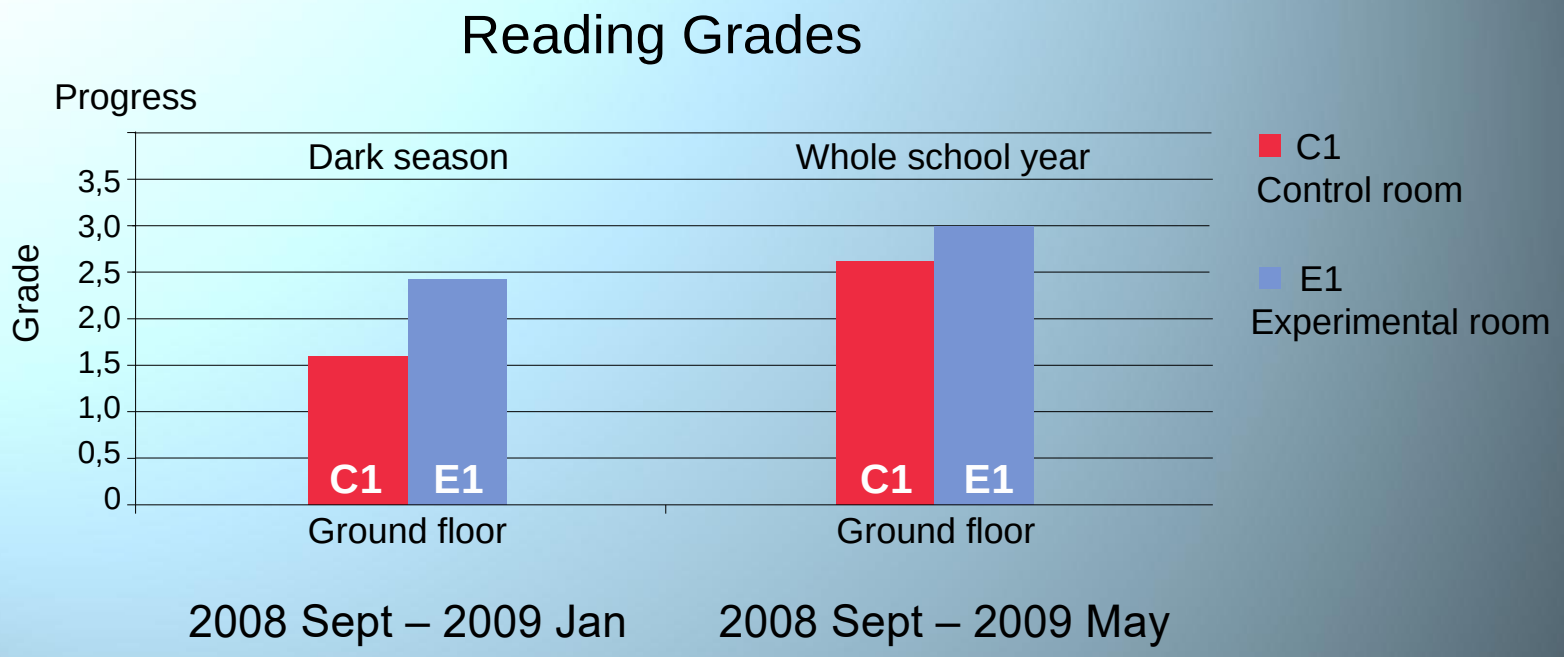
ANOVA Repeated measures

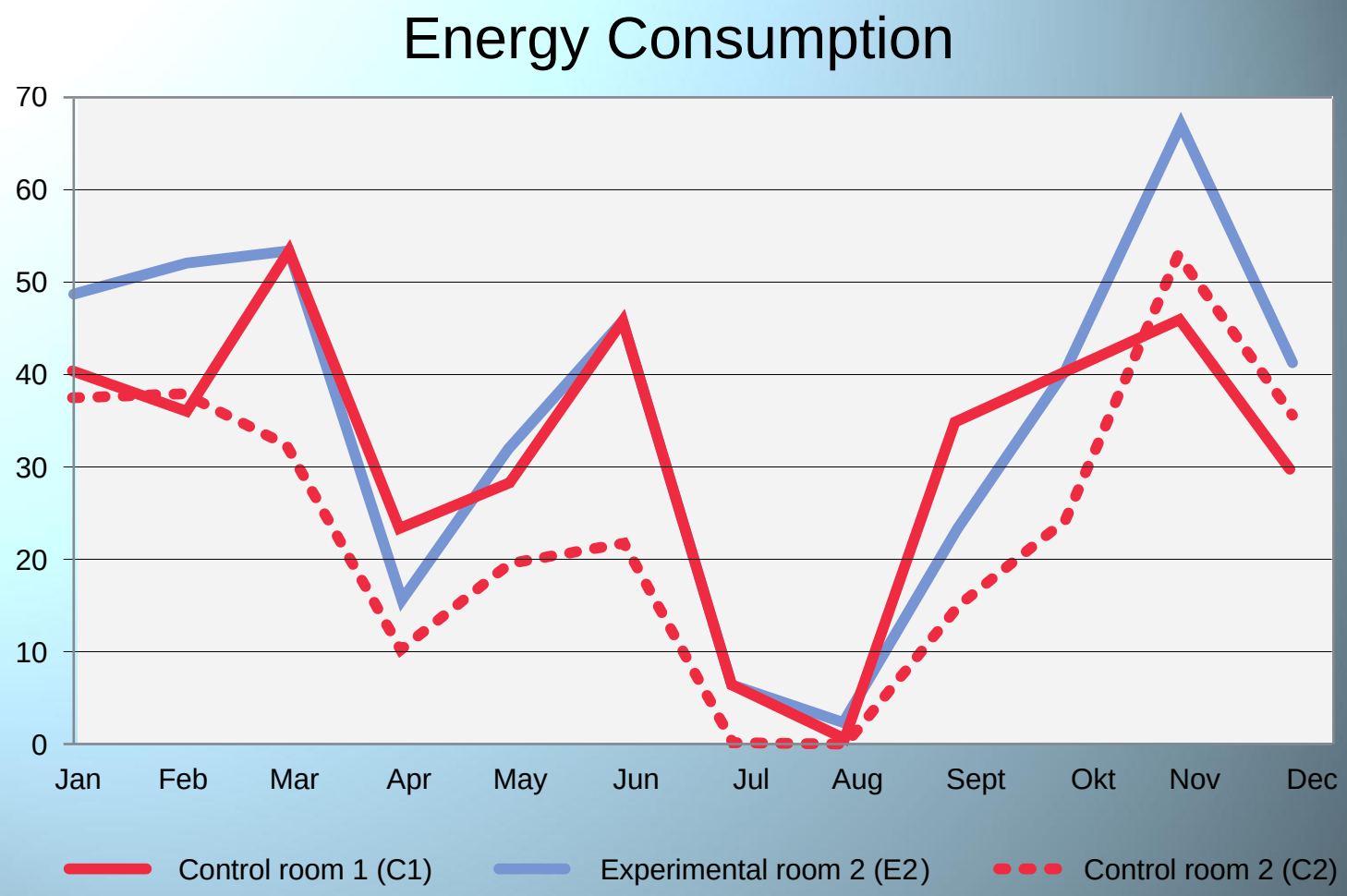
Comparison in Mood on ground floor – C1 vs. E1



ANOVA Repeated measures

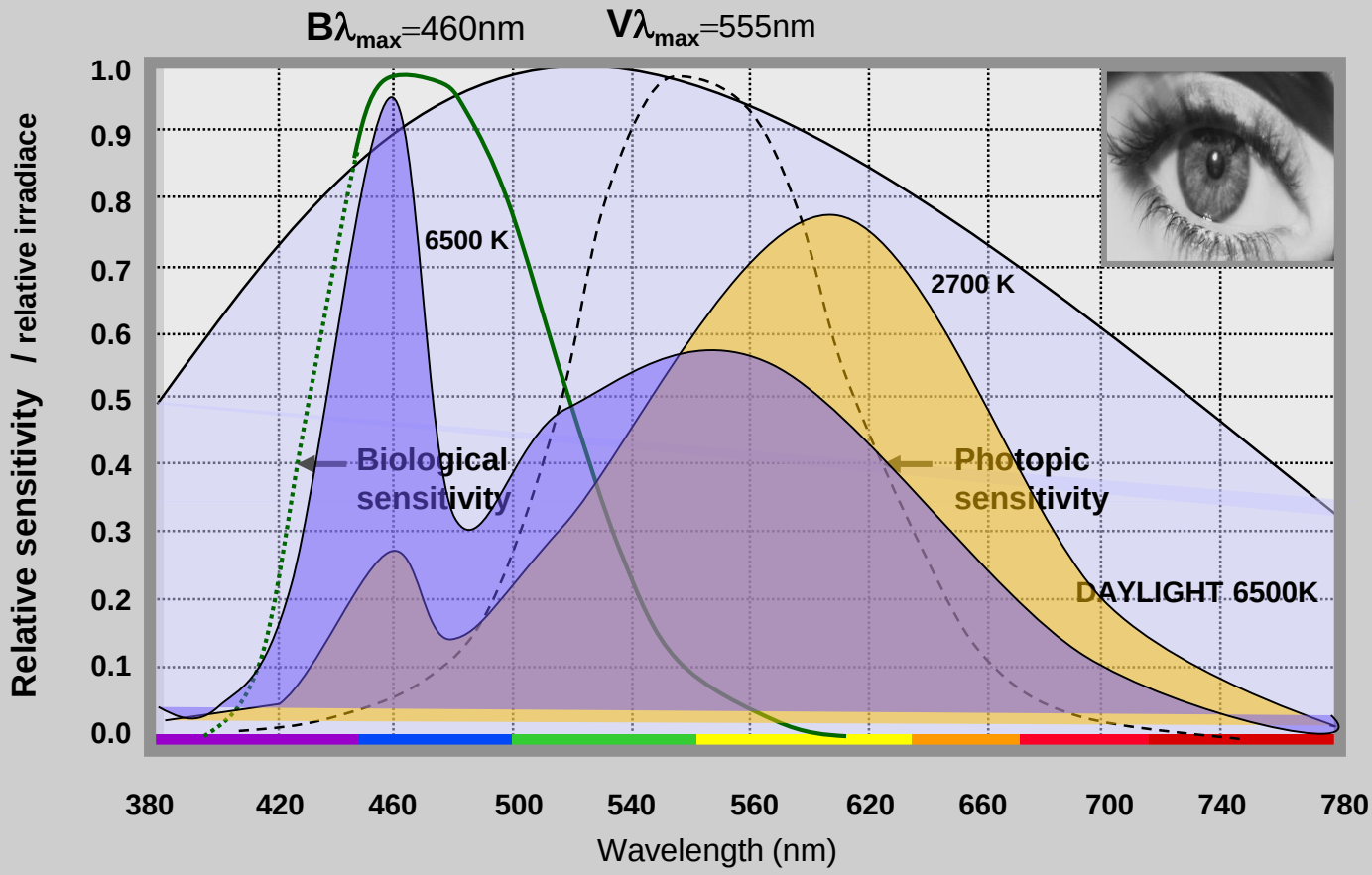

Math
Progress
Grade
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0
Dark season
Whole school year
C1
E1
C1
E1
Ground floor
Ground floor
2008 Sept – 2009 Jan
2008 Sept – 2009 May
C1
Control room
E1
Experimental room


Reading Grades
Progress
Grade
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0
Dark season
Whole school year
C1
E1
C1
E1
Ground floor
Ground floor
2008 Sept – 2009 Jan
2008 Sept – 2009 May
C1
Control room
E1
Experimental room


Energy Consumption
70
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Okt
Nov
Dec
Control room 1 (C1)
Experimental room 2 (E2)
Control room 2 (C2)

Science – Biological vs Photopic sensitivity

"Biological" sensitivity curve B_λ vs. **Photopic** sensitivity curve V_λ /CIE/



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