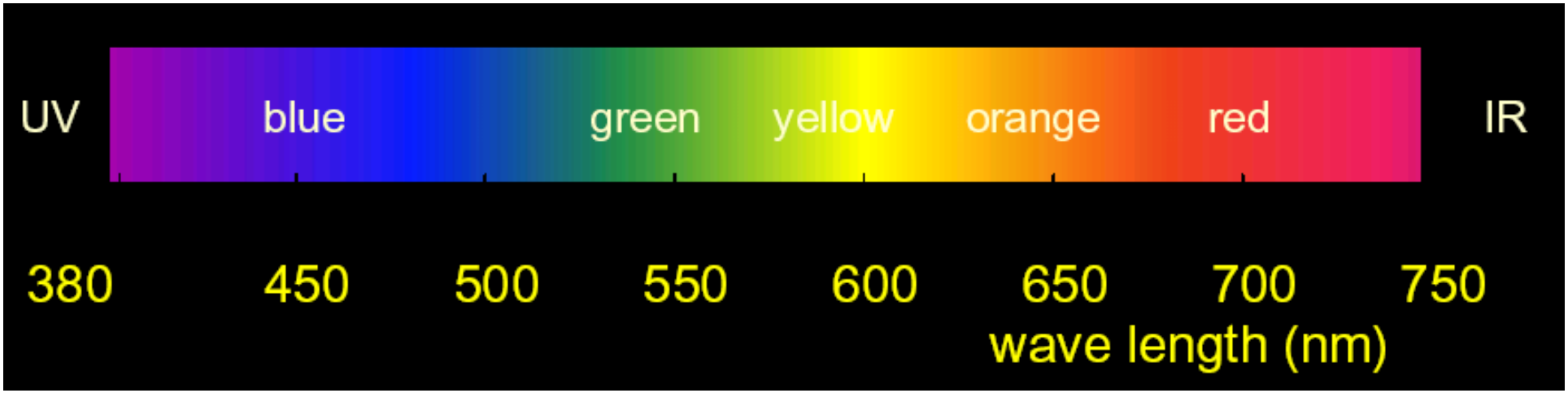
PERENCANAAN TEKNOLOGI & SISTEM BANGUNAN (PTSB) *03*


No architecture
without light!

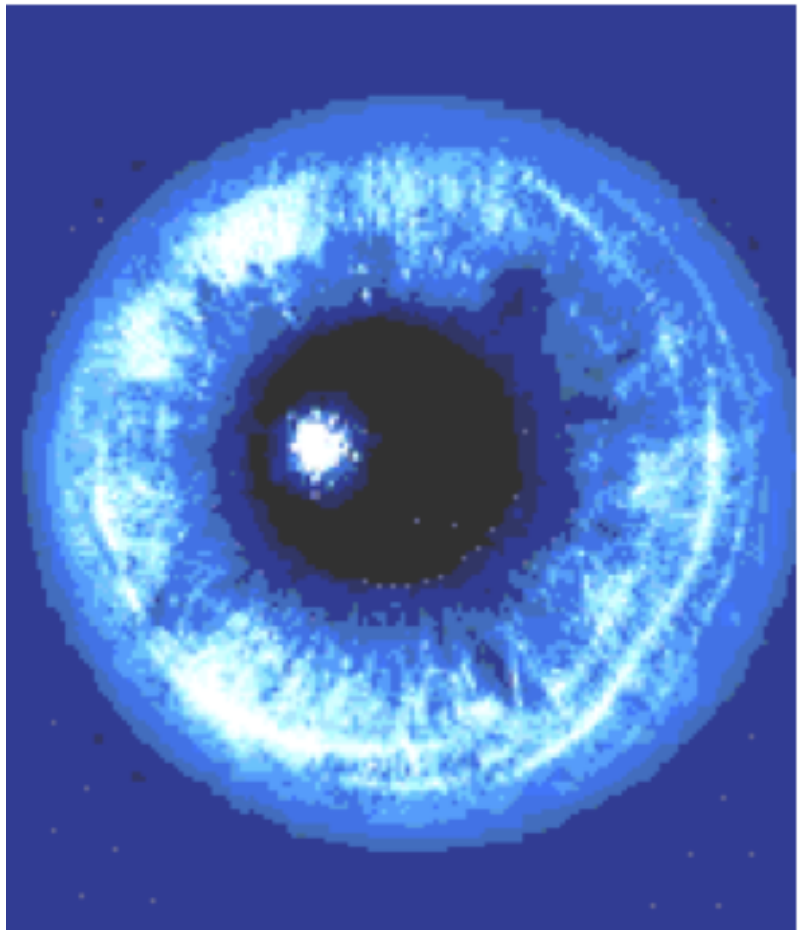
What is Light ?

- *electromagnetic radiation which is travelling in space*
- *when enters our eyes, it creates sensation of 'vision'*
- *a perceived phenomenon & depends on the sensitivity of eye*

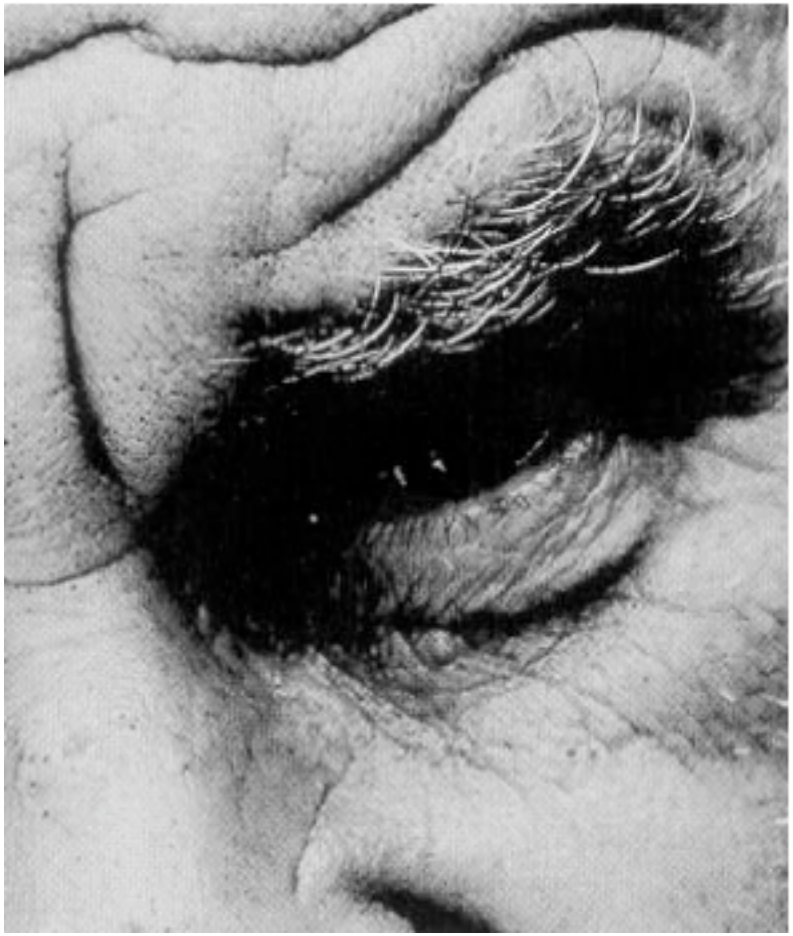
Electromagnetic Spectrum



- wave length 380nm - 800 nm , known as Light
- indicated by Violet to **Red**



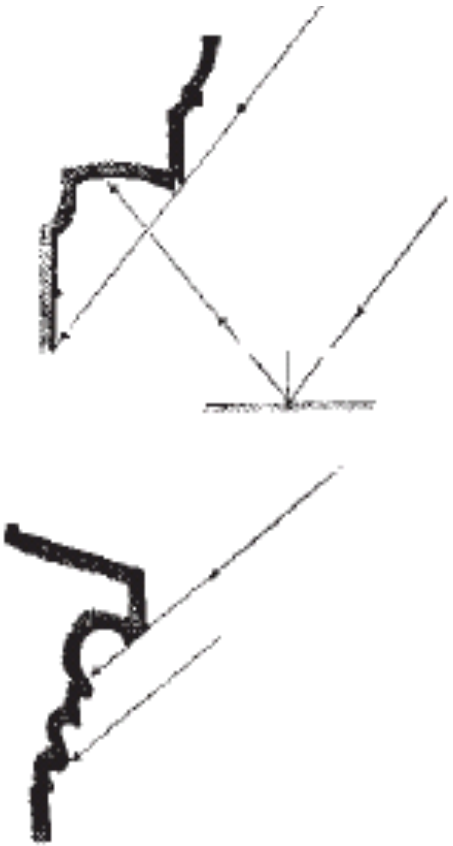
FISIOLOGIS



PSIKOLOGIS

Daylight architecture

- Depends on conditions in the various climatic zones of the globe.
- To render spatial bodies three-dimensional. An excellent means for controlling our perception on a psychological level.



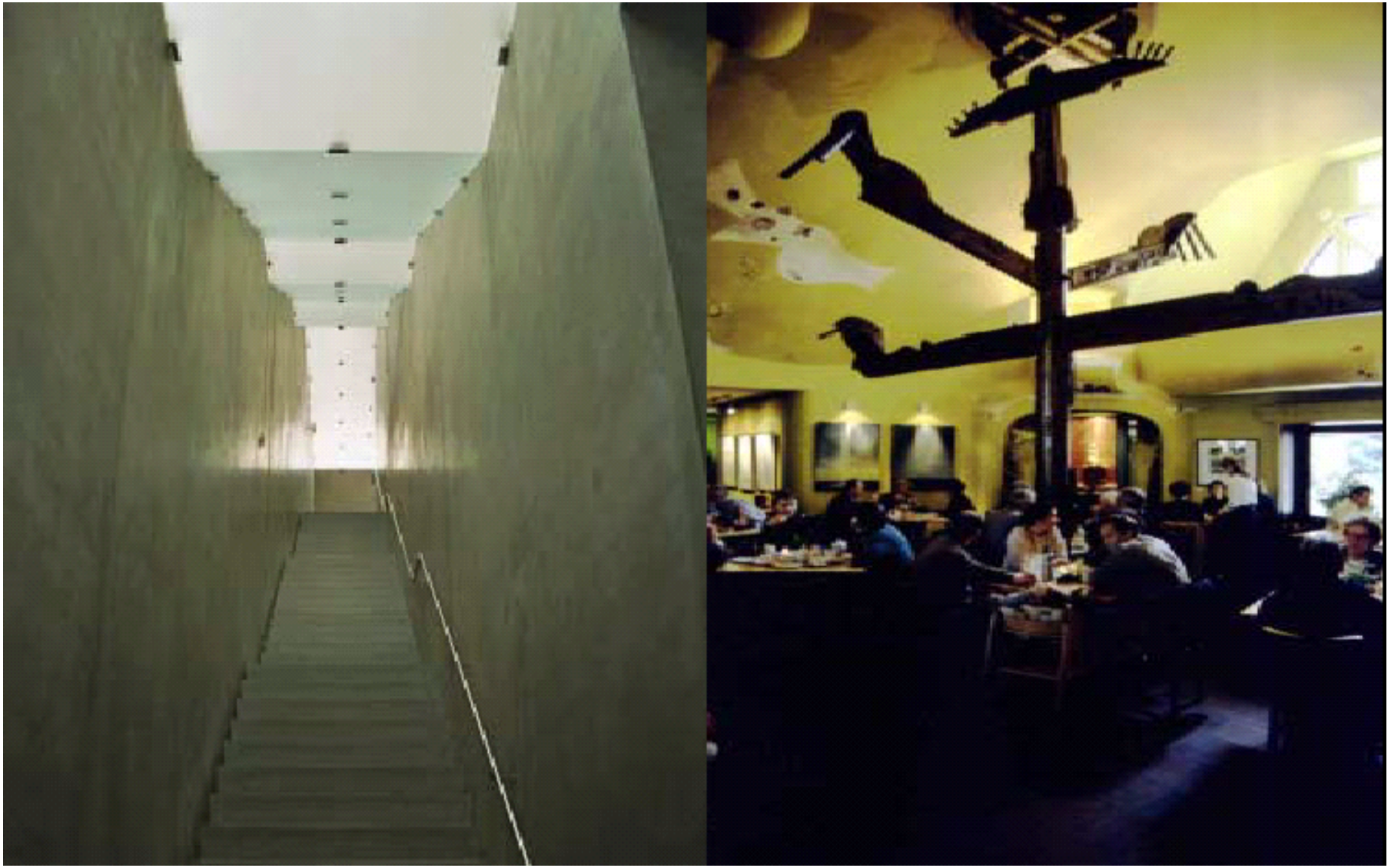
Transparent – Enclosure Bauhaus Dessau – Seminar room Swiss

Static – Active Energiezentrum Berlin – Wohnungsbau Österreich

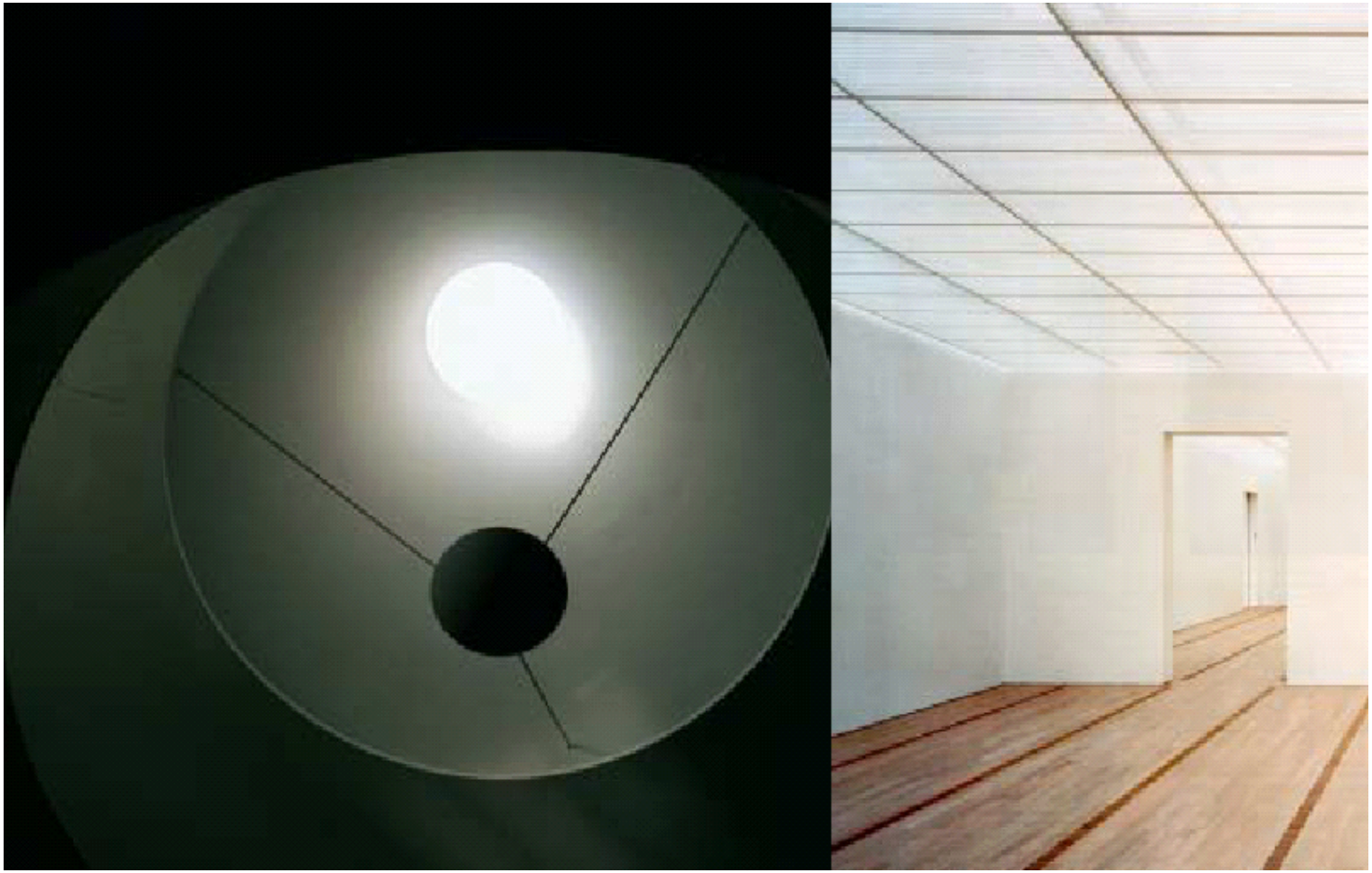
Light in smoke

Realistic – Mystic (right) Don Bosco, Brasilia, Brasil 1960

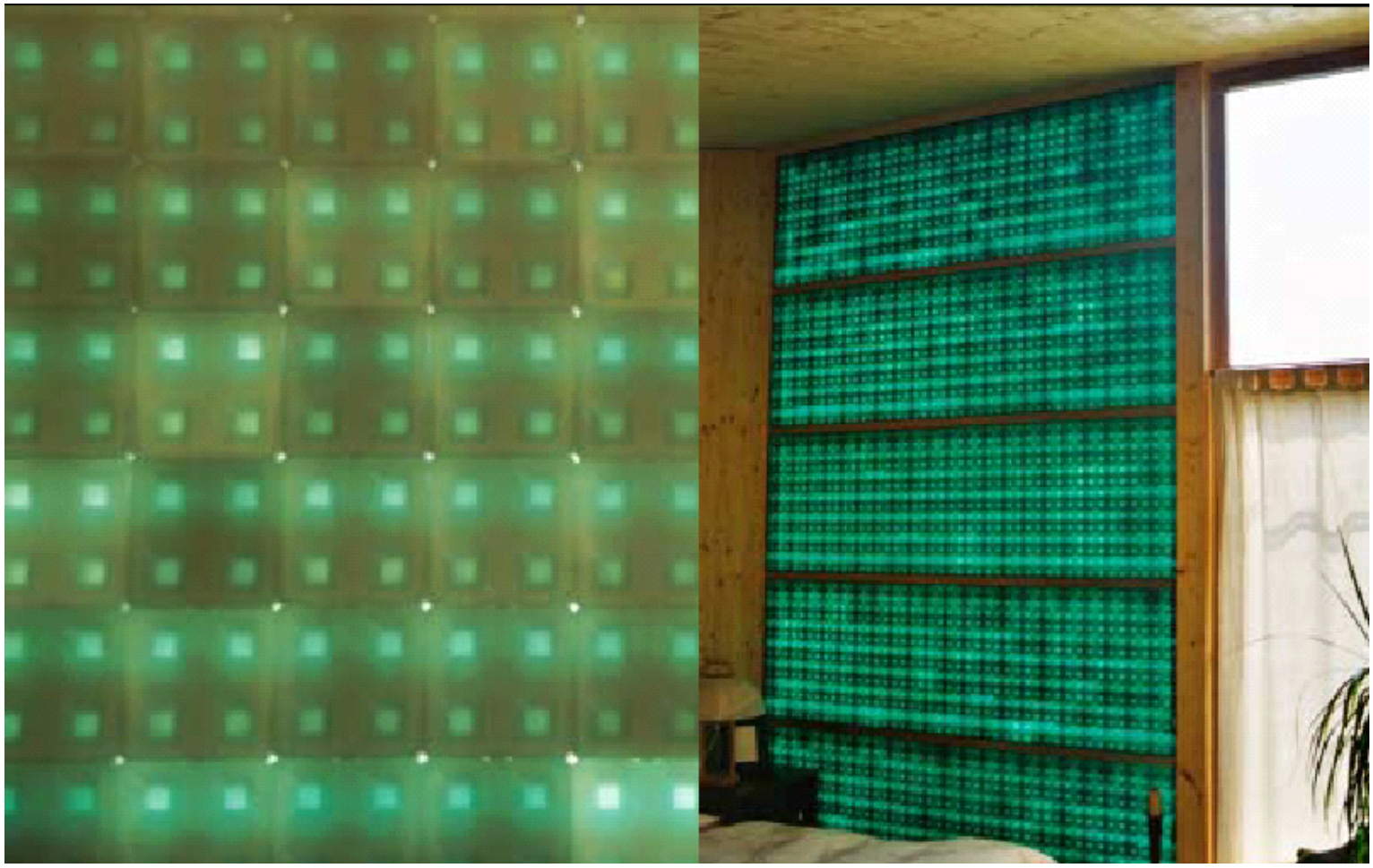
Light and Shadow - Monastery Santa Maria do Bouro, Portugal



Cold – warm Kunsthaus Bregenz - Künstlerkolonie Worpswede



Direct and indirect light – Porto University – Museum Renzo Piano

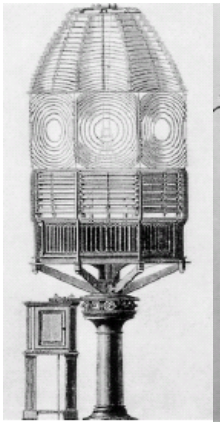


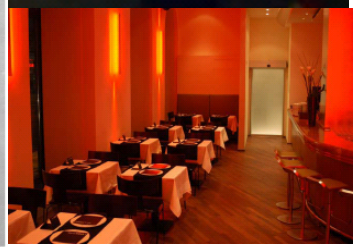
Filtered light Facade with Paraffin, Wohnhaus Schweiz, A: Schwarz

Artificial lighting

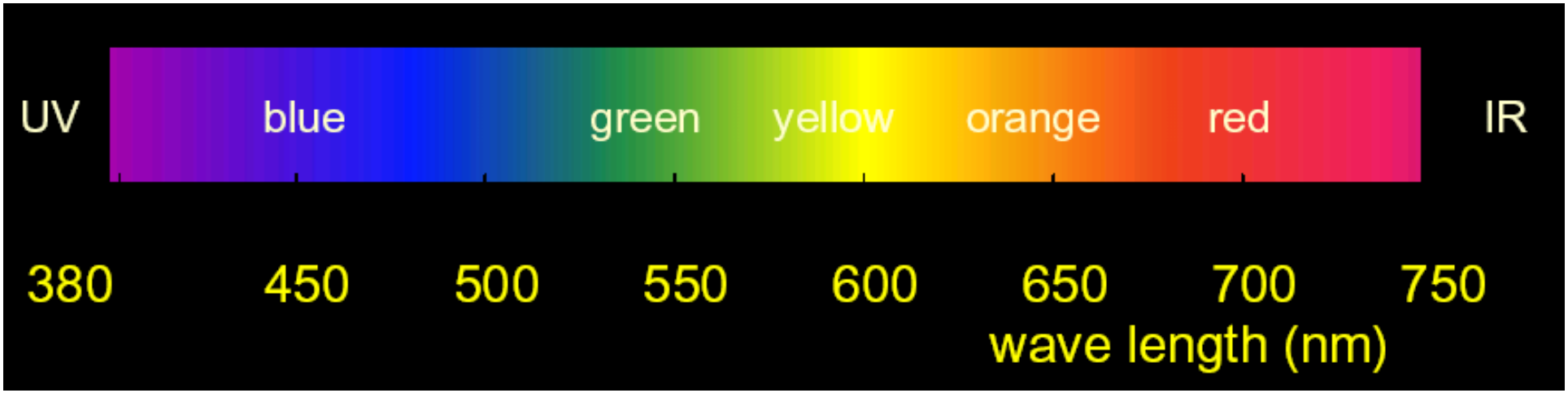
- Confined by the inadequate luminous power provided by the light sources available.
- Give impacts to environment directly
- Fire → Prismatic/lens → Gas → Electric



Electromagnetic Spectrum



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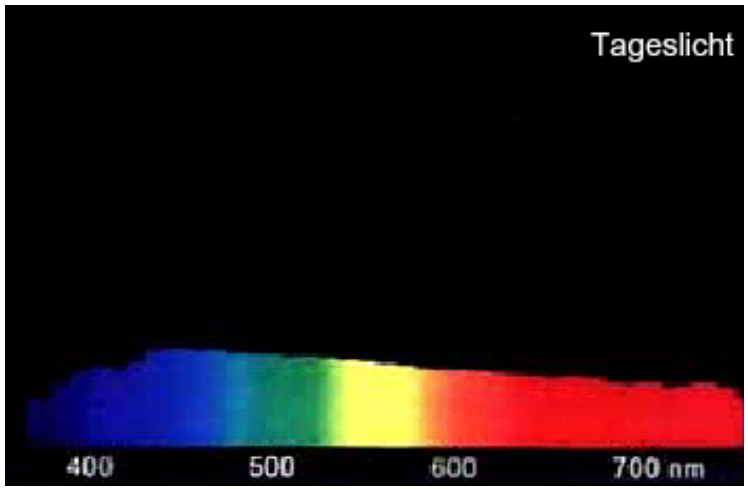
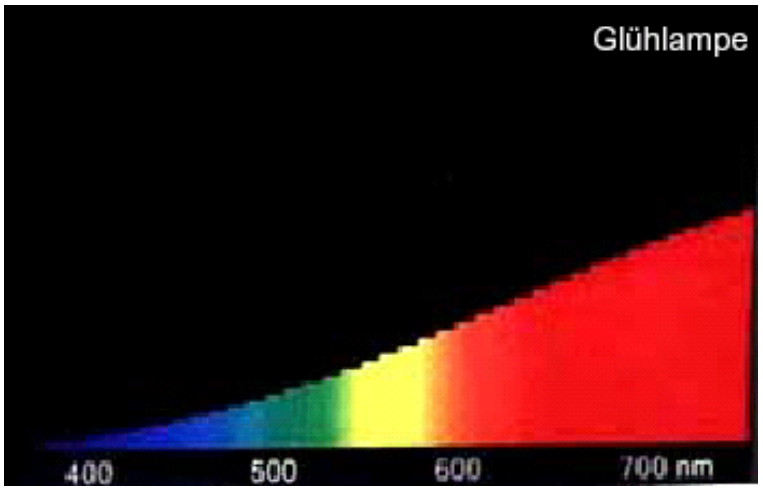
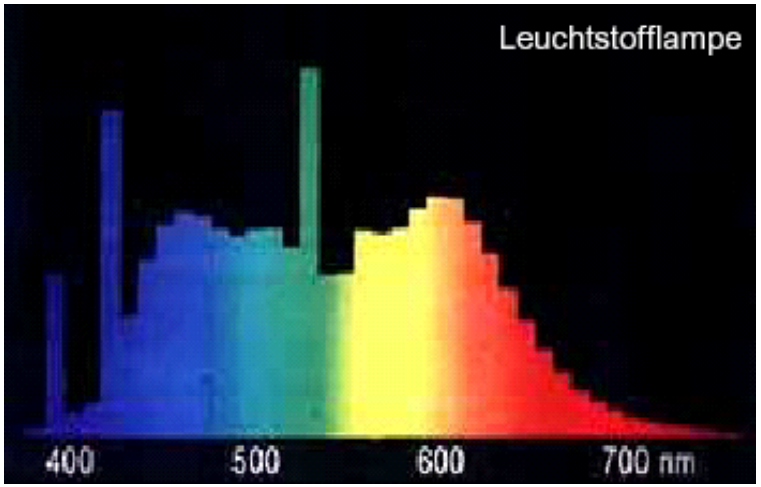




Spectral Intensity distribution

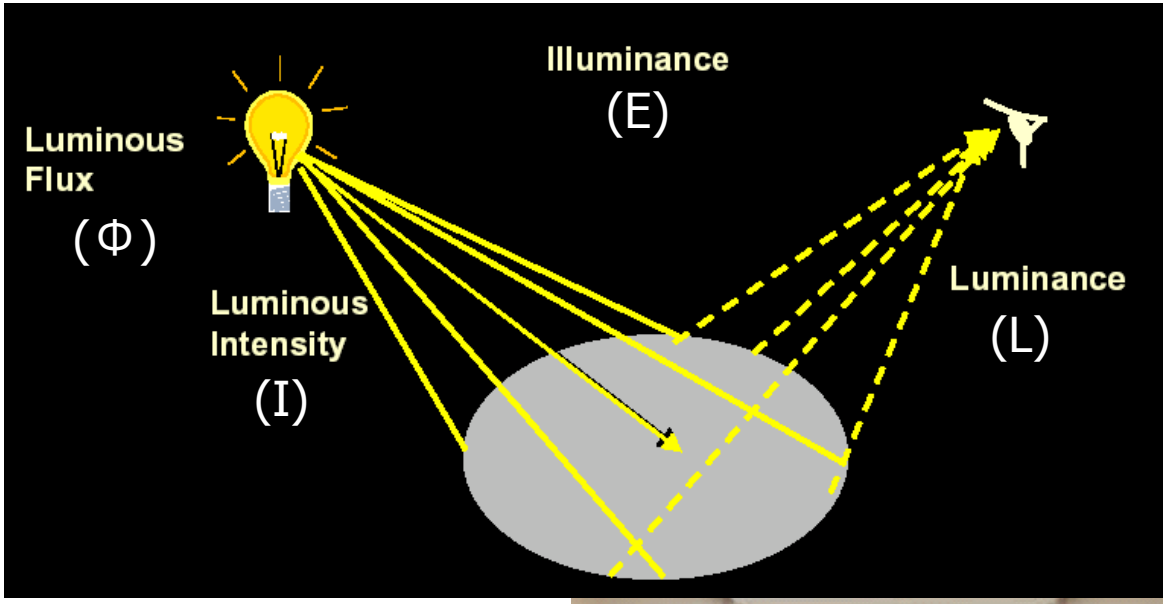


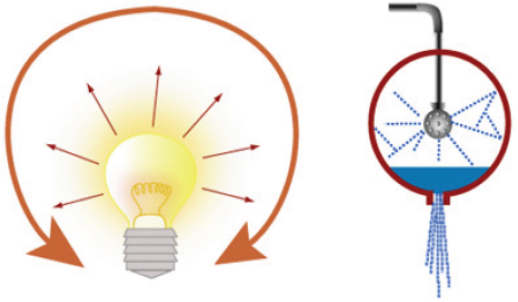
Principal Lighting Criteria

- Lighting Level
- Luminance Distribution
- Freedom from Disturbing Glare
- Spatial Distribution of Light
- Light Color and Color Rendering

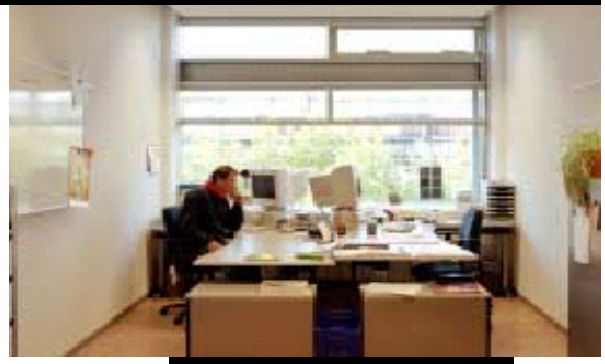
Photometric Quantities

Quantities	Symbol	Unit	Unit symbol
Luminous intensity	I	Candela, candlepower	cd
Luminous flux	Φ	Lumen (=Watt)	lm
Illuminance	E	Lux (=W/m²)	lx
Luminance	L	cd/m²	Cd/m²

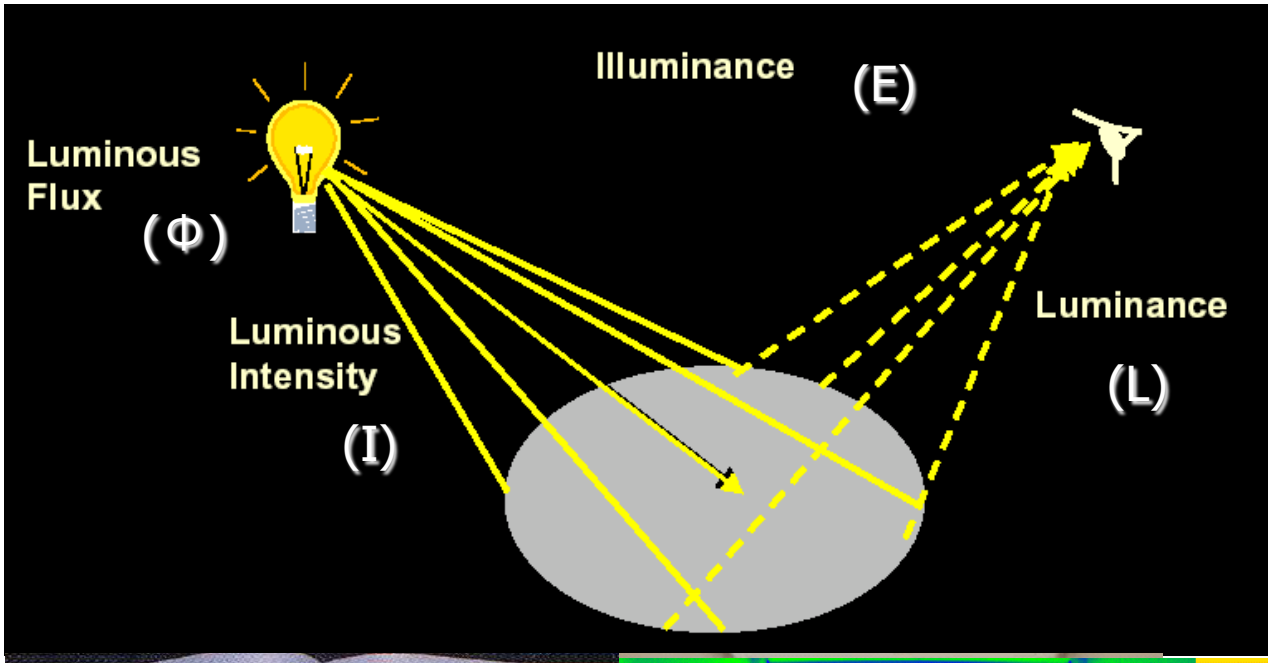




lumen (=Watt)



Cd

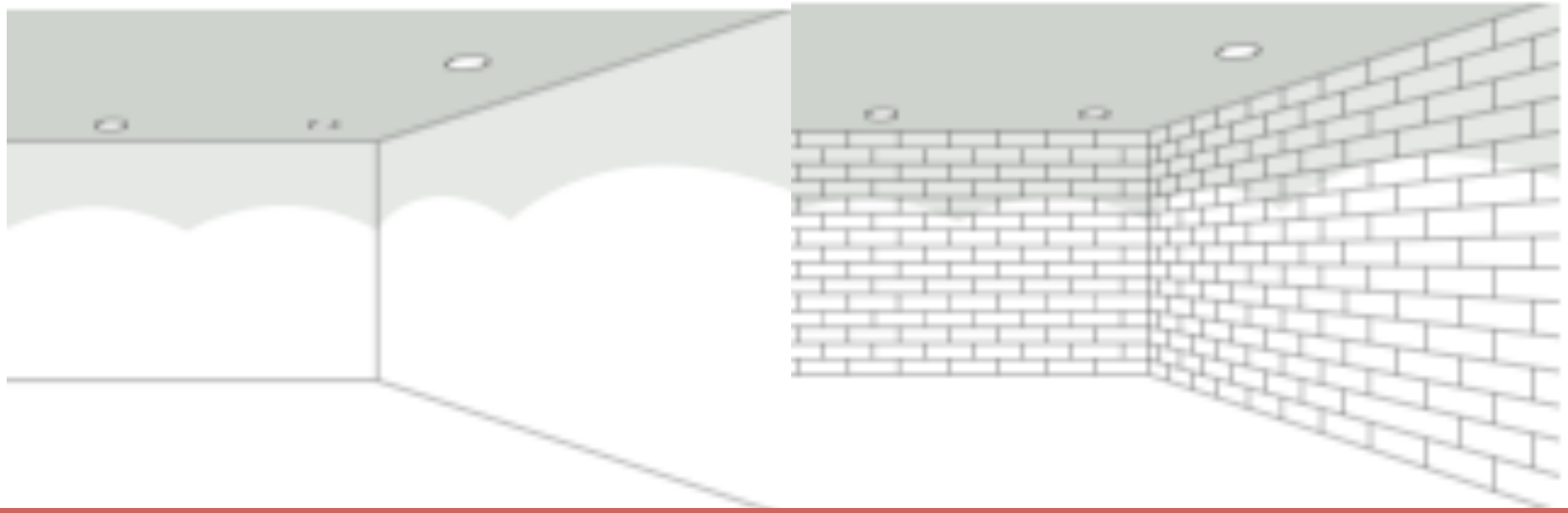

Illuminance
(E)
Luminous
Flux
(Φ)
Luminous
Intensity
(I)
Luminance
(L)


Lux (=W/m²)


1000
600
300
200
100
60
30
20
10
Cd/m²

Requirements	Illuminance (lx)	Examples
Low	20 - 70	Circulation, stairs
Moderate	120 - 185	Entrance, restaurant
Medium	250 - 375	General task
High	500 - 750	Reading, writing
Very high	> 1000	Precision task

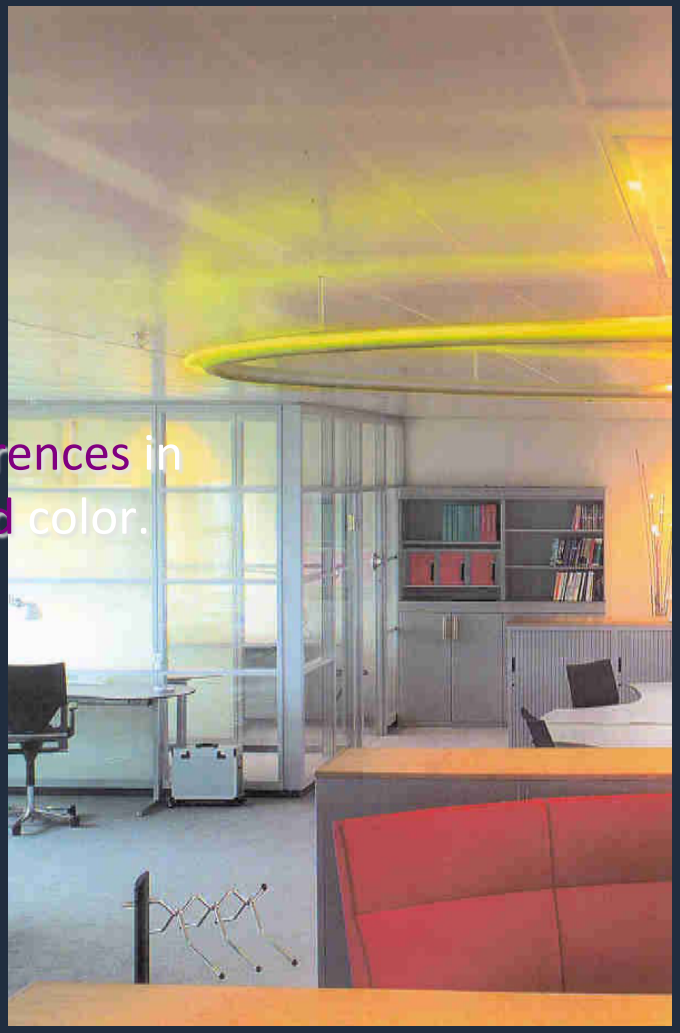
	Illuminance [lux]		
Type of space and function	Min	Mid	Max
Circulation, corridors, theatres, concert halls	50	100	200
Workshops, retail centres	200	300	400
Schools, offices, usual tasks, reading, writing, computer work, ...	300	400	500
Delicate work, drawing, technical tasks, ...	500	750	1000
Precision workshops, clockwork, color control, visual quality control, ...	1000	to	5000

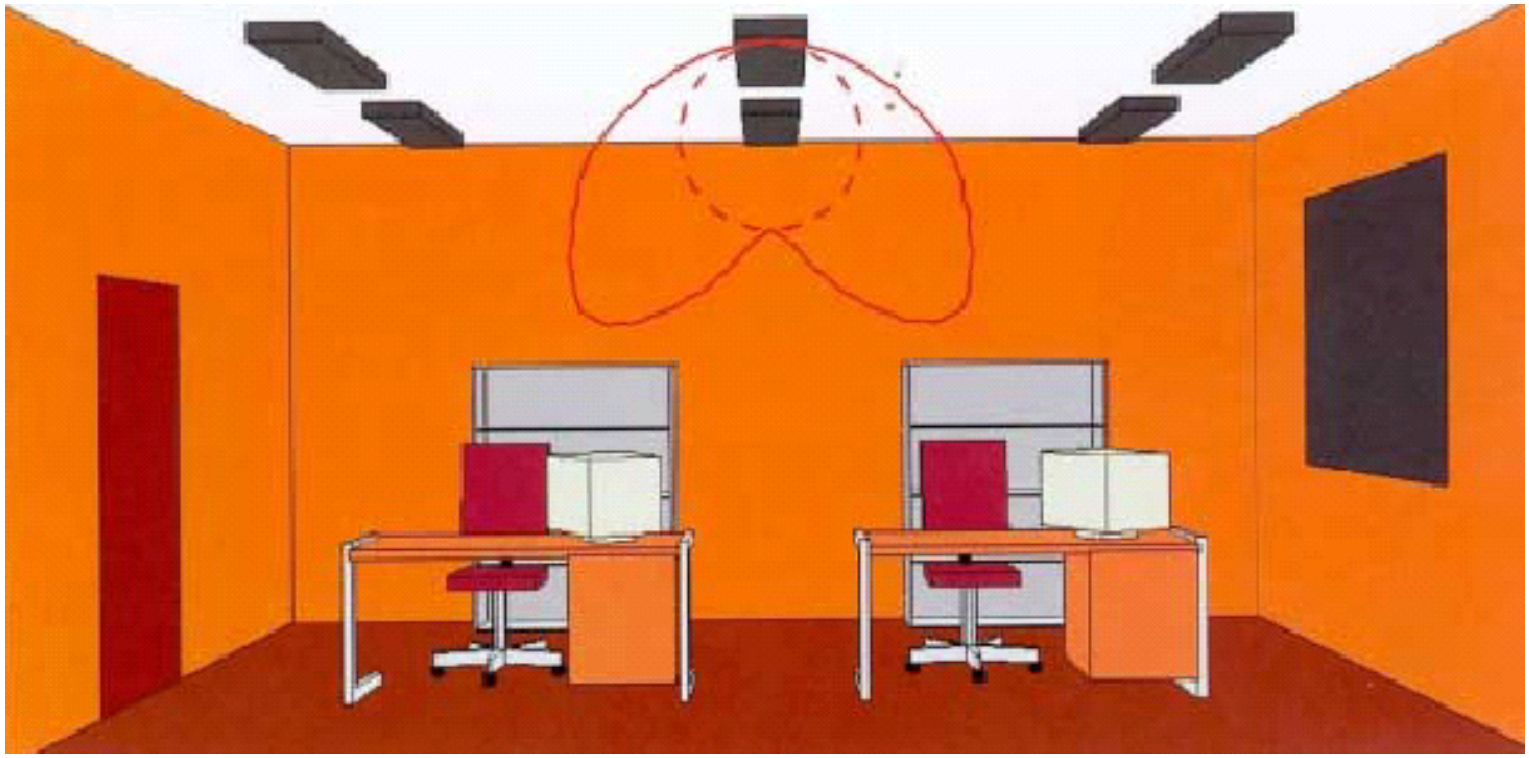


PERCEPTION (Lighting Distribution)

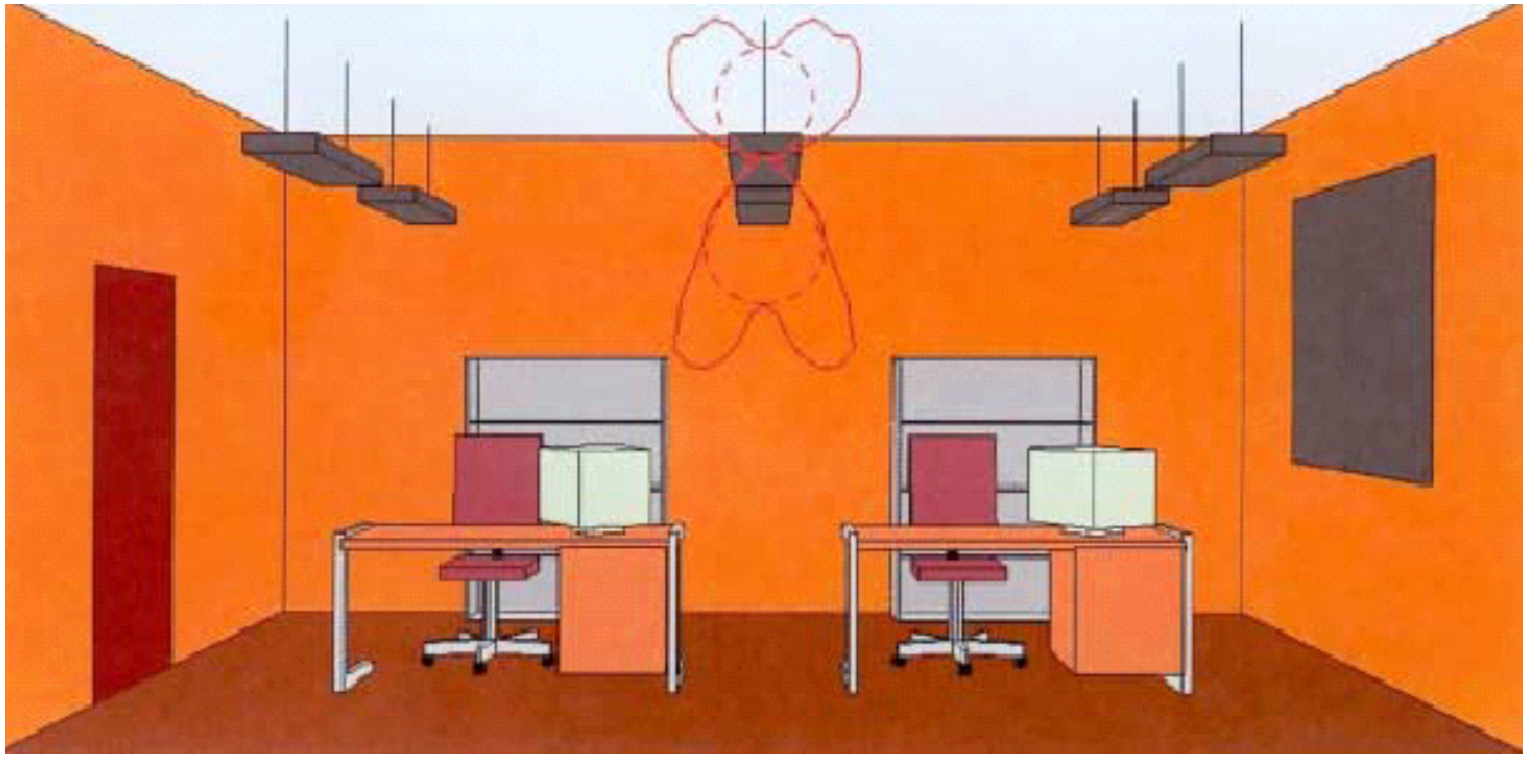
Dynamic Lighting

Contact with the outside world
People like the dynamics of day light
Privacy and flexibility
Different people have different preferences in lighting. So, flexibility in light level and color.
Comfort
Lighting that makes you feel at ease.
Emotion
People like surprising light effects. It stimulates, activates, and motivates..

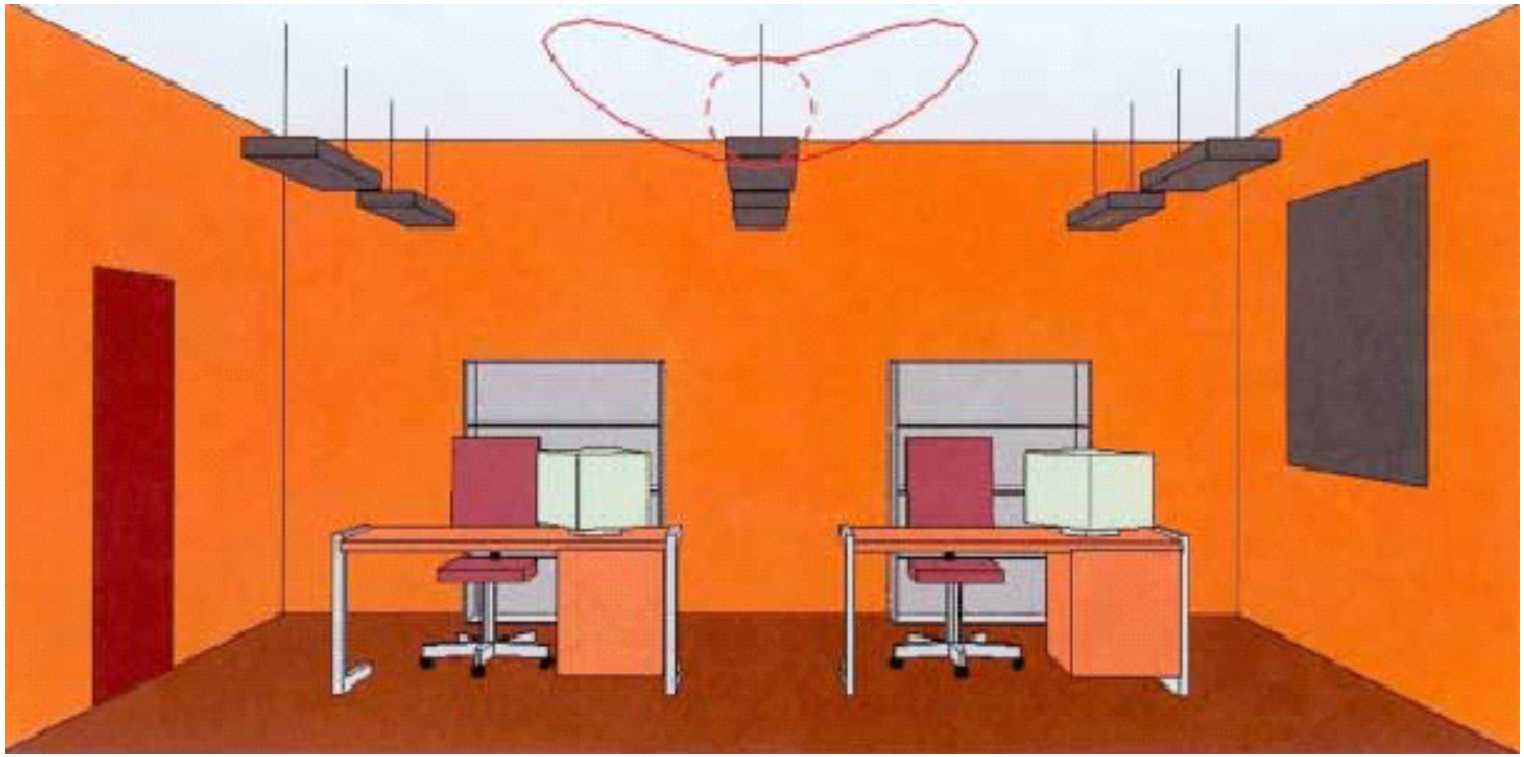




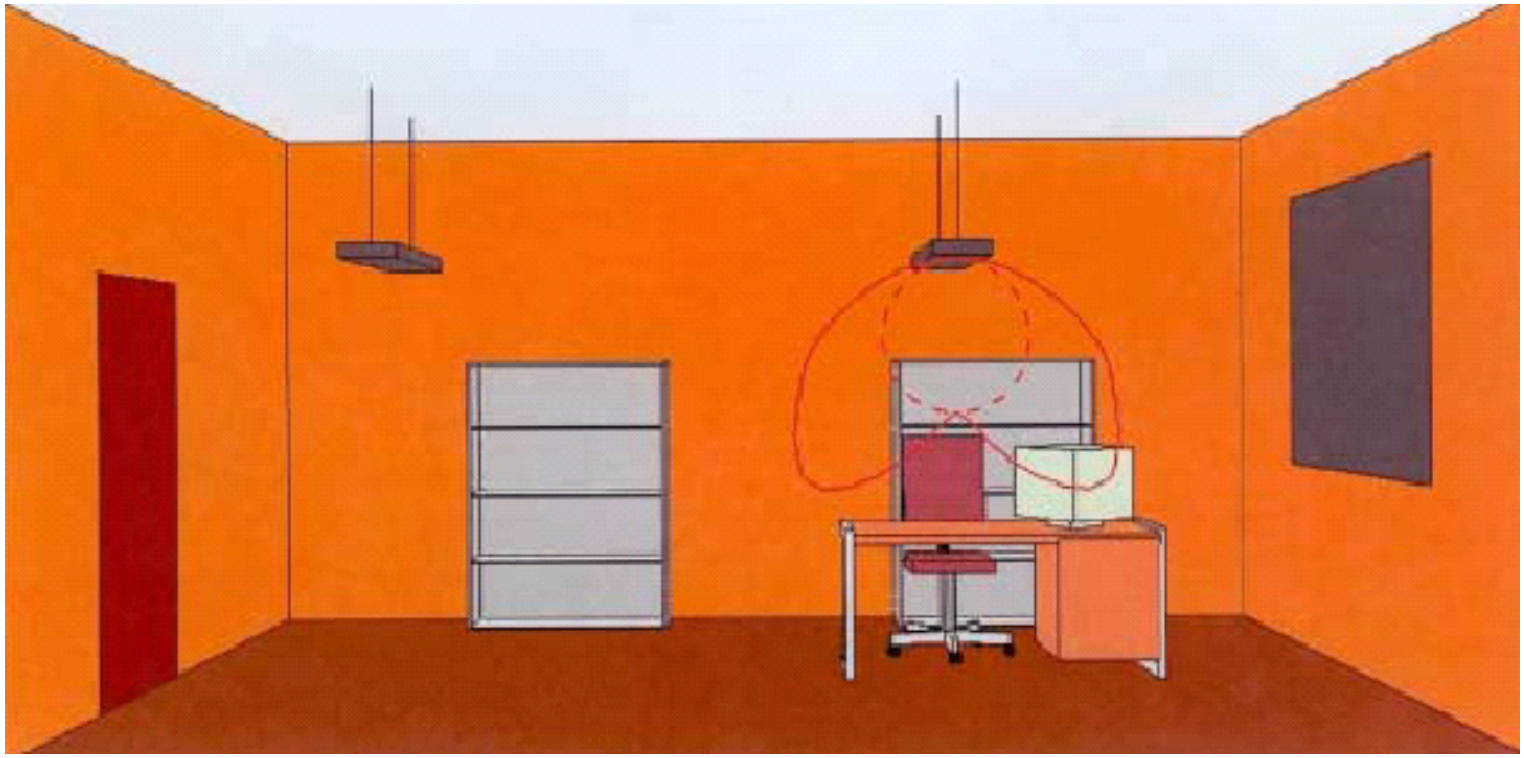
Direct – general lighting



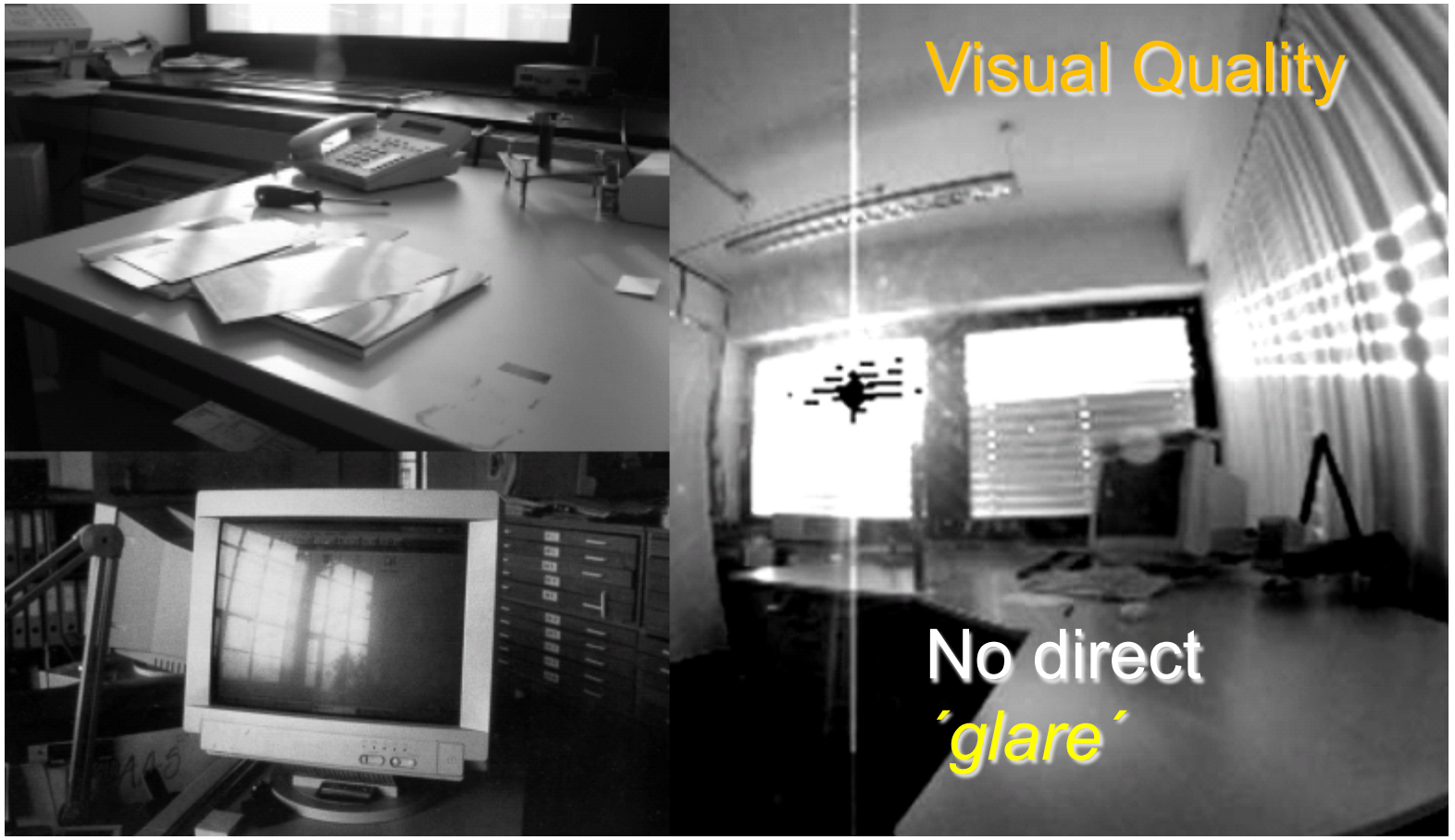
Direct – indirect lighting



Indirect – general lighting



Direct – task lighting



Glare is caused by brightness of any objects within the visual field which is brighter than the adaptation level of eye

CRI (Ra)

describes lighting quality using scale (0 – 100)

PERTEMUAN 22: SISTEM PENCAHAYAAN (2)

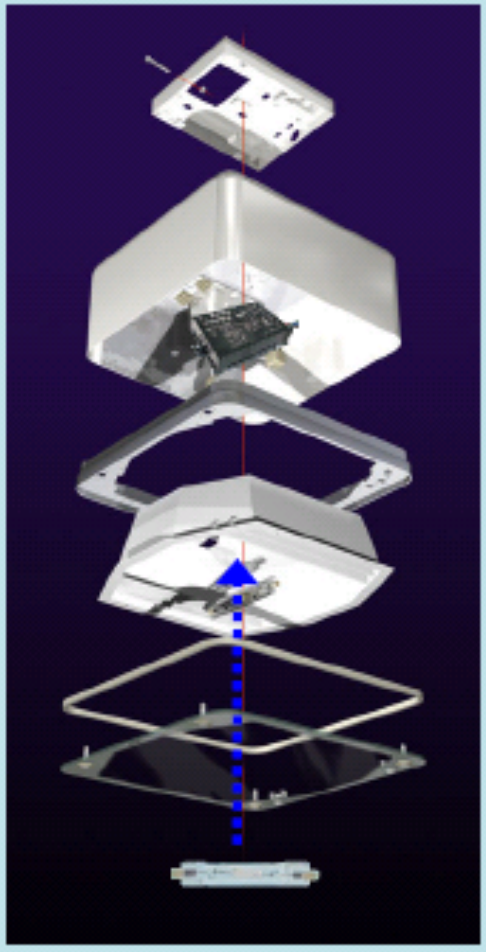
LUMINAIRES

+

LIGHTING ELECTRONICS (LE)

+

LAMPS



LIGHTING SYSTEM

PERTEMUAN 22: SISTEM PENCAHAYAAN (2)

LIGHT Generation

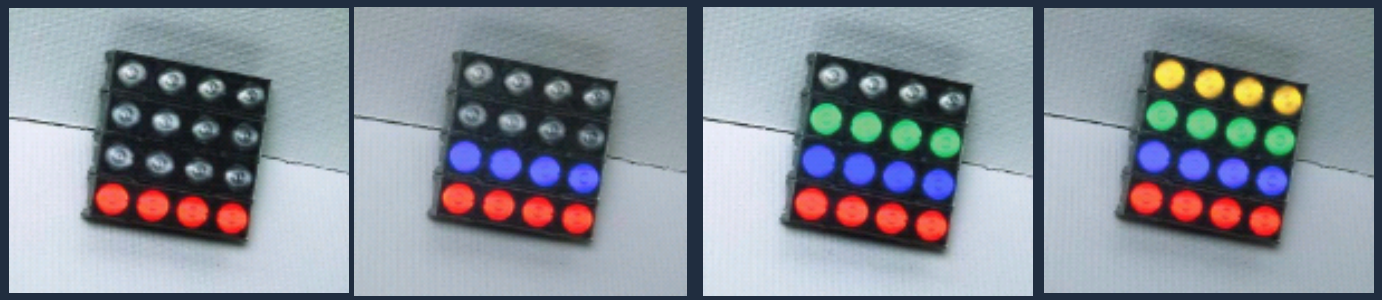
- INCANDESCENT Lamps

Electricity → THERMAL Radiation

- GAS DISCHARGE Lamps

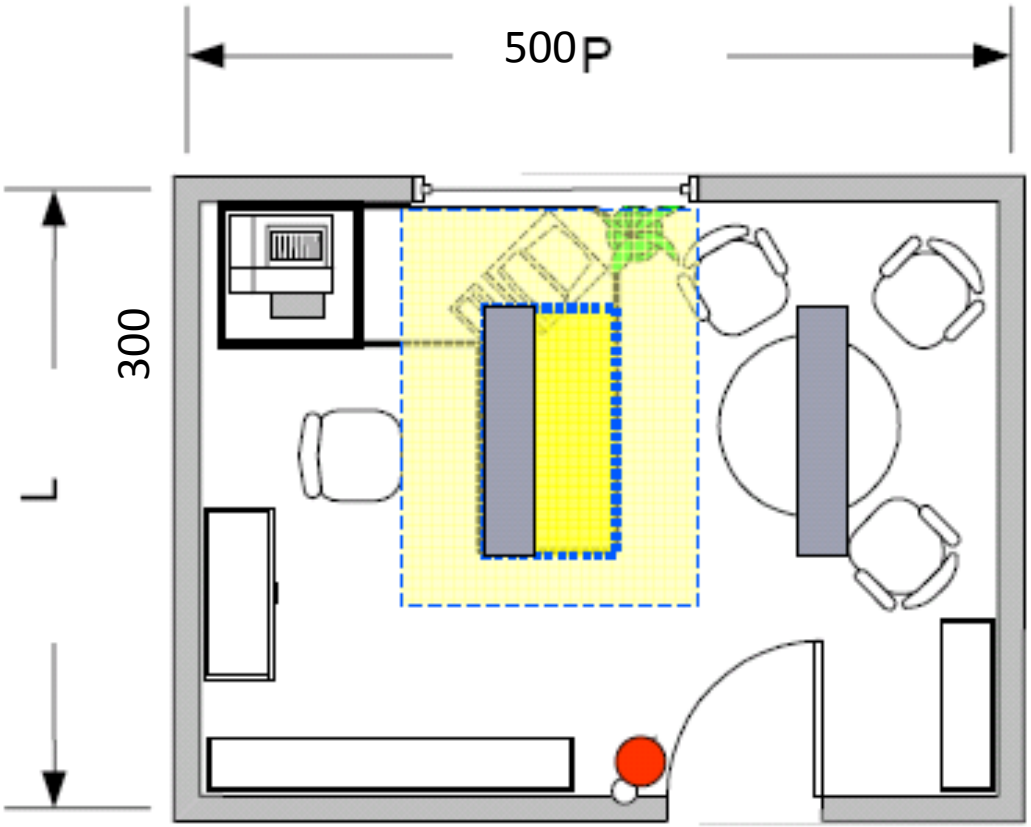
Electricity → Selective Radiation + Luminescenen

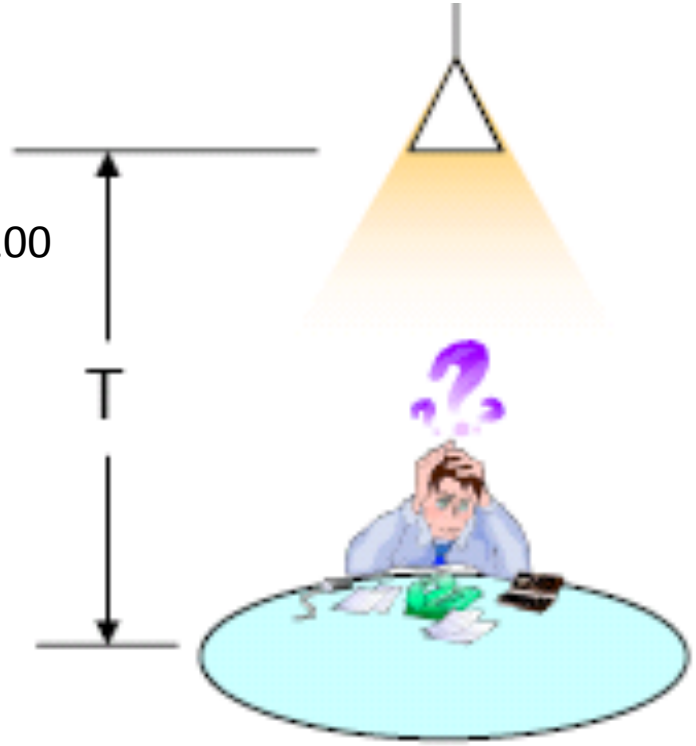
PERTEMUAN 22: SISTEM PENCAHAYAAN (2)



LIGHT EMITTED DIOED (LED)

1) ROOM INDEXS





THE LUMEN METHOD

$$(K) = \frac{P \times L}{T(P+L)}$$

(2) DESIGN FACTORS

Design Factor = Utilization Factor x Maintenance Factor

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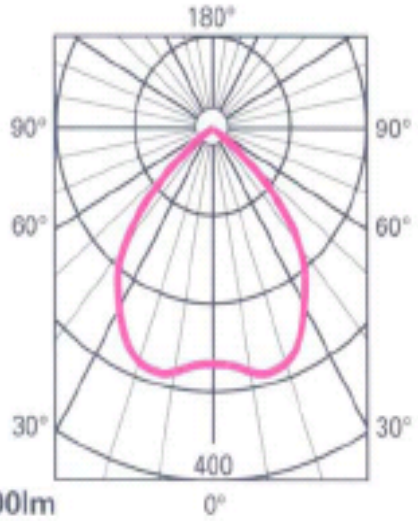

cd/1000lm γ	0°	30°	60°	90°
0	270			
5	271			
10	281			
15	288			
20	284			
25	267			
30	242			
35	213			
40	179			
45	138			
50	84			
55	23			
60	9			
65	7			
70	5			
75	3			
80	2			
85	2			

room index k	70 50 30 10 30	50 30 10 30	30 10 10	0 0 0
0.60	0.33 0.30 0.27	0.32 0.29 0.27	0.28 0.27	0.26
0.80	0.38 0.34 0.32	0.37 0.34 0.32	0.33 0.31	0.30
1.00	0.42 0.39 0.36	0.41 0.38 0.36	0.36 0.35	0.34
1.25	0.46 0.42 0.40	0.44 0.41 0.39	0.39 0.38	0.37
1.50	0.48 0.45 0.43	0.47 0.44 0.42	0.41 0.40	0.39
2.00	0.52 0.50 0.47	0.50 0.48 0.46	0.44 0.43	0.42
2.50	0.55 0.52 0.50	0.52 0.50 0.49	0.46 0.45	0.44
3.00	0.56 0.54 0.52	0.53 0.52 0.50	0.48 0.47	0.46
4.00	0.58 0.56 0.55	0.55 0.54 0.52	0.49 0.48	0.47
5.00	0.59 0.58 0.56	0.56 0.55 0.54	0.49 0.49	0.48

THE LUMEN METHOD

(2) DESIGN FACTORS

Design Factor = Utilization Factor x Maintenance Factor

$$\frac{0.58 - 0.55}{3 - 2.5} \times 0.2 = 0.012$$

THE LUMEN METHOD

(3) LUMEN

$$E = \frac{\text{Lumen x (Design Factors)}}{\text{Area}}$$

LAMPS - TL / TLD	LUMEN	° K	CRI
Cool Daylight			
TL 40 W - Serie 54	2500	6500	70
TLD 36 W - Standard Serie 54	2500	6500	77
TLD 36 W - Super 865	3250	6500	85
TL5 35 W HE 865	3400	6500	85
Cool White			
TL 40 W - Serie 33	2850	4000	50
TLD 36 W Standard Serie 33	2850	4000	66
TLD 36 W Super 840	3350	4000	85
TL5 35 W HE 840	3500	4000	85

THE LUMEN METHOD