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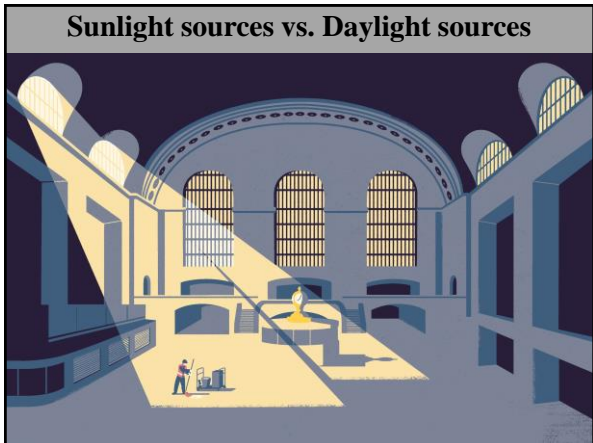
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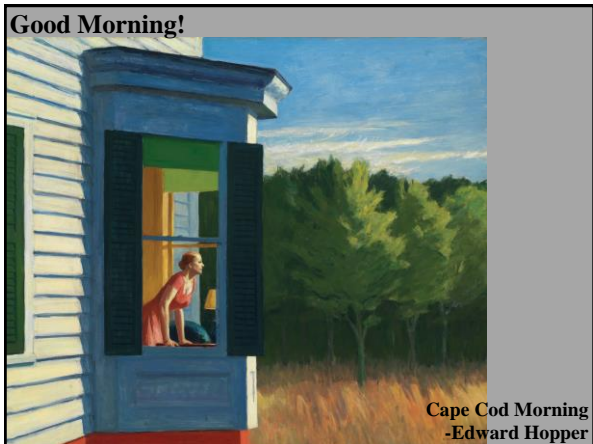
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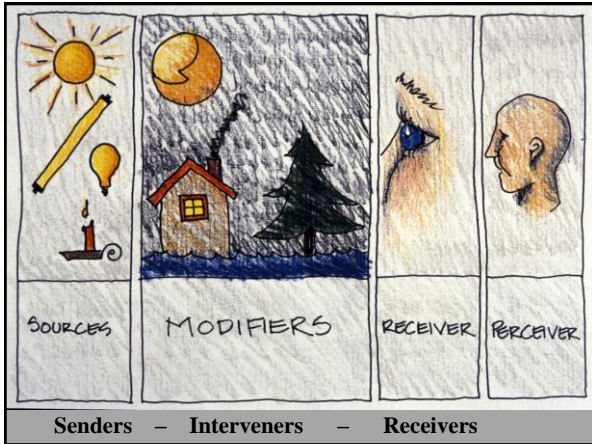
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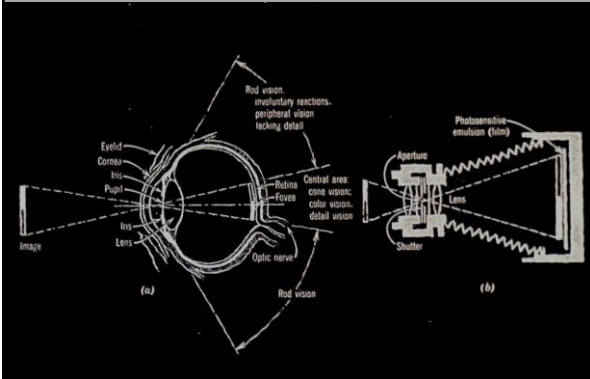
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## Receivers —Natural and Man-Made



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## Interveners

### •Transmitters

- Specular
- Semi
- Diffuse

### •Reflectors

- Specular
- Semi
- Diffuse



Taliesin West  
Scottsdale, AZ  
F.L. Wright

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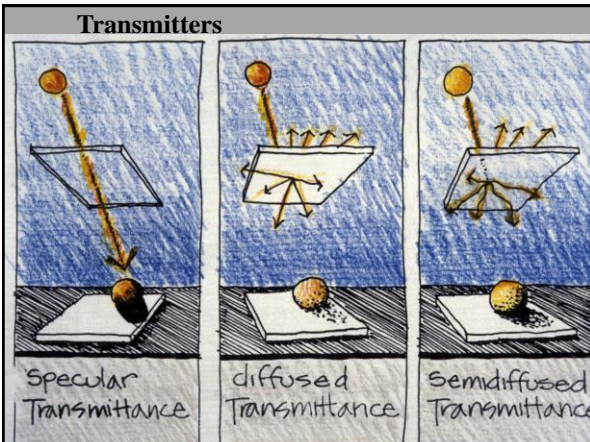
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## Transmitters



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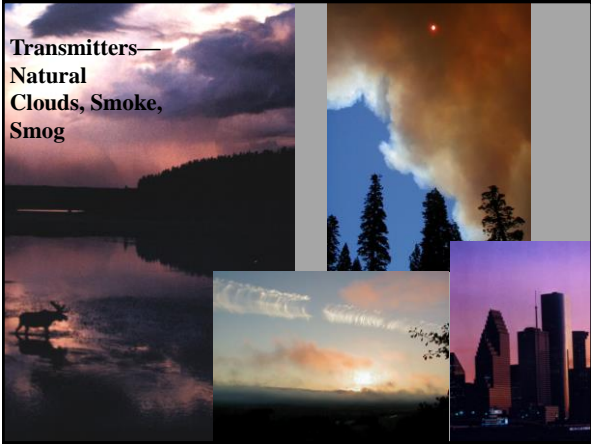
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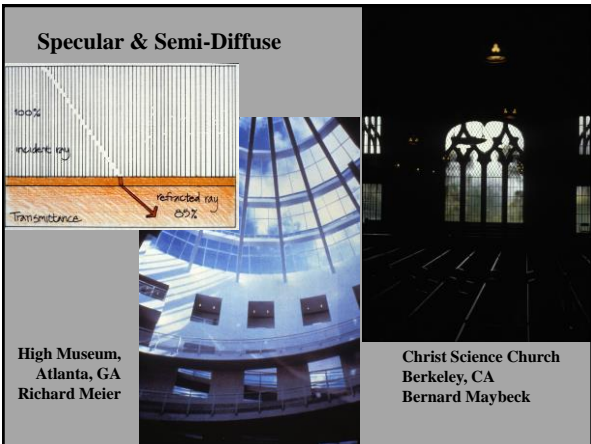
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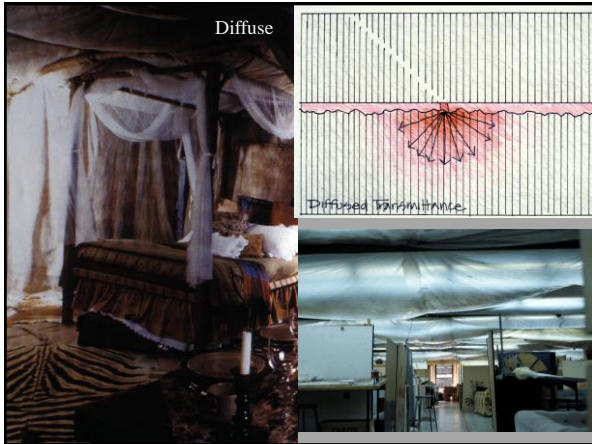
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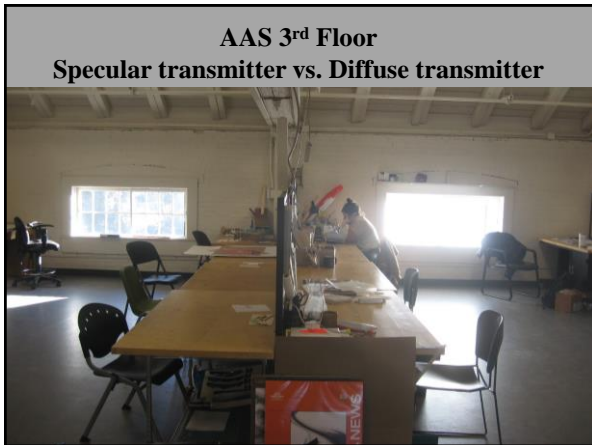
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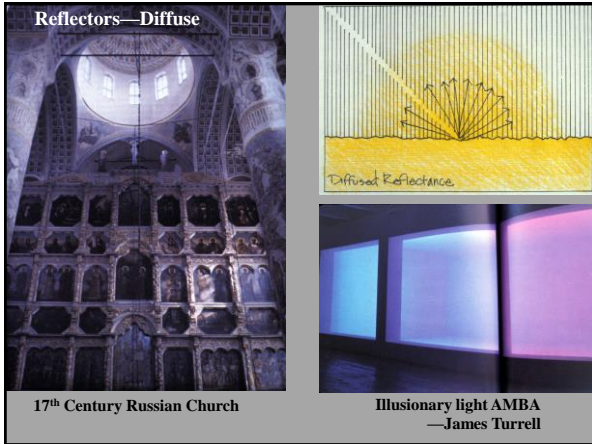
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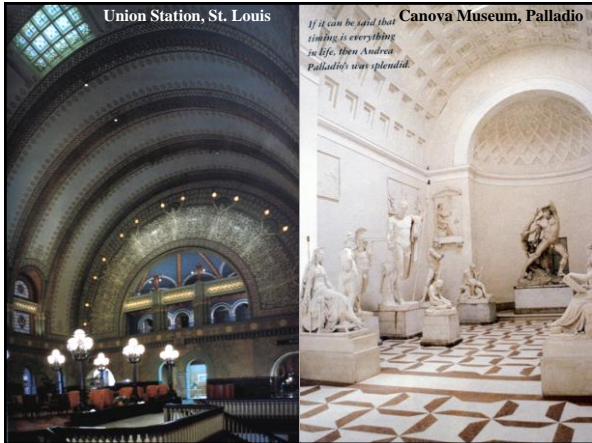
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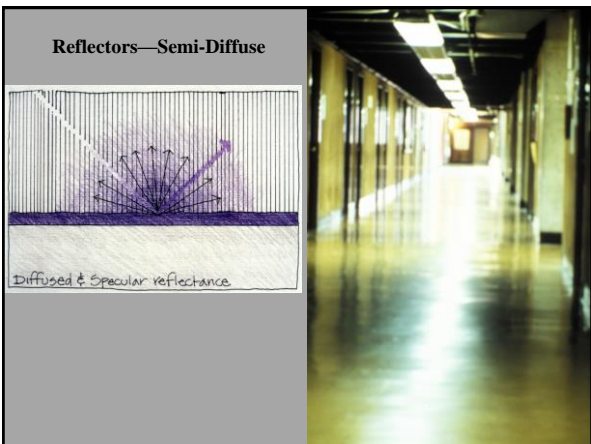
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### Two Relationships of Interest

- |   |   |
|---|---|
| 1. Remote Senders & Local Interveners<br>“natural lighting” | 2. Local Senders and Interveners<br>“electric lighting” |
|---|---|



West Baden Hot Springs, IN c.1901



Hauserman Furniture Showroom c.1980

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### Point-of-View: Qualitative vs. Quantitative

Human receivers have a subjective manner for assessing lighting  
Mechanical senders have an objective means of providing light



Imagine a perfectly clear night on the Palouse...

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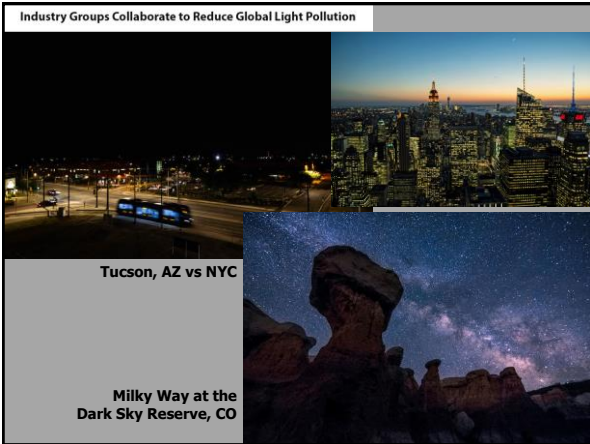
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### 5 principles for responsible outdoor lighting

Custom LED fixtures in London's Queen Elizabeth Olympic Park provide diffuse, dappled light.  
Photo © James Newton.

- All light should have a clear purpose:** Before installing or replacing a light, determine if it is needed and consider how it will impact the area, taking into account wildlife, nature and sustainability. In some instances, reflective paint or self-luminous markers for signs, curbs, and steps might reduce the need for permanently installed illumination.
- Light should be directed only where needed:** Use shielding and careful aiming to direct a light beam so that it points downward and does not spill.
- Light should be no brighter than necessary:** Use the lowest light level required and be mindful of surface conditions as some surfaces reflect light into the night sky.
- Light should be used only when useful:** Use controls to ensure that light is available when needed, dimmed or turned off when possible.
- Use warmer color temperatures:** Limit the amount of shorter wavelength (blue-violet) light, which some consider to be harmful.

--IES & Int'l Dark Sky Assn.

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### Weber's Law

$\frac{\text{Perceivable change in stimulus}}{\text{Total stimulus}} = \text{Constant}$

10 units

↓

Room A

500 units

↓

Room B

If you could detect a difference in lighting with 12 units in Room A, how much light would have to be added to room B?

Hint:  $2/10 = x/500$  or  $x = 500(2/10) = 100$

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There is a logarithmic relationship between senders and receivers...between subjective and objective...

Equally perceived intervals of sensation	Corresponding quantity of stimulus
1	10 or $10^1$
2	100 or $10^2$
3	1,000 or $10^3$
4	10,000 or $10^4$
5	100,000 or $10^5$
...	...

Therefore, 5x the sensation requires  $10^5$  the stimulus

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The art of designing lighting is to understand the relationship of stimulus to sensation, of perception to reception, of quantitative to qualitative...




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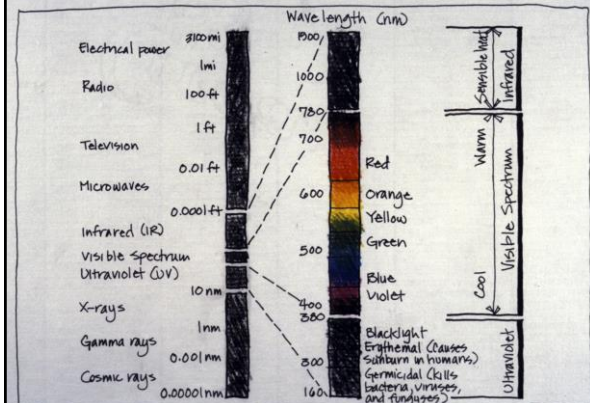
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Objectively, we can measure visible light's wavelength...




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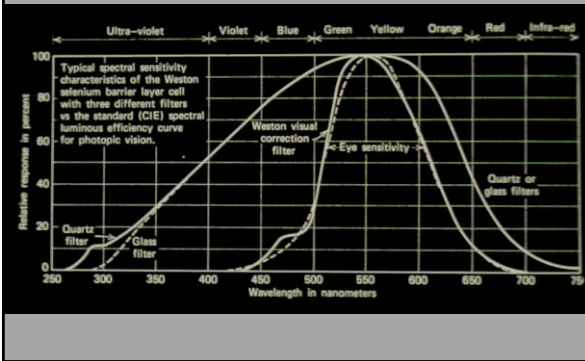
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...subjectively, our eyes are most sensitive to yellow-green.




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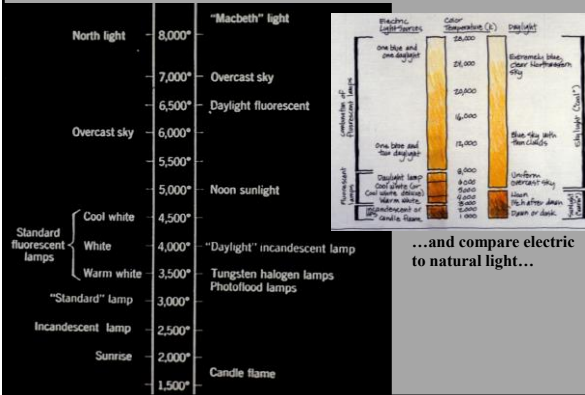
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Objectively, we can measure visible light's color temperature...




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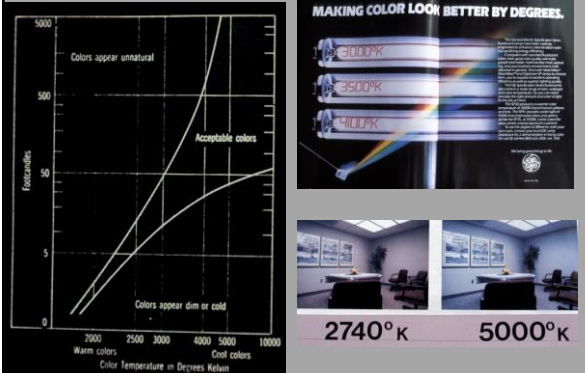
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...subjectively, we see colors naturally when color temperature and illumination level are well-matched.




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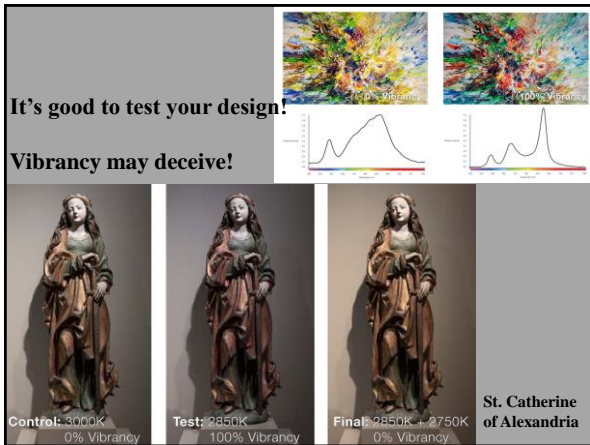
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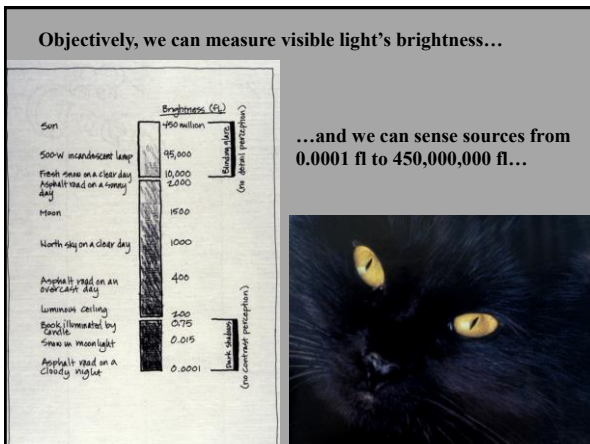
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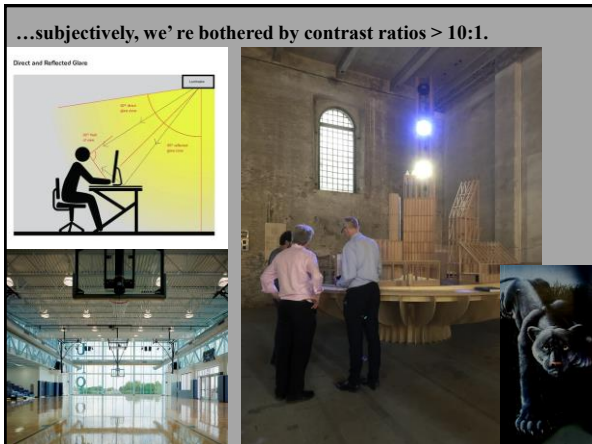
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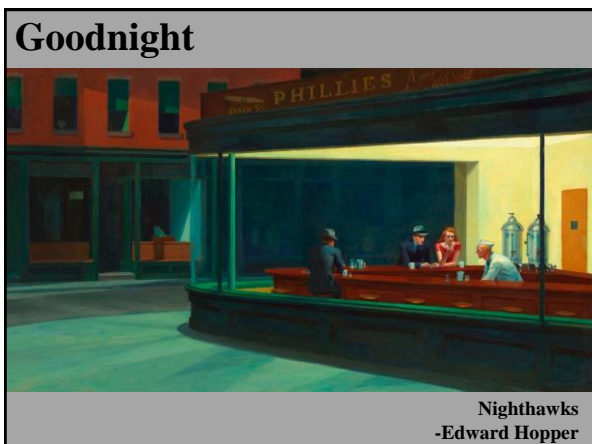
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