Light and Vision

LIGHT

What is Light?

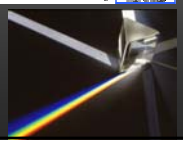
What do we want to know about it?

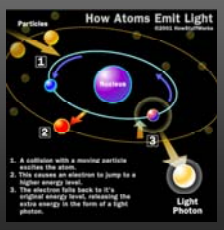
Light has different significance for different people, depending on their perspective.

People relate to light and how they intend to use it.

LIGHT - Technician

- For the Technician or Scientist, light is the visible spectrum – a part of the spectrum of electromagnetic energy that excites our neurological visual system that enables us to see.
- Light can be measured, calculated, and controlled – light is radiant energy.





LIGHT - Writer

Light *= noun, adjective*

- something that makes things visible or affords illumination: *All colors depend on light.*

Light *= adjective*

- having light or illumination; bright; well-lighted: *the lightest room in the entire house.*
- pale, whitish, or not deep or dark in color: *a light blue.*
- of coffee or tea) containing enough milk or cream to produce a light color.

Light and Vision

LIGHT - Poetic

For the poet, it might be a metaphor …

- QUOTATION: *Not every light is a true light;*
  To the wise the light of truth is light itself.
  Tiruvalluvar (c. 5th century A.D.), Tamil sage, poet.

or a connotation of mood …

- QUOTATION: *A sudden light transfigures a trivial thing, a weather-vane, a wind-mill, a winnowing flail, the dust in the barn door; a moment,—and the thing has vanished, because it was pure effect; but it leaves a relish behind it, a longing that the accident may happen again.*
  Walter Pater (1839–1894), British writer, educator.

LIGHT - Painter

To the Artist, light is a vehicle of expression.

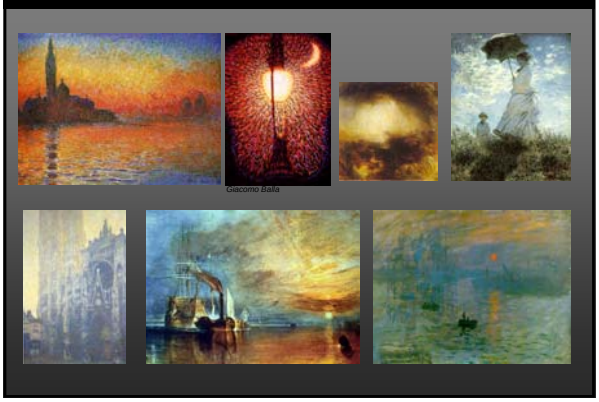
- **Edward Hopper**
  Am. 1882 - 1967
- ***Morning Sun*** 1952
  His paintings embody in art a particular American 20th-century sensibility that is characterized by isolation, melancholy, and loneliness.
  The stark play of light and shadow convey an atmosphere of all-embracing loneliness and almost eerie solitude - the mood was the real subject of the work.

LIGHT - Painter

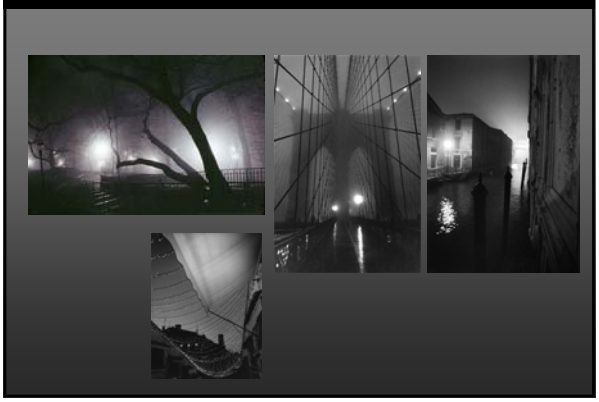
- **Johannes Vermeer**
  Dutch (1632 – 1675)
- **Young Woman with a Water Pitcher c. 1662**
- Soft light subtly portrays the tranquility of domestic life. Conveys a sense of well – being.

Light and Vision

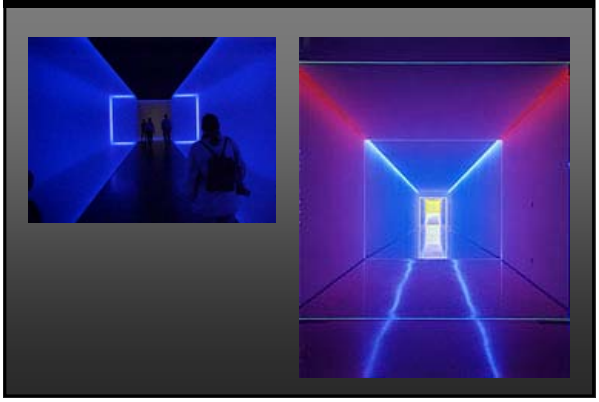
LIGHT - Painter



LIGHT - Photographer



LIGHT - Light Artist



Light and Vision

LIGHT - Light Artist

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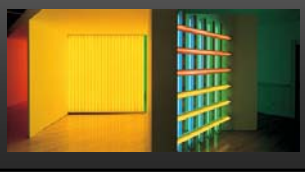
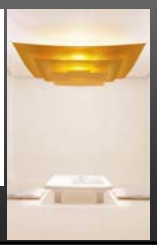
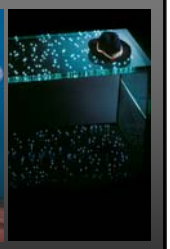


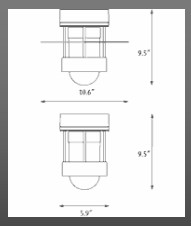
LIGHT - Industrial Designer





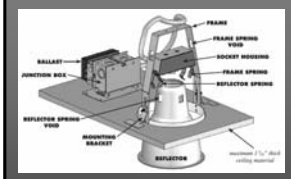
Light and Vision

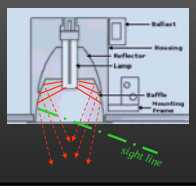
LIGHT - Fixture Designer

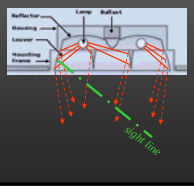


- The Industrial or Product Designer looks at light as a physical object, designed to satisfy a lighting need in a stylistically interesting package.

LIGHT - Fixture Designer







LIGHT – Environmental Designer

The Architect and Interior Designer are interested in the environmental impact of light.

- creating an atmosphere
- creating a sense of space, both physically and experientially/ psychologically
- describing materials and surfaces
- meeting the needs of use of the space

Light and Vision

LIGHT – Lighting Designer

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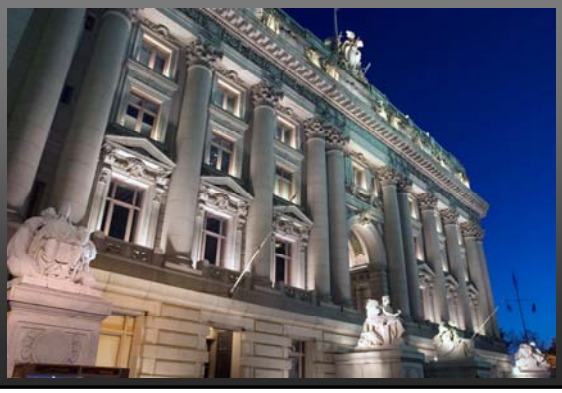


Light and Vision

Designing with Light

While our primary point of view as Interior Designers is environmental, all other considerations:

- scientific,
- poetic,
- artistic,
- industrial design,

impact and inform our decisions as we develop a Lighting Design

Designing with Light

The majority of the information that we receive about the world around us comes through our eyes.

Light is not only an essential prerequisite, it is the medium by which we are able to see.

Through its intensity, the way it is distributed and through its properties, light creates specific conditions which can influence our perception. Lighting design is, in fact, the planning of our visual environment.

Good lighting design aims to create perceptual conditions which allow us to work effectively and orient ourselves safely while promoting a feeling of well-being in a particular environment.

Designing with Light: Perception

- An awareness of objects and other data through the medium of the senses:
  - visual perception = seeing
- Insight or intuition as an abstract quality:
  - visual perception = projecting meaning on what we see

Light and Vision

Designing with Light

- Light plays a central role in the design of a visual environment.
- The architecture, people and objects are all made visible by the lighting.
- Light influences our well-being, the aesthetic effect and the mood of a room or area.

- It is light that first enables “what you see”.

Vision

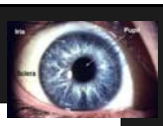
Visual System

Light Sources	Secondary Light Sources	Eyes	Brain
Generators – Transmitters	Modifiers and Re-transmitters	Receivers – Encoders	Decoder – Interpreter

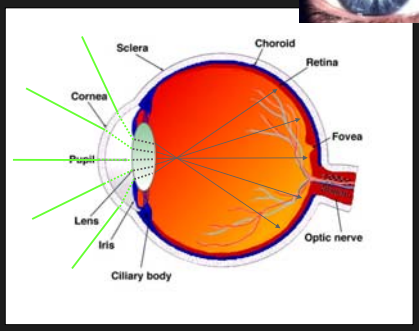
Sun, Discharge lamps, fluorescent lamps. Incandescent lamps, Open flames, etc.	Atmosphere, Air, Water, Planets, Lenses, Windows, Tress – All natural or manufactured objects which modify light waves before they reach the eye.	Cornea, Iris, Lens, Rods & Cones, Optic Nerves	Analysis, Identification Association Perception

Light and Vision

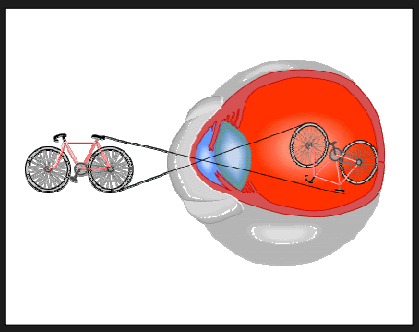
Structure of the Eye



- Cornea
- Iris
- Lens
- Retina
- Fovea

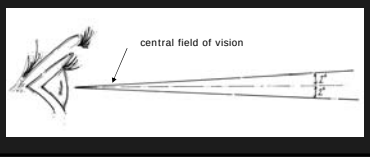


Light Entering the eye is projected upside down!



Eye's Field of Vision

- Central field of vision:
  - ~2 degrees above and below the direct line of sight
  - Visual acuity (ability to see detail) is best in this range
- Peripheral area:
  - Horizontal area to the sides of the central vision
  - Vertical areas above and below the central field of vision
- Brightness and motion best seen in peripheral vision



Light and Vision

Processing of Visual Information

- Color Perception

  this visual process provides us details regarding the color of a surface or an object

- the cones detect color…..a normal person is trichromatic…we see all colors
- **Color Deficiencies in the Visual System** - color blindness

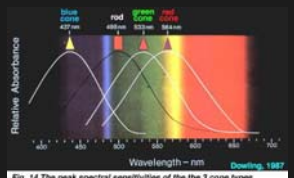


Fig. 14.The peak spectral sensitivities of the the 3 cone types and the the rods in the primate retina (Brown and Wald, 1963). From Dowling's book (1987).

Day & Night Vision

Photopic – Day Vision (Cones vision)

The cones of the eye are of three different types. These are the primary colors (additive) in light, which are red, green, and blue.

Scotopic – Night Vision (Rods vision)

The rod is responsible for night and peripheral vision.

Mesopic - Dim Light Vision (Rod and Cone vision)

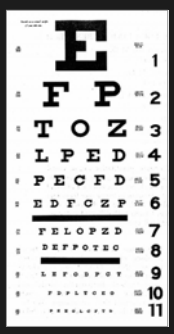
This occurs when the light levels are low but there still is the ability to see color (between .01 and 1 cd/m^2 adaptation luminance).

Measuring Vision

- Visual Acuity (20/20 Vision)

  Snellen Eye Chart: *the first number is refers to the distance from the chart, the second is what a normal person can read the chart….20/20 is normal…but, 20/60 says that person could read 20 feet what normal person can read at 60 feet*

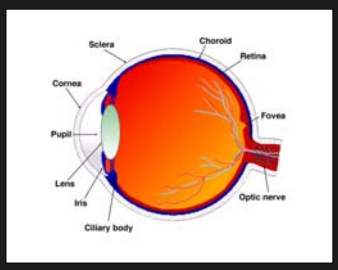
- *Contrast Sensitivity*
- *Contrast Detection*



Light and Vision

Effects of Aging

- Yellowing of the lens
- Opacity of the lens
- Less Elastic Lens
- Amount of light reaching the Retina
- Time required for Visual Process
- Visual Acuity and Sensitivity decrease



Common Defects:

Myopia: can't focus on far objects (Near-sighted)

Hyperopia: can't focus on near objects (Farsightedness)

Astigmatism: distortion in the shape of the lens

Presbyopia: lens loses it elasticity….corrected with bifocals to read near

Functions Performed by the Eye

You can NOT control

- Adaptation

  How?

  1. The Pupil Size changes,
  2. Photochemical - the cones and rods bleach
  3. Transient – over time

You can control

- Accommodation

  How?

  1. The lens changes shape to focus

- Eye Movement

  How?

  1. The eye can move smoothly or jump using six muscles around the eye
  2. Binocular – using both eye…..Monocular – using one eye

Visibility and Visual Performance

- Contrast
- Size
- Background Luminous
- Viewing Time