What are the properties of light?

- Light is one of electromagnetic radiation.
- Electromagnetic radiation refers to all forms of wave produced by electrically charged particles:
  - AC circuits
  - FM radio
  - Radar
  - Infrared rays
  - Ultraviolet rays
  - X-rays
  - Gamma rays etc.
- The visible light that humans see occupies only a small portion of the electromagnetic radiation spectrum.

Other organisms respond to other portions of the spectrum:

- Pit vipers and boa constrictors have sensory organs that are sensitive to infrared rays, which are to the right of the visible spectrum. These animals can therefore form heat-sensitive images of their potential prey.
- Bees have receptors that are sensitive to polarized light and bees and birds have receptors for magnetic fields.
- The human visual system cannot detect wavelengths as long as those of infrared rays.
- Our visual system also cannot detect short wavelengths such as ultraviolet rays and X-rays.

Light is made up of waves. We can describe light in terms of its wavelength:

- Wavelength is the distance the light travels during one cycle, that is the distance between two peaks.
- Wavelength is typically measured in nanometers. A nanometer (nm) equals 1 billionth of a meter.
- The shortest wavelengths that we can see are represented by violet. Which has a wavelength of about 400 nm.
- The longest are represented by red. Which has a wavelength of about 700 nm.
**Light**

- **Amplitude** is the height of the light wave.
- The perceptual correlate is **brightness**.
- **Wavelength** is the peak of one wave to the peak of the next wave measured in nanometers (nm).

- The perceptual correlate of wavelength is **color** or **hue**.
- **Spectral purity** is the degree of mixture of other wavelengths of lights.

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**Light**

- The perceptual correlate of purity is **saturation**.
- Example of spectral purity:
  - Pure blue — saturated
  - Baby blue — unsaturated (more white light)
- You may have noticed that we mentioned three pairs of attributes:
  - Wavelength and hue
  - Purity and saturation
  - And amplitude and brightness
- The first member of each pair describes a characteristic of the physical stimulus.
- Where as the second member describes what we perceive, a psychological reaction.

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**Light**

- Unfortunately for the sake of simplicity, there is no simple “one-to-one” relationship between the physical and psychological dimensions for light.
- For example, the perceived brightness of light is in general related to the light’s intensity.
  - In that increasing the light’s intensity will make it look relatively brighter.
  - But the actual brightness that is perceived would be greatly influenced by the light’s wavelength.
  - If a number of wavelengths had identical intensities;
    - The wavelengths near the middle of the spectrum in the 530 - 560 nm range
    - Those wavelengths that normally look green or yellowish-green
  - Would appear brighter to us than wavelength near to either end.

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**Light**

- Another problem in relating physical and psychological dimensions of light concerns the association of wavelength with hue.
- When different wavelengths of light are combined together.
- The difficulty here is that two perceptually identical hues can result from two totally different wavelength combinations.
- For example:
  - Color mixture of specific red (650 nm) and green (495 nm) monochromatic wavelength can produce a yellow hue.
  - A yellow hue identical to the yellow produced by a single wavelength of 578 nm.

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**Light**

- The perceived saturation of the red-green mixture may be less than the perceived saturation of the single wavelength light.
  - That is, it may appear more washed out.
- But the hues of both stimuli would be judge as the same.
- Somehow, the physical characteristics of light are transformed into the psychological characteristics of light.
  - By the information-processing structures of the visual pathway.
  - The complex relationships of intensity to perceived brightness.
  - And of wavelength to perceived hue are only two of the major challenges for perceptual psychologists studying the visual system.
We said that wavelength is typically measured in nanometers but there are numerous ways to measure amplitude of light. A frequent measure used in psychology journals is candelas per meter square (cd/m²). A measure based on how much light is reflected from the surface of the stimulus. Light reflected from the page of a book is approximately 32 cd/m². Under the best of condition, you can detect a light that is only 0.000003 (3 millionth) cd/m². Light can also be considered to be composed of individual and indivisible particles called photon.

Visual stimuli can be broken down into two categories. Distal stimulus and proximal stimulus. Distal stimulus is the reflected light from an object outside the retina. That is, a stimulus located at a distance from the observer. For example, reflected light from a tree. Proximal stimulus is the image on the retina. That is, the image of the reflected light from a tree on the retina.

Proximal stimulus is on the retina. Distal stimulus is a distance from the observer. A term that is often use to identify the size of proximal stimulus on the retina is visual angle. The visual angle is determined by extending one line from the nodal point of the observer’s eye, a point near the center of the lens, to the top of the object and another line from the bottom of the object. The visual angle is the angle between those two lines. It is extremely important to realize that visual angle depends not only on the object’s physical size. But also its distance from the observer. Visual angle is, therefore, determined by both an object’s physical size and its distance from the observer.