

Perceptual feelings

Date: Venerdì, febbraio 15 @ 12:23:20 CET

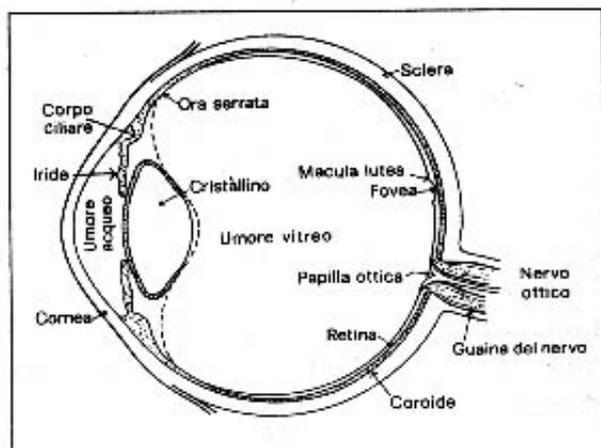
Topic: Educational Lighting Site

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The vision process begins with the conversion of packets of electromagnetic energy, photons or energy quanti, into light signals that the brain is able to analyse.

This process is carried out by the eye photoreceptors, cells that are arranged as a mosaic on the back surface of the retina, while the neurons cover the internal part of the eyeball.

The cornea and the crystalline of the eye send an image of the outside world on the layer of photoreceptors. Each cell absorbs the light from an individual point of the image and generates an electric signal that codifies the quantity of light absorbed.



These signals are transmitted through a complex system of nerve connections located in the retina and in the brain. At the level of these connections the signals coming from the photoreceptors are added up and compared. This process allows the visual system to obtain information on the shape, the movement and the colour of the world surrounding us.

The eye contains two kinds of photoreceptors: cones and rods. The latter allow the vision with a faint light, but they are so sensitive that in the normal daylight

they are oversaturated, thus becoming unable to transmit any signal. The cones allow vision in the daylight because they function effectively with high light intensities, thus providing a more detailed vision in terms of time and space and allowing colour perception.

Cones and rods contain organs responsible for the transduction and the transmission of signals. On one extremity (the farthest from the crystalline) the so-called external segment is located; it absorbs the light radiation and generates electric signals. The external segment of a rod is cylindrical, while that of a cone is pointed (hence the names given to these two cells).

The rods' ability to sense the photons is exceptional, but not perfect. Even in total darkness, the rods occasionally produce a signal that is identical to the one determined by the absorption of a photon. For instance, it takes a rod 300 milliseconds to carry out the process of signal emission following the absorption of a photon. Thanks to their faster response time, the cones manage to better perceive rapidly changing visual stimuli.

Therefore, in visual perception, sensitivity and temporal resolution compensate one another: the cones' small and fast responses allow the visual system to detect sudden changes of intensity or rapid movements of objects, when there is a high level of illumination and the rods are saturated; on the other hand, their slower and more intense signals are best suited to detect photons, when the level of illumination is low.

The sensitivity of a single receptor to a light comprising different wavelengths is determined by the probability with which they will absorb photons with a specific wavelength. Measurement carried out on the spectrum sensitivity of single cells, provide a physiological base to explain the characteristics of visual perception. Electromagnetic wavelengths of visible light are located approximately between 400 and 750 nanometers (one billionth of a metre).

Light with an exceeding wavelength (close to the ultraviolet) can be absorbed by visual pigments, but does not reach the retina because it is absorbed by the cornea and the crystalline.

The peak of higher spectrum sensitivity as measured in psychophysical experiments on human vision, is around 560 nanometers in the yellow-green colour region.

Photon - elementary particle of radiating energy.

Photoreceptor - organ that perceives light stimuli.

Colour - visual sensation given by the stimuli that the reflected light of bodies offer the eye.

The human eye perceives colours ranging from red (the low limit of the range) and violet (the high limit): below the range we have infrareds and above it ultraviolet. The latter are not visible, but it is possible to sense the energy carried by light when it strikes the skin.

Light in physics is considered in its ondulatory component (as an electromagnetic wave).

The two limits (red and violet) thus correspond to the borderline wavelengths of the visible.

Electrons - those elementary articles charged with negative energy that rotate around the nucleus of the atom, which is charged with positive energy.

Transduction - in technical language, and in relation to energy, it is the transferral of energy from one point to another in a system, such energy can also be changed into an energy of a different kind. For instance, to transduct light energy into electricity.

Retina - the membrane that completely covers the eyeball and, more specifically, its back sensitive portion where images are formed.

This article comes from Accademia della Luce - educazione alle tecniche della luce
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