
An introduction to artificial daylight

Background

People need daylight to live and work with a sense of well-being. This is the central idea behind Virtual Daylight®.

The lack of natural daylight in many peoples lives appears to create problems for them and their health.

Virtual Daylight® is a Clearvision brand of artificial light with several of the key characteristics of daylight.

Appearance

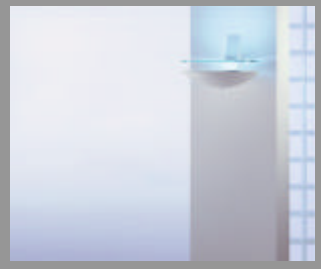
Using this approach means creating ambient lighting that will come close to daylight in colour.

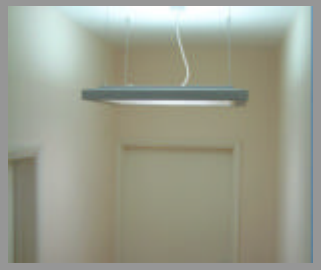
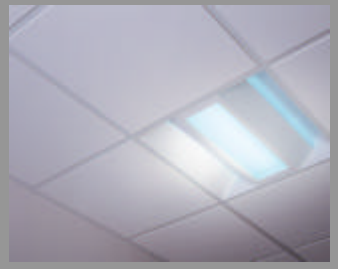
The light is much whiter than most artificial light people are used to.

Sometimes this is called cool or bluish, but in reality it is close to the colour of light from a window that is out of direct sunlight.

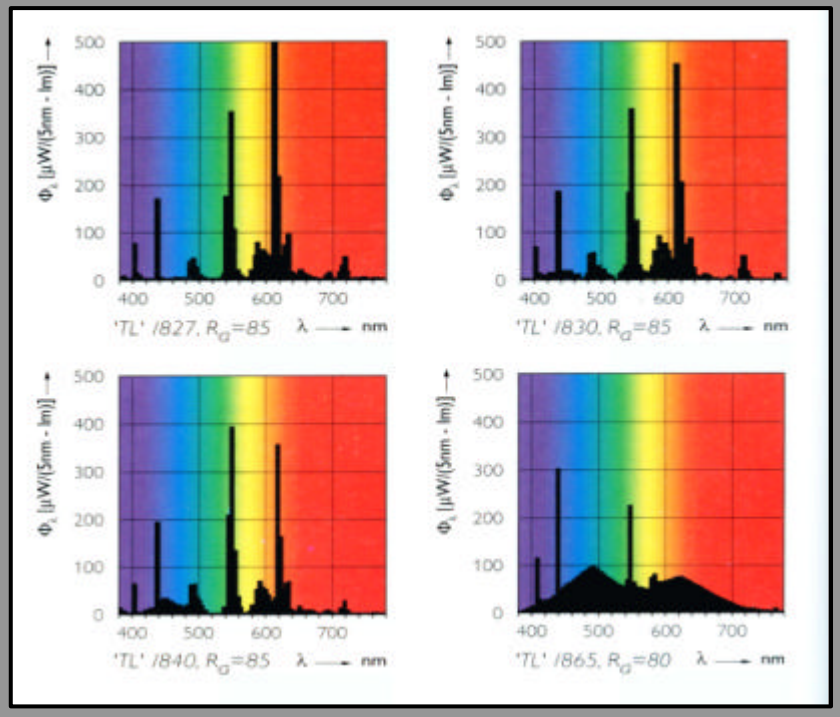
Artificial daylight fittings

The light fittings themselves are not restricted to specific luminaires and a great variety is possible, although not all are strictly Virtual Daylight® specification


The Visible Spectrum



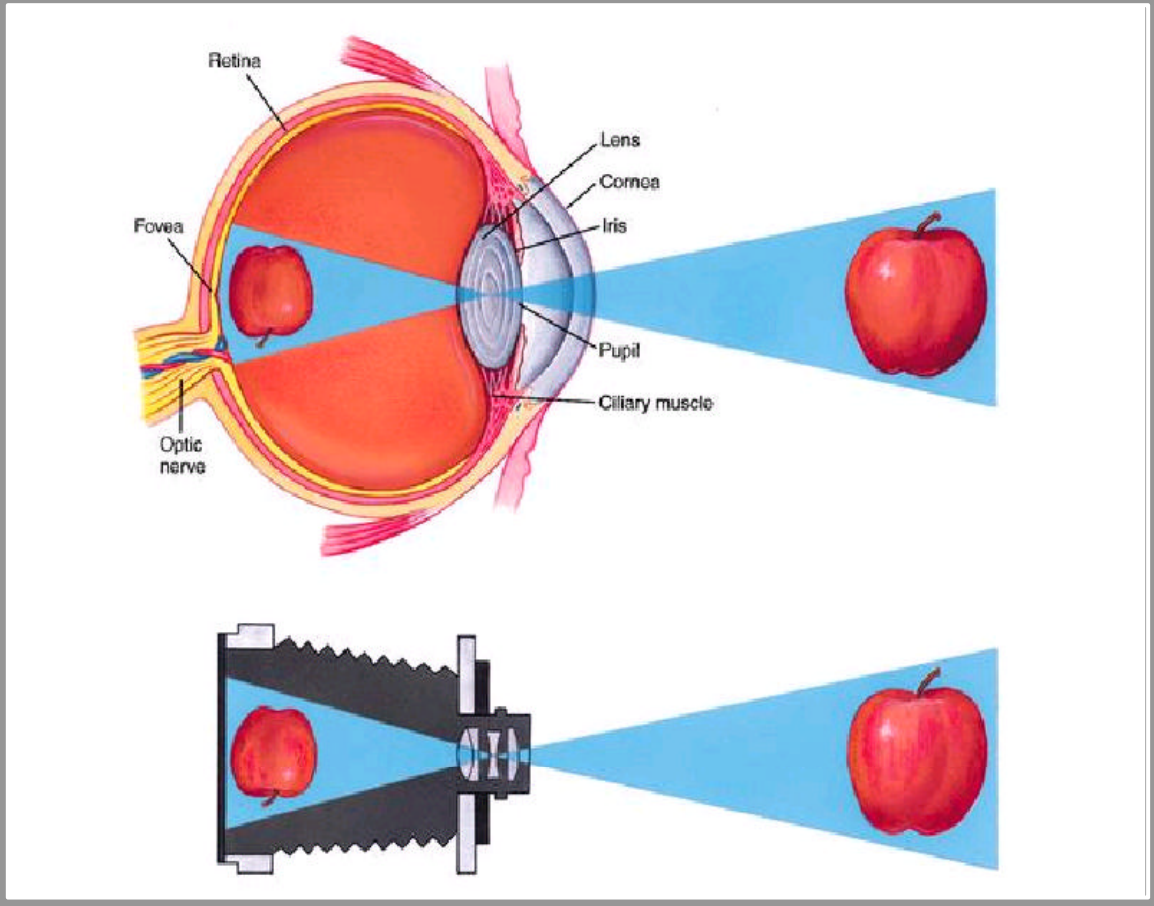
Visible light is part a continuous spectrum of electromagnetic waves that interact with our biology. The visible spectrum begins just above 400 nanometres and ends just above 700 nanometres. Below 400nm are UV, X-rays and gamma rays and above 700nm are Infra-Red (heat) and radio waves. The visible spectrum is the sensation of 400-700nm wavelengths interacting with photoreceptors in the human eye. The sensation is different for people from animals and from person to person. This subjective aspect of lighting and its measurement is essential to a proper understanding of creating an ergonomic lighting workplace.

The human eye and vision

It is the interaction of light with the retina of the eye that creates vision.

The retina contains nerves and photoreceptors that respond to light in the visible spectrum. It is the variable sensitivity of these photo-receptors that creates the perception of colour.

The eye has a different sensitivity to colour in the centre of its visual field to that around the outside.

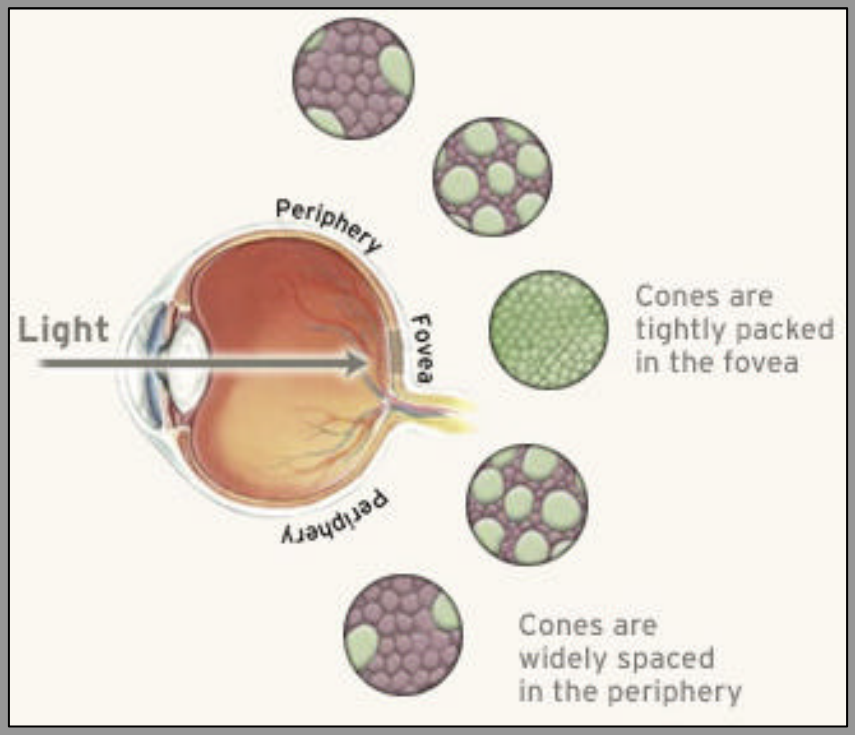


Retina

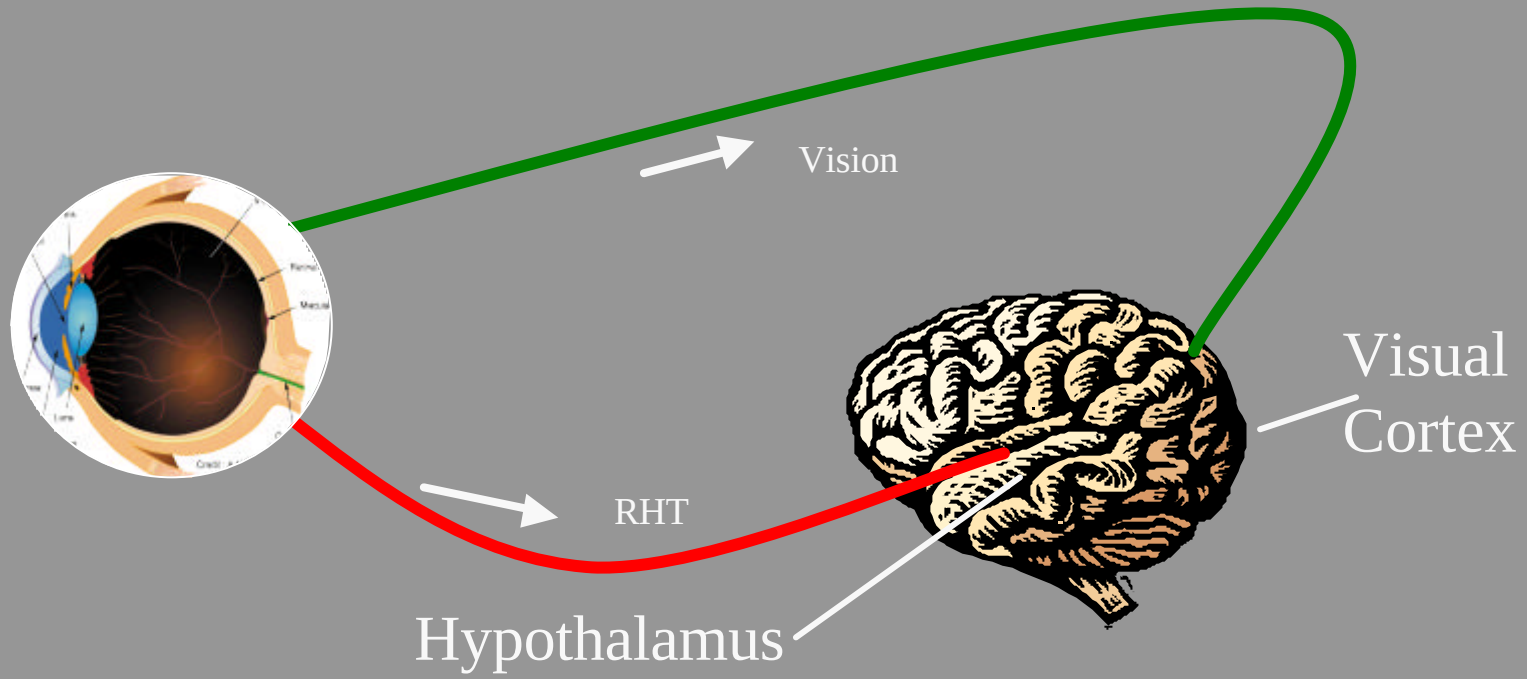
In the centre of the retina is the fovea, an area packed with photoreceptors that are very responsive to red/green light. This is the area of focal view, but is only a very small part of our total visual field. The sensitivity of the eye in this focal view is used as the basis for the lighting measurement (lumen/lux)

The problem with this measurement is that it ignores the effect of the periphery of the retina on our visual perception. The predominance of photoreceptors that are sensitive to blue light in this outer area means that light rich in blue has a higher apparent brightness and greater biological effect.

The paradox is therefore white light that measures lower, but appears brighter.

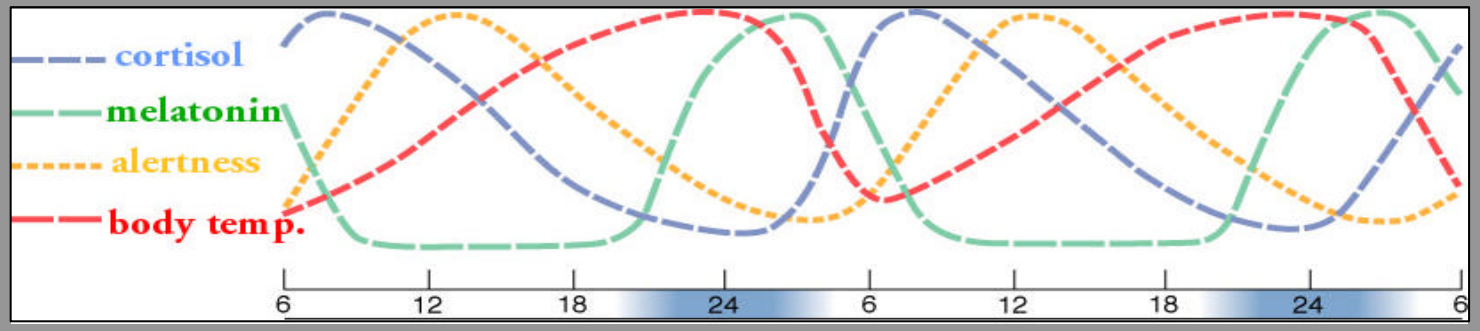


The Biology of Light



Human eyes communicate with the brain via two separate pathways – the first is optic tract that passes visual messages for processing in the visual cortex. A second pathway – the RHT – connects to the hypothalamic region of the brain, which controls which is a critical element of the endocrine (hormone) system. Directly or indirectly, the hypothalamus controls functions such as heart rate, body temperature, mental alertness and the sleep/wake cycle. The hypothalamus is responding directly to light messages and is a key factor in maintaining a healthy Circadian Rhythm.

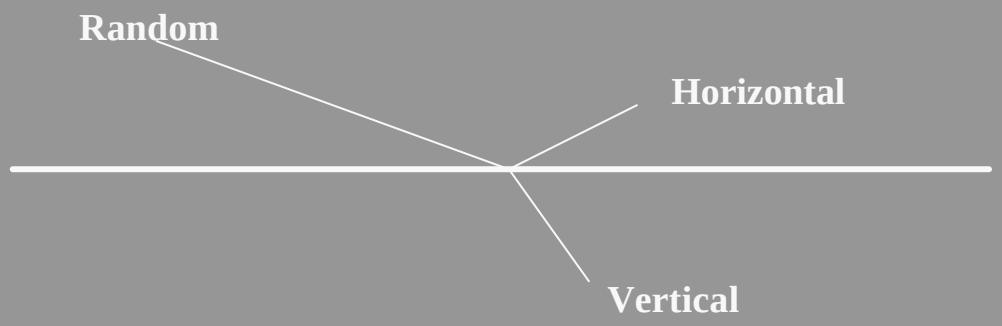
Circadian rhythms



The biological effects of lighting are becoming much better understood with the growth in chronobiology and endocrinology as study areas. We now understand much better the link between key hormones, in particular melatonin, and human well-being. For example and in simple terms, human health requires a functioning circadian rhythm. This in turn means low melatonin during the day and high melatonin during the night. High melatonin during the day creates drowsiness and depression, whilst low melatonin at night produces insomnia and impairs the immune system.

We now know that the mechanism by which melatonin is turned on and off is through photosensitivity to mainly blue light. It is therefore essential that we receive an adequate amount of blue light content during the day and do not expose ourselves to this light when we wish to sleep.

Polarisation



Virtual Daylight® is polarised light. So also is natural daylight. The advantages of polarising light are that it reduces glare and the amount of light that reflects from the surface of objects, which in turn can lead to better vision. In Virtual Daylight® a lens is used to reduce the potential for glare from the bright white light.

The actual process of polarisation relates to the helical path of photons as they travel along the lighting waveform. The waveform can be divided into a horizontal and a vertical element, with broadly equal amount of each present in unpolarised light.

In Virtual Daylight® a multilayer lens is used to induce polarisation. Multilayer polarisation increases the vertical element and reduces the horizontal element through a series of differential refractions.

Control Gear

Virtual Daylight® is always produced using high frequency control gear, which is free of the flicker and hum that is associated with some of the worst characteristics of fluorescent lighting.

High frequency control is also substantially more efficient in energy use than conventional magnetic control gear.

Daylight lamps + Polarising lens = Virtual Daylight®

www.virtualdaylight.com