# Colour and luminance calculation of danish daylight situations

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# COLOUR AND LUMINANCE SIMULATIONS OF THE DANISH DAYLIGHT SITUATIONS

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## ABSTRACT

Daylight is free and abundant. During day time it can be the main indoor light source, provided that our living spaces are properly designed. Daylight is a strongly variable light source subjected to complex radiative transfer through the atmosphere and scattering from our surroundings. Hence, if we would like to make precise planning based on daylight conditions, accurate simulations of our specific daylight situation is an essential premise. Recent advents in computer simulations of daylight facilitate such elaborate investigations. We will here demonstrate our results with a specific emphasis on Danish conditions.

Keywords: visual comfort, daylight quality, daylight design, daylight planning, perception, cloudcover.

## 1. EXPERIENCING DAYLIGHT

In order to have a comfortable visual environment – we need to be able to see things as they are without having to strain our eyes. Daylit living spaces can be optimised with proper understanding of the daylight. Fig. 1 illustrates a daylit living space.

We know the daylight so well; daylight is a part of our everyday lives. We also know that daylight vary and fluctuate during the day and throughout the year. Also, and not least, daylight differs according to our location on the Earth.

But our experience of daylight is based on intuition. If we would like to make precise planning based on daylight conditions, or, if we would like to optimise our lighting comfort, accurate simulations of our specific daylight situation is an essential premise.

## 2. THE CHARACTERISTICS OF LIGHT

No matter on what latitude we are situated, one can describe light by the following three characteristics: the spectral distribution (colour), the luminance (perceived energy) and the distribution (directional or diffuse light). Those three characteristics together fully describes the quantities and the qualities of the light. Those characteristics are also the main elements in our way of perceiving light, and they affect how we experience spaces; they vary according to the local geographical settings and climatic conditions – in particular the position of the Sun in the sky and the type of clouds hovering below it.

Clouds are translucent. Therefore, not only the fractional amount of clouds in the sky, but also, their thicknesses affects the characteristics of light at the surface.

**Fig.1: Daylit room with representation of the qualities of light**

## 3. DAYLIGHT SIMULATIONS

Traditionally, daylight conditions have been described in a much generalised way, in which only a few climatic sub-types have been considered. In Fig. 2 an example of this is shown. Although this has been very useful for comparing daylight with artificial light sources, it is now well worth while to perform a more elaborate investigation of

how the climatic variations in the sky affect the lighting conditions.

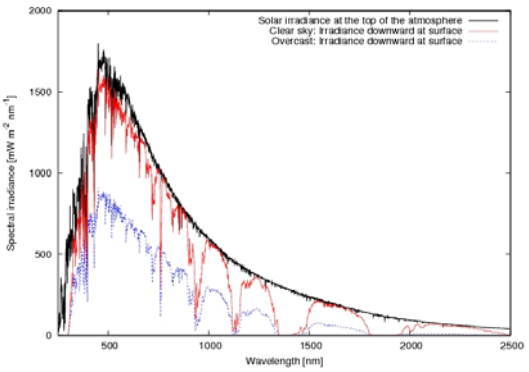


**Fig.2: Traditional illustration of the daylight characteristics**

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