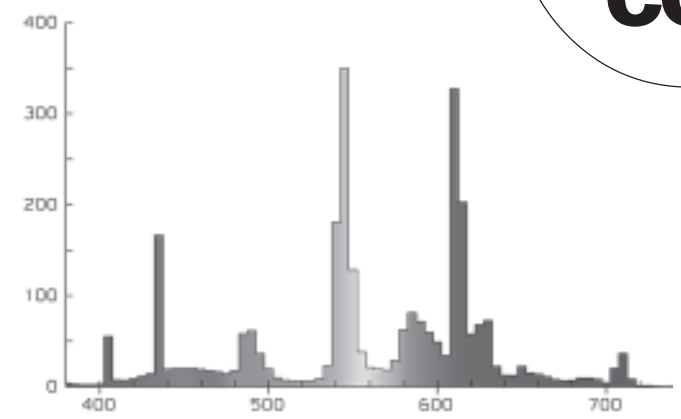
light & color.

by Craig DiLouie & Eric Strandberg



Above: every light source has a unique blend of frequencies of light at various wavelengths. Above is a spectral distribution curve of a 3500K lamp. Units are in nanometers
Courtesy Philips Lighting

correlated color temperature (CCT).

Describes the color appearance of the light that is produced, in terms of its warmth or coolness. The CCT relates the color appearance of the lamp to the color appearance of a reference source when the reference source is heated to a particular temperature, measured on the Kelvin (K) temperature scale. A low color temperature (3000 K or lower) describes a warm source, such as a typical incandescent lamp and a warm fluorescent lamp. A high color temperature (4000 K and higher) describes a cool source, such as a 'cool white' lamp.

color rendering index (CRI).

A measurement of the amount of color shift that objects undergo when lighted by a light source as compared with the color of those same objects when seen under a reference light source of comparable color temperature. CRI values generally range from 0 to 100. Older-style 'warm-white' lamps were 52 CRI. and 'cool-white' lamps were 62. Today's T8, T5 and CFL lamps range from 75 CRI to 95 CRI.

The design goals always determine the characteristics of the lighting system. However, there are general guidelines for specifying lamp color characteristics. A broad variety of options are available to produce lighting effects from the simple to the theatrical, with some applications presenting extraordinary opportunities for the lighting designer to be artistic. However, greater complexity requires greater time, budget and attention to detail; in these applications, it may be desirable to mock up the installation to test the system.

• **Establish Desired Color Temperature**: One of the most important factors to consider is the psychological impact of various light sources. Warm light sources are generally preferred for the home, restaurants, hospitality and high-end retail applications to create a sense of warmth and comfort, while neutral and cool light sources are generally preferred for high-activity areas such as offices, schools, supermarkets and similar applications to create a sense of alertness.

A good example is to compare two restaurants—one a fast-food restaurant and one a high-end restaurant. In the fast-food place, where the food is relatively cheap, the lighting is typically cool fluorescent, providing an environment for the function of eating, enticing us to eat our meal quickly, get up and make way for the next customer. In the high-end restaurant, where the food is more expensive and we are purchasing the experience as much as the food, the lighting will most often be warmer incandescent and/or even simple candles, creating pools of intimacy, warmth and comfort, inviting us to stay as long as we like to enjoy the experience.

Another consideration regarding color temperature is research that suggests that cooler light sources, saturated in blue wavelengths, appear to enhance visual clarity and brightness perception at lower light levels.

• **Decide Importance of Color Rendering**: Once color temperature is established, we must decide the importance of rendering the colors of objects across the spectrum accurately. In general, in spaces that are occupied for long periods, whether it be for work or recreation, highest-color-rendering sources would be practical. The costs associated with worker productivity far outstrip the incremental costs of upgraded lighting.

• **Consider Daylight in your Color Scheme:** One of the first environmental questions is whether daylight is available. Daylight offers dynamic color characteristics that change during the cycle of the day and season. For most of the day, daylight is a very cool light source with excellent color rendering. Daylighting's dynamic qualities, while difficult to control, are actually part of its great appeal to office workers, who generally desire a connection to the outdoors and patterned variability in an otherwise monotonous, uniform environment. Therefore, it may be advantageous to optimize daylighting in the space depending on its design goals.

The color scheme of the space also determines selection of the light source. In a room with heavy red accents, a warmer source will reveal these reds as richly as possible. Conversely, cooler sources work well with blues, greens and other cool colors. And again, specifying a high-color-rendering light source (above 80) may be desirable to enhance the predominant color scheme but also properly render other colors in the space.

(This is an excerpt from a longer article that is available for download for free from our website - *www.lightingdesignlab.com*)