Color Rendering: Beyond Pride and Prejudice

Generally, sources with good color rendering properties are expected to enable people to discriminate between subtle hues and should not distort color appearance relative to natural daylight. Just as Dean Judd, one of the developers of CRI, believed a half-century ago, LRC scientists have demonstrated that color rendering index (CRI), the sole measure of color rendering for the lighting community, needs to be complemented with another measure of color rendering to meet these expectations. Based upon the results of several studies, the LRC recommends a two-metric system of color rendering.

The strengths of CRI and of gamut area index (GAI), a measure of color rendering similar to that proposed by Thornton in the early 1970s, seem to counteract the weaknesses of one another, such that together they can be used to guide lighting practitioners in choosing a source that will provide good color rendering of most objects in most applications.

Experiment arrangement.

Experiment

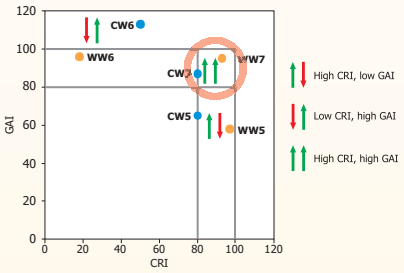
In this latest study of color rendering, LRC investigated whether sources, both warm and cool, with high levels of both CRI (above 80) and GAI (above 80 and less than 100) were judged better than ones with high levels of just CRI or just GAI.

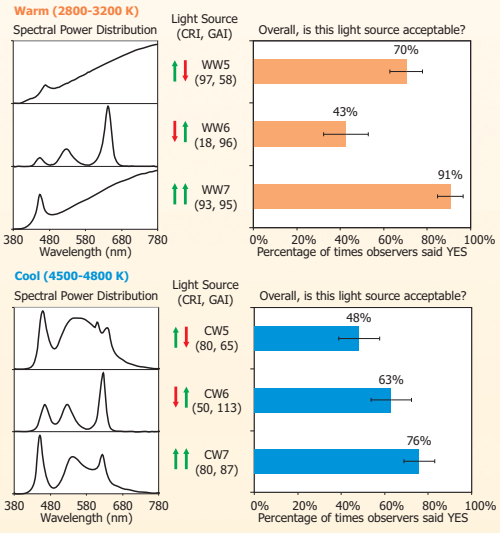
Fresh fruits and vegetables and one color chart were arranged in a viewing cube to emulate a store display. In each session, the display was seen by every observer three times under each of the spectral power distribution scenarios described above. Participants then rated the color rendering properties of each scenario for naturalness and vividness.

Results

- Statistical analyses supported the hypothesis that a light source with both a high level of CRI and a high level of GAI will render the display more naturally than the other two sources of the same correlated color temperature (CCT), but having either a high level of CRI or a high level of GAI.
- GAI is the better indicator of subjective ratings of vividness and, based upon the results of a previous study, color discrimination.
- High levels of GAI can distort colors, reinforcing the need for both an upper and a lower limit for the GAI of a light source for optimal color rendering. Similarly, high values of CRI do not ensure, by themselves, high ratings of naturalness.

Experimental warm (orange data points) and cool (blue data points) light sources grouped by high CRI but low GAI, low CRI but high GAI, and both high CRI and GAI (inside target circle).





Relative spectral power distribution of the light sources (left); the CRI and GAI of the light sources (center); and average acceptability of each light source. Error bars represent ± one standard error of the mean (n=18).

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