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I would like to start with a few comments on the subject of this conference, "full-spectrum" lighting.

The suggestion that full-spectrum lighting has health benefits is interesting, but compelling evidence does not exist. If adequate and acceptable scientific proof were available. then lighting design procedures could include such health aspects as one of the criteria of good design practice.

A long-standing argument used to support full-spectrum lighting has been the claim that "natural" daylight has health benefits that other forms of lighting do not and that the goal of all man-made (artificial) lighting systems should be to duplicate daylight. But this approach is vacuous for a variety of reasons. For example, daylight, both in magnitude and spectral distribution, is highly variable, and a unique goal does not exist. Even when one specific condition of daylight is used as a reference, factors must be carefully selected or omitted in order to suggest a match. "Natural" has become a fashionable but simplistic goal in many issues. However, one can just as well argue that man exists in spite of, rather than because of, what occurs in nature. There are many poisons and carcinogens in nature, and even sunlight is known to damage skin and to have carcinogenic properties. Whether or not there is a similarity between a lighting system and natural conditions is irrelevant in determining if health benefits can be ascribed to the lighting.

There are published studies that purport to show beneficial effects of full-spectrum lighting; e.g., Mayron, Ott, Nations, and Mayron (1974) claimed that children exposed to full-spectrum lighting showed a greater reduction in hyperactivity than did children exposed to cool-white fluorescent lighting. A subsequent study of the same issues by O'Leary, Rosenbaum, and Hughes (1978) could not replicate the claimed effect. They pointed out that the study by Mayron et al. was "seriously faulted by unspecified observational methodology, very brief observations, and possible varying illumination levels in the two conditions."

Medical issues often are invoked in connection with full-spectrum lighting without clearly discussing all relevant aspects. For example, early studies investigating light therapy for Seasonal Affective Disorder (SAD) and circadian phase shifting utilized "full-spectrum" fluorescent lamps. This could suggest health benefits attributable to full-spectrum lighting unless it also is mentioned that no difference in efficacy was found between full-spectrum fluorescent lamps and conventional cool-white fluorescent lamps (Lewy, Sack, Miller, & Hoban, 1987). Many medical treatments have been developed using light or light plus drug modalities, e.g., treatments for hyperbilirubinemia or psoriasis. The entire area of photodynamic therapy in relation to treating various forms of cancer is a rapidly developing field. Nevertheless, such specific treatments for particular diseases are irrelevant to the issue of environmental lighting for the general population.

In regard to health claims for full-spectrum lamps, one should be aware that the FDA's 27 August, 1986 Enforcement Report carried a "Health Fraud Notice". This stated that a manufacturer's claims for a full-spectrum type fluorescent lamp were a "gross deception of the consumer".

The study reported by Dr. Hathaway is interesting, but there are many issues that make it difficult to accept the conclusions. I will list only a few as examples:

1. The daylight illuminance component, although variable, ranged from two to three times that of the installed lighting based on note a of Table 2.
2. Skylight, as well as sunlight, has an appreciable ultraviolet component, and typical glazing materials can transmit significant amounts of all but the shortest UV wavelengths in daylight.
3. The cumulative daylight exposure of the students outside of the classroom was not determined.
4. The study was not double-blinded nor arguably even single-blinded, and it should be noted that even a double-blinded type of this type may have hidden biases (Skrabanek & McCormick, 1990). Considering the popular articles on light and health and the fact that at least one of the schools "was selected as a result of an informal request to Alberta Education for full-spectrum

lamps to replace cool-white fluorescent lamps," *assumptions* regarding the recognition of light and its putative health effects, i.e., blinding, are inadequate.

5. Failure to randomize treatment imposes a burden of proof (if it is even possible) to show that any results are not artifacts of the selection process.
6. Population size is a particularly difficult issue here due to the large number of uncontrolled and potentially confounding factors; it needs to be adequately assessed. I suggest that the HPSV school data contributes nothing to the full-spectrum and UV issues since this generally is considered an inappropriate light source for classroom lighting. Omitting this school, 190 students remained at the end of the study although "some missed specific tests and measurements at the end of the study."

If one collectively reviews the best of the studies relating to full-spectrum lighting, I would suggest that we are not yet ready to justify the use of this concept on the basis of improved health. Further, there are many other issues besides that of health; for example, the psychological effects of light source colour. Although fluorescent lamps with good colour rendering properties are available over a large range of colour temperatures, lighting designers generally have found that colour temperatures below about 4000 K are preferred for interior lighting. Since this statement has a widespread but anecdotal basis, studies need to be made to evaluate the possible psychological effects and long-term acceptance of a general change to noticeably higher colour temperatures on the order of 5500 K. Without question, in most lighting situations a sufficiently high colour temperature would be considered unacceptable.

References

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