



# Lighting in indoor environments: Visual and non-visual effects of light sources with different spectral power distributions

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## ABSTRACT

Since the end of the 1990s, good quality lighting was that which balanced the needs of humans, economic and environmental issues, and architectural design. Recent studies aimed to find a correlation between environmental lighting and human performance and health, with positive results. What is known, is that insufficient or inappropriate light exposure can disrupt standard human rhythms which may result in adverse consequences for performance, safety, health. By studying the relationship between human physiology and light, research in photobiology has advanced to the point where some attempts to foresee what the lighting practice will be in future. The question is if lighting practice and lighting practitioners are ready for changes.

This paper has the aim of introducing the recent discoveries in photobiology to those interested in lighting design, starting from a critical overview of traditional parameters since now used in lighting applications and then presenting a new theoretical approach to introduce non-visual parameters for lighting applications.

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## 1. Introduction

Light is a basic need for humans: it is generally known that it is able to affect physical, physiological and psychological behaviors.

Since the end of the 1990s, good quality lighting was that which balanced the needs of humans, economic and environmental issues, and architectural design. Good lighting should provide for the needed level of visual performance, but it also determines spatial appearance, it provides for safety, and it contributes to well-being [1–3]. With the first discussions on the role of light on human health, the lighting quality concept has become more complex, and a change in the way of thinking has occurred [4–8]. Recent studies aimed to find a correlation between environmental lighting and human performance and health, with positive results. What is known, is that insufficient or inappropriate light exposure can disrupt standard human rhythms which may result in adverse consequences for performance, safety, health [9–14].

A shift away from the dominance of visual performance as the chief goal for a lighting installation is now occurring, and the

direction is pointed out by the recent discoveries in photobiology, that are creating a link between lighting and health and well being. Visibility still remains an essential part of any lighting installation. But good quality lighting is becoming a matter of other important features, like the quantity and quality of light required for well being and health, interpersonal relationships, aesthetic tastes [15–21].

By studying the relationship between human physiology and light, research in photobiology has advanced to the point where some attempts to foresee what the lighting practice will be and need in future are ongoing [22–24]. The idea of designing and using light as a health measure is obviously fascinating, but there are questions to be answered before considering the idea of changing lighting practice [17]. The question then is if the lighting practice, and lighting practitioners and designers as well, are ready for a change. And if not, what is missing to be ready.

At the best of our knowledge, very few considerations have been developed to consider the role of these recent discoveries within the lighting field [22] and none from a theoretical point of view, for future lighting applications.

Starting from the traditional lighting design approach, this paper has the aim of introducing in the lighting application field, and especially to those interested in lighting design, the recent discoveries in photobiology, which can in future have an impact on the way lighting in buildings is designed. Illuminating engineers

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