Light quality and wellbeing

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Abstract
What is light? Scientists define it as an electromagnetic radiation in the visible wavelengths; this radiation spreads throughout space, reaching objects, going through them or being reflected, and as it travels, it reaches our eye, thereby giving rise to the phenomenon of vision. Light therefore allows us to perceive colours, space, objects, and it is perhaps the first form of art that nature gives us.

The first gas lamps had already laid the foundations for a new relationship with light within cities, but it was only with the advent and spread of electricity on a large scale that it definitively expanded its meaning for mankind. The introduction of various types of lamp threw the doors wide open for previously unimaginable scenarios and light became at once a way to illuminate the night in a functional way, prolonging human activities on the streets and in the home, and an art form, creating new atmospheres and emotions, giving rise to a new way of experiencing urban spaces.
For the first time, towards the end of the 19th century, technological solutions started to be developed which allowed for levels of illumination during the night which were comparable to those during daylight hours; thus the first modern indoor lighting and the first attempts at technological street lighting were born, but these were indeed merely attempts. The effects of glare generated by the light sources were such as to make the use of these solutions disadvantageous, but at the same time the need started to arise to take advantage of the developments which were appearing and to study the technical and physiological aspects of artificial light. It was at this point that lighting technology was born, along with the need to use light in the best possible way, designing it to be suitable for its application. Lighting Design as we understand it today was born.
Over the years, the technology of light sources and fixtures has gradually progressed; simultaneously, the first work was undertaken to study the interaction between light and man, discovering how a series of physiological processes are

governed by this very elementary relationship. Today it is becoming increasingly clear that light is for man; it is an interaction with man and good lighting, an adequate technical lighting design, cannot exist if one does not try to include all of these facets. For the past five years, we have been experiencing a renaissance in the world of Lighting: man is the centre of illumination (Human-centric Lighting).

The decisive push to revive the debate and studies on these issues came with the introduction of LEDs into lighting, which led to the blossoming of an entirely new sensitivity. Said LEDs are a very versatile technology; the energy consumption is significantly reduced and this was a decisive factor for its spread. In addition, it covers a significant variety of applications with a high level of customisability; with the right mix of Phosphors, it is possible to obtain a wide range of Colour Temperatures with high colour rendering indexes, we can generate the most varied emission spectra, with the aid of sensors and drivers we can modulate the light according to our needs, we manage to obtain very high beams with very small emitting surfaces. It is this small size that allowed the path to be cleared for product design, releasing it from many constraints and creating new possibilities.

Due to the high luminance of the LED source, it has become increasingly important to develop solutions which blend it with the need for greater visual comfort. This concept is naturally linked to the concept of glare, a term generally used to describe an effect of reducing visual performance; specifically, the main working point of LED light sources has become the reduction of the glare, be it direct or indirect, generated by the light source. It must be specified that, as the luminance generated by the emitter increases, a physiological deterioration of the eyesight begins (physiological glare) and that over a certain threshold (around 104 cd/m2), an effect of fully-fledged visual incapacity is created which is known as disability glare. Disturbance to vision can also be generated in other ways, for example by sources whose luminance is not high in absolute terms, but which, in the context of a particular environment, create high levels of contrast which “distract” the eye from its visual task (discomfort glare).

There are multiple solutions for limiting the onset of this effect. By taking advantage of the small size of LED sources, it is possible to implement an optical design which allows for the source to be hidden or to create optimal distributions of luminous intensities; possible solutions can be developed, such as diffusing glass (also known as comfort glass), or studying the mechanics of lighting equipment so as to create shielding angles which prevent the light source from being viewed directly. These measures are chosen and designed by companies according to their contexts of application; on the other hand, different applications require different solutions.

Glare, however, is not the only major issue which has come back into the spotlight in recent years; as previously written, studies on the interaction between man and light have led to the discovery of certain physiological processes which are activated and regulated by the quantity and spectral composition of the light itself, and these go by the name of non-visual effects.

Particularly relevant in this regard are the studies and results obtained on the circadian cycle, which is the cycle of about 24 hours which characterises the majority of living species and which governs, amongst other things, the melatonin production. This cycle is particularly sensitive to the wavelengths of blue, which are relevant in LED light sources, especially those with cooler colour temperatures (5000K, 6000K, etc.). This has opened the door to many, and sometimes controversial, debates on the topic but, at the same time, has allowed for some key points of lighting design to be changed, mostly in the outdoor field; no longer is efficiency the sole consideration, but rather one to be accompanied by light sources with colours and colour rendering indexes which are appropriate to the context of application. As such, demand for projects with 3000K sources has risen, mainly for parks and urban or pedestrian areas, also driven by certain regional laws which have recently been approved; and that is how new 2200K white light sources have appeared, with a colour temperature whose perfect application is in historical contexts and near specially protected areas (wildlife parks or nature reserves) thanks to their low blue content.

The developments are changing the face of urban spaces; every day, we help to make cities more beautiful, more sustainable, more smart.

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