

Lamp's Dynamic Lighting

Architectural spaces are evolving and are becoming more and more humanised. Discover how lighting responds to these new needs.

Introduction

To speak of dynamic lighting, we must first speak of darkness, and understand the relationship that human beings have with it: Our life cycles are governed by sleep-wake periods that are closely linked to the natural cycles of light-darkness.

In 2017 the Nobel Prize for Medicine went to doctors Jeffrey C. Hall, Michael Rosbash and Michael W. Young, who for 20 years researched the biological alterations that our organism suffers and which are naturally synchronised with environmental factors, fundamentally lighting and temperature, to optimise the functioning of the organism.

However, according to the WHO*, we currently spend 90% of our time indoors, often subject to excessive static, artificial lighting, which has altered our patterns, especially sleep patterns.

Human beings perceive light thanks to photoreceptors located in our eyes:

Rods are responsible for peripheral vision in dim light conditions, while cones enable daytime vision and colour perception.

However, the recent discovery, in 2002 by a team of researchers at Brown University led by neuroscientist David Berson, of a third type of photoreceptor known as ipRGCs (intrinsically photosensitive ganglion cells), enabled us to learn about the physiological impact that light has on our organism. These ipRGCs are responsible for sending information to our brain to regulate our biorhythms, and therefore our states of alertness and rest.

Lighting, therefore, has an impact on human beings on three levels:

- **Visual**

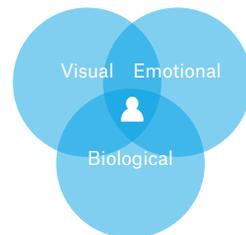
Allowing us to use and recognise spaces and to be able to develop tasks in it, defining levels of lighting, strategies of contrasts, levels of visual comfort according to the duration of the exposure to sources of light, etc.;

- **Emotional**

Establishing the correct relationship between lighting levels and colour temperature better suited to the activity we are engaged in, as well as defining an environment that connects with our state of mind;

- **Biological**

Synchronising our daily biological rhythm, through the induction to states of activation and alertness, through the suppression of melatonin, or inducing us into a state of relaxation, giving rise to the generation of melatonin, and respecting and improving our pattern of rest.



Visual and circadian lighting

When talking about lighting design or planning we need to begin to discern between visual lighting and circadian lighting.

If we are talking about quantifiable aspects of visual lighting we must take into account parameters such as illuminance (lx), luminance (cd/m²), contrast strategies, CRI, colour temperatures, etc.

However, when we talk about circadian or melanopic lighting, we need to know that we will be taking into account the colour temperature, but even more so the light spectrum. Currently the two most widespread methods of calculating circadian lighting are:

- **Equivalent Melanopic Lux (EML)**, reference measure of WELL V2;
- **Circadian stimulus (CS)**, method adopted by LRC (Light Research Centre).

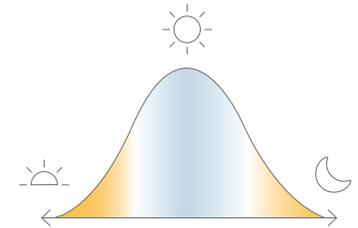
In both cases it is necessary to have at our disposal the spectral information of the light source, through the SPD, to be able to carry out the necessary calculations and studies to define some parameters that serve to implement a dynamic lighting that respects and activates our biorhythms in a beneficial way.

In day-shift workspaces, it would be most appropriate to have lighting that stimulates our circadian system (CS>0.3 for at least 1 hour) during the early morning hours, suppressing the generation of our melatonin, improving our conscious and unconscious alertness as well as improving people's ability to concentrate and perform properly in the workplace.

In the afternoons and evenings, it is best to have lighting that, unlike in the early hours of the day, helps the user to enter a state more apt for rest (CS<0.1).

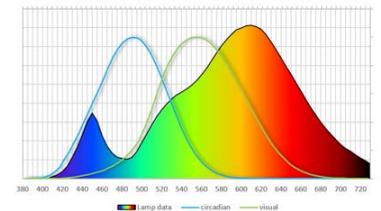
However, in those spaces where work is carried out at night, it is necessary to alter this natural sequence in order to try to favour their hours of rest, opposite to the cycle of sunlight.

Natural light cycle

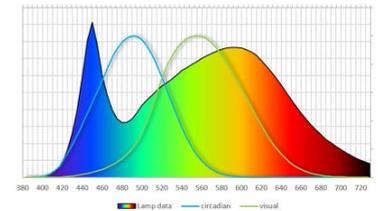


Example of light spectrum (SPD)

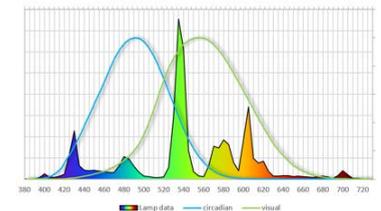
LED 2700K



LED 4000K

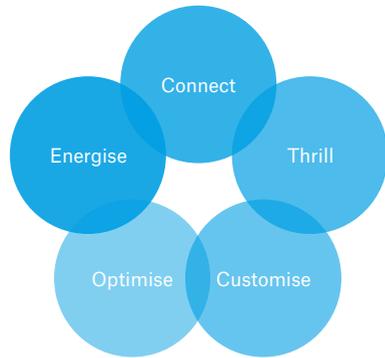


FLUORESCENCE 4000K



Applications

However, the benefits of the application of **dynamic lighting** go beyond even synchronization with solar cycles according to their area of application:



General Lighting: Flexibility and Well-being

Users' spaces and needs are transformed, and so is the way we light them.

Dynamic lighting allows us:

- Connecting indoor areas with their surroundings by synchronising artificial lighting with the dynamic character of natural lighting;
- Generating an atmosphere users can relate to emotionally;
- Customising the space by choosing the most appropriate colour temperature for the activity being carried out at any given moment.



Hospitality: Customisation

Creating spaces that make a difference and leave a positive emotional mark on users through light.

- Generating customised experiences for each user;
- Design lighting scenarios and set the mood: Relaxation, concentration, etc. Depending on people's moods;
- Establish lighting scenes that accompany the natural cycles of human body sleep by establishing a "resting light" and a "dawn light";
- Allow night lighting scenes that do not disrupt natural sleep cycles.



Retail: Making spaces more dynamic

Maximise the experiences of commercial spaces and enhance brand creation through lighting.

- Generating differential experiences of physical trading as opposed to online trading, adapting to the new consultative and experiential habits of purchase;
- Making commercial and exhibition spaces more dynamic, matching seasonality changes;
- By making lighting interactive, adapting the luminous ambience to parameters such as traffic, density or the use of spaces.



Services associated with dynamic lighting

1. Consultancy

Lamp can advise on the design of the most suitable lighting scenes for each space and project. Once the location has been analysed and the forms of use and the needs of users have been understood, a pattern of lighting scenes is designed, starting from the matrix of the relation of illuminances and colour temperatures, where the general basic areas of different types of lighting are established according to their level of stimulation of the circadian cycle. With the analysis of the needs and routines of users, and depending on these general areas, it is possible to define, through our client, an itinerary of the lighting scenes befitting the space to offer more comfort and well-being to the users.

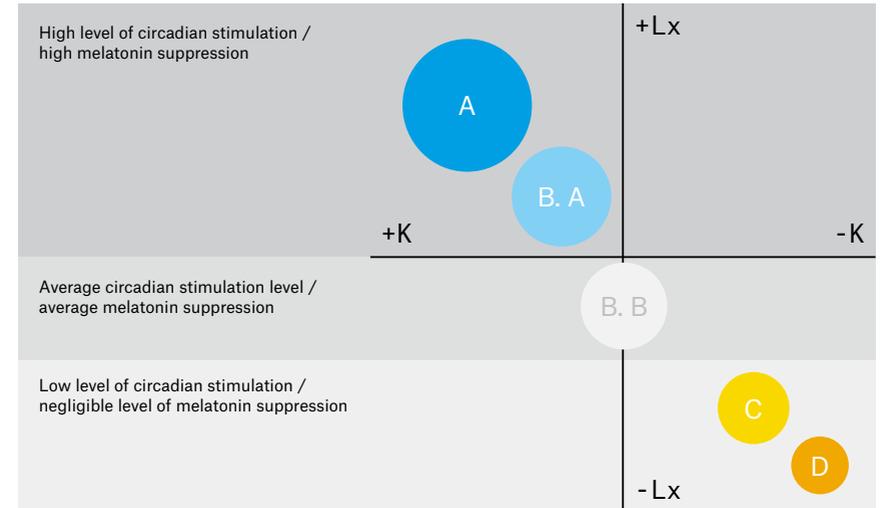
2. Configuration and commissioning

Lamp offers the services of commissioning and implementation of these previously defined itineraries.

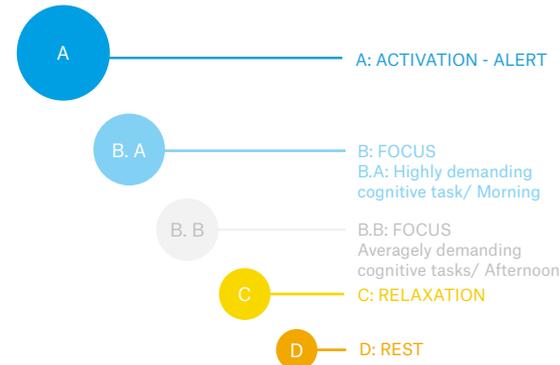
3. Consulting and maintenance

During the first months of installation and normal operation, a Lamp team qualitatively monitors the installation to ensure that the theoretical needs meet the expectations of the space's real users, and if necessary ensure the required adjustments are made to the itineraries of the scenes to match the real needs.

Illuminance ratio and colour temperature matrix



GENERAL BASIC AREAS OF CIRCADIAN LIGHTING TYPES



Examples

Below, we can see two examples of design scenes laid out in two spaces, where users devote much of their time to tasks that require a great deal of cognitive effort.

Office



Corporate Zenith, Mexico City, Mexico

Dynamic lighting varies in intensity and colour temperature to achieve greater synchrony with natural lighting cycles, favouring user performance while being respectful of their natural rest cycles.



Schools



French Lycée, Barcelona, Spain

The lighting in classrooms must generate the most conducive energetic states in order to optimise teaching spaces according to the cognitive task and the level of concentration required. In addition, lighting is a factor that modulates mood, for example, using lighting that promotes relaxation after play activities involving a high level of excitement.



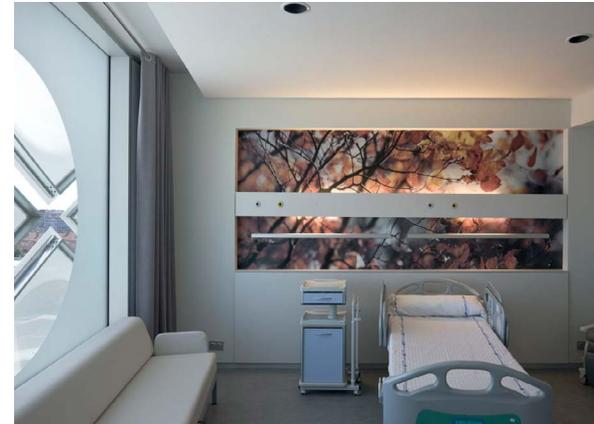
Hospitals (Night shift workers)



Mollet Hospital, Mollet del Vallès, Spain

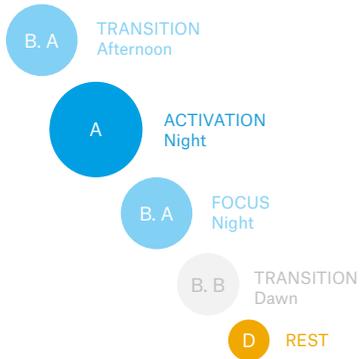
For this type of use, a correct application of dynamic lighting is key to promote a state of alertness during working hours and during moments of rest, which in this particular case involves phases contrary to the natural light cycle.

Hospitals (Rooms)



Rey Juan Carlos Hospital, Móstoles (Madrid), Spain

In these spaces where the user (patient) is in an indoor space during their stay, lighting is the main link to external space, improving the patient's sense of well-being by improving the synchrony of their biorhythms. In addition to proposing a very soft sequence of light scenes that replicates the natural solar cycle, it is important to have night navigation lights that enable circulation through the room, if necessary, without interrupting the sleep cycle.





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