Lighting Services

Shining more light on human-centric lighting

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Lighting has a profound effect on people. The reason is simple; light is the most powerful regulator of our circadian rhythm. Light also has visual, biological and emotional benefits: it makes people see better, feel better and function better. And that makes human-centric lighting paramount for people's health and wellbeing.

At Signify we have a deep understanding of the effects that light can have on people, coupled with the technological know-how to deliver quality solutions that enhance visual comfort, wellbeing and performance. As human-centric lighting applications gather momentum, we have the expertise to deliver a wide range of high-quality lighting solutions that building occupants, facility managers and installers can use to create more inclusive and satisfying workspaces.

Light to see better

Lighting is essential for vision. Without sufficient light, we cannot see clearly and struggle to focus on finer details. But too much light has quite the opposite effect; it dazzles, creates harsh glare and can cause visual discomfort. The secret to light the lets us see better lies in lighting solutions that create exactly the right balance between clarity and comfort.

The Philips portfolio includes high-quality, human-centric solutions, like Fortimo LED strip CES and Fortimo LED strip tunable white, that provide the best quality, reliable lighting. They also prevent the unwanted, negative effects such as temporal light artefacts like flicker and strobe that come with cheaper indoor lighting alternatives. All our LED solutions are rigorously tested and covered by the six pillars of quality that you can count on: lighting, assurance, innovation, people, support and leadership.

Light to function better

The biological effects of light are what determines our general sense of wellbeing. Humans have lived outdoors for thousands of years, so it's natural that our bodies have evolved in response to the changing patterns of light. Natural daylight provides the right light, in the right quantity, with the right spectral content, at the right time to keep our circadian rhythm in sync.

In a perfect world, we would all spend more time outdoors to boost our health and wellbeing with natural daylight. But the reality is, we live more than 90% of our time indoors, and 36% of that is in the workplace[1]. Indoors, most of us do not receive the right amount of daylight that we need to feel healthy and happy.

During an average sunny day, people are exposed to light levels of 100,000 lux, or 10,000 lux on a cloudy day. But spend a day in the office and this is reduced to 500 lux, or just 300 lux whilst attending school. In contrast, buildings with superior indoor lighting that offers the right light nutrition, can have positive effects. Because exposure to good light is extremely important for our mood, energy levels, comfort, productivity, quality of sleep, and our health and wellbeing in general.

+90%

of our time spending indoors

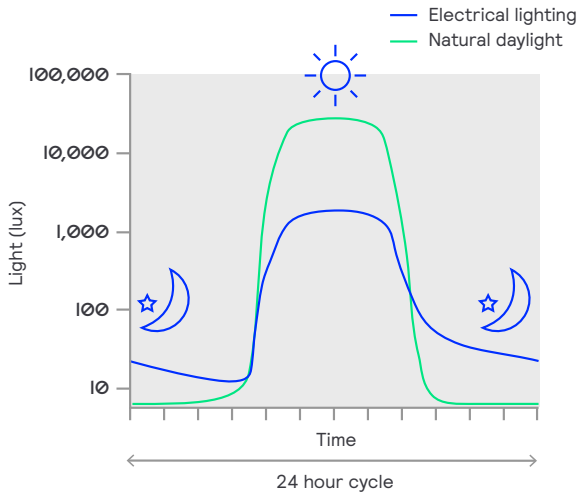

Figure 1: Light exposure in natural and electrical lighting

Light nutrition and the sleep-wake cycle

To be active during the day and sleep well at night, our body needs a stable predictive cycle that tells it when to expect darkness or light. But for most people, the central pacemaker in the suprachiasmatic nucleus (SCN) part of the brain is likely to have a clock that's longer than 24 hours[2]. That means if it's not entrained to the external light/dark cycle, it will rapidly start to run out of sync – even if the periods of light remained constant. Furthermore, synchronizing the SCN and other clocks in the body takes time. That's why we don't adapt instantly to changes in the light-dark cycle, and explains why we experience jet lag[3,4].

This phenomenon was experienced in 1962 when Michel Siffre, a French geologist, spent two months in an underground glacier near Nice. With no access to sunlight, clocks or calendars, he let his body dictate his sleep-wake cycle. His journal later revealed that although he spent a third of his time sleeping, as he would normally, his sleep-wake cycle was not 24 hours, but was, in fact, 24 hours and 30 minutes. In the absence of light, Siffre had started living according to his own internal time, rather that his body clock, which is governed by the rising and setting of the sun.

We can see another example of this in Figure 2, below. Each line represents the movement of a nocturnal animal (hence active at night) during 24 hours. The activity is entrained to light offset during the first part of the experiment. When the animal is kept in complete darkness, its rhythm starts to free-run, shifting forward every day.

But can we see this phenomenon in our everyday lives? Actually yes. Because today there is a significant incidence of circadian misalignment in the general population. For example, one in three adults suffer from sleep disorders, while 70% of adolescents are still in deep sleep in the morning. This doesn't just put our sleep-wake cycle out of sync; it also affects how we process food, our mood and performance, and the way we restore our bodies. Circadian misalignment has also been linked to health problems such as weight gain, an increased risk of diabetes, cardiovascular disease, mood disorders and cancer.

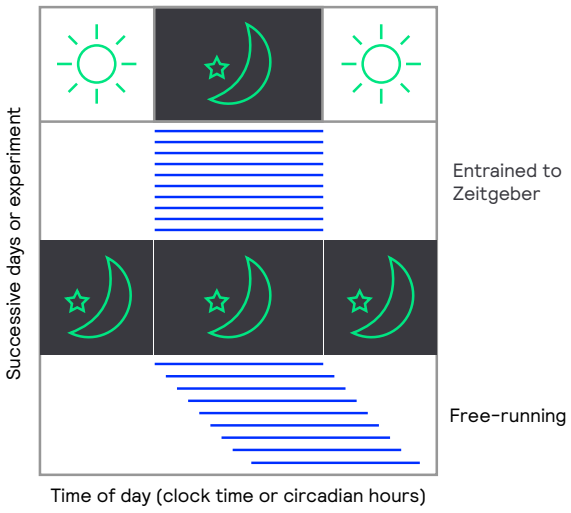

Figure 2: Entrainment of the biological clock by light[5]

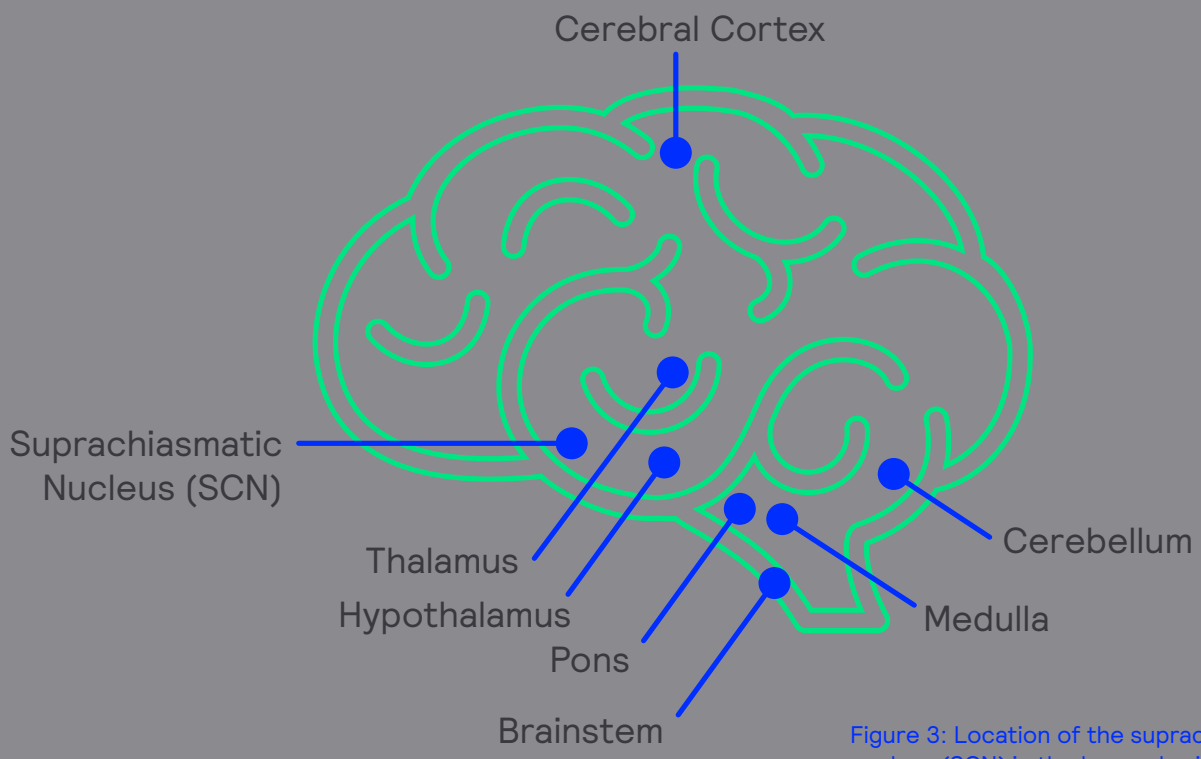

Figure 3: Location of the suprachiasmatic nucleus (SCN) in the human brain

The biological clock and circadian rhythms

Almost all cells in the human body need input from the outside world to synchronize with the daily light/dark cycle. The central pacemaker, which is located in the suprachiasmatic nuclei (SCN) in the hypothalamus, just behind the eyes[6,7], plays a key role.

The SCN has around 20,000 neurons divided into a light-sensitive part and a non-light sensitive part[8,3]. The non-light sensitive part drives our internal circadian rhythms without any external input, telling the body when to expect darkness or light. In contrast, the light-sensitive part, which receives input from the eyes, adjusts our internal clock to changing external circumstances, such as when the length of daytime changes with the seasons.

Levels of melatonin and the core body temperature trigger signals from the SCN to the rest of the body to give it an estimate of the external light/dark cycle[9]. These signals drive a whole range of other processes in the body with 24-hour rhythms, such as heart rate, blood pressure and the release of hormones like cortisol and insulin[10] – all of which have a strong influence on the sleep/wake cycle.

Biological active light

So what's the answer? Around the beginning of the 21st century, it was discovered that some ganglion cells in the retina are light sensitive with a peak sensitivity around 480 nm (the cyan part of the spectrum). Electric light that activates these cells is known as biological active light or circadian light. This is quantified using the melanopic daylight efficacy ratio (melanopic DER). It is this ratio, coupled with the amount of light that falls into the eye, that measures how well a lighting design supports people's biorhythms.

During the day, people need a high activation, preferably in the morning for applications such as office lighting. Light in the morning triggers us to wake up and bright light during the day enhances our circadian rhythm, which regulates our sleep-wake cycle, daytime engagement and mood.

However, during the night the opposite is true. Deep, more efficient sleep is important for health and wellbeing. In the short term it aids alertness, learning and memory, improves our safety, strengthens restoration, enhances our mood and is part of a healthy lifestyle. In the long term, that helps to develop an active immune system, healthy brain and is good for our cardiometabolic health. Therefore at night, a low activation is required in applications such as hospital patient rooms or 24/7 environments like emergency call centers.

Brighter office lighting

So, we know that sufficient light nutrition during the day makes us less sensitive to late-evening light to promote sound sleep and an easy wake up. But we also need light that supports how we see, feel and function at work. And that requires brighter office light - high intensity, cyan-enhanced lighting that falls comfortably into the eye. Because solutions with biological active light, comfortable brightness and a high activation during the day offer the most effective way to create a healthy office environment.

That raises a challenge. Because replicating the 10,000 to 100,000 lux that people experience outdoors is not realistic, or efficient, in an indoor setting. People also have a preference for lighting that does not have a too cold color temperature. But the light spectrum is also key to balancing our visual and biological needs, as can be seen in Figure 4.

The photopic curve shows our experience during the day in a well-lit space, when we are sensitive to the green-yellow part of the light spectrum (555 nm). The melanopic curve shows the visual and biological impact of light, such as the suppression of melatonin in blue-rich light (480 nm).

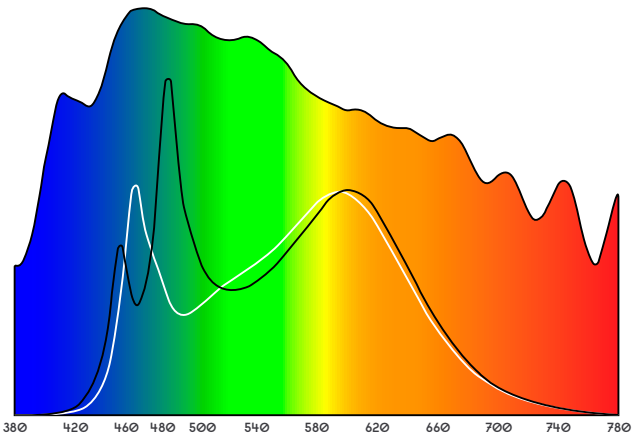

Figure 4: The sensitivity of melanopic and photopic vision to the light spectrum

Finding the right balance

LED boards with a high illuminance (lux) and cyan-enhanced spectrum can help to achieve this balance via a correlated color temperature (CCT). However, spectral engineering can also be used to keep the CCT at around 4000K, the most frequently used CCT in offices. Using optical design to improve lighting distribution can also contribute to eye comfort by increasing the ratio between light that lands on vertical and horizontal surfaces. When this is combined with cyan-enhanced tunable white technologies, LEDs can provide biological active light that enhances light-related workplace satisfaction and creates a connection with the dynamics of natural light.

So what's the best way to achieve that? One way is to increase the horizontal photopic lux levels on an office desk to around 1000 lux. But this would need extra investment and consume twice the amount of energy. A better way to get more light to fall into the eye is to use spectral tuning and switch to cyan-enhanced office luminaires. This will have the same benefits as using 500 lux, using less energy, while still activating the ganglion cells and positively affecting circadian rhythm.

Philips Fortimo LED strip CES is a quality solution from Signify that can help you achieve that:

- Neutral white color temperature as common in office applications
- CRI >80
- Biological active light with a high melanopic DER
- Activation close to natural daylight spectrum
- Conform to office standards like LEED and BREEAM
- Helps to attain at least 4 WELL points for lighting.

Light to feel better

But what about the emotional benefits of light? One way that lighting can make people feel better in the office is via personal control. People often have very different lighting preferences and feel better when they can take control of them. Smart solutions that enable them to fine-tune light recipes and light levels to suit different tasks from concentration to brainstorming improve feelings of workplace satisfaction. Employers can also create lighting schedules that make people feel better while addressing their business, whether that's for 9 to 5 working hours, shifts or for seasonality.

Lighting up engagement

Employers are increasingly realizing that people are their great asset, not just their highest cost. To attract and retain talent, they are now prioritizing health and wellbeing because they know flourishing employees are what drive a thriving business. And that means that human-centric lighting like luminaires equipped with Fortimo LED strip CES will play a central role in their thinking.

As 90% of business costs are staff related, investing in comfort can be one of the fastest ways to boost efficiency. So it's not surprising that many organizations are keen to enhance workplace comfort to gain WELL Building and other similar certifications. Investing in human-centric lighting also makes perfect business sense because healthy and engaged employees make a positive contribution to productivity. In fact, leading employee experience firm DecisionWise found that disengaged employees cost organizations an average of $3,400 a year for every $10,000 in annual salary[11].

What's more, as the nature of work is increasingly characterized by solving complex tasks, concentration, motivation, engagement and mood are all essential for employee productivity. Those who are committed to an organization, emotionally as well as mentally, are likely to perform best at work and will miss 20% fewer work days[12].

Countless opportunities

As pioneers in this new era of light for wellbeing, we believe a whole host of opportunities are about to open up for human-centric lighting. This offers an unprecedented opportunity for lighting manufacturers, developers and designers to re-define indoor lighting. Quality solutions like those from Signify can transform it from a practical way to overcome the dark, into a powerful way to maintain people's health and wellbeing, and ultimately their satisfaction and performance at work.

To find out more about unlocking the power of human-centric light for your business, contact your local Signify representative or visit online.

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