Blue Light: Three Frequently Asked Questions About Blue Light and Good, Healthy Vision in the Digital World

Blue, high-energy visible light is a much-discussed topic. It's often mentioned in relation to eye and vision health and named as the main cause of eyestrain as well as sleeping trouble. The blue parts of the spectrum, particularly the parts emitted by screens and LED bulbs, are mostly blamed. For some time now, the press and specialist media have been publishing a number of different stories and myths about blue light and its effects on the eyes. But is there any truth to these stories? We have taken a closer look at the topic of "blue light".

What exactly is blue light?

A definition of blue light gives a starting point for understanding.
Everyone is surrounded by radiation of different wavelengths – the so-called electromagnetic spectrum. Light is the part of this spectrum that enters the eye and creates visual perception. The visible light spectrum encompasses wavelengths of 380nm to 780nm
Specifically, blue light forms the part of the visible spectrum with the shortest wavelengths between 380 and 500 nanometers and occurs in different forms – in natural light emitted from the sun or in artificial light generated by LED bulbs or screens, for example.

There are two types of blue light: the natural blue emitted from the sun or the artificial light generated by LED lamps and displays.

FAQ 1: Is blue light from smartphone and computer screens harmful to the eyes?

Studies repeatedly cause a stir by stating that the blue light emitted by smartphone and computer screens as well as LED bulbs can damage the retina. As a matter of fact, the blue spectrum borders directly on the ultra-violet range, which has long been established as a health hazard with detrimental effects on biological cells. Some studies state that certain intensities and durations of short-wave blue light exposure can cause photo-oxidative stress in the retina. This stress can trigger metabolic processes. Age-related macular degeneration (AMD), a chronic

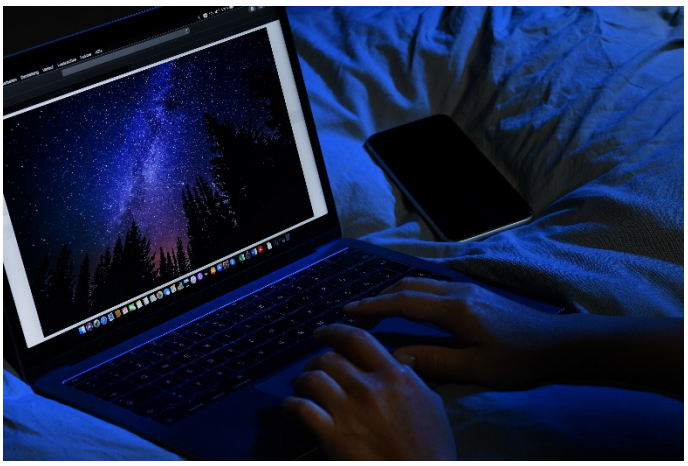
condition that ultimately causes blindness, is sometimes noted as a long-term effect of this type of blue light exposure. However, many different risk factors also play a major role in this condition. There is currently no conclusive evidence in science and medicine on what the magnitude of blue light exposure to AMD genesis is. In addition, the scientific basis of the current evidence is based on long-term studies of people who work for long hours in bright sunlight. There is currently no scientific study that links AMD genesis to blue light from LEDS and displays.

The intensities of artificial blue light from LEDs and screens are also far below any currently defined thresholds related to blue light hazards. Nevertheless, scientific studies dating back to ten or more years show that blue light can definitely have an impact on our visual comfort, wellbeing, and our wake-sleep cycle, which brings us right to the next question.

FAQ 2: Does blue light affect the quality of sleep?
Another criticism against blue light is that people who surf the internet or are exposed to blue light from other sources just before going to bed have trouble falling asleep or complain about poor sleep quality. In fact, there is a strong link between blue light exposure and the regulation of our circadian rhythm that synchronizes our bio clock and impacts our wake-sleep cycle. Special photoreceptors in the retina contain the protein melanopsin which is particularly sensitive to a specific sub spectrum of the blue light. Although the metabolic process is complex, the result can be described as follows: blue light exposure of these retinal photoreceptors suppresses the production and secretion of the hormone melatonin (also known as the “sleep hormone”). As a consequence, we stay alert, awake and agile. When there is no more blue light exiting these photoreceptors the blocking of the hormone melatonin secretion will stop. The consequence will be relaxation, growing fatigue, and, eventually, sleep.

“If blue light reaches the retina, it will inhibit the production and distribution of melatonin, keeping us awake and alert. This changes as soon as the intensity of blue light is reduced – we feel sleepy.”
Christian Lappe,
Head of Technical Communication at ZEISS Vision Care

Although we rely on this natural process to keep us alert and awake during the day, it’s not ideal to experience the effects at late hours and at night. Some studies indicate that the quality and duration of sleep, particularly in young people, are impaired by using screens during the evening. So, just put your smartphone and tablet away and focus on getting a decent night’s sleep.



Too much artificial blue light, for example from LEDs, screens, and monitors, impairs the sleep-wake rhythm and therefore the quality of our sleep and wellbeing.

FAQ 3: Does blue light reduce visual comfort and lead to digital eye strain?

One of these effects is scatter, which is determined by the wavelength. What exactly does this mean? The shorter the wavelength, the greater the scatter. An everyday example is the colour of the sky during the day – which is blue. The spectrum of sunlight includes all colours (and much more radiation). However, the short-wave blue component of the light is scattered to a greater extent in the atmosphere and more of it reaches the observer. The opposite happens in the evening when the sun is low on the horizon. The white sun appears to be a yellowy-red colour because a large proportion of the blue light is dispersed on the long journey through the atmosphere. Under certain conditions this effect (also called “visual noise”) can lead to an increased perception of glare, subjective reduction of contrast, and blurred vision.

Another effect of blue light is the refraction of the light or “optical dispersion,” which varies with the wavelength. This phenomenon is, for instance, visible in the way that light is split when it passes through a prism. The short-wave blue part of the light is removed from the optical path to a greater extent compared to the other wavelengths. Translated to our visual system this effect causes the eye to see the focal points as slightly displaced in relation to one another. Scientists call this phenomenon “longitudinal chromatic distortion” (LCA). The eye does not see blue, green, and red light with the same degree of sharpness. This effect may become noticeable if an excess of blue light is present, which can cause irritation while accommodating and lead to perceived blurry images. In other words, short-wave blue light definitely does present some challenges for our eyes and vision. These challenges become amplified by the increase of blue light exposure in our daily lives.

The new generation of blue light protection from ZEISS

The ZEISS BlueGuard Lenses were specifically designed to counteract the symptoms of vision discomfort and eye strain by absorbing part of the shorter, problematic wavelengths between 380 to 455 nanometers. The beneficial properties of blue light, which influence general well-being and are located in a higher range of wavelengths of around 455 to 500 nanometers, are deliberately left unaffected. You can read more about ZEISS BlueGuard here.