

[Understanding Vision](#) Oct 16, 2017

How does color vision work?

And what does this mean for people who wear sunglasses?

You aren't even thinking about it while it happens: our eyes perceive over 200 different shades of color, differentiate completely between the most detailed nuances and recognize over 20 saturation and 500 brightness levels. You can see the result: every day we assimilate millions of color stimuli – a dream-like world of colors which often leaves us speechless. But how does all this work? Why does the sky look blue or red at certain times or grey at others? And what does this have to do with the production of sunglass lenses?

Your cones do the job – that's how color vision works.

Your eyes have two different types of sensory cells: rods and cones. These two types of photo-receptors in the retina divide up the work and perform different tasks: the rods enable us to perceive changes in brightness up to a certain light intensity. The rods in your eyes are essential for twilight and night vision. They enable you to see both when it's bright and when it's dark. The cones are in charge of color perception. They come in three different varieties, each of which reacts to different wavelengths:

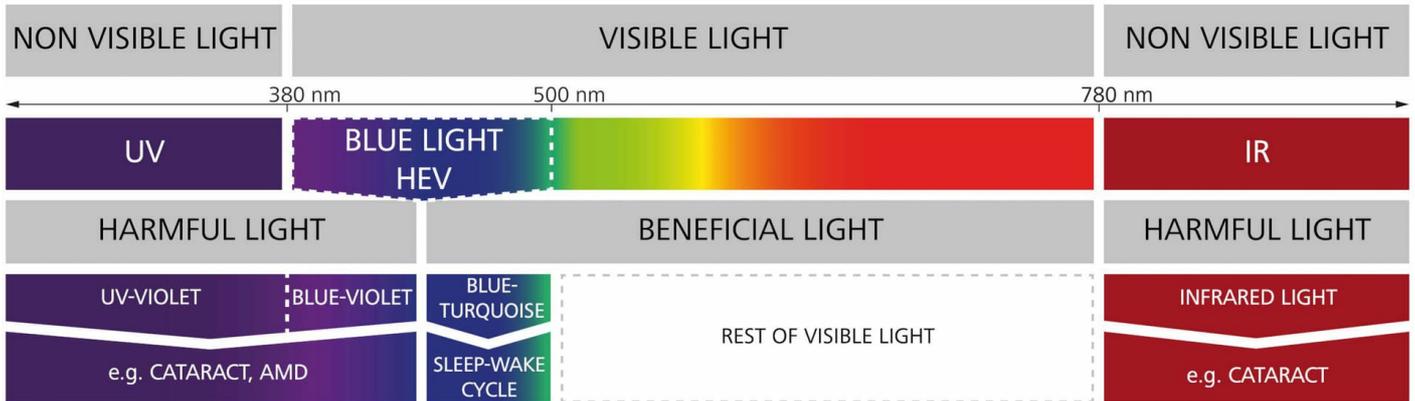
1. **Cones for blue light (S-cones - the S stands for "short"; these react to shorter wavelengths)**
2. **Cones for green light (M-cones - the M stands for "medium"; for medium wavelengths)**
3. **Cones for red light (L-cones - the L stands for "long"; for longer wavelengths)**

And how does this affect your color vision? – If a surface reflects only short waves, then this surface looks blue to your brain. If only long waves are reflected, then you see red. Medium-length light

rays make you see green. You only perceive mixed colors like yellow, purple, orange or violet when a surface reflects waves with different lengths. If these types of cones perceive all waves lengths simultaneously, then your brain sees them as white.

But there's another important factor which affects our color perception: objects do not only reflect colors, they also absorb them. A ripe cherry, for example, has such a lovely red color because the surface of the fruit absorbs the green and blue light and only reflects long light waves, i.e., those which appear red. Which colors we perceive thus depends on the proportion and strength of light absorbed by the three colors blue, green and red.

Your eyes usually process a light spectrum between 380 and 780 nanometers. They don't perceive light with shorter (UV) and longer (infrared) waves, i.e., everything which is below and above the visible light spectrum.



HEV - High Energy Visible Light, UV - Ultraviolet Light, IR - Infrared Light ©ZEISS 2017

Why is the sky blue?

Sunlight is normally white because it contains all light colors in equal measure. If you use a prism to refract a light ray, you'll see the entire color spectrum for light.

When the sun is in the sky, it's easy for light to penetrate the earth's atmosphere and reach you. Only a small blue portion is absorbed, which is why the sun looks yellow. It's different with the sky: a cloudless sky looks blue because the path of the light through the atmosphere is relatively short. Molecules in the air such as oxygen and nitrogen particles deflect the light rays and disperse them. The blue, short-wave light is more easily deflected than the long-wave red light. Since mostly blue light is reflected, the sky looks blue. The light's path through the atmosphere is longer when the sun is low in sky in the morning or evening. Only the red, long-wave light makes it through. That's why the sky appears red. If the sky is cloudy or the air is dusty and damp, then the sunlight is reflected entirely rather than being split. Thus you see long-wave white in the sky or, if the weather's bad, gray. There's no atmosphere on the moon. The sky on the moon is black because the light hits the moon's surface without being deflected. If you're standing on the moon, the sun appears bright white.

What do sunglasses do for your eyes?

Sunglass lenses are more than just a fashionable accessory. They also protect your eyes from harmful, short-wave UV radiation which is entirely invisible to the human eye. Sunglasses also provide us with more comfortable vision and they're pleasing to wear because they minimize the unpleasant glare from strong sunlight. The more intense the sunlight and the reflections, such as on the water or up in the snow-covered mountains, the more important it is that you protect your eyes. This also means that the tint should likewise be darker. > [Additional coatings](#) can help in extreme conditions.

Here's a rule of thumb: the more neutral the color of the sunglass lenses, the less it influences your color vision. The goal when producing sunglass lenses is to optimally attenuate light and enable you to see the entire color spectrum naturally. This holds especially true for sunglasses designed for driving a car or riding a motorcycle. When purchasing sunglasses, it's vital that you ensure that the sunglass lenses you purchase are suitable for driving. Don't pick too dark a tint with too much absorption. Otherwise the lens color could adversely affect your ability to distinguish between traffic light signals. A few tints, such as dark blue or red, are not suitable for driving. All sunglass lenses with an absorption greater than 25% are not suitable for driving at night or at twilight. Be a safe driver – make sure you pay attention to these factors! Your eye care professional will be happy to give you more information.

There are a few instances – for both fashion and practical reasons – where the standard gray, brown and dark-green tints are insufficient.

> [You can also purchase ZEISS sunglass lenses with any colored tint you would like.](#) The effect on your natural color vision depends on the color. But after a while your eyes will adjust to the filter and your brain will suggest the correct natural color.

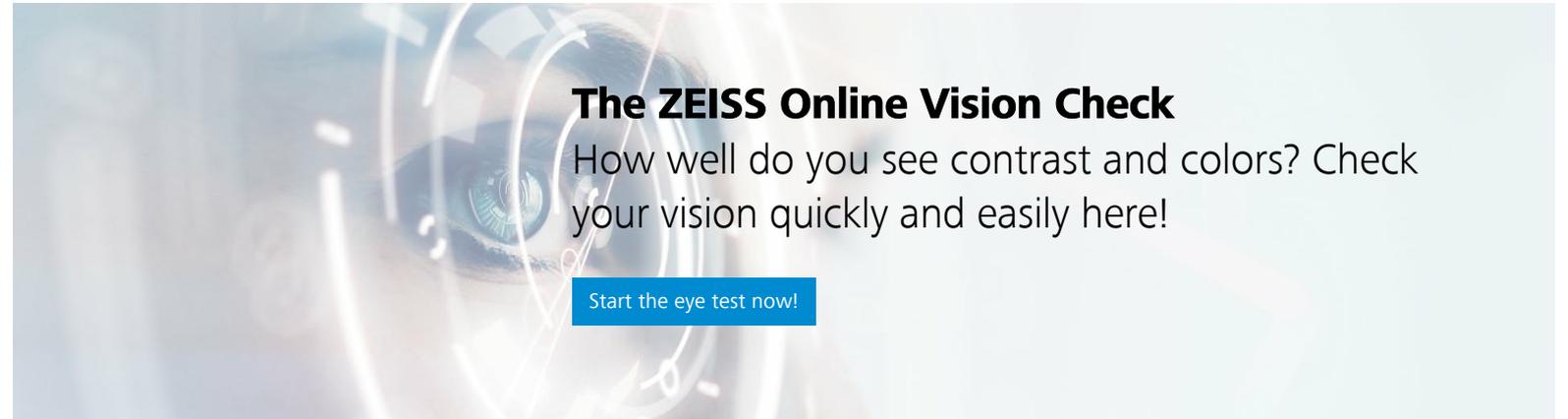
There are many myths about how a particular color tint might affect your vision or mood. But that fact is that how much a colored tint positively or adversely affects someone varies from person to person. That's why you should try out different tints with your eye care professional.

Higher-performing sunglass lenses

Sunglass lenses do a lot: they protect your eyes from UV light, reduce glare, correct visual impairments and are a fashionable accessory. But some sunglasses are better than others. Contrast-enhancing sunglass lenses can offer you an improved visual experience. There are three versions available from ZEISS:

- ✓ Skylet Fun (70% light reduction)
- ✓ Skylet Road (80% light reduction)
- ✓ Skylet Sport (90% light reduction) [Product explanation/use](#)

As the names imply, these sunglass lenses are designed for different areas of use. All three increase color contrast. You have clearer and more comfortable vision, even in diffuse light or with extreme glare. Take the test at your eye doctor.



The ZEISS Online Vision Check

How well do you see contrast and colors? Check your vision quickly and easily here!

[Start the eye test now!](#)

How do sunglass lenses increase contrast?

We've already learned that direct sunlight is scattered. The blue portion of the light is scattered the most because of particles in the air which make the sky appear blue in strong sunlight.

[> Learn more about ZEISS sunglass lenses](#)

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