

# The Aging Eye

***Some deny it. Some dread it. Far fewer embrace it. But, no matter how you feel about aging, getting older is inevitable.***

by Kate Smith

I have no doubt that I can happily live with a less than youthful appearance. What might not be so easy for me to accept is a loss in my ability to clearly see colors, but that too may be inevitable. A 2014 study published in the journal *Optometry and Vision Science* shows that the risk of abnormal color vision increases as people age, with the most significant changes starting at around age 70.

## **Color Vision and the Aging Population**

More commonly, as we age, the natural deterioration of the eye is referred to as Color Vision Deficiency. While the hue and saturation of a color may vary for those with this deficiency, lightness and brightness remain normal.

A 2011 study in *The Journal of Gerontology* on color vision and the aging eye demonstrated which particular qualities of color are more difficult for seniors to see. The study measured the “losses of color vision in the dimensions of hue, saturation, and brightness.” The study demonstrated a “loss of discrimination of saturation beginning at age 50, with rapid change noted after age 60. Similar findings were seen for hue but were not evident for brightness.” The participating scientists concluded with the hope that this “information will provide a basis for planning safer, more functional environments for elderly people.”

“We find the color discrimination declines with age and that the majority of color defects among the older population are of the blue-yel-

low type,” wrote Marilyn E. Schneck, PhD, and colleagues of The Smith-Kettlewell Eye Research Institute, San Francisco, CA, in their 2014 study.

Although color-vision abnormalities were uncommon in people younger than 70, color-vision problems in the blue-yellow spectrum affected 45 percent of people in their mid-70s, and that proportion rose to two-thirds by the time people reached their mid-90s. Few people had problems with the red-green spectrum.

Nearly 80 percent of the abnormalities involved confusion of the lighter (pastel) shades of blue versus purple and yellow versus green and yellow-green. Blue and green become more difficult to tell apart than red, yellow, and orange, which Schneck attributes largely to the yellowing of the lens. These “blue-yellow” errors are distinct from the “red-green” errors observed in people with inherited color blindness.

The report covers factors that may contribute to changes in color vision with aging, and to blue-yellow defects in particular. These may include reduced pupil size, admitting less light into the eye; increased yellowing of the lens inside the eye; and changes in the sensitivity of the vision pathways. All of these are known changes with age to the human eye.

Increased rates of eye diseases are another potentially important contributor. Schneck and coauthors add, “The most common age-related eye diseases (glaucoma, age-related macular degeneration, and diabetic eye





The thickening and yellowing of the lens as we age alters the way color is perceived. Many elderly experience a reduction in contrast perception ability, resulting in difficulty differentiating between subtle changes in environment, such as between carpets and steps. Another effect is the reduction in perceived saturation or color vibrancy, so, for example, reds begin to look like pinks, as well as the “blue-yellow” errors that make it difficult to distinguish blues and greens. Image courtesy of C. Cunningham, R. Pollock, and B. McGuire, *Light and Lighting Design for People with Dementia*, copyright 2011.

disease) all produce blue-yellow color vision anomalies, at least in the pre-clinical or early stages.”

### The Aging U.S.

The human eye can distinguish more than 10 million colors. Given that the U.S. population reached a milestone in November 2016, with more than 50 million people aged 65 and older, the effect of aging on color is of significant market interest.

A few key facts about the aging U.S. population:

- The number of Americans ages 65 and older is projected to more than double from 46 million today to over 98 million by 2060, and the 65-and-older age group's share of the total population will rise to nearly 24 percent from 15 percent.
- More than one-fourth (27 percent) of women ages 65 to 74 lived alone in 2014, and this share jumps to 42 percent among women ages 75 to 84, and to 56 percent among women ages 85 and older.
- The aging of the baby boom generation could fuel a 75 percent increase in the number of Americans ages 65 and older requiring nursing home care, to about 2.3 million in 2030 from 1.3 million in 2010.

### How Aging Affects Eye Structure

While glaucoma and cataracts are frequently considered to be the prima-

ry causes of age-related color-vision issues, more subtle changes in our vision and eye structures also take place as we grow older. For example, as we age, muscles that control our pupil size and reaction to light lose some strength. This causes the pupil to become smaller and less responsive to changes in ambient lighting.

Because of these changes, people in their 60s need three times more ambient light for comfortable reading than those in their 20s. “If you took a healthy young person and dimmed the lights enough, they would start producing the same blue-green errors as an older person does under bright light,” said Schneck in an interview in Sherwin-Williams’ *Stir* newsletter.

### Color and the Aging Eye

This need for greater light reaching the eye can be addressed through appropriate lighting, considering not only the fixtures and their placement, but the bulbs as well. Specify installations that render colors cleanly and provide ample sources of light without casting strong shadows.

In terms of specifying color, consider brighter colors, which bounce more wavelengths of light back to the eye than duller colors. Cells in the retina that are responsible for normal color vision decline in sensitivity as we age, causing colors to become less saturated and the contrast between different colors to be less noticeable. In particular, blue colors may appear faded or “washed out.” This is the “blue-yellow” error referred to

in the report authored by Schneck. While there is no treatment for this normal, age-related loss of color perception, it's important to be aware of this loss, especially if your profession (e.g., designer, workroom, etc.) requires fine color discrimination.

Another specific color issue Schneck covered included the fact that pastels that look distinct to a young person can look very similar to an older person. "If they were to give the color arrangement test to older people, young interior designers might be quite surprised by the errors their test subjects make," said Schneck. For example, confusing reddish-orange with blues. To help counteract, this use rich, saturated colors whenever possible. If using pastels, avoid going from one to another, particularly when demarcating transitions such as stairs, or floors and countertops. Contrast via alternating light and dark hues is especially important for these surfaces to aid in depth perception.

The "blue-yellow" shift in older eyes also means that blues that are dark to begin with appear even darker to an older audience. "Older people can still see blue and call things blue, but it's darkened considerably," said Schneck. She has done testing in various elderly environments and finds that many are invariably found to be too dim, especially private homes. "Given the smaller pupils and the yellowing of the eye lenses, it's visually as if they're wearing sunglasses in the house," she added. Another reason to consider increased and improved lighting for elderly clients.

There are challenges to designing welcoming spaces that compensate for reduced color perception and I expect to see more well-thought-out projects that address this issue in the future—sooner or later we'll all need it! 



The isle of Burano, in Venice, is considered to be one of the world's most colorful locations, with brilliantly painted homes in a range of striking hues. But an inevitable effect of aging is to reduce the intensity and contrast of colors as we see them.



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