Probing Question: What is colorblindness?

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Midnight Blue, Burnt Orange, Aquamarine. Since 1903, Crayola crayons -- with their fanciful names and hundreds of hues -- have introduced generations of American children to the nuanced beauty of the color spectrum. Imagine the public's surprise when Crayola's senior crayon maker, Emerson Moser, who molded a record-breaking 1.4 billion crayons in his 37-year career, announced upon his retirement that he was color blind.

Moser is not alone: Up to 8 percent of men around the world -- and more than 10 million American males -- have a congenital color vision disorder, or "colorblindness." Although women are more often the carriers of the recessive X chromosome defect that causes colorblindness, it is mostly males who inherit the condition.

"The term color-blindness is a misnomer to some extent," said Penn State psychology professor Rick Gilmore, whose research focuses on human brain development, specifically spatial vision and memory.

Explained Gilmore, specialized light-receptor cells within the retina called cones are responsible for our ability to see color. There are three kinds of receptor cones and each is designed to absorb different wavelengths of the visible light spectrum. Color vision is dependent on the interaction of these three cones, one of which is particularly sensitive to red light, another to green light, and a third to blue light. When one or more of these cones in an individual's retina is absent or damaged, some kind of color vision impairment will result.

True "blindness" to color -- the inability to see any colors but shades of black, gray or white, a condition called called monochromacy -- is exceedingly rare, Gilmore noted. More commonly, "People with color-blindness sort light wavelength patterns into fewer separate categories than do those with a larger complement of photoreceptors," he said. "So, if you have a smaller working complement of photoreceptors than I do, you aren't 'blind' to color, you just see fewer categories than I do and perhaps lump together colors that are distinct to my eye."

About 99 percent of all colorblindness is a form called anomalous trichromacy, which usually results in problems distinguishing reds and greens, or -- less frequently -- blues and yellows.

It is a common misconception that people with red/green colorblindness see reds as greens and vice versa. In reality, they see these two colors as very similar. When looking at a color spectrum chart, most colorblind people see variations of yellow, beige, blue and gray instead of the greens, reds, pinks and teals.

There is no treatment for colorblindness, and although for most it's a minor disability, being colorblind can create some frustrations and even occasional dangers. If you're a red/green colorblind person, that color-coded Weather Channel map won't be much help to you. Traffic lights -- and more dangerously, single caution lights -- won't look red or green to you. And you probably won't be very good at picking out ripe tomatoes in the supermarket or telling whether a piece of meat is raw or well done.

How do you know if you're colorblind? While there are diagnostic tests (such as the Isihara dot pattern test that superimposes symbols on a background of mixed colors,) there are limits to our total understanding of how another individual sees the world. As Gilmore pointed out, "There is no way to know whether one person's subjective experiences

are the same as another's. So I'll never know whether my perception of red is the same as my wife's."

"However," he adds, "I can tell objectively whether we agree on color names and color categories. There is a high degree of consistency across cultures in the names people with normal color vision give to similar patterns of light wavelength."

There is a growing trend towards making objects and information -- from traffic lights to Web sites -- more accessible to the color impaired. Graphic designers, including Web designers, are more frequently using dark black text on a white background -- a high contrast design visible to almost everyone -- with colors limited to the less critical aspects of the page. There are even programs such as "Vischeck" that simulate colorblind vision and "color correct" an image to make it easier for the colorblind to see.

Though some careers are off-limits to the colorblind (perfect color vision is required of pilots, firefighters and electricians, among others,) there are many successful role models to inspire colorblind kids. The actor Paul Newman is colorblind, as was children's television pioneer Fred Rogers. Don't rule out a career as an artist -- Van Gogh and Renoir are thought to have been had color-impaired vision. And if you're interested in crayons, there just may be a spot for you with the Crayola company.

Source: By Josh Ambrose and Melissa Beattie-Moss, Research/Penn State