

Researchers pinpoint how detecting social signals may have affected how we see colors

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Our color vision is superior at spotting 'social signaling,' such as blushing or other facial color changes, when compared to other types of color vision, including the type we design for digital cameras and other photographic devices. In their study, the researchers had 60 human subjects view a series of digital photographs of female rhesus macaque monkeys, above, whose facial color changes to give social cues. Credit: Constance Dubuc (NYU).

The arrangement of the photoreceptors in our eyes allows us to detect socially significant color variation better than other types of color vision, a team of researchers has found. Specifically, our color vision is superior at spotting "social signaling," such as blushing or other facial color changes—even when compared to the type of color vision that we design for digital cameras and other photographic devices.

"Our [color](#) vision is very strange," says James Higham, an assistant professor in NYU's Department of Anthropology and one of the study's co-authors. "Our green receptor and our red receptor detect very similar colors. One would think that the ideal type of color vision would look different from ours, and when we design color detection, such as for digital cameras, we construct a different type of color vision. However, we've now shown that when it comes to spotting changes in color linked to social cues, humans outshine the type of color vision we've designed for our technologies."

The study, which appears in the journal *Proceedings of the Royal Society B*, focuses on trichromatic color vision—that is, how we process the colors we see, based on comparisons among how red, green, and blue they are.

One particularly interesting thing about how our visual system is structured is how significantly it differs from that of cameras. Notably, the green and red photoreceptors we use for color vision are placed very close together; by contrast, the equivant components in cameras are situated with ample (and even) spacing among them. Given that cameras are designed to optimally capture color, many have concluded that their ability to detect an array of colors should be superior to that of humans and other primates—and wondered why our vision is the way it is.

One idea that has been well-studied is related to foraging. It hypothesizes that primate color vision allows us to detect between subtle shades of

green and red, which is useful, for example, when fruit are ripening against green leaves in a tree. An alternative hypothesis relates to the fact that both humans and primates must be able to spot subtle changes in facial color in social interactions. For instance, some species of monkeys give red signals on their faces and on genitals that change color during mating and in social interactions. Similarly, humans exhibit facial color changes such as blushing, which are socially informative signals.

In their study, the researchers had 60 human subjects view a series of digital photographs of female [rhesus macaque monkeys](#). These primates' facial color has been known to change with their reproductive status, with female faces becoming redder when they are ready to mate. This process, captured in the series of photographs, provides a good model for testing the ability to not only detect colors, but also to spot those linked to social cues—albeit across two species.

In different sets of photographs, the scientists developed software that replicated how colors look under different types of color vision, including different types of color blindness, and the type of trichromatic vision seen in many artificial systems, with even spacing of the green and red photoreceptors. Some of the study's subjects viewed photos of the transformation of the monkeys' faces as a human or primate would see them while others saw pictures as a color-blind person would and others as a camera would. During this period, the study's subjects had to discriminate between the different colors being exhibited by the monkeys in the photos.

Overall, the subjects viewing the images using the human/primate visual system more accurately and more quickly identified changes in the monkeys' face coloring.

"Humans and many other primates have an unusual type of color vision, and no one is sure why," first author Chihiro Hiramatsu of Japan's

Kyushu University notes. "Here, we provide one of the first experimental tests of the idea that our unusual [vision](#) might be related to detecting social signals in the faces of others."

"But, perhaps more importantly, these results support a rarely tested idea that social signaling itself, such as the need to detect blushing and facial color changes, might have had a role in the evolution or maintenance of the unusual type of [color vision](#) shown in primates, especially those with conspicuous patches of bare skin, including humans, macaques, and many others," concludes co-author Amanda Melin of the University of Calgary.

More information: Experimental evidence that primate trichromacy is well suited for detecting primate social colour signals, *Proceedings of the Royal Society B*, [rspb.royalsocietypublishing.org1098/rspb.2016.2458](https://royalsocietypublishing.org/doi/10.1098/rspb.2016.2458)

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