Researchers find languages can acquire new color concepts after exposure to other languages

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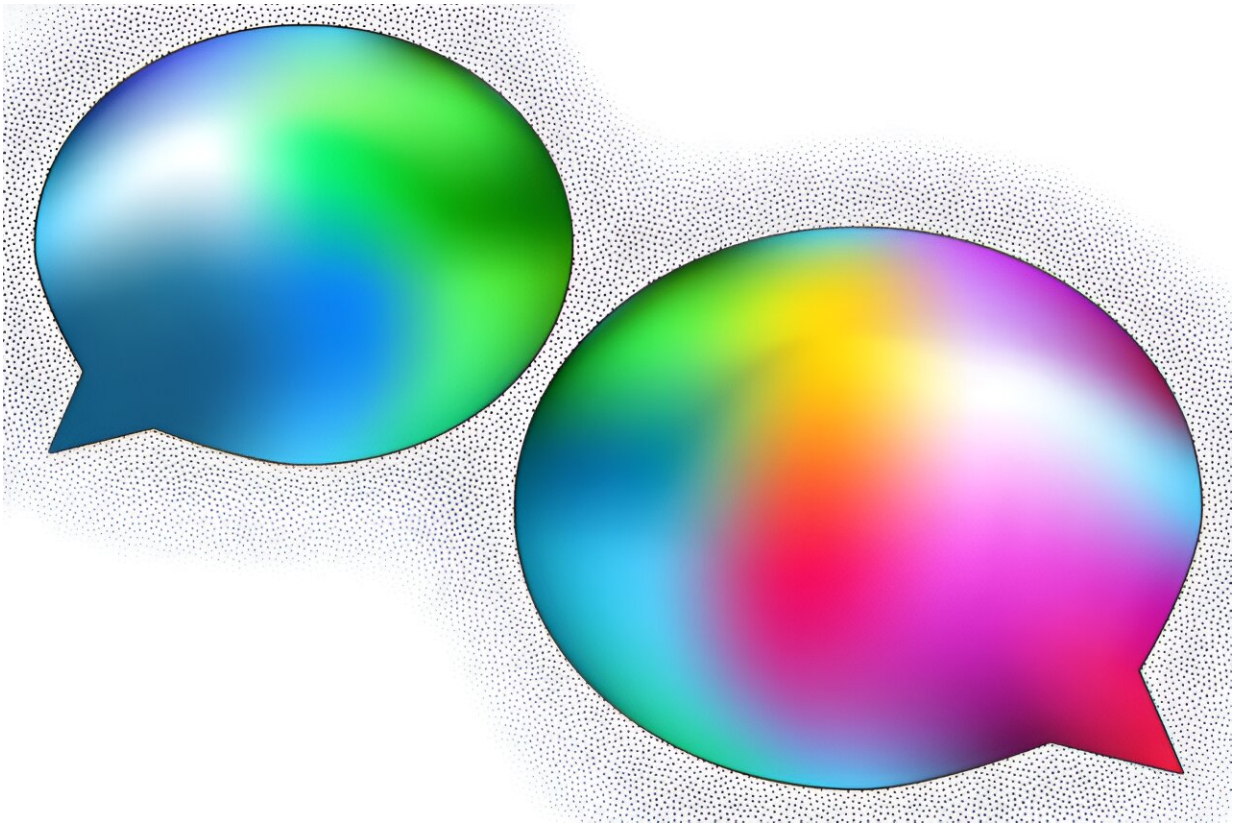

MIT researchers have found that languages can acquire new color concepts, such as the distinction between blue and green, after exposure to other languages. Credit: Christine Daniloff, MIT

The human eye can perceive about 1 million colors, but languages have far fewer words to describe those colors. So-called basic color terms, single color words used frequently by speakers of a given language, are often employed to gauge how languages differ in their handling of color. Languages spoken in industrialized nations such as the United States, for example, tend to have about a dozen basic color terms, while languages spoken by more isolated populations often have fewer.

However, the way that a language divides up color space can be influenced by contact with other languages, according to a new study from MIT.

Among members of the Tsimane' society, who live in a remote part of the Bolivian Amazon rainforest, the researchers found that those who had learned Spanish as a second language began to classify colors into more words, making color distinctions that are not commonly used by Tsimane' who are monolingual.

In the most striking finding, Tsimane' who were bilingual began using two different words to describe blue and green, which monolingual Tsimane' speakers do not typically do. And, instead of borrowing Spanish words for blue and green, they repurposed words from their own language to describe those colors.

"Learning a second language enables you to understand these concepts that you didn't have in your first language," says Edward Gibson, an MIT professor of brain and cognitive sciences and the senior author of the study. "What's also interesting is they used their own Tsimane' terms to start dividing up the color space more like Spanish does."

The researchers also found that the bilingual Tsimane' became more precise in describing colors such as yellow and red, which monolingual speakers tend to use to encompass many shades beyond what a Spanish

or English speaker would include.

"It's a great example of one of the main benefits of learning a second language, which is that you open a different worldview and different concepts that then you can import to your native language," says Saima Malik-Moraleda, a graduate student in the Speech and Hearing Bioscience and Technology Program at Harvard University and the lead author of the study.

Kyle Mahowald, an assistant professor of linguistics at the University of Texas at Austin, and Bevil Conway, a senior investigator at the National Eye Institute, are also authors of the paper, which was published this week in *Psychological Science*.

Dividing up the color space

In English and many other languages of industrialized nations, there are basic color words corresponding to black, white, red, orange, yellow, green, blue, purple, brown, pink, and gray. South American Spanish additionally divides the blue space into light blue ("celeste") and dark blue ("azul").

Members of Tsimane' society consistently use only three color words, which correspond to black, white, and red. There are also a handful of words that encompass many shades of yellow or brown, as well as two words that are used interchangeably to mean either green or blue. However, these words are not used by everyone in the population.

Several years ago, Gibson and others reported that in a study of more than 100 languages, including Tsimane', speakers tend to divide the "warm" part of the color spectrum into more color words than the "cooler" regions, which include blue and green. In the Tsimane' language, two words, "shandyes" and "yushñus," are used

interchangeably for any hue that falls within blue or green.

As a follow-up to that study, Malik-Moraleda wanted to explore whether learning a second language would have any effect on how the Tsimane' use color words. Today, many Tsimane' learn Bolivian Spanish as a second language.

Working with monolingual and bilingual members of the Tsimane', the researchers asked people to perform two different tasks. For the bilingual population, they asked them to do the tasks twice, once in Tsimane' and once in Spanish.

In the first task, the researchers showed the subjects 84 chips of different colors, one by one, and asked them what word they would use to describe the color. In the second task, the subjects were shown the entire set of chips and asked to group the chips by color word.

The researchers found that when performing this task in Spanish, the bilingual Tsimane' classified colors into the traditional color words of the Spanish language. Additionally, the bilingual speakers were much more precise about naming colors when they were performed the task in their native language.

"Remarkably, the bilinguals really divide up the space much more than the monolinguals, in spite of the fact that they're still primarily Tsimane' speakers," Gibson says.

Strikingly, the bilingual Tsimane' also began using separate words for blue and green, even though their native language does not distinguish those colors. Bilingual Tsimane' speakers began to use "yushñus" exclusively to describe blue, and "shandyes" exclusively to describe green.

Borrowing concepts

The findings suggest that contact between languages can influence how people think about concepts such as color, the researchers say.

"It does seem like the concepts are being borrowed from Spanish," Gibson says. "The bilingual speakers learn a different way to divide up the color space, which is pretty useful if you're dealing with the industrialized world. It's useful to be able to label colors that way, and somehow they import some of that into the Tsimane' meaning space."

While the researchers observed that the distinctions between blue and green appeared only in Tsimane' who had learned Spanish, they say it's possible that this usage could spread within the population so that monolingual Tsimane' also start to use it. Another possibility, which they believe is more likely, is that more of the population will become bilingual, as they have more contact with the Spanish-speaking villages nearby.

"Over time, these populations tend to learn whatever the dominant outside language is because it's valuable for getting jobs where you earn money," Gibson says.

The researchers now hope to study whether other concepts, such as frames of reference for time, may spread from Spanish to Tsimane' speakers who become bilingual. Malik-Moraleda also hopes to see if the color language findings from this study could be replicated in other remote populations, specifically, in the Gujjar, a nomadic community living in the Himalayan mountains in Kashmir.

More information: Saima Malik-Moraleda et al, Concepts Are Restructured During Language Contact: The Birth of Blue and Other Color Concepts in Tsimane'-Spanish Bilinguals, *Psychological Science*