Seeing Colors: New Study Sheds Light on Sensory System Quirk

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In the psychological phenomenon known as “synesthesia,” individuals’ sensory systems are a bit more intertwined than usual. Some musicians, for example, report seeing colors when musical notes are played.

One of the most common forms is grapheme-color synesthesia, in which letters or numbers (collectively called “graphemes”) are highlighted with particular colors. Although synesthesia has been well documented, it is unknown whether these experiences, reported as vivid and realistic, are actually being perceived or if they are a byproduct of some other psychological mechanism such as memory.

New research published in the June issue of *Psychological Science*, a journal of the Association for Psychological Science, attempts to shed some light on the veracity of these perceptions.

Danko Nikolic, a researcher from the Max Planck Institute for Brain Research in Frankfurt, Germany, and his colleagues relied on a variation of a classic psychological method known as the Stroop task to test this. In this task, participants must name the color of the font that a color word is printed in. For example, if the word “blue” was printed in red ink, the participant would say “red” — a moderately difficult task that requires some mental gymnastics.

To understand Nikolic’s version of the experiment, a rudimentary understanding of color perception is required: When anyone views a particular color, specific neurons in the visual cortex area of our brain are activated. These specific neurons will deactivate, however, if a color from the opposite end of the spectrum is presented. So, any neuron activated when the color blue is present will deactivate when it’s exact opposite, yellow, is comes into the visual field.

Using this logic, Nikolic presented grapheme-color synesthetes with their five most color eliciting letters or numbers. The color of the letter or number was either the same as its common association (congruent), different but not completely opposite of the color association (incongruent independent), or on the opposite end of the spectrum from the associated color (opponent incongruent). The researchers then measured how long it took the participants to name the color of the grapheme.

As expected, opponent incongruent colors made it quite difficult for individuals with grapheme-color synesthesia to respond quickly. On average, it took participants two and a half times longer to name opponent incongruent colors than independent incongruent colors. Congruent colors — colors that matched the association — actually facilitated the process of naming the colors.

In a separate experiment, the researchers found that this color-opponency system did not work for memories. They presented the same participants with pictures of objects that a color is commonly associated with (a lemon, for example). But like the previous experiment, the objects were in unexpected colors. Reaction times in this experiment were significantly less impeded by the color change and did

not differ from reaction times of control. Coupled with the results from the first experiment, these findings suggest that synesthetic colors are perceived in a realistic way, just as synesthetes report.