

Synesthesia - What does blue taste like to you?

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What do Vincent van Gogh, Marilyn Monroe, Pythagoras, and our very own Lady Gaga have in common? They all experienced something strange, called synesthesia!

As cool as the word sounds, its meaning is even more bizarre! It derives from the words 'Syn,' meaning union, and 'aesthesia,' meaning sensation. In short, a union of sensation. Synesthesia is a rare condition where sensory stimuli cause unusual additional experiences. For most of us, sensation is diligently separated; eyes for vision, ears for hearing, tongue to taste and so on. Now imagine, every time you eat a chicken sandwich, you hear the musical note of C sharp ring in your ears; Or every time you saw the number 7, it was always red in color. These are examples of two types of synesthesia, the latter most common, called grapheme synesthesia (word-to-color mix-up).

Wait, what if I remember the color red when I see 7? Maybe I was gifted seven red roses as a child, creating a powerful memory linking the two. Am I a synesthete? I wish. Two important differences set synesthetes apart – First, they see every 7 in red, whether it is part of 87, 1739, or 777. Second, no matter when and how they are tested, these extra sensations are very consistent (a tenet of scientific testing). Okay, so what causes synesthesia, and are people born with this superpower?

Not exactly. Although 40% of synesthetes have a synesthete family member, we haven't pinned down a mutant gene that causes it.

One theory of how this happens is by local cross-activation in the brain. Vision is super complex and is handled by the visual cortex, at the very back of our brain. Here, the area that deals with grapheme (numbers and letters) sits right next to the area that responds to color, called hV4! Since they're such close neighbors, this theory asks if a direct cross-activation between them (like cross wiring in a circuit!) can happen in rare individuals, making them involuntarily 'see' a color when shown a number. In fact, a study found some evidence to support this, where synesthetes' brains showed more activation in hV4 when they were shown numbers, compared to non-synesthetes (figure below).

Another theory proposes that unusual patterns of a process called 'neuronal pruning' could lead to the over activation of some regions in the brain. As our baby brains develop, we actually start with more neuronal connections than we need as adults! So, some of these connections are cut off during development. If this pruning goes awry, excess connections remain and run havoc in the brain, signaling to unwanted neurons and activating their corresponding functions.

Of course, these are two theories among many. Neither of them explains synesthesia fully, nor do we know which one is accurate. Since the brain is so incredibly complicated, many brain mechanisms possibly work in parallel to produce these effects.

While the mystery of synesthesia is remains unsolved, this much seems true - many synesthetes wouldn't trade their creative and colorful brain for the world!

Reference

Hubbard and Ramachandran, V.S. (2005). Neurocognitive Mechanisms of Synesthesia. *Neuron* 48, 509-520.

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About the author

I am Swathi Suresh, a postdoctoral fellow at Mount Sinai, studying some of the molecular underpinnings in Alzheimer's disease. My interest in Neuroscience spans a range of topics, including neurogenesis, inflammation, and their relevance to pathological conditions, such as Alzheimer's and Huntington's disease.