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Synesthesia: The Sounds of Colors, Tastes, and Smells—Opinion Editorial by Douglas L. Beck, AuD

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Every now and then, as I read neuroscience books, and sometimes while reading popular science magazines and journals, I've stumbled across "synesthesia." It never made much of an impression on me. It was always sort of an oddity that I hoped to one day learn more about. Recently, I read a new book, *Embracing the Wide Sky*, by Daniel Tammet (2009). I have to admit, I was impressed. Here's a bit of what I learned. (And to be fair, as I needed a title for this article and because I'm an audiologist and because this article is for the American Academy of Audiology, I came up with "Synesthesia: The *Sounds* of Colors, Taste and Smells," but clearly synesthesia is not just about *sounds*).

People who have synesthesia perceive one sensation as another. For example, while thinking about numbers, they may perceive or recall numbers as having colors or shapes. They may perceive music as colors, textures, or shapes. Perhaps a particular word elicits a specific taste or smell. Wikipedia (2009) reports more than 60 types of synesthesia. The actual prevalence is unknown but may be as high as 1 in 25 (Wikipedia) to perhaps 1 in 2,000 (Sacks, 2008, page 179). Synesthesia appears to have a strong familial preponderance.

Of course, for the people with synesthesia, whatever they perceive is what they perceive. Perception is reality (duh). In other words, if you were to perceive red as blue, and blue as red, yet you always named the colors correctly (in accordance with everyone else) how would you know your perception was different from everyone else's? It seems this would be very difficult to realize, unless you compared notes with friends or colleagues based on your unusually good (or bad) performance in particular areas such as math, science, music or art, and then the "aha !" moment might occur.

Okay, then, back to Daniel Tammet.

Tammet has been described as one of the world's 100 living geniuses. He has Asperger's, which is a mild form of autism. Tammet describes synesthesia as a "cross wiring of the senses" (page 73). He reports the numbers zero through nine are, to him, different sizes. Tammet speaks 10 languages and he learned to speak Icelandic in one week. In March 2004, Tammet recited the mathematical constant Pi from memory, to 22,514 digits (page 57) after studying for weeks and while perceiving the numbers as multidimensional colors, shapes, and textures. To him, the numbers appeared as a "rolling numerical panorama" or as a "visual song." Among the many amazing aspects of Daniel Tammet's mind, is that despite his numeric recall, he cannot recall faces as well as most people. Tammet states the difference between the savant's memory and the normal memory is not so much "how" we remember, but "what" we remember. His book offers amazing insight into memory. For example, he states there is no one "memory" location within the brain. Rather, different parts of memory are stored in different parts of the brain. When we remember, we reconstruct the thought from here and there. That is, memory is a reformulation, not a replication. Thus, memory is malleable, not fixed and firm and as we all know, memory changes. In addition, speaking of memory, consider that our brains have 100 billion neurons, many of which change over time. However, the *connections* between and among the 100 billion neurons are approximately 1 quadrillion. So when we remember, there are many paths to the information we seek and the route the brain takes to gather those thoughts can (and apparently does) influence the recollection.

Levitin (2006) suggests babies are thought to be synesthetic. That is, babies are unable to differentiate input from specific senses. Levitin reports neuronal clusters may have originally responded equally to sensory

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stimulation via sound, sight, touch, etc. However, as the baby matures, neural pathways are "pruned" and become specialized over time with additional exposure and thought and become dedicated to specific sensory input. Therefore, for most of us, pruning reduces options and directs our sensory input to traditional parts of the brain and common percepts.

However, for those who have had unusual pruning or no pruning, perhaps some of the original percepts are maintained by various or unusual neuronal processes. Recall there are one quadrillion pathways!

Sacks (2008) believes synesthesia is a rare but physiologic-based phenomenon dependent on the cortex and the connections between brain structures. Sacks has had patients who report music as evoking colors and shapes. Other patients have reported days of the week as having their own colors and Sacks reports a patient who responded with specific tastes to certain musical scales and keys. Sacks also reports on a psychologist who has colors and shapes evoked from car horns, thunder, animal sounds, and voices. Like Levitin, Sacks reports that we are born with "hyperconnectivity," which is pruned quickly within a few weeks or months after birth (page 193).

In a new *Medical News Today* report (February 8, 2009) the authors report that the *American Journal of Human Genetics* has a new article in their February 5 edition, which reportedly identifies specific chromosomal regions linked to auditory-visual synesthesia. *Medical News Today* reported synesthesia is present in less than 1 percent of the population and chromosome 2 has the strongest linkage to synesthesia. Interestingly, that particular chromosome is also highly associated with autism.

Douglas L. Beck, AuD, Board Certified in Audiology, is the Web content editor for the American Academy of Audiology.

For More Information, References and Recommendations:

Wikipedia https://en.wikipedia.org/wiki/Synesthesia (February 28, 2009)

American Synesthesia Association www.synesthesia.info/news.html

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