MORE THAN A QUIRK OF THE HUMAN MIND – THE FASCINATING CONCEPT OF SYNESTHESIA

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Brief message

My name is Natalie, and I joined RAMS in May 2020 as a scientific editor. Since then, I have enjoyed writing several articles, as well as the brief message about colour synesthesia. How we individually perceive what is commonly referred to as "reality" has fascinated me for the longest time, especially when we consider that it is slightly different for every single person we meet. Nobody perceives the world just like you. Colour synesthesia is just another form of how these individual differences can come to light, and to me, it is truly a breathtaking phenomenon. Sue me, but the brain is fascinating! I hope you enjoy reading the brief message just as much as I did writing it. And maybe it even gets you to marvel at your very own reality for a little while. I know; it definitely did it for me. Have a fabulous day, and take a step back to admire life whenever you can.

Let us perform an experiment. What do you perceive when I say the following numbers: five, eight, and twenty-three? You might think that sounds silly and be inclined to put this piece away to do something more fun. You might, however, also be one of the lucky few to experience a phenomenon called 'synesthesia'.

Synesthesia describes a condition where one sensory stimulation elicits another unstimulated sensory output, in addition to the output corresponding to the primarily stimulated sense. In easier words, so-called "synesthetes" (people who experience synesthesia) will connect two unrelated outputs. For example, synesthetes can associate visual information (like seeing a particular letter or number) with specific smells or colours [1]. Interestingly, they do so in a reproducible way, so the same letter will always be associated with the same colour. Additionally, the association seems to be unidirectional, so a letter will be connected to a colour, but not the other way around. The field of synesthesia is vast, and there are numerous subforms, ranging from experiencing colours from sounds, specific letters or numbers, to perceiving tastes from phonetic sounds [2-5].

The ability can be either congenital, acquired via neurological conditions, like migraine or thalamic strokes, or it can result from drug ingestion [6-9]. Synesthesia has, furthermore, been described in the case of sensory deprivation, such as blindness [6]. About 4.4 per cent of the population is thought to have congenital synesthesia, although the prevalence differs between the different subforms [10]. Of note, though, the prevalence of this condition in the general population is probably underestimated due to stigmas surrounding the idea that an individual perceives inputs that the majority would not [6]. Strikingly, synesthesia seems to be quite common among people in art-related fields. One study, in particular, determined the prevalence of synesthesia among fine arts students using a questionnaire and found it to be as high as 23 per cent [11]. This is supported by anecdotal evidence of synesthesia in several well-known and impactful artists, like Vincent van Gogh and Wassily Kandinsky [6].

But what are the mechanisms behind synesthesia? While we do not know the pathophysiology exactly, it is most likely due to either direct crosstalk between two brain regions or indirect feedback via a third brain region [12]. Which regions are involved depends on the form of synesthesia an individual has. In the case of grapheme,

referring to letters or numbers, and colour synesthesia, for example, synesthetes show specific brain activity patterns compared to non-synesthetes [13]. Upon hearing audio recordings of graphemes, they display a significantly increased number of connections between six regions associated with colour perception and three so-called 'grapheme regions' ($p<0.024$) [13]. Nonetheless, the anatomical basis of synesthesia remains elusive. Further research will be essential to fully understand the underlying mechanisms, as well as to determine the prevalence of the different subtypes of synesthesia in the general populations.

So maybe, next time when you see colours and shapes appearing in front of your eyes while you are listening to music, you will appreciate your super ability a bit more. Remember, you are not going crazy; you are just special.

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EXAM QUESTION

Question 11

Do you want to test your knowledge regarding neurology? Then, have a look at the exam question below.

The somatosensory cortex is organised in a specific pattern, often depicted as the sensory homunculus. The sensory homunculus is a map that identifies several cortical areas based upon a particular factor. Which factor is this?

A. Frequency
B. Place
C. Proprioception
D. Tonotopy

The answer to this question can be found on page 34 in this journal.