

## Synaesthesia in Autism

Synaesthesia (Greek *syn* – ‘together’ and *aesthesis* – ‘perception’) or ‘cross-sensory perception’ [‘unified senses’, ‘cross-wired senses’, ‘joint sensations’] is an involuntary physical experience of a cross-modal association, i.e. the stimulation of one sensory modality triggers a perception in one or more different senses. To translate it into plain English: synaesthetes see sounds, or smell colours, or taste shapes, or feel sounds on the skin, or hear colours, etc. (The ‘trigger’ is termed as ‘inducer’, and the ‘triggered’ is called ‘concurrent’. For example, hearing certain sounds (inducer) brings the perceptions of colours (concurrent). Most typical inducers are: sounds, digits, letters, words, days of the week, months; and the concurrent experience is most typically related to colour or space (Novich *et al.* 2011). Traditionally, the forms of synaesthesia are presented according to inducer-concurrent pairs, e.g., sound-colour, digit-colour.) Synaesthesia was actively investigated between 1860 and 1930, followed by decades of neglect and recently we witness a revival of interest in this mysterious condition. At present there is an increasing interest in synaesthesia and many new definitions, categories and hypotheses have emerged. (However, there is no unanimous consensus at how synaesthesia is defined, classified and explained).

Although not specific to autism, synaesthesia seems to be quite common among autistic individuals:

*Wednesdays are always blue, like the number nine or the sound of loud voices arguing...Tuesdays are a warm colour while Thursdays are fuzzy (Daniel Tammet [Asperger syndrome]).*

*In the beginning, [the speech therapist’s] presence was just the sound of her voice, which tasted like tamarind pickle. As days passed, her presence became a peacock blue, dipped in the taste of tamarind pickle... (Tito Mukhopadhyay [non-verbal autism]).*

In autism quite common is the form of synaesthesia that produces tactile sensations without the individual being physically touched, for example, looking at something can bring a tactile experience. Or the other way round, when somebody looks (or stares) at them directly, they feel it on the skin. Some autistic individuals experience ‘being touched’ by sounds, i.e. certain sounds are more felt than seen. Lucy Blackman (2001) calls this phenomenon ‘sound-feeling’. Often the skin sensation comes from sounds other people cannot hear. But there are

no strict rules as the experiences, interpretation and response change at different times. Some can be even *hit* by sounds. What is even more interesting, the sound can be both felt on their skin and seen by their eyes simultaneously. Too much noise creates visual chaos – making it impossible to interpret their environment and comprehend what is going on around them.

Synaesthesia is not homogenous and can manifest in different ways; in other words, there are different variations/forms/kinds of synaesthesia. Many synaesthetes have more than one form of synaesthesia.

Different kinds of synaesthesia are classified according to the time they occur, for example:

- *Constitutional synaesthesia* (Grossenbacher 1997) starts very early in childhood, and it is constant during the lifetime. Constitutional synaesthesia is also known as *developmental synaesthesia* (Harrison & Baron-Cohen 1997), *idiopathic*, or *strong synaesthesia*.
- *Acquired or postaccidental synaesthesia* occurs during adulthood as a result of neurological dysfunction, or an accident, or disease.
- There are some other phenomena that some researchers consider as variants of synaesthesia, e.g.: *pain synaesthesia*: when pain is felt in colour (Taber's 1981).

According to the number of senses involved, several classifications have been suggested. For example, Marks and Odgar (2005) distinguish between the *intramodal synaesthesia* (when the inducer and the concurrent are of the same sensory modality, e.g., while reading a printed text, the words are perceived in colour) and the *intermodal synaesthesia* (when the inducer of one sensory modality triggers the concurrent in another sensory modality).

The constitutional synaesthesia can be of two types:

- *Two-sensory* (or *bimodal*) synaesthesia, when stimulation of one sensory modality triggers the perception in a second modality, in the absence of direct stimulation of this second modality. For example, someone may complain about the sour taste of the neighbour's voice. There can be many different combinations of senses. The examples of this type are: coloured-hearing (when a sound triggers the perception of a colour); coloured-olfaction (when a smell triggers the perception of a colour); coloured-tactility (when a touch triggers a colour); coloured-gustation (when a taste triggers the perception of a colour); tactile-hearing (when a sound triggers tactile sensation); tactile-vision (when a sight triggers feeling shapes and textures

pressing the skin); tactile-gustation (when a taste is experienced as a shape); audiomotor (when the sounds of different words trigger different postures or movements of the body etc.)<sup>1</sup>

- *Multiple sensory (or multimodal) synaesthesia*, when more than two senses are involved, i.e. when one inducer evokes simultaneous sensations in several sensory modalities. That's when it gets really complicated. A child may experience the taste of the sound while simultaneously seeing the colour and experiencing tickling sensation on the skin. One individual with autism (cited in Cesaroni & Garber 1991) describes the experience of sounds as 'vague sensations of colour, shape, texture, movement, scent or flavour. It is as if information was received in several modes even though the signal comes from one source.' Jim Sinclair speaks about the colours of voices and the tactility of music.

Examples of seeing colours while hearing sounds in synaesthesia are well known. Some individuals seem to see not only the colours of their acoustic environment but also the density, shape and movement of sounds. E.g.:

*"I could hear nothing but social talk from voices, which slowly formed a collective tunnel around me. I could gradually see the tunnel turning solid around me, as more voices gathered to shape it. Its opaqueness prevented me from seeing the wall or the ceiling or the bouncing energy across the room that I had seen before. I saw myself in that tunnel, within its diameter"* (Mukhopadhyay 2008).

While 'crossing the tunnel' in order to 'see the light and breathe in fresh air', Tito actually crossed the street to come to the door of the house opposite. His mother followed him, and it was her voice that melted the tunnel back into the conventional physical world.

Another major distinction is made between *sensory synaesthesia*, also known as the *lower form of synaesthesia* – occurring on the lower sensory level, and *cognitive synaesthesia* which combines sensory (usually colour) and semantic triggers – when letters/words/numbers are heard or read they are experienced as colours; or numbers are experienced as shapes or form. There is a variant of the cognitive synaesthesia – a *conceptual synaesthesia*: when abstract concepts (e.g., units of time, mathematical operations) are perceived as shapes or colours projected internally or into the environment

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<sup>1</sup> This strange form of synaesthesia seems to be rare. Cytowic (2002) reports one case of an adolescent who positioned his body in various postures according to the sounds of different words (both English and nonsense sounds.) The physician who described this case re-tested the boy (without warning) ten years later and this boy, without hesitation, assumed the identical postures of a decade earlier.

(Carpenter 2001) or, for example, when an arithmetic problem was presented:  $5+2$ , the answer was ‘yellow’ (for 7) (Dixon *et al.* 2000).<sup>2</sup>

One of my first experiences of synaesthesia was during my teaching days at my school for autistic children. I brought some coloured alphabet blocks into the classroom for fun learning. But seven year-old Lena definitely didn’t think this idea was much fun. She grabbed a block and threw it across the room: “The colour is wrong!” “C” isn’t yellow, it’s brown!” More blocks (with Lena’s commentaries) followed the first one.

In his fascinating book *Born on a Blue Day*, Daniel Tammet (2006), an adult with Asperger syndrome describes fascinating ways he perceives numbers and words. He describes experiencing numbers as cities which he can walk through, while the colour of the word depends on the initial letter, for example:

*‘yoghurt’ is a yellow word, ‘video’ is purple (perhaps linked with ‘violet’) and ‘gate’ is green. I can even make the colour of a word change by mentally adding initial letters to turn the word into another: ‘at’ is a red word, but add the letter T to make ‘that’, the word’s colour is now orange. Not all words fit the initial letter pattern: words beginning with the letter A, for example, are always red and those beginning with W are always dark blue (Tammet 2006).*

Some synaesthetes have several forms of synaesthesia, while others – only one form of synaesthesia.<sup>3</sup>

More often synaesthesia is unidirectional: for example, sight may be experienced as touch but touch does not trigger visual perceptions.

Most people with synaesthesia do not complain of their condition because for them it is their normal perception of the world and they are not aware of it causing any disadvantages. Moreover, they often enjoy it and think that losing their unique perception would be upsetting. When asked if they’d want to rid of their synaesthetic experiences, most would say ‘no’, because they see their condition not as a problem/disability but rather as a

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<sup>2</sup> Nikolić (2009) has suggested a new term to describe this phenomenon – ‘ideaesthesia (meaning, ‘sensing concepts’ or ‘perceiving meaning’), because mental activation of a concept or idea is associated with a certain perception-like experience. However, in these forms of synaesthesia, learning seems to play an important role – before one has, e.g., letter/word/number-colour/flavour, etc. So, the triggers are cultural artefacts (numerals, letters, words) which are acquired after extensive experience. In contrast, synaesthetic experiences represent more natural categories which are ‘just there’ in the outside world and which can be understood without cultural education (Meier 2013).

<sup>3</sup> The most famous case of multiple synaesthesia is described by A.R. Luria in *The Mind of Mnemonist* – his detailed observations of Shereshevsky (referred to as S. in the book) who had synaesthesia of a much greater degree than in many other cases – Shereshevsky’s synaesthesia involves at least four senses – sight, sound, taste and touch: he experienced a word’s taste and weight, while simultaneously sensing something oily through his hand, or a slight ticking in his left hand caused by a mass of tiny, lightweight points.

different (and wonderful!) way to perceive the world, and they cannot imagine their life without it.

This leads to the paradoxical conclusion that dysmodularity is not always maladaptive (Baron-Cohen 1996). Though it is true only if synaesthesia is unidirectional, whereas in case of ‘two-ways’ (bidirectional) synaesthesia (when, for example, a synaesthete not only sees colours when he hears sounds, but also hears sounds whenever he sees colours) the individual really suffers from the condition: they can experience stress, dizziness and information overload. Because of this, they may avoid noisy or colourful places, and may withdraw completely. And if a synaesthete has autism (with other sensory problems as well) it becomes harder to deal with sensory overload (Bogdashina 2016; Богдашина 2014); or a child can experience problems with the voice of his communicative partner because the voice hurts or sends flashes of colour that disrupts the understanding. Or the voice may be so pleasant (with pleasurable sensory experiences – colour, movement, etc.) and fascinating that the person cannot focus on the conversation and lose the meaning of verbal utterances, e.g.:

*“[Test in a research laboratory] I was aware that I was supposed to hear what he [Claude, researcher] was reading. I was aware that I would be asked questions... And I was also aware that I did hear. The difference is that I heard his voice more than I heard his words. Claude read. I heard his voice fill up the space between the files... I saw the voice transform into long apple green strings... Claude read. I watched those strings vibrate with different amplitudes... I saw those snapped strings form knots like entangled silk, the color of apple green and yellow. Claude read. I heard his voice and saw its vibrations blowing away those silk threads all over the floor. [When asked what Claude was reading and given a piece of paper and a pencil] I [wrote] about the beauty of the color green, when yellow sunshine melt its way through newly grown leaves. Why did I write that, instead of just writing that I had not listen to his passage? I wanted to be honest in my own way about my experience of this situation, as my perception was interpreting it to me when translated into language” (Mukhopadhyay 2008).*

When Alex (a child with autism and synaesthesia) is in a state of sensory overload, his synaesthetic experiences aggravate his condition (autism) and can lead to ‘panic attacks’ and aggression. After one of these ‘incidents’ he tried to give his explanation of what had happened: *‘In the shop I heard black, then the word broke down into pieces and they*

*entered my eye. I became blind because everything was black.*' At the time I was bewildered with his explanation, and placed his 'reports' into the category 'confusing'. However, in 2011 I came across the account by Brian King, a social worker who is on the spectrum himself, as well as father of three autistic children. King says that when he is listening to someone speak, he can see each word; words scroll through the air in front of him. If someone repeats a word in a conversation Brian sees it in a darker colour; and if his communicative partner emphasises that word while speaking, it literally jumps out at him like 3D. So Alex sees not only colours in response to sounds, but also words (yes, words) when he hears them. If he sees the 'wrong word' (or as he says his 'eyes see the wrong word') we are all in trouble. His panic attack is not far away, and the consequences may be unpredictable.

The research of prevalence shows that from two to five per cent of the population have synaesthesia (Simner *et al.* 2006). Though the fact that synaesthesia does occur in autism is recognized, it is considered to be rare. The analysis of the personal accounts of autistic individuals shows that synaesthesia is not rare in this population and practically all combinations of senses have been found. Probably, the reported low incidence of synaesthesia in autism can be accounted for by the fact that because many autistic children with synaesthesia don't realise that other people cannot, say, hear sounds while seeing colours. To them, it's a normal way to perceive the world. Even very articulate adults with autism find it difficult to express their experiences because they are so different from the 'norm'. And of course, unappreciated...

Synaesthesia is believed to be genetic.<sup>4</sup> Synaesthetic experience is very individual; for example, among people who see coloured sounds there is no specific colour for each sound from person to person. Learning disabilities seem more common in synaesthetes,

There are some general features of synaesthesia, suggested by Cytowic (1995/2002):

- Synaesthesia is involuntary. It is a passive experience that happens to someone. The sensations cannot be suppressed or incurred, though the intensity is influenced by the situation they occur in.
- Synaesthesia is projected into the environment: it is not just in the head but the individual actually sees a sound, hears a sight, etc.; it is perceived externally in peri-personal space, the limb-axis space immediately surrounding the body.

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<sup>4</sup> The most famous case is that of the Russian novelist Vladimir Nabokov's family where both he and his mother perceived letters and words in colour. (Interestingly, they couldn't agree on the colour of letters as their synaesthetic experiences were not identical.)

- Synaesthetic perceptions are durable and generic, i.e. they do not change over time or situation and they are always experienced with the stimulus.
- Synaesthesia is memorable: the synaesthetic sensations are remembered best.
- Synaesthesia is emotional: having this experience causes ecstasy.

Synaesthetes are observed to have uneven cognitive skills. They are reported to prefer order, neatness, symmetry and balance. They are more prone to unusual experiences such as déjà vu, clairvoyance, etc. Among their deficiencies the most commonly reported are right-left confusion (allochiria), poor math skills and a poor sense of direction. Here we can see some similarity between the synaesthetic and autistic features.

One of the most common features of synaesthetes is their superior memory (due to their parallel sensations). Synaesthetes often remember the secondary perception better than the primary one. Some people may forget the name of the person they know but remember the colour, or taste, or even the temperature of the word. This is how Daniel Tammet accounts for his ability to remember words and numbers:

*Seeing words in different colours and textures aids my memory for facts and names... It also helps me to learn other languages. I currently know ten languages... Associating the different colours and emotions I experience for each word with its meaning helps bring the words to life... When I read or think about the word I immediately see the colour in my head, which evokes the meaning (Tammet 2006).*

*...[M]y mind perceives numbers as complex, multidimensional, coloured and textured shapes. Using these shapes, I was able to visualise and remember the digits of pi in my mind's eye as a rolling numerical panorama, the beauty of which both fascinated and enchanted me (Tammet 2009).*

They remember conversations, verbal instructions, movie dialogues, text blocks in books, precise location of objects, furniture arrangements, etc. in every detail.

Cytowic proposes the concept of synaesthesia as the premature display of a normal cognitive process. This implies that we are all synaesthetic, and that only a few people are consciously aware of the holistic nature of perception. Meier & Rothen (2013) have provided empirical evidence that synaesthesia is associated with a distinct cognitive style – a vivid imagery cognitive style. Graphemes involve serial, analytic processing (a verbal cognitive style), whereas colours are visual and involve parallel holistic processing (a visual cognitive style); the combination of a verbal and a vivid imagery visual styles and their ability to switch easily between the two may be the core of the cognitive benefits

related to grapheme-colour synaesthesia.

Many autistic people with synaesthesia cherish their unique perspectives as a valid way to perceive the world around them, e.g.:

*I gain so much beauty and meaning from the way my senses work! My hearing is oversensitive and this is bothersome at times, but I wouldn't change it because I don't want to lose the colors of voices and the tactility of music (Sinclair 1998).*

### [Box:] Some tips : Synaesthesia in Autism

(These are meant only as a very general guide to what to think about.)

#### 1. How to recognise synaesthesia:

These are just a few indicators of possibility of synaesthesia.

##### *Sensory synaesthesia:*

Watch the reactions of the child to sensory stimuli: you can suspect synaesthesia if the person:

- covers/rubs/hits/blinks eyes in response to a sound/taste/smell/touch;
- covers/hits ears in response to a visual stimulus/taste/smell/touch/texture;
- complains about (is frustrated with) a sound in response to colours/textures/scent/flavour/touch;
- makes swallow movements in response to a visual/auditory stimulus/smell/touch;
- complains about (is frustrated with) taste in response to a visual/auditory stimulus/smell touch;
- covers/rubs/hits, etc. the nose in response to a visual/auditory stimulus/taste/touch;
- complains about (is frustrated with) feeling colours/sounds, etc. while being touched;
- complains about (is frustrated with) feeling being touched when being looked at;
- complains about (is frustrated with) backache, etc./heat/cold in colourful/crowded, noisy places with lots of movement;
- involuntary movements/postures of the body in response to a visual/ auditory stimulus/smell/taste.

##### *Conceptual synaesthesia:*

- complains about (is frustrated with) the 'wrong' colours of letters/numbers, etc. written on coloured blocks, etc.
- talks about 'wrong words', 'wrong colours', etc.;
- (when asked where he sees words, numbers, etc.) points in the air in front of him.

There are many more unique experiences and interpretations of the environments which are



hard to categorise as each individual develops their own systems and associations.

2. There are many forms of synaesthesia, which we don't know yet:

Listen to your child, don't dismiss their attempts to explain what they experience. (Many won't talk about it either because they are not aware that their experiences are different from those around them, or because they don't want to be considered 'mad'/'psychic', or because of their communication problems (inability/difficulty to express themselves), or lack of language altogether.

Some synaesthetes have only one form of synaesthesia, while others – several forms and variants of synaesthesia.

3. Different perception:

Most synaesthetes don't complain about their condition because for them, their perception of the world is normal – the colours of voices, tactile experience of music, smells of sounds and many other unique perceptions. The experiences are very real. In many ways, it's an enriched multidimensional experience of the world, leading to creativity and originality of thoughts, insights and expressions.

4. Problems:

'Two-way' (bidirectional) synaesthesia can be overwhelming, resulting in sensory information overload, stress and disorientation – making it impossible to interpret their environment and comprehend what is going around them. If this is the case, it's better to avoid noisy crowded places and/or provide respite from difficult situations. We should remember that the child's synaesthesia can be aggravated by many other sensory problems that can (and must) be addressed.

Some autistic individuals with synaesthesia can be intrigued by the colour and movement of the voice that they are unable to comprehend what the voice is saying and become confused and disoriented in social situations. If you suspect this is the case, talk in small 'doses' (1-2 sentences) and regularly pause to check if the child is 'with you' (following what you are talking about).

5. Strengths and advantages:

It's useful to see synaesthesia as a distinct cognitive style. Seeing sounds/words/numbers in colours, feeling them as textures help them to remember information. Often their secondary perceptions are much more vivid and vibrant than the primary ones; so they provide additional cues to retrieve the information from memory. The combination of a sensory imagery and a verbal thinking styles provide original ways to solve problems.

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Yes, sometimes there are problems, BUT a synaesthetic experience of each autistic person with synaesthesia is a unique (and valid) way to perceive the world they live in. Yes, it's puzzling for many others, BUT they must be puzzled as well – why can't people see the range of colours in a noisy environment or and the words floating between us?

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