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The Discovery of Synesthesia in Childhood

Abstract. Children with synesthesia often become aware of their unusual perceptions when they find out that not everyone has such sensory experience. How do children become aware of their synesthesia and how can educators facilitate and help them in this process? Self-reports of synesthetes, cognitive theories of development, and a number of specific art education projects on synesthesia in primary schools are discussed in this article and some implications for school education systems are drawn.

Keywords: synesthesia; primary school children; art education; aesthetic development; senses; perception.

Synesthesia is not a sheer learned and not a sheer inherited ability to perceive uncommon intersensory phenomena like colored sounds, textured tastes, visual smells etcetera. It manifests itself in early childhood, for instance when children start to learn letters and numbers and perceive some or all of them in distinct colors (cf. Seaberg 2011; Campen 2007; Emrich et al. 2002; Adler & Zeuch 2002; Duffy 2001; Cytowic 2002; Marks 1978).

Here, I will focus on the subjective recalls of synesthetes; how they became aware of their synesthesia in childhood. Then I will reflect on theories

of development of synesthesia in the brain and what types of environments, e.g., art educational projects, mold brain structures. My essay follows three central questions: 1. How do children become aware of synesthetic perceptions? 2. What are the roles of brain development and the environment in this process? and 3. What are the implications of these findings for (art) education in schools?

Children discover synesthesia

In interviews, I have asked grown-up synesthetes what was their first experience of synesthesia that they can recall (Campen 2007). Their answers show that none of them became aware that they were synesthetic in one day; for all, it was a gradual process. Many synesthetes only realize they possess a special ability when they learn that other people do not share their synesthetic perceptions. Johannes Koch describes this in the following anecdote:

> For as long as I can remember, I have perceived vowels in color. I never asked myself if that was normal or not, until one moment during a language lesson in my fifth year of primary school. I don't remember exactly what the lesson was about, but it had to do with words. When it was my turn, I explained that words have colors for me, for instance, that the word "suitcase" (which I had just learned in an English lesson) has a blue-yellow color (*u* is blue and *i* is yellow; *a* is red, but does not play a role in this color experience). My classmates were very surprised and rather unsympathetic, and even the teacher did not know how to react to my confession. She seemed a bit confused at that moment. After a while, she continued with the lesson, and she never returned to the subject. My classmates also were not interested in my colored words. They thought it was weird and did not know what to think of it. For me, the confession was a turning point in my life. From that moment on, I realized that most people do not share my perceptions of colored words.

Types of synesthesia such as perceiving letters and numbers in color can begin to emerge only when children learn to recognize letters and numbers. Obviously, synesthetes are not aware of colored letters or numbers before they learn the symbols. That is an important clue to the understanding of this type of synesthesia. It indicates that perceiving colored words relates to learning symbols. In addition, there is a difference between colored

graphemes (letters) and colored phonemes (sounds of letters). Hearing phonemes in color often starts earlier in life, as Rymke Wiersma recounts:

> I remember very well a moment in the daycare center, when I was three or four years old. We had to make a drawing of a story of love and hate. The result was not much more than some scribbling but I scribbled in well-chosen colors: red for love and yellow for hate. The teacher was very pleased with it, because she said red is the color of love and yellow is the color of hate. I did not express my astonishment to her, but for me, the colors did not match the meaning of the words but rather matched the sounds of the words! I remember telling this story to my little girlfriend at the time and at home to my parents. But it seemed to me they did not understand that the sound of words had colors, which was beyond my comprehension. Later, my parents asked me what color their names were and I could tell them exactly. I still know what colors I stated at that moment; I also remember the times when I was not sure, because some name colors differed from the colors that I associated with the person. For instance, the color of my own name is transparent and silvery, but at the same time, I think of myself as being a deep dark blue. I found it strange that the colors of names did not match my favorite colors, and some name colors I found a bit weird. But that very fact made it clear to me that I was not inventing the name colors. I found it odd that other people did not understand this color thing, though it was a bit special, too—a kind of funny secret world!

Several synesthetes have discovered their gift in childhood in conversations with their mothers. The novelist Vladimir Nabokov (1899–1977) has written about this in his autobiography, *Speak, Memory* (Nabokov 1951; Dann 1999). In general, mothers react two ways. The mothers who are themselves synesthetes are not surprised, but they might dispute the colors reported by the child, whereas the non-synesthete mothers often ask in amazement what the colors of other words are. Judith Palinckx, whose brother and mother are both synesthetes, writes about this:

> I remember that when I was about seven years old, I became really angry with my brother, who is two years older, because he saw the number three in red and the number four as orange, which was exactly the other way around for me. My mother did not see these numbers in orange or in red but rather in very different colors. Her colors, I could understand; but in the case of my brother, I really

> got upset because he saw it the other way around and I could not convince him otherwise. We still see our colored numbers as we did then. As long as I can remember, words have had colors. The big difference between now and then is that I used to think that everyone perceived words this way. Because my mother, and my little sister, too, also saw words this way, they did not react funny to my statements like "I don't know its name, but it's something red." At most, there was some dispute as to what color a name had, but the fact that the name had a color was beyond discussion.

In another example of a mother and son, both synesthetes, David Bisschop Boele tells this story:

> I always had vivid images of the days of the week. I thought everyone else had them, too, but one day, when I said something about it at the dinner table, I learned that my mother had entirely different color associations with weekdays; her colors happened to match those of my youngest brother. My eldest brother had not the faintest idea what we were talking about, so I found out that not everyone has colored weekdays. I don't remember ever mentioning it at school. I found it normal because the majority in my family perceived in the same way; in our family, it was common knowledge. When I asked a cousin about it, he appeared to have it, too, though his mother, my aunt, responded, "I did not know that. Why have you never told me?" He answered, "I thought everyone had it."

Development of synesthesia

What are scientific explanations for the development of synesthesia in childhood? Maurer (1993; Maurer & Mondloch, 2005) argued that the neonatal synesthesia of babies disappears slowly as their senses start to develop. The sensory life in the brain of the newborn presumably has little order to begin with. There is an abundance of neural connections, and everything literally touches everything else, which is why a single sound might evoke images, tastes, and smells all at the same time. As the senses start to specialize into specific domains of perception, the idle neural connections between sensory domains are "pruned." This means that a great number of connections between sense modalities in the brain are eliminated so that specific connections within sense modalities can develop. According to this

theory, most intermodal connections are eliminated in the first six months; the process becomes slower from the ages of one to eleven years.

Brain imaging studies on adult synesthetes (Rouw and Scholte 2007) have linked synesthetic experiences with a more hyper-connected brain-structure, and so, Maurer and colleagues have suggested that the early hyper-connected brains of all children might therefore be accompanied by experiences of synesthesia at that age (Maurer and Mondloch 2005). During normal human development from childhood into adulthood, these abundant connections are slowly pruned away by normal processes of cell-death and elimination of synapses, leaving the average adult with a far fewer connections than the average child. The neonatal synesthesia hypothesis is widely accepted within the synesthesia research community (Baron-Cohen et al. 1996; Simner and Hubbard 2013).

Synesthesia is indeed more common in children (Hall 1883; Galton 1883; Werner 1940; Révész 1923; Lenzberg 1923; Riggs and Karwoski 1934; Marks 1978; Cytowic 2002; Hurley and Noë 2007; Campen 2007). A more recent study looked at the prevalence of one particular type of synesthesia in two age groups (ages 6 and 7 years) and found a trend for greater numbers in the younger age group. It showed there were two-and-a-half times more synesthetes in the younger population of age 6 compared to the older population of 7 years (Simner et al. 2009).

However, the sensory development varies for each child, because each environment is different, and the environment of the child directs the pruning process. This is clearly demonstrated in the case of a congenitally blind child who develops sensory abilities (such as fine-tuned hearing) different from those of a child who is able to see. Brain scans of blind people have shown that the visual cortex is active when they are reading in Braille. Similarly, according to brain researchers, the auditory centers in the brains of congenitally deaf persons show activity in response to visual stimuli (Sur and Leamey 2001; Sur et al. 1988).

Art education projects in primary school

In order to observe "young synesthetes at work," artist Clara Froger and I did a workshop with children between the ages of four and six years in a fine arts project at a primary school in Utrecht, the Netherlands. We converted a gym hall into a multimedia studio with painting tables and audio equipment (Campen and Froger, forthcoming; Campen 2007).

Our intention was to study how children respond spontaneously to music and how they translate these impressions into images. We chose three short pieces of music with different characteristic atmospheres: one calm, relaxed piece with a harp playing and a bird singing; one exciting piece from the *Nutcracker Suite*, by Tchaikovsky; and finally the sweetly soothing *Brahms' Lullaby*. We prepared the children by inviting them to sit in a circle and listen first to one piece with their eyes closed. Then they were free to dance a little to the music in the hall, where we gave them some instruction on how to handle the brushes, paint, and papers (to prevent them from mixing all the colors into one muddy color). Finally, when the children were ready, we asked them to listen to the music and paint whatever they felt, saw, or heard.

About forty children painted more than 120 paintings; some children were eager to do more than one painting for each musical piece. The children responded in very diverse ways to the music. Some painted what they would have painted without music: cars, houses, flowers, trees. One child painted a sky with the typical music symbol of a note with its little flag. However, a number of children painted nonfigurative forms that seemed to reflect the music to which they were listening. Some children even danced while they painted. We observed that the music took over the physical movements of some of the children as well as what they produced in paint on paper. They dotted the brush on the paper to the rhythm of the music or swayed the brush in long sweeps like a waltz as they listened to the music.

Painting to music is an approved method in Russian and West European music education. Continuing the line of research that started in the beginning of the twentieth century in Vienna, where the method of "musical graphic" was invented, Irina Vanechkina and Bulat Galeyev (Vanechkina, 1994) of the Prometheus Institute in Kazan, Russia, conducted a long-term experiment with children: they offered two types of music education programs to two groups of children in primary school. One group was educated traditionally in musical notation and the second group learned to analyze musical pieces with the help of visual aids such as drawing and painting. After the programs ended, not only were the children in the second group more interested in music but they also had a better understanding of it. Five years later, it turned out that the children of the second group had acquired a more profound knowledge of music than the children in the first group.

In Germany, Christine Söffing has organized workshops on color and synesthesia for children and teachers for many years now. In a school project, they have made for instance a synesthetic sensual city map of two districts of Ulm, Germany. The participants of the school projects work with materials (paint, sculptures, musical instruments, and fragrances) that

stimulate different sense modalities; not only color and sound, but also touch and smell. The effect is that teachers and children become aware of synesthetic aspects of perception and the interrelatedness of the senses. Söffing often starts with simple questions to the children, asking for instance if they can hear colors, if they can taste music or if they can feel smells. This represents the beginning of an exploring odyssey through the senses and the children return with synesthetic experiences that are new to most of them (Söffing, et al., forthcoming).

In Belgium, the national institute for art education RASA invited a visual artist, a sound designer, and a fragrances expert to construct a synesthetic space for children in primary school. Prik! (Stimulate! Cf. www.rasa.be) is an installation built in a candy pink painted trailer. The children enter the space on a moving ground covered with a long-haired dark carpet; left and right they are surrounded by gauze curtains where, from time to time, moving objects bump into them. The action is accompanied by fragrances and soft musical sounds. The children are excited by this multisensory playground, and sometimes over-awed, so it was decided to let them walk the space in pairs and hand in hand to feel safe in this new environment. The learning aim of the project, that travels in a trailer by truck through Belgium and visits many schools and educational centers, is to make children aware of their senses, their interrelations, and, in some children, their synesthetic abilities (Campen, in press).

For a long time, we have taught children at school that sensory experiences are separated into five senses according to the Western division, which is based on the exterior characteristics of eyes, ears, mouth, nose, and skin. We do not teach children to follow their own senses and we do not encourage them to explore their multisensory experiences of the environment.

New and experimental art experiences during art lessons are challenges for the brains of young children. Experimental art forms challenge the regular ways of perceiving via the five sensory domains that they have learned in school, and open ways to multisensory perceptions in audiovisual art forms, for example. Experimental art forms have a viable function in helping people find new ways of experiencing and perceiving, including synesthesia. They can help raising awareness of intersensorial aspects of experience in children, which will boost their creativity. Painting music and other intermedia art projects in schools play an important role in the development and awareness of intersensorial perception.

Concluding reflections

What happens in the developing child who interacts with its environment to produce a synesthete? Do synesthetes develop their gift because it provides them with certain advantages in daily life? For instance, is it possible that synesthesia is useful when learning the alphabet or learning to read? Does synesthesia offer a way to process complex impressions?

I would guess that synesthetic children develop their gifts to come to grips with a fast-whirling world full of new impressions, emotions, and symbols (Emrich, forthcoming; Dittmar 2007). I wonder if the school system is not too focused on developing cognitive skills. After all, though it is true that children learn a lot in school, they also unlearn certain skills in school. A more spontaneous (and less rational) development of the senses might teach children how to deal intuitively and instinctively with other people and events in life. In contrast, the rationalization of the senses—the conditioning of the senses as tools that process bits of information in an efficient way—certainly has advantages in subjects such as math and grammar. However, children can have a wider repertoire to use as they become acquainted with the world in which they live. Their senses contain more ways of knowing than the school system may suggest, or allow.

In response to the emphasis on cognitive skills (e.g., memory, attention, planning, language and thinking skills), a number of educators and scholars have been pleading for a better teaching of non-cognitive skills in the curriculum (Heckman and Krueger 2005). Non-cognitive skills include esthetical, emotional and empathetic abilities. The argument is that non-cognitive skills, or 21st century skills, as they are sometimes called, are necessary for young people to succeed in participating in society (Trilling and Fadel 2012).

How can children become aware of synesthesia? One way to begin is to become aware of common sensual correspondences like those in the rhythms in music and film or the correspondences in the "brightness" of the sounds of vowels and colors. Once you have trained children to be aware of these common sensualities, you can start to explore their personal sensualities and perhaps discover their synesthesias.

Synesthetes report that they have become aware of their synesthesias at all stages of life. Some discover their synesthetic gifts as preschool children, some in the years when they learn language and math in school, and some as grown-ups.

Nonetheless, when adults become aware of it, they report that it was already existent in their childhood. When children go to primary school and start to learn cognitive skills such as writing and calculating, their synesthetic gifts seem to subside into the background. The cognitive training asks much of their concentration and energy. Little energy is left to explore their sensory skills. Take, for example, the decrease in drawing skills and imagination at that age, which is reported by teachers and child psychologists alike (Eisner 1979). Learning the letters of the alphabet and counting numbers is an important moment in the development of children and in particular of synesthetes, because, at this phase, the symbols get their solidified colors. It is the earliest age synesthetes can remember consciously when numbers and letters have their particular colors and shapes.

During school years and adolescence, socialization becomes a factor in the awareness of synesthesia. Children do not like to be different from their peers. They do not want to be ridiculed. Announcing that you perceive letters and numbers in color may seem rather deviant in the eyes of other children your age. Little is known of the social processes that influence the awareness of synesthesia. So far, scientists have been more interested in the neurological and perceptual aspects and less in the social development of young synesthetes. Synesthesia associations and informal groups on social media platforms play an important role in supporting young people with synesthesia.

When children go to school, their sensory development is squeezed between the main lessons in cognitive development and the less-valued lessons in physical development. In the end, children are judged in school on their cognitive skills, not on physical and sensory skills. Most schools pay little attention to the sensory development of their children. One study has shown empirically the very low levels of awareness of synesthesia in schools in the UK. In questionnaire responses, only 5% of head-teachers and 29% of learning support educators had heard the term ‘synesthesia’, and only 14% of learning support educators could provide an accurate definition. None of the 21 schools sampled had any systematic provision to identify children with synesthesia or to cater for their educational and/or welfare needs (Simner 2011, in preparation).

The ability of children to know the world not only by means of words and numbers but also by their own senses, let alone the awareness of their synesthetic abilities, is hardly developed at school. Consequently, multisensory development is in effect halted by neglect. Children would benefit from a rebalancing of cognitive and physical-sensory skills in the school program. They would have more opportunities to preserve their synesthetic talents and develop them.

To conclude, I would like to share a type of discussion that I have had several times with parents of children with synesthesia. Parents ask: "My child is a synesthete, should I tell it to the teacher? Will my child be treated "differently", like an outsider?" And I typically answer: You may tell the teacher, but please do not ask for a special treatment. That would make the child into a 'child with a problem'. Teachers should treat children with synesthesia like other children. Every child with synesthesia is different. I recommend them to read personal accounts by adults with synesthesia who reflect on their synesthesia in childhood (e.g., the quotations in the beginning of this article). Self-reports about synesthesia can help teachers and educators to become generally aware of the phenomenon and help them to better understand the perceptions of children, and that will help them to support the children in their mental and sensory education.

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