



Developmental synesthesia, perception, and performance: challenges and new directions in music education and research

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Abstract: In addressing individual differences in the perception of music, this study considers ways in which music education can benefit from new inclusive methodologies. Developmental synesthesia entails one of the many forms of musical perceptual experience that have been overlooked in scholarly literature. Since it drastically impacts behavioural response and performance, synesthesia deserves, like other perceptual modes, a more holistic analysis on the part of research in music education. This study fosters the idea that an inclusive and holistic formation of artists and researchers is fundamental for the future of perceptual multiplicity in the experience of music.

Keywords: Developmental synesthesia. Music synesthesia. Synesthetic music perception. Inclusion/inclusiveness. Music education.

Sinestesia Constitutiva, Percepção e Performance: Desafios e Novas Diretrizes na Educação e Pesquisa em Música

Resumo: Ao abordar diferenças individuais na percepção da música, este estudo considera maneiras em que a educação musical pode beneficiar-se de novas metodologias inclusivas. A sinestesia constitutiva envolve uma das várias formas de experiência perceptual musical que tem sido negligenciadas na literatura científica. Uma vez que ela impacta drasticamente respostas comportamentais e desempenho, a sinestesia merece, tal qual outros modos de percepção, uma análise mais holística da parte da pesquisa em educação musical. Este estudo promove a ideia de que a formação inclusiva e holística de artistas e pesquisadores é fundamental para o futuro das multiplicidades perceptuais na experiência da música.

Palavras-chave: Sinestesia constitutiva. Sinestesia musical. Percepção musical sinestésica. Inclusão. Educação musical.

1. Introduction

Although we all differ in our perception of the world, some individuals experience the environment in especially peculiar ways. Synesthetes certainly fall into that category. Synesthesia is currently defined as an abnormal neurological condition characterized by abundant connectivity between different areas of the brain. It is also commonly referred to as ‘joining of the senses’ in popular culture. It normally involves an outer stimulus, or *inducer*, perceived from the environment. This can be a sound, a letter or a number. The inducer stimulates an inner automatic, consistent, and involuntary synesthetic sensation called a *concurrent*, which can be a particular colour or smell, to name a few. Different types of the condition are classified in synesthesia literature according to the inducer-concurrent pair that characterizes them (e.g., grapheme-colour, grapheme-shape, sound-shape, etc.).

The present paper contemplates developmental synesthesia—the genetically inherited form of the condition—as a unique and relatively uncommon perceptual mode. It fosters the idea that for the individual who manifests this condition synesthesia is a fundamental aspect of perceiving and making sense of the surroundings, and without which the environment may be simply devoid of proper meaning. Since synesthesia as a condition allows for a perceptual engagement with music that is essentially different from that of non-synesthetes, it deserves a specialized analytical evaluation on the part of music education.

This project focuses on developmental synesthesia due to both its genetic component and its early manifestation. This form of the condition provides cases in which cross-talk between normally specialized brain areas is consistent in an individual's experience over a large period of time in proportion to age, as opposed to other acquired forms of synesthesia. Because developmental synesthetes are often exposed to fireworks of sensorial information when engaging with music, this condition influences their experience significantly in both positive and negative ways. Yet, although research on synesthesia has flourished over the last few decades, it has been considerably overlooked in literature on music education. In an attempt to mind this gap, this study discusses how synesthetes engage with and learn music and how synesthesia influences their perception and performance. It also considers innovative avenues in research aimed at more inclusive pedagogical methodologies and techniques in the formation of new musicians.

2. Developmental music synesthesia and its challenges

Since its first account in 1812 (JEWANSKI, 2013), the phenomenon now associated with the term synesthesia has gone from being considered an eccentric curiosity to being referred to as a neurological condition (HUBBARD, 2007: 193). Over the last two centuries the study of synesthesia has slowly and gradually progressed, attracting attention by researchers in psychology, psychiatry, neuroscience, anthropology, and sociology, among many other disciplines. Formal research on synesthesia from musicological and music-pedagogical standpoints, nonetheless, is relatively new and limited in scope. This is surprising since synesthesia often involves music. The present study is rooted in a survey of extant research on synesthesia and begins with attention to some of the challenges music researchers and music educators like myself have encountered in trying to understand and address this neurological condition. It concludes with a consideration on future music-based research on synesthesia.



The recent publication of *The Oxford Handbook of Synesthesia* (SIMNER, 2013), which includes several recent ongoing studies on the topic, highlights the rapidly changing perspectives on synesthesia. It also attests to the fact that it is a relatively unexplored field. Synesthesia is proven to influence music making in dramatic ways, since it impacts performance and behavioural responses. Yet sadly, as a unique condition, music synesthesia still lacks the rigour in approach in its assessment at various stages of music education. As I will discuss in more detail, identifying synesthesia in those students who manifest the condition during early stages of music instruction, may lead to novel ways of addressing it throughout the teaching/learning process. In this sense, research on music synesthesia entails an engagement on the part of music educators, psychologists, researchers, and artists alike.

An important aspect of my research—and even a central motivation for it—is the fact that I am a synesthete. I can attest to the multiple ways this condition has influenced my own experiences of music. Synesthesia plays a very important role in my musical perception and has also proven to be a powerful tool for musical memory and improvisation. However, synesthetic experiences vary drastically in intensity and quality from one individual to another. To some, it can be a disturbing experience, impairing their musical performance and negatively influencing their learning process. Thus, new approaches to how different individuals perceive music, as well as the development of techniques that address these differences specifically, are necessary in the formation of instructors, researchers, and artists. Oftentimes music education still falls short of instructors who are willing to deal with difference in an inclusive way—especially because inclusive approaches are bound to challenge traditional methods and clash with established pedagogical systems.

Music education, not only during early learning stages, but in all levels of instruction up to the post-secondary level, is still heavily rooted in (and often limited to) outmoded teaching traditions and unilateral methodologies that frequently fail to acknowledge diversity of perception. While some of these music education systems may work for most individuals, there are learners who struggle through the pedagogical process and, although they might demonstrate much potential as musicians, fall by the way side. Not enough effort is made to understand the idiosyncrasies of their perception and their individual needs. To be sure much research work has been done in regards to more pronounced cases of altered perception such as autism spectrum disorders and Asperger's syndrome. But students whose perceptual experience differs moderately from those deemed 'normal' by music education standards are often left to struggle.

In my own research of synesthesia I have found that current methodologies of music education are frequently unilateral and exclusive. That is due to the fact that the music education system itself is, in most part, exclusive. In this sense, the best ‘prophylactic measure’ at this point is to develop inclusive methodologies to fight an essentially exclusive system, rather than attempting to change the system itself. Throughout this paper, in briefly demonstrating how some of the traditional music notation and its visual representations can be troublesome for synesthetes, I hope to present developmental synesthesia as but one of a myriad of existing perceptual modes. I also hope to communicate that research, methodologies, and teaching techniques should be flexible and adaptable to these many different kinds of perception. Additionally, while this study is to some extent informed by my own form of the condition, it does not focus on or limit itself to it. To be sure, my research thus far has helped me to understand this phenomenon as it plays out in my own experience. However, my aim is to provide a broader understanding of the experiences of other individuals as well, especially musicians and music students who are synesthetes.

3. New directions in music education

As I have mentioned above, fireworks of synesthetic colour can enhance the musical experience of the synesthete. Oliver Sacks remarks on how composers’ synesthesias influence their creative work positively (SACKS, 2008: 180). However, the condition is not without its negative implications for some individuals. On the bright side, for those with genetically inherited types of synesthesia, the phenomenon is a part of their everyday life and a fundamental aspect of their perception of the world. In this sense, synesthetes may gradually learn how to live with the condition and often report to enjoy their synesthesia (CYTOWIC, 2009: 34). They grow into it throughout their lives. But for those who acquire the condition later in life, it could be a particularly disturbing and overwhelming experience¹ (CYTOWIC, 2009: 243). Researchers have started to look at how synesthesia can negatively affect the successful performance of a given task in comparison to non-synesthetes.

There are several studies that address the issue of improvement versus impairment in performance by synesthetes (PRICE, 2013). The most commonly used test to measure discrepancies in behavioural performance between synesthetes and non-synesthetes is the Stroop Test (CYTOWIC, 2009: 58). This test has been extensively employed in research on types of synesthesia that involve a colour concurrent sensation. The Stroop Test is a practical task that measures whether performance is significantly delayed when the synesthete is exposed to incongruence between his/her synesthetic colour and a real colour. Incongruence



may also happen between two different synesthetic colours. Results have varied in research, showing that depending on the case synesthetes may either have a certain degree of advantage over non-synesthetes, no advantage whatsoever, or disadvantage.

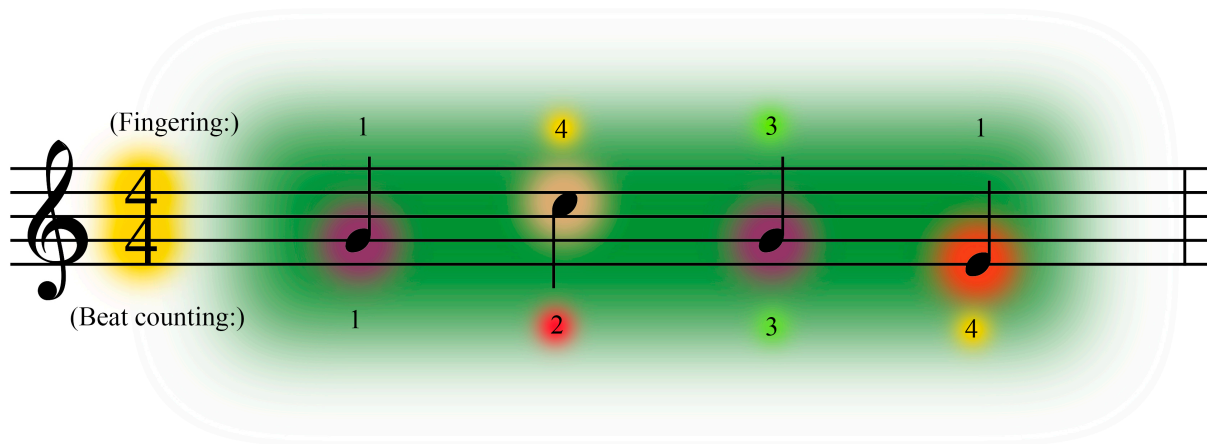
Most studies focus on the usual topic of grapheme-colour synesthesia. In exploring ‘coloured letters’ Sacks reports on how synesthesia affects the experience of one of his subjects both positively and negatively:

When I asked Christine how her synesthesia affected her reading and writing, she said that though she was perhaps a slow reader because of the varied color of letters and words, this allowed her to ‘savor’ words in a special way, a way unavailable to ordinary people. She is fond of certain words because of their colour (blues and greens are especially to her liking), and she feels this may incline her subconsciously to use them in her writing (SACKS, 2008: 188).

Further research on how synesthesia affects behavioural performance in music positively or negatively has yet to be pursued and thus promises a rich range of possibility for interested scholars. For example, there are not many studies, to my knowledge, that have been specifically concerned with synesthetic congruence and incongruence in the perception of music. I have, however, recently started to look into it more closely myself. Thus, it is on the very issue of synesthetic incongruence that I would like to focus attention at this moment, for it is potentially one of the most dramatic ways in which synesthesia can affect a musician.

For practical purposes, I will turn to one of the music synesthesia types that I have studied the most throughout my research work: *notation-colour music synesthesia*—in which any notated symbol may trigger a synesthetic colour. In notation-colour synesthesia concurrent incongruence may take place whenever multiple inducers are involved in the same musical event. Various notated elements often combine to designate a single event: for example, the notated pitch E, played with finger 1, on beat 4, on the D-string. In this example, four different concurrent colour sensations may be perceived almost simultaneously as a result, thus crowding attention with incongruent perceptual information. Different ways of referring to the same musical event or material (‘third string’ as an alternative to D-string, for instance) also may result in incongruent synesthetic colours. As a synesthete, I find it particularly hard at times to verbally refer to fingering, for example, using a number whose synesthetic colour differs from the note to be played.

The following example depicts approximately how I perceive the music event just described, with the visual synesthetic sensations that its elements trigger:



Example 1. Graphic representation of my own synesthetic perception of musical events featuring incongruent colours.

Elements such as individual notes, chords, key, string, fingering, etc., trigger individual colours and are more or less prominent in my phenomenology as I focus attention on them. This example shows that traditional notational indications in a single musical event—especially when combined—may entail conflicting sensorial experiences for a synesthete, thus overloading perception and impairing behavioural response. This can influence performance negatively.

I argue, thus, that synesthetes are prone to experience extra perceptual information, which may significantly influence their ability to succeed in performing a task in comparison to controls (‘normal’ individuals). Additionally, synesthetic perception is in no way limited to visual forms of music synesthesia such as the one just described. In fact other modes of music synesthesia (grapheme-taste, pitch-taste, pitch-colour, etc.) can be involved, creating even more complex perceptual processes.

So far, it is possible to conclude that, although synesthesia can affect performance positively—chiefly among advanced musicians—it may prove to be especially confusing for students at early stages of music education or training on an instrument. Beginners, independently of age, constitute ideal cases for research, since advanced students and professionals with synesthesia who are mature musically are likely to gradually develop individual ways to interact with their condition on a long-term basis. Beginners, on the other hand, are more susceptible to the downsides of synesthetic incongruence, being already prone to struggle with any incongruence at all. They may mistake fingerings for beat counts, notated pitches for fingerings, etc. As a synesthete, I can speak to how challenging administering

incongruence can be, and I have also been able to identify similar struggles and frustrations in a few students of mine.

Methods for beginners on the violin, for instance, such as Leslie C. POTTER's (1990) *Elementary Method*, prove especially challenging for synesthetes. The very first lesson (POTTER, 1990: 2) is characterized by already excessive visual inputs and musical symbols. The page is covered in fingerings, numbers, notes, and other musical instructions. Since *all* beginners struggle with excessive graphical information itself and their relation to the auditory events they signify, teaching from passages like this can be confusing even for the 'normal' beginner. Needless to say, teaching a synesthete from a method like this can be especially troublesome for both the student and the instructor. For a synesthete, every graphical element on the page is likely to trigger a concurrent sensation, thus overloading perception with incongruent information and potentially impairing behavioural response. In teaching synesthetes, it would be necessary to come up with a method that eliminates excessive information at all costs.

I argue that identifying synesthesia during primary stages of musical education would allow for novel ways to address it as a unique perceptual experience. This is to say that, similarly, any and every unusual perceptual modality needs to be assessed and addressed in its own context. I believe that awareness about different perceptual modes and methodological inclusiveness throughout all levels of music education—that is, from its initial stages to the post-secondary level—allow for the formation of musicians and researchers that are likely to display that awareness throughout their own career paths.

4. Final thoughts

Although general studies have been conducted on how synesthesia positively and negatively affects behavioural response, future research has much to do in regard to the condition's implications for music perception and performance. As a phenomenon that can dramatically influence music learning, like other neurological conditions, music synesthesia still falls short of pedagogical techniques that assess it specifically. To be sure, the fact that synesthesia normally does not affect other areas of cognition like other neurological conditions (such as autism spectrum disorders, for instance), may have contributed to a lag in the development of teaching methods and techniques that address it properly. Yet only if studied holistically and also in their own context can different modes of music synesthesia be analyzed and understood correctly. I strongly believe that inclusiveness, adaptability, flexibility, and self-evaluation in designing courses and subjects, as well as in the formation



of musicians, performers, and artists today will yield a generation of researchers that acknowledge diversity and multiplicity in the experience of music.

In any case, since there are other challenges that can pose a stumbling block to research, inclusiveness and awareness are not the only solutions for conditions like synesthesia. For example, finding a consistent and large number of synesthetes that are engaging in musical activity is difficult. This problem is compounded when the consideration aims to work cross-culturally. Access to indispensable equipment such as MRI/fMRI scanners and other laboratorial facilities can be expensive as well. Yet, much as synesthesia is a condition that involves multiple areas of the brain working together, its study will benefit from the cooperation of researchers working in different disciplines. In this sense, I reckon that it is the combination of inclusiveness, interdisciplinary approaches, and access to resources that will positively affect further developments in the study of music synesthesia.

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Notas

¹ CYTOWIC (2009) discusses the negative influences of synesthesia on cognition and performance. See also Jacques Lusseyran’s report of an overwhelming synesthetic experience of music upon the onset of blindness, quoted in SACKS (2008: 194).