Mark Konewko

Audiation and Improvisation as they Relate to Synesthesia in the Organ Music of Olivier Messiaen

Abstract. The purpose of this article is to explore the relationship between audiation, improvisation, and synesthesia in the music of Olivier Messiaen. "When I hear a score or read it, hearing it in my mind, I visualize corresponding colors which turn, shift, and combine, just as the sounds turn, shift, and combine, simultaneously" (Samuel 1986: 37). The function of audiation, synesthesia and improvisation are manifest in the creative procedure of Messiaen's in compositions. Messiaen "audiates" in his compositions the sensation of color. Harmonic configurations that Messiaen utilizes his fashioned Modes of Limited Transposition that dictate particular harmonic colors. For Messiaen and other individuals who have the neurological trait synesthesia, music generates within these individuals a perceived wash of colors. The complexity of neurophysiology and information processing within neuronal networks are considered in this investigation. In view of cytoarchitecture, along with the auditory cognition research and theories of Cook and Baldwin and the concept of improvisation, an exploration of the complex reality of audiation, improvisation, synesthesia, and cognition within the music of Messiaen is explored.
Keywords: audiation, improvisation, synesthesia, cognition, messiaen, composition.

Introduction

The aim of this article is to recognize part of the compositional technique of Messiaen through his audiation of sound and color. Messiaen, through his development of the Modes of Limited Transposition and their direct relations to various colors, paints sonic landscapes. Messiaen, being a fine improvisator on the organ, used the instrument and room at La Trinité to realize his audiations. These improvisations became a release of the sonic material that was in his head. Understanding the cerebral processes of improvisation and synesthesia can add a positive dimension to music and a greater appreciation of the compositional method. Synesthesia, in and of itself, is a complex trait that is not fully understood. There is a brief attempt to clarify the cognitive process of improvisation and the synesthesia trait that some individuals possess.

Audiation

Edwin Gordon developed a music learning theory in 1975 that is based on audiation, where individuals see, hear, and imagine music inside their head. Exercises to sharpen music performance and composition were designed for students in elementary music education. Audiation certainly existed prior to this date as practice for musicians and non-musicians, but it was not formalized as a study until this time. "Audiation is the process of assimilating and comprehending (not simply rehearing) music momentarily heard performed or heard sometime in the past. We also audiate when we assimilate and comprehend in our minds music we may or may not have heard but are reading in notation or composing or improvising" (Gordon 2012: 3). This is the working definition of audiation in this inquiry. This process of "hearing" music in our heads is a common practice when remembering a melody or a musical texture or when a musical squib comes to mind. This concept of adapting or integrating a heard melody is the process of audiation. "In regard to audiating tonal patterns and rhythm patterns in terms of their difficulty level and growth rate in pedagogical procedures, it is recommended that they be considered in accordance with the principles of music learning sequence" (Gordon 1976: 146). At a remedial level both the structures of sonic patterns and rhythmic constructions should be introduced to students on an easy to difficult scale respectively. This gradual introduction to music composition through audiation is crucial. Another very important part of audiation is understanding or realizing music, actual comprehension of music. This analytical quality and inspiration are the roots of composition.

As in language, one function of musical expression is to communicate. The auditory process and the cognition of that process are aligned with music perception and cognition. Gordon states that "We audiate when listening to, recalling, performing, interpreting, creating, improvising, reading, or writing music. Consider language, speech, and thought. Language is the result of [a] need to communicate. Thought is what we communicate. Music, performance, and audiation have parallel meanings. Music is the subject of communication. Performance is the vehicle for communication. Audiation is what is communicated" (Gordon 2012: 5).

These were the basic concepts presented by Gordon and practiced within an elementary school music education model. In 1994, John Kratus conducted rudimentary children's compositions research with children. Along with the work of Roger Sessions (1970: 76), who describes a composer as a person who has "tones in his head" and other studies by Stan Bennett that revealed that children often compose and revise

their musical compositions without the sound being actually present (Bennett 1976), work behaviors specify that audiation is necessary in any creative musical production (Kratus 1994: 116). These references to audiation reinforce the model of creative musical thinking in which tonal and rhythmic imagery are "enabled skills" (Kostagiolas et al. 2017: 126).

Improvisation is included in Gordon's list of what is audiated. According to Gordon, improvisation is a process that embraces the act of improvisation. It is curious that improvisation, which is usually an external phenomenon, is part of the audiation process, which is internal. Indeed, as Baldwin (2012: 51) suggests, "Auditory processing requires the interaction of hearing (a sensory process) and interpretation of the acoustic signal (a perceptual-cognitive process)." Herein lies the foundation of improvisation as an audiated process and its facility to composition.

Improvisation

The American experimental composer and philosopher John Cage once said that he did not believe that improvisation was a technique for composing (Brett 2017). Cage's theory was based on the notion that improvisational material only comes from what the improviser already knows. However, the compositions of Messiaen, profoundly influenced by the improvisation that Messiaen did on the organ using specific pitches, rhythmic elements, and various colors or timbres, were the result of his improvisations that explored novel territories. "Improvisation has played a significant role in Messiaen's musical life, influencing his approach to composition. Indeed, many of his organ works began as extemporizations. His opportunities to improvise at La Trinité provided Messiaen with a compositional laboratory where he could experiment with rhythm, harmony, and melody" (Benitez 2007: 1). In this compositional laboratory, Messiaen was able to realize the previous audiation of melody and harmony he presented in his organ works. But most significantly, Messiaen's fixation with time and eternity was realized in improvisation and the organ, with its ability to sustain sound indefinitely. Thus, the improvisations on the organ allowed Messiaen to audiate in the world of time and eternity. "As an improviser, Messiaen recognized that the organ's seeming power to sustain sound endlessly allowed him to explore relationships between time and eternity by experimenting with duration" (Benitez 2007: 1). This fascination with time led to the development of thematic material within an improvisation, allowing Messiaen to realize an audiated idea of eternity.

As aptly presented in the work of Jackson (2018), musicians who improvise categorize musical structures by developing their functional significance rather than focusing on the localized chord-to-chord progressions. "The improvising musician will see and realize many different representations of music structure including notation with chord symbols that indicat[e] the collection of notes to be played" (Jackson 2018: 68). He continues his discussion regarding musicians, adding that improvisers "have a stronger response to the stimuli with a functional deviant compared to those with an exemplar deviant, as the functional deviant contains novel information, rather than reconfigured information. Result[s] from the behavioral data showed that improvisation experience significantly correlated with quicker and more accurate responses to functional deviants" (Jackson 2018: 69).

The juncture of neural and musical constructions involves cataloguing.

This composite directs one to the prospect of networks with sections of the brain involved in perceptive regulation, such as the anterior cingulate cortex and the medial prefrontal cortex, which are linked to conscious judgment of stimuli, interior incentive and recompense, and conflict checking (Cohen et al. 2000). These positions are specifically situated in intangible neural activity. Expanding the arena to embrace visual stimulus, as much of Messiaen's music does, relates to color, and those cognition zones are correspondingly locatable. "Functional magnetic resonance imaging (fMRI) activation associated with a visual motion perception task was used to characterize local changes in brain activity at baseline and after training" (Chaieb et al. 2014: 195).

Synesthesia and Cognition

Synesthesia is a perceptual phenomenon in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway (Cytowic 2002). Synesthesia is the creation of a sensation that is associated with one bodily sense by stimulation of an alternative sense or part of the body. Chromesthesia, sound to color synesthesia, is experienced by Olivier Messiaen and Mikalojus Kanstantinas Čiurlionis, as by many other musicians and artists such as Vincent van Gogh, Alexander Scriabin, Billy Joel, Tori Amos, Duke Ellington, and Franz Liszt. In fact, 4% of the population experiences

some form of synesthesia. Synesthesia is a joining of sensation. Having one type of synesthesia, like color/sound, increases the chance of having a second, third, or fourth type. It is a trait, not a disorder. The hyperconnection of brain neurons is involved with synesthesia.

Cognition can be understood as moments of ordered configurations of small links of neurons, and less emerging purposes can be understood as the consequence of the hierarchical arrangement of small networks. According to Cook (2002: 5), "three behaviors most clearly distinguish human beings from other animal species – language, tool-use, and music – and all three involve functional asymmetry of the cerebral hemispheres." With magnetoencephalography, both the right and left hemispheres demonstrate diverse areas that are activated with language and musical conditions. The debate over the reality of left-right asymmetries in history has dropped in and out of fashion over more than 150 years (Cook 2002: 8–9). Currently, it is vital for an understanding of human cognition. The supreme complexity of the human mind, to which artificial intelligence is often compared, far outweighs existing artificial intelligence systems. "As complex as the neurophysiology of information-processing in multimillion neuronal networks may actually be, cognition is often considered among the so-called easy problems of the human mind for the simple reason that basic logical functions and memory mechanisms are theoretically well-understood and can be implemented in computers using simulated neurons. … Even the largest, most complex and most expensive artificial systems do not rival the functions of primitive living brains, so that no practitioner of modern AI would claim that anything approaching the full complexity of ant (much less, human) cognition has been implemented" (Cook 2002: 158).

It is curious that both Messiaen and Čiurlionis had this trait of synesthesia. Čiurlionis, also a painter, clearly brought his painting and imagery into his music. Messiaen appreciated painting, but he was taken by the colors that were formed by the sun shining through stained glass. According to Cytowic (1989: 51), "synesthesia represents a fundamental quality of sensation." Early development of children can teach us much about sensation and how cross talk within the brain results in a synesthetic experience. Research suggests that "all neonates are synesthetic, only to lose the trait around the age of three months. One possibility for why the cross talk that produces synesthesia exists is that the normally occurring excess connections are insufficiently pruned for some reason and accordingly persist in the adult" (Cytowic 2018: 225).

Cytoarchitectonic organization describes the nature of the brain and the way it is organized by viewing various sections of the brain as responsible for various sensations and cognitive functions. For example, one cytoarchitectonic method illustrates the cortical mantle sectioned into five forms that exhibit a continuous growth in organizational intricacy and variation. This deportment of the brain would suggest that synesthesia can be localized in a particular area of the brain – taste is in the frontal lobe, whereas color is further back.

Like a metaphor in which seemingly unrelated things have the ability to link other unrelated things, seeing the similar in the dissimilar, sensory coupling, or "cross-talk exists in all brains except most of us are unaware of it. An altered dynamic between excitation and inhibition brings that cross talk to the surface in synesthetes. And synesthesia exists not in any one place but as an event triggered dominate process in a distributed system" (Cytowic 2015). Senses are neither discrete nor compartmentalized.

As Kadosh et al. (2009) suggested, the regular dispersal of linguistic-color associations indicates that synesthesia is recognized in an unlimited number of ways very much comparable to a learning progression. "Current research suggests that synesthesia and cross-modal matching may be a kind of tacit knowledge. Generally, the boundaries between synesthetic and non-synesthetic associations are hard to establish" (Rogowska 2015: 31). For synesthetes, phonemes can stimulate taste or color, and graphemes also can stimulate taste or color. "Metaphors often take the form of cross-sensory associations (Cytowic 2009: 163). Yet non-synesthetes, understand "sharp cheese" or "sweet person" or "what's your taste in music." Movies persuade us to believe that the people on screen are talking when really one speaker behind the middle of the screen, three speakers on each side and a subwoofer create the "impression" that speech comes from those on the screen. Inwardly we are all synesthetes, but outwardly we are unaware of the couplings that are happening all the time.

The standard view of how the brain works is based on the idea that there is a linear flow of information to discrete parts of the cortex, and this is coupled with the notion "that there is a hierarchy which makes the cortex supreme, dominating everything else below it" (Cytowic 1993: 18). The second part of the standard view of the brain is the localization of function. "The occipital lobe is concerned with vision, the parietal lobe with touch, and the temporal lobe with hearing" (Cytowic 1993: 19). There is an elaboration of neural building blocks. "This is how discrete faculties supposedly evolve out of a less specialized brain. That is, with increasing phyletic development the senses should become more physically separated. According to this scheme, synesthesia should not exist" (Cytowic 2002: 220). But it does, and this is because, as Cytowic states, there

are cortical columns of various neurons that are constructed in various layers that "connect" with neighboring columns. "These facts of neuronal organization – vertical and largely local – are hard to reconcile with speculations that synesthesia results from 'connections' or 'cross-wiring,' possibly retained by neoteny, occurring at the border between sensory entities" (Cytowic 2002: 225). It is "these three variables of cytoarchitecture, extrinsic connections, and function that define the cortical area" (Cytowic 2002: 227). It takes more than the standard view of the brain to explain synesthesia. The cross talk between columns of neural networks connecting/communicating with other areas begins to flesh out the workings of synesthesia. The cognition needed to suggest understanding is yet another level of complexity.

Messiaen

In 1986, Claude Samuel spent a significant time questioning and talking with Messiaen. During these conversations, Messiaen spoke freely about his synesthesia. "I am all the same affected by a sort of synesthesia, more in my mind than in my body, that allows me, when I hear music and also when I read it, to see inwardly, in my mind's eye, colors that move with the music; and I vividly sense these colors, and sometimes I've precisely indicated their correspondence in my scores" (Samuel 1986: 40). Messiaen was acutely aware of the audiation he underwent in his compositional process. He stated, "when I hear a score or read it, hearing it in my mind, I visualize corresponding colors which turn, shift and combine, just as the sounds turn shift, and combine simultaneously" (Samuel 1986: 37). Here Messiaen clearly discusses audiation and its relation to synesthesia. These visualized colors correspond to harmonies. "Truthfully, one cannot talk of an exact correspondence between a key and a color; that would be a rather naïve way of expressing oneself because, as I've said, colors are complex and are linked to equally complex chords and sonorities" (Samuel 1986: 42). The complex chords devised by Messiaen come from his musical language, which is rather strict in the choices made in composition.

For Lerdahl, musical grammar consists of two components, compositional grammar and listening grammar. Regarding improvisation, "a natural compositional grammar depends on the listening grammar as a source. Otherwise the various musical functions could not evolve in such a spontaneous and unified fashion" (Lerdahl 1988: 101). The relationship between improvisation and composition is complex to say the least. Jackson articulately presented in his studies on music improvisation: "As music improvisation is a practice that requires the practitioner to negotiate a number of harmonic subspaces as they are pressed against the precipice of time, experimenters have the added challenge of coming up with questions that speak to the neural responses to the act of improvising in expert musician and non-musician groups, and the neuro-structural responses of improvisers in improvisatory and non-improvisatory situations" (Jackson 2018: 23).

La Trinité was a workshop of sonic ideas where Messiaen's improvisations later were controlled and disciplined by the self-imposed methodology employed in his compositional system.

While discussing his Modes of Limited Transposition, Messiaen states, "Mode 2 revolves around certain violets, blues, and violet-purple, while Mode 3, in its first transposition, corresponds to an orange with red and green pigments, to specks of gold, and also to a milky white with iridescent, opaline reflections" (Samuel 1986: 42). These undulating colors that are present in Messiaen's Modes of Limited Transposition become the framework for his melodic development. With the melodic development, seen by Messiaen as a supreme aspect of music, supported by the continuous shifting of colors formed by his harmonies, he paints a masterpiece of colorful music.

Conclusion

Audiation and its relationship to improvisation, composition, and synesthesia is presented in the research of Kratus. According to Kratus (1994: 16), "I view compositional products as fixed, replicable sequences of pitches and duration and compositional process as the fluid thoughts and actions of the composer in generating the product." When Messiaen heard music in his head or went to the organ to improvise with his melodic and harmonic colors, these three elements were the building blocks of his organ compositions. The study of cognition as it relates to synesthesia and improvisation, in many ways, is still in its infancy. The complexity of the neural networks and the cross-wiring that facilitates synesthesia along with the use of improvisation to test or examine sonic possibilities is but one possible approach to composition. Understanding the organ music of Messiaen can lead to a deeper understanding of improvisation, synesthesia, and audiation.

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Audiacija ir improvizacija bei jų santykis su sinestezija Oliverio Messiaeno vargoninėje muzikoje

Santrauka

Audiacija – tai gebėjimas matyti, girdėti, įsivaizduoti skambesį, kartu tai ir kognityvinis muzikos procesas, kuris yra improvizacijos ir jos ryšių su komponavimu pamatas. Oliveris Messiaenas, kaip M. K. Čiurlionis ir dar 4 proc. visos žmonių populiacijos, naudojo ribotų transpozicijų dermes spalvinių garsovaizdžių tapybai. Būdamas puikus vargonininkas improvizatorius Messiaenas gebėjo ištransliuoti harmoninius, melodinius ir ritminius komponentus, tūnančius jo galvoje. *Méditations sur le mystère de la Sainte Trinité* vargonams (1969) yra garsinių idėjų studija, kurioje užrašytos Messiaeno improvizacijos. Vėliau jos buvo sutvarkytos pagal jo paties nusistatytą komponavimo sistemą.

Cerebrinių improvizacijos ir sinestezijos procesų suvokimas padeda labiau įsigilinti į Messiaeno vargoninių kūrinių subtilybes. Sinestezija ir suvokimas – kompleksiniai reiškiniai, kurie iki šiol nėra visiškai aiškūs. Citoarchitektonika (sisteminė neuronų padėtis) nusako smegenų veiklos principus – kokios atskiros smegenų sritys yra atsakingos už skirtingus potyrius ir kognityvines funkcijas. Sinesteziją nulemia anomalinis signalų perdavimas tarp skirtingų neuronų tinklų, atsakingų už įvairius potyrius.

Messiaenas, išgirdęs muziką savo galvoje (taip pasireiškia sinestezijos simptomai), vargonais improvizuodavo melodinėmis ir harmoninėmis spalvomis. Tai ir yra pagrindinė jo vargoninių kūrinių konstrukcinė medžiaga. Suvokimo, sinestezijos ir improvizacijos ryšio studijos yra labai jauna tyrimų sritis, o neuronų tinklų ir sinesteziją nulemiančių jų anomalinių ryšių gretinimas su improvizacija kaip įrankiu garsinėms išraiškos priemonėms tyrinėti yra tik viena iš daugelio komponavimo alternatyvų. Įsigilinimas į Messiaeno vargoninę muziką gali padėti geriau suprasti tiek improvizacijos, tiek sinestezijos, tiek audiacijos subtilybes.