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Music and Synesthesia

Abstracts from a Conference in Vienna, scheduled for July 3–5, 2020

Jörg Jewanski, Sean A. Day, Saleh Siddiq, Michael Haverkamp,
and Christoph Reuter (Eds.)

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Foreword

Synesthesia is a remarkable phenomenon: it unites scientists and artists, scholars and laymen, as well as different disciplines such as neuroscience, psychology, musicology, art history, philosophy, and linguistics. It is 'the' interdisciplinary issue par excellence. This book provides the abstracts of a scientific-artistical conference *Music and Synesthesia* in Vienna, scheduled for July 3–5, 2020, with participants from different countries inside of Europe, from North, Central, and South America, and even from Australia.

We understand synesthesia as a rare neurological trait that causes unusual, often cross-sensory, experiences (e.g., seeing colors when listening to music). This is of interest to a broad range of scholars: neuroscientists, psychologists, musicologists, art historians, philosophers, linguists, as well as artists: musicians, visual artists, poets.

During a first intensive phase of research during the last third of the 19th century, a first international conference on synesthesia took place in Paris, in 1889, as a symposium inside the International Conference of Physiological Psychology. This is more than 130 years ago. Many international conferences were to follow, especially during the last two decades. All of them dealt with many different types of synesthesia. Our idea was to concentrate a synesthesia conference on one single aspect: Music. In its idea of fusing scholars, artists, laymen, synesthetes and non-synesthetes, our conference regarded itself as being in the tradition of Georg Anschütz's concept of his four Hamburg Farbe-Ton-Kongresse (Color-Tone-Congresses) 1927–1936.

To provide a varied concept of our conference, which dealt not only with synesthesia, but also with similar phenomena, we encouraged contributions on

- historical, theoretical, artistical, pedagogical and empirical questions, which deal with the relation between music and synesthesia, the relation between music (and also sound, pitch, accords, timbre) and crossmodal correspondences, commonalities and differences between synesthesia and crossmodal correspondences in the context of music;
- case studies of synesthete composers and performers of music from different genres and cultures: classical, pop, rock, jazz, and especially music of non-western cultures;
- the question how synesthesia can influence the way of composing, interpreting or improvising music;
- mappings between music and the senses in the context of crossmodal correspondences;
- questions about colored hearing;
- questions about synesthesia and crossmodal correspondences in the context of ethnomusicology;
- relations between music (as well as its parameters) and color, even outside of synesthesia and crossmodal correspondences, for example color and notation, color organs, light shows, music and color in (experimental) film.

This book provides the abstracts of the accepted submissions, even if the author was not able to attend the conference or to submit a poster. As an introduction we chose three articles: one about synesthesia in general, one about physiological foundations of hearing and seeing, and one about synesthetic music painting.

We want to thank the sponsors to our conference:

- the FWF (Austrian Science Fund), who provided a grant for the project The History of Colored Hearing from 1812 until 1988. A Bibliographical Study with Special Emphasis on Timbre-Color-Synesthesia for Jörg Jewanski (Lise Meitner Programm, M2440-G28), from which this conference is a part;
- the University of Vienna;

- the International Association of Synaesthetes, Artists, and Scientists (IASAS) with its president Sean A. Day;
- the Spanish foundation artecittà with its director María José de Córdoba Serrano.

Our special thanks go to Sabine Ladislav, the secretary of the Vienna University's musicological department, whose experiences in organizing conferences was an invaluable help for us.

Vienna, March 30, 2020

Jörg Jewanski
Sean A. Day
Saleh Siddiq
Michael Haverkamp
Christoph Reuter

P.S.: Currently, end of March, the novel disease Covid-19 is spreading especially in Europe and governments have begun taking actions to contain it. The University of Vienna is shut down and more and more conferences scheduled for springtime get canceled by the day. At this stage, we hope our conference will take place as scheduled.

FWF Der Wissenschaftsfonds.

universität wien

IASAS INTERNATIONAL ASSOCIATION OF SYNAESTHETES, ARTISTS, AND SCIENTISTS

artecittà FUNDACIÓNINTERNACIONAL

Conference program

Conference venue

Universität Wien
Institut für Musikwissenschaft (Musicological Department)
Spitalgasse 2, Hof 9 (Campus)
A-1090 Wien
Reading Hall 1 & 2 (ground floor)

Executive team

Jörg Jewanski, University of Vienna, Austria
Sabine Ladislav, University of Vienna, Austria
Saleh Siddiq, University of Vienna, Austria
Christoph Reuter, University of Vienna, Austria
Michael Haverkamp, Cologne, Germany
Sean A. Day, International Association of Synaesthetes, Artists, and Scientists (IASAS), Charleston, South Carolina, U.S.
María José de Córdoba Serrano, Fundación Internacional artecittà, Granada, Spain

Friday, July 3

10.00–10.30 Welcoming speeches

10.30–12.00 *Keynote I: Synesthesia*
Richard E. Cytowic (Washington, D.C., US)

12.00–12.30 Break

Music-Color Synesthetes: Case Studies

12.30–13.00 *A red symphony out of the canvas: Exploring the neurophenomenological dimension of music-color/form and music-touch synesthesias*
Helena Melero (Madrid, Spain)

13.00–13.30 *The reflection of synesthesia in the work of four musicians: Joyce Yang, J. J. Sechan, Ben Wolfe, and Aaron Jay Kernis*
Greta Berman (New York, US)

13.30–14.00 *Konstantin Saradzhev's music-related development as a bell-ringer and music theorist as determined by his microtonal pitch-to-color/shape synesthesia*
Anton V. Sidoroff-Dorso (Moscow, Russia)

14.00–15.30 Lunch

Music and Synesthesia: Empirical Studies I

15.30–16.00 *Chromesthesia influences on musically inspired immersive experience design*
Annika R. Johnson, Elise N. Gray, Lance J. Radtke, & Scott A. Bailey (Seguin, Texas, US)

16.00–16.30 *An experimental feedback model of musical development for synesthetes and absolute pitch possessors*
Solange Glasser (Melbourne, Australia)

16.30–17.00 *What happens to the color perception of timbre-color synesthetes if the timbre diminishes or changes step by step?*
Jewanski, Jörg, Christoph Reuter, Isabella Czedik-Eysenberg, Andrea Gantschacher, Jamie Ward (Vienna, Austria & Brighton, UK)

17.00–17.30 Break

Synesthete Visual Artists: Personal Insights

17.30–17.50 *The exploration of sound shape synesthesia and painting collaboratively designed sound*
Timothy B. Layden (London, UK)

17.50–18.10 *Music-to-color-synesthesia in the painted picture: Does every sound have a distinct colored shape and will be represented 1:1 in a painting?*
Christine Söffing (Ulm, Germany)

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Michael Haverkamp (Cologne, Germany)

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Umut Eldem (Antwerpen, Belgium)

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Michael Haverkamp (Cologne, Germany)

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Crossmodal correspondences

12.00–12.30 *Physiology of color and pitch perception*
Saleh Siddiq (Vienna, Austria)

12.30–13.00 *The colors of musical instruments: An intercultural comparison on timbre-color mappings with non-synesthetes in Austria/Germany and in Madagascar*
Jörg Jewanski, August Schmidhofer, & Christoph Reuter (Vienna, Austria)

Music and Synesthesia: Empirical Studies II

13.00–13.30 *What color is a flute? Timbre-color synesthetes in the 19th century: A compilation and evaluation*
Leonardo Capanni & Jörg Jewanski (Paris, France & Vienna, Austria)

13.30–14.00 *Exploring the contemporary listening experiences of synesthetes*
Solange Glasser, Amanda E. Krause, & Margaret Osborne (Melbourne, Australia)

14.00–15.30 Lunch

Postersession

15.30–16.00 Two-minute-presentations of each poster (Reading Hall 1)

16.00–16.45 Reading Posters and Asking Authors (Reading Hall 2)

16.45–17.00 Break

Synesthete Musicians: Personal Insights

17.00–17.20 *Benefits of and distractions due to multiple synesthesias in my attempts at compositions*
Sean A. Day (Charleston, South Carolina, US)

17.20–17.40 *Walking Down the Street: The sequel*
Jasmin Sinha (Aubange, Belgium)

17.40–18.00 *Exploring mirror sensory synesthesia through music: Can a contemporary composition reveal the mirror-touch experience?*
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Peter Stasny (Vienna, Austria)

11.00–11.30 *Vladimir Baranoff-Rossine, Grigory Gidoni, Léon Theremin: Experiments in the field of sound/light/choreography (1920–1930)*
Olga Kolganova (St. Petersburg, Russia)

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12.00–12.30 *Tearing down light art's musical scaffolding: From color organs to art galleries*
Ralph Whyte (New York, US)

12.30–13.00 *The first visualization as a film of Scriabin's Prométhée, directed in 1964 in Russia by Bulat Galeyev: Principles of his interpretation*
Rustem Sakhabiev & Anastasia Maximova (Münster, Germany & Kazan, Russia)

13.00–13.30 *Audiovisual hallucinations in the synesthetic films of Jordan Belson and James Whitney*
Henry Balme (New Haven, Connecticut, US)

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15.00–15.30	*MuVi. An international project on synesthesia and visual music* María José de Córdoba Serrano & Dina Riccò (Granada, Spain & Milano, Italy)
15.30–16.00	*Synesthesia and Digital Perception 2019: The visual music scene and multisensory sound-based practices in Brazil* Sérgio Basbaum (São Paulo, Brazil)
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16.15–17.00	Concluding discussion

Poster contributions

1. *Music-color synesthesia: A sensorimotor account*
   Caroline Curwen (Sheffield, UK)

2. *Translating chromesthesia for non-synesthetes*
   Selma A. Espino, McKay A. Bloxham, Spencer A. Lee, & Scott A. Bailey (Seguin, Texas, US)

3. *Multimedia technologies for the composer's synesthetic experience expression*
   Elena Fatianova (St. Petersburg, Russia)

4. *How synesthesia is used to obtain AIDA: The role of synesthesia in branding female musicians*
   Elke Hager (Vienna, Austria)

5. *In defense of musical 'pseudosynesthesia'*
   Maiko Kawabata (London, UK)

6. *Hearing color: How synesthesia constructs intimacy in Eric Whitacre's 'Alleluia'*
   Samantha Kelly (Los Angeles, California, US)

7. *Amy Beach: Synesthesia and a comparative analysis of colored composition*
   Maris Loeffler (San Luis Obispo, California, US)

8. *From synesthetical ear training to creativity of consciousness*
   Svetlana Malakhova (Moscow, Russia)

9. *Color sings too: The emancipation of color and its role in the development of a visual music expression in 20th century art*
   Maura McDonnell (Maynooth, Ireland)

10. *Musical art and synesthesia: Synergy between smell, color and sound in music*
    Iluminada Pérez Frutos (Granada, Spain)

11. *Symbolist composer Alexander Scriabin: Reception history and his synesthesia: Music analysis for Sonata No. 9 and Préludes op. 74*
    Svetlana Rudenko (Dublin, Ireland)

12. *Colored hearing of two guitar concerts: comparative results*
    Clara Soto (Guanajuato, México)

13. *Znamenny chant as a synesthetic phenomenon*
    Alisa Timoshenko (St. Petersburg, Russia)

14. *When audio is always visual*
    Milja Vanhalen (Finland)

15. *D'Annunzio and Scriabin*
    Luigi Verdi (Rome, Italy)

Introduction

What is synesthesia?

Sean A. Day

Synesthesia is the general name for two sets (or "complexes") of over 77 related cognitive traits. In the first set, "sensorial synesthesia", stimuli to one sense, such as smell, are involuntarily simultaneously also perceived as if by one or more other, additional senses, such as sight and/or hearing. For example, the sounds of musical instruments might make one also see certain colors, each color specific and consistent with the timbre of the particular instrument playing. Or, the taste of espresso coffee could make you also see a pool of dark green oily fluid about four feet away. One highly documented case of synesthesia involved Michael O. Watson, "the man who tasted shapes", who synesthetically felt at or within his right hand shapes and textures corresponding to different flavors—the flavor of spearmint, for example, felt like cool smooth glass columns (Cytowic, 1993).

With the second form of synesthesia, called "ordinal sequence" synesthesia (also known as "cognitive (category) synesthesia"), certain sets of things which individual cultures teach us to put together and categorize (and also usually serialize) in some specific way—such as letters, numbers, or people's names—also get some kind of sensory addition, such as a smell, color or flavor. The most common forms of ordinal sequence synesthesia involve colored written letter characters (graphemes), numbers, time units, and musical notes or keys. For example, the synesthete might see, about a foot or two before her, different colors for different spoken vowel and consonant sounds, or perceive numbers and letters, whether conceptualized or before her in print, as colored; e.g., the letter "a" as pink, "b" as blue, and "c" as green, no matter what color of ink they are printed with.

The word "synesthesia" comes directly from the Greek συν- (syn-) "union", and αίσθησις (aisthesis) "sensation", thus meaning something akin to "a union of the senses". "Synaesthesia" is the British English spelling of the word; in American English, it is often spelled "synesthesia", without the first "a".

Synesthesia is not a disease, nor is it a deficit, in most cases. I tend to refer to synesthesia as a "trait", like left-handedness, or having red hair or green eyes.

So, from a synesthete's point of view, why would the study of synesthesia be important? Investigating synesthesia might benefit the study of other, serious and life-threatening disorders. Synesthesia appears to have some aspects in common with—and thus helps us to understand—such conditions as phantom limbs. There is also indication that synesthesia may have some possible connections or associations with some forms of autism, some types of epilepsies, and migraines. These are unquestionably worthwhile causes to pursue for further research.

However, I feel that one major reason for studying synesthesia frequently and persistently seems to be over-looked: There are a lot of synesthetes out there in the world who live with synesthesia—and with being a synesthete—all of their lives.

Synesthesias are usually talked about in terms of the "inducer", the sensory stimulus or cognitive concept which initiates the synesthetic perception, and the "concurrent", the synesthetic perception itself. Thus, for example, if a synesthete smelled the scent of fresh mown grass, the inducer, he might have an added synesthetic perception of seeing or sensing the color dark purple "in his mind's eye", "concurrent" with perceiving the grass scent. When talking about types of synesthesiae, the standard current practice is to notate things in terms of the inducer first, leading to the concurrent; e.g., for the example just given, "odor to color". So, for example, "sound to flavor" synesthesia would be such that hearing a sound makes one also, in addition, perceive a flavor; not vice versa that the flavor of a particular food item makes one synesthetically hear a sound.

There are currently two main over-arching theories of synesthesia causation. Both incorporate the idea of there being dedicated areas of the brain which specialize in one or more certain specific functions. For example, the visual cortex can be further subdivided so as to note those areas that deal specifically with color processing (called the fourth visual areas, or V4 area), or those areas that deal with motion processing (V5).

The "cross-activation" theory suggests that synesthesia emerges when activity in one region of the brain spills over into another, usually—but emphatically not always—adjacent, region of the brain. The areas do not have to be adjacent as long as there are anatomical connections. The "disinhibited feed-back" theory proposes that synesthesia emerges from a reduction in the level of inhibition along neuronal feedback pathways. Information travels not only "forward" from primary sensory areas to association areas, but also "back" from "higher/later" cortical regions to the "lower/earlier" sensory areas. The rate of feed-forward and feedback fluctuates within a fairly balanced rate most of the time for most people. However, if something disrupts the level of inhibition, then more signals from later stages could influence earlier stages of processing, which would then feed again to later stages, and could even go back-and-forth a couple of times in a loop.

Note that the cross-activation theory and the disinhibition theory are not mutually exclusive. Both processes could occur towards creating different kinds of synesthesia in the same one individual. Further-more, both processes can occur simultaneously in a given individual; thus, you could have synesthesias where both types of information feed are playing off of one another.

It has been proposed by some that all human infants start out as "synesthetes", with any sensory input, whether through the eyes, ears, nose, mouth, skin, or otherwise, producing a mélange of perception which is simultaneously all and one vision-hearing-taste-touch-etc. The senses then differentiate, in part via gradual pruning of connections, beginning at about age 4-6 months, in a process which typically lasts well into the mid-teen years. However, in regards to terminology, this is not quite accurate. "Synesthesia" means a combining of "the senses";

an addition of perceptions from a secondary, "concurrent" mode to the perceptions of the primary, "inducer" mode. Thus, by definition, in order to have "synesthesia", the senses have to be (deemed) already separated. It would be more correct to instead refer to neonates as "mon(a) esthetes" (from the Greek μονο- (mono-) "one" and αίσθησις (aisthesis) "sensation"), having only one sense. Developmental synesthesia thus results from a neotenic retention of aspects of neonatal monesthesia past the maturation point where, for most children, those sensory modes have now separated.

Richard E. Cytowic (1989; see also Cytowic, 2002, pp. 67–70) originally posited eight diagnostic features of neurological synesthesia; synesthesia is:

(1) involuntary and must be elicited;
(2) projected, when visual, about a foot or two in front of a synesthete's face;
(3) durable;
(4) discrete;
(5) generic regarding its perceptions;
(6) memorable;
(7) emotional; and
(8) noëtic.

Cytowic's statement that visual synesthesia is projected (number 2 above) is incorrect, and has been the topic of frequent discussion amongst the synesthete community over the past twenty-some years. From these discussions, it has become quite apparent that the majority (somewhere around 80–85%) of synesthetes who "see things" do so "inside the head", as if the image is projected onto a screen or just "in the mind's eye". Or, for those in this group, there is instead a "feeling of the color"; that is, for example, the sound of middle C on a piano "feels" red. These types of synesthetes have been labeled "associators".

For those who do see things "out there", the images may range from a half meter or less away to fifty meters or more, although most are around the one-half to three meter range. Members of this latter group

of synesthetes are currently commonly called "projectors". It is possible for a multiple synesthete to be both a projector of one or more types and a non-projector (associator) of other types, or even for a synesthete to be both in regards to one type, varying between projecting and non-projecting with situations. Furthermore, although extremely rare, it is even possible for a synesthete to simultaneously both project and associate for the same inducer—with noticeably different concurrents, such as the letter 'A' being red "in the mind's eye" but also projected as green onto the page.

Returning to Cytowic's list of diagnostic features, "Durable" here means that the associations and relationships stay the same. For example, if the sound of a piano is sky-blue, it always has been and always will be that synesthetic color. "Discrete" means that different items have different, distinct synesthetic associations. For example, the written letters 'A' and 'R' might both be synesthetically red, but they will be different shades of red, and will be readily and finely discriminated. "Generic" primarily pertains to synesthetically perceived visual shapes. The shapes are basic geometrics, like circles, triangles, curves, spirals, clouds, or blobs, rather than complex structures such as, say, the Chicago skyline. "Memorable," here, means that the synesthetic experience is very easy to remember; it does not mean that synesthesia improves one's general abilities to remember things, even things within the immediate realm of one's synesthesia. "Emotional" means that a synesthetic experience is usually an emotional one, to some degree; this defining feature has since been somewhat discarded. "Noëtic" pertains to a sort of "of course" feeling; that is, for example, a synesthete might feel that "of course" the sound of a saxophone is neon purple, "of course" the letter 'A' is red, or "of course" the month of December is pastel pink. This defining feature is currently being questioned, but, for the moment, appears to hold.

Regarding these diagnostic criteria, one thing to keep in mind is that synesthetes do not get to choose their associations between things, and which things get associated with which has nothing to do with likes or dislikes, "good" or "bad" or any other emotional aspects. For

example, I like the sound of French horns, but dislike the school bus yellow color they synesthetically evoke. I also like the sound of saxophones, and love the electric neon purple shapes they evoke. That is, likes may go with dislikes, or *vice versa*, or likes may go with other likes, etc. And this is throughout the synesthete's entire life.

What types of music to X synesthesia are there? The majority of people, apparently world-wide, tend to rate higher pitched sounds (that is, a faster rate of vibratory frequency) as being spatially higher, physically smaller, and prettier and brighter than lower pitched (a slower rate of frequency) sounds, which are deemed to be spatially low, big and fat, and darker and uglier.

When one speaks of 'music to color' or other types of music-induced synesthesiae, there are actually many different aspects of music, any one of which might be the given inducer for the particular synesthete in question. For many if not most of such synesthetes, it is the designation of the musical note which gets associated with a color or other synesthetic perception. That is, for example, B-flat = blue, and C-sharp = pink. Those who have this type of synesthesia usually (but not always) also have a 'grapheme to X' type (most typically 'grapheme to color'). Thus, for example, the red color of the letter 'A' transfers over to the note 'A', and, from there, a notation grapheme (e.g., a quarter note, ♩) written on a staff on the line designating 'a' will become red.

Then there are those for whom it is the (absolute) musical pitch itself which determines the synesthetic perception. Here, rather than it being, say, the note E-flat which has a particular color, instead it is the pitch of, say, 440 Hz, whatever that pitch may be called (usually, that is the standard A above "middle C") depending upon different tunings.

A variant on the 'musical note to X' theme is where the musical key determines the synesthetic perception. For example, music in the key of G-major will synesthetically look quite different than music in the key of c-sharp minor. For that matter, even though the key of C-major and a-minor are almost identical (depending upon which minor scale is used), the synesthetic perceptions will nevertheless change upon awareness of the key change.

Somewhat rare are those for whom it is the modality of the music which determines the synesthetic perception. Here, the difference is in whether the music is in, for example, the Dorian or Mixolydian mode or on the 12-tone chromatic scale as opposed to a whole-tone scale.

Another type involved those for whom it is the chord structure which determines the synesthetic perception. Here, the difference is in, say, color, stems from whether the chord is, for example, a major seventh chord or a minor sixth chord. A variant of this involves what inversion the chord is in; for example, while the notes of the musical scale remain the same, there will be a difference between a D7 chord structure D-F#-A-C (with D as the root) and one structured F#-A-C-D (with F# as the bass note).

Then there are those, such as myself, for whom it is the timbre of the instrument(s) playing which determines the color(s) seen. For example, the same musical passage will synesthetically look different if played on a violin as opposed to a saxophone.

The genre of the music in question might also be the synesthetic inducer, for some. In this case, the difference in color comes, for example, from whether the music is a classical waltz as opposed to a 1950s doo-wop, as opposed to ragtime, as opposed to a passage from a Wagner opera.

There is also the situation where individual songs take on a color. With this type, songs of a similar style or genre tend to have similar colors.

If we look at forms of music-related synesthesia which are not grapheme induced but instead are based upon an auditory inducer, there is evidence (Zamm et al., 2013) that a greater than average amount of white matter in the right inferior fronto-occipital fasciculus, a pathway connecting visual and auditory association areas to frontal regions, may be involved. One variant of this type which has been reported (Beeli, Esslen & Jäncke, 2005; see also Hänggi et al., 2008) is 'musical piece to flavor'. An area of the brain which processes tastes lies next to an area which processes music; this gives support to the idea that 'music to flavor' synesthesia works as per what is suggested

by the cross-activation theory (see Hubbard et al., 2011). Other music-related types of synesthesia which exist, but for which we have little information, include music to odor, music to personality, music to spatial location, and music to temperature differences.

References

Beeli, G., Esslen, M., & Jäncke, L. (2005). When coloured sounds taste sweet. *Nature*, *434*, 38.

Cytowic, R. E. (1993). *The man who tasted shapes.* G.P. Putnam's Sons.

Cytowic, R. E. (1989). *Synesthesia: a union of the senses.* Springer.

Cytowic, R. E. (2002). *Synesthesia: a union of the senses* (2nd ed.). Cambridge, MA: MIT Press.

Hänggi, J., Beeli, G., Oechslin, M. S., & Jäncke, L. (2008). The multiple synaesthete E.S. – Neuroanatomical basis of interval-taste and tone-color synaesthesia. *NeuroImage*, *43*, 192–203.

Hubbard, E. M., Brang, D., & Ramachandran, V. S. (2011). The cross-activation theory at 10. Journal of *Neuropsychology*, *5*, 152–177.

Zamm, A., Schlaug, G., Eagleman, D. M., & Loui, P. (2013). Pathways to seeing music: enhanced structural connectivity in colored-music synesthesia. *NeuroImage*, *74*, 359–366.

Physiology of color and pitch perception

Saleh Siddiq

Musical synesthesia mostly concerns pitch and often color. This is an introduction to the physiological foundations of the sensory modalities involved, providing the ground for other contributions to address advanced topics more closely related to synesthesia itself. This contribution offers only a brief introduction to the basics of anatomy and transduction (literature for further reading is provided) before focusing on the basal mechanisms of color and pitch perception.

Anatomy of the eye

Evolution came up with a broad variety of sensory organs sensitive to light to very different extents. They can be divided into two general types: The *compound eye*, as known e. g. from insects, and the *camera eye* (single-aperture eye), as e. g. the human eye (Müller, Frings, & Möhrlen, 2019, pp. 615–617). The human eye is a basically a clear, sphere shaped, gelly structure that catches visible light and converts it to neural information. For comprehensive anatomical descriptions see Paulsen & Waschke (2011, pp. 97–132; English) and Schünke et al. (2009, pp. 142–161; German).

The innermost layer of the eyeball is called the *retina*. It's the light sensitive layer and contains the photoreceptor cells as well as the next two neurons of the visual pathway. The receptor cells count as the first neuron, so called *bipolar cells* as the second and the *ganglion cells* as the third visual neuron. (Schünke, Schulte, & Schumacher, 2009, pp. 152–153). A thorough applied description of the retinal anatomy is given by Remington (2012, pp. 61–93). The eye bears two distinctive types of photoreceptors called *rods* and *cones* (Rogers, 2010, p. 32). Their *outer segment* is a stack of photoreceptive discs (Remington, 2012, p. 64). Rods are receptive to very low levels of illumination. Cones serve at higher illumination levels and, as discussed below, relay color information (Fairchild, 2013, p. 8; Müller, Frings, & Möhrlen, 2019, p. 605). Rods are absent from the fovea centralis with the highest concentration just outside of it and gradually thinning out towards the periphery whereas cones are densely packed in the fovea, experiencing an abrupt drop-off just outside, and being outnumbered by rods in the retinal periphery (Rogers, 2010, pp. 12–13, 33). The *fovea centralis* is a tiny circular dent in the retina. It's the spot of the highest cone density and therefore the spot with the highest visual acuity (Remington, 2012, p. 84; Schünke, Schulte, & Schumacher, 2009, p. 153). Several (up to 130) rods feed one ganglion cell increasing sensitivity at the expense of acuity. In contrast, cones in the fovea only feed a single ganglion cell which thus excels in acuity but lacks in sensitivity (Fairchild, 2013; p. 11; Remington, 2012, pp. 66–67). At the back of the eyeball, off-center

from the eyeball's axis, is an orifice where blood vessels and the axons of the ganglion cells (forming the optic nerve) exit the eye. It is called the *papilla* but is better known as the blind spot of vision (Schünke, Schulte, & Schumacher, 2009, p. 153). So called *horizontal cells* and *amacrine cells* provide horizontal interconnections bundling small retinal areas into so called *receptive fields*. Receptive fields have a central field, one or a few receptors, and a periphery, comprising of the immediate neighbors of the central receptors (Remington, 2012, pp. 81–82). Thus, through receptive fields, ganglion cells receive information from a wider retinal region (Müller, Frings, & Möhrlen, 2019, p. 639).

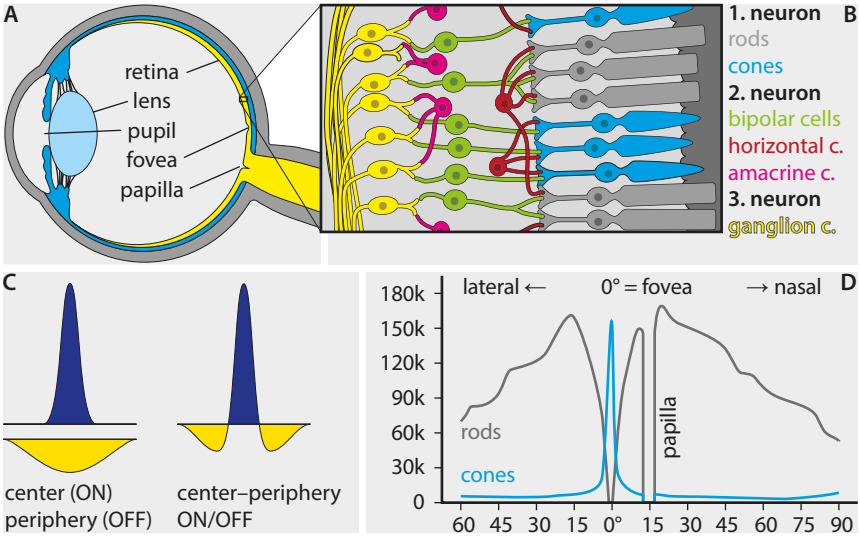


Fig. 1: (A) Topview on right eyeball. (B) Closeup view of retina with photoreceptors, bipolar cells, and ganglion cells. (C) receptive field with ON/OFF central and peripheral reactions (adapted from Rowe, 2002, p. 94). (D) Amount of cones and rods throughout the retina.

Phototransduction

The process of converting electromagnetic energy into neural information is called *phototransduction* (Remington, 2012, p. 79). As discussed above, the receptor cells are organized in receptive fields. The central

receptor has a direct *afferent* (I. e. bottom-up) connection to a ganglion cell and, via horizontal connections, its immediate neighbors are bundled to the same ganglion cell. When light strikes the outer segment of the central receptor, its photopigments start a series of biochemical reactions eventually hyperpolarizing the cell. This reduces the amount of neurotransmitters telling the bipolar cells to modulate their potential (Müller, Frings, & Möhrlen, 2019, pp. 608–609; Remington, 2012, p. 79). At the same time, the adjacent receptors receive negative feedback and thus are depolarized, i. e. inhibited. A receptive field always shows opposite reactions in the center and periphery to any given stimulus (ON/OFF or OFF/ON). In general, the firing rate increases with stimulus intensity, i. e. brightness (Fairchild, 2013, p. 16).

Color perception

The modern theory of color perception involves a first stage of three chromatic receptors (i. e. trichromacy) and a second stage of processing the input into opponent signals. Hence, it is also called a *stage theory* (Fairchild, 2013, p. 20).

Rods are highly sensitive and work well in dark conditions but by no means are true broadband receptors and indifferent to wavelengths. Their sensitivity peaks at short wavelengths around approx. 500 nm (Fairchild, 2013, p. 9; Müller, Frings, & Möhrlen, 2019, p. 612). Subsequent neurons have no way to tell if an increase in response frequency is elicited by increasing intensity or a change in wavelength towards the sensitivity peak at 500 nm (Müller, Frings, & Möhrlen, 2019, p. 625). Consequently, low-light vision (i. e. so called *scotopic* vision) is monochromatic. In bright conditions (*photopic* vision), rods are saturated and cones take over (Müller, Frings, & Möhrlen, 2019, p. 611; Remington, 2012, p. 76). In the human retina, three types of cones are found. Cones adapted to short wavelengths with found sensitivity peaks around 420 nm are called S-cones. Cones adapted to medium wavelengths with found sensitivity peaks between 531 and 534 nm are called M-cones. Cones adapted to long wavelengths with found sensitivity peaks between 564 and 588 nm are called L-cones. At very

short wavelengths around 380 nm, L-cones regain a little sensitivity which is the reason why the upper end of the visible range isn't clear blue but violet. Cones effectively split the information into three chromatic channels (hence, humans are *trichromats*). It is worth noting that the common knowledge thinking of LMS-cones as red-, green-, and blue- (i. e. RGB-)receptors is an unfortunate misconception (Fairchild, 2013, p. 9). Actually, it is irrelevant if the receptor's sensitivity peaks match any specific wavelength. The only necessity are different response intensities between at least two of the three chromatic channels to convey color information (Müller, Frings, & Möhrlen, 2019, p. 627).

The images of the three cones are not conveyed to the brain as separated color channels. Instead, the retinal neurons translate them into opponent color information (Fairchild, 2013, p. 20). For *tri*chromats, the subsequent processing arranges information in *three* opponent color channels. The channels are built by adding or subtracting (i. e. opponent reactions ON/OFF or OFF/ON) the chromatic information. The first channel is a L−M opponent system, effectively a red/green opponent color channel. The second channel adds L+M (red + green = yellow) and contrasts it to S ((L+M)−S) which effectively is a yellow/blue opponent color channel. The third channel adds intensities of all channels (L+M)+S into a luminance (or luma) channel (Rowe, 2002, p. 93). The basis of this opponent color systems are the retinal receptive fields although it remains unclear where along the visual pathway the full-fledged opponent system is actually located (Müller, Frings, & Möhrlen, 2019, p. 640; Rowe, 2002, pp. 95–96).

The opponent color system not only provides a profound explanation of color vision itself but also explains commonly known side effects a pure trichromatic system could not explain. These encompass phenomenons such as (1) why red and green as well as blue and yellow never combine into a single perception, (e. g. a reddish green), (2) simultaneous contrasts (e. g. objects in a red environment appear greener), and (3) after images, although the latter ones might be a result of adaption in

the trichromatic receptors. And last but not least, it explains perception deficiencies such as the well-known red/green blindness (Fairchild, 2013, pp. 19–21; Müller, Frings, & Möhrlen, 2019, pp. 638–639).

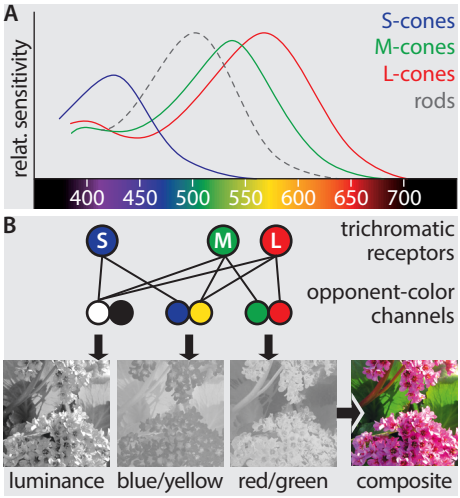


Fig. 2: (A) Sensitivity curves of the photoreceptors. Blue: S-cones, green: M-cones, red: L-cones, grey dotted: rods. The X-Axis indicates light-wavelengths in nanometers (nm, 10^{-9} m). The Y-axis shows the relative sensitivies of the different receptors. (B) trichromatic receptors (SML-cones) provide the basic input for the three channels of color opponent system. L–M (red/green) channel, (L+M)–S (yellow/blue) channel, (L+M)+S (luminance) channel. Together they comprise the composed image we perceive.

Anatomy of the ear

The ear can be divided into three sections: the outer ear, the middle ear, and the inner ear (Schünke, Schulte, & Schumacher, 2009, p. 126). For comprehensive and illustrated descriptions of the the ear's anatomy see Paulsen & Waschke (2011, pp. 133–160; English) and Schünke et al. (2009, pp. 126–141; German).

The inner ear actually consists of two physiologically completely independent organs: the sensory organ of balance and the sensory organ of hearing (Gelfand, 2018, p. 37). The snail-like *cochlea* houses the sensory organ of hearing. For a very profound description of the cochlear anatomy see Gelfand (2018, pp. 37–68) or Yost (2007, pp. 83–120). The cochlea is a convoluted duct, lengthways divided by two membranes, the *basilar membrane* (BM) and *Reissner's membrane*. Both membranes enclose the *endoplymph* filled *cochlear duct* while the outer divisions, the *scala vestibuli* and *scala tympani*, are filled with *perilymph*.

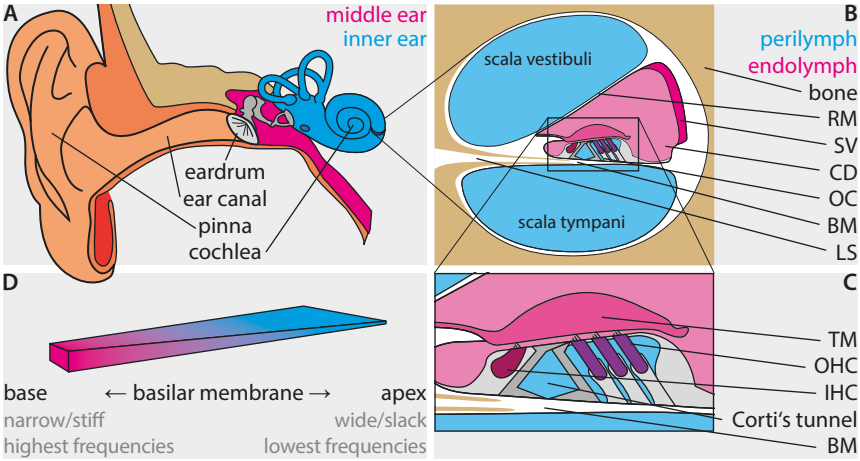


Fig. 3: (A) front view of left ear. Outer ear: pinna & ear canal. Middle ear: eardrum, ossicles (grey), tympanic cavity (magenta). Inner ear (cyan). (B) cross section of the cochlea. RM: Reissner's membrane, SV: stria vascularis, CD: cochlear duct, OC: organ of Corti, BM: basilar membrane, LS: spiral lamina. (C) organ of Corti. TM: tectorial membrane, OHC: outer hair cells, IHC: inner hair cells, BM: basilar membrane. (D) the special anatomic structure of the BM is the basis for its resonance frequency gradually decreasing from the base to the apex.

The BM, medially complemented by a bony shelf called *spiral lamina*, is narrow and stiff at the cochlear basis widening and slackening towards the cochlear tip, the *apex* (Gelfand, 2018, pp. 39–40; Schünke, Schulte, & Schumacher, 2009, pp. 134–136). Therefore, its resonance frequency constantly decreases from the basis to the apex of the cochlea (Yost, 2007, p. 98). In effect, this evenly spreads all audible frequencies along the cochlea from the highest at the base to the lowest at the apex. It's comparable to the piano keys spread on a claviature from high (right) to low (left). This linkage of place and frequency, is known as *tonotopy* (Kemp, 2010, p. 95). Along the edge of the BM lies the *organ of Corti*. It contains the sensory cells. Medially of *Corti's tunnel* lies a single row of sensory cells, hence called the *inner hair cells* (IHC). Laterally lie three rows of *outer hair cells* (OHC). Their head plates, the *cuticular plates*, bear

tiny *stereocilia* giving the notion of some kind of hairstyle, thus "hair cells" (Gelfand, 2018, pp. 42–43). Projecting from the spiral lamina, the *tectorial membrane* (TM) extends over the organ of Corti (Gelfand, 2018, p. 43). The stereocilia of the outer hair cells are attached to th TM while the stereocilia of the inner hair cells are not (Gelfand, 2018, p. 45). The neurons of the *spiral ganglion* are located in a canal inside the base of the spiral lamina. Its dendrites contact the hair cells. Without going into to much detail, IHC are predominantly contacted by afferent fibers and OHC are primarily contacted by *efferent* (i. e. top-down) fibers (Gelfand, 2018, pp. 48–51).

Mechanoelectrical transduction

There is a great deal of mechanical processing going on in the cochlea leading to the excitation of the hair cells that would go far beyond the scope of this introduction. For a compact and detailed description see Gelfand (2018, pp. 95–135) or Yost (2007, pp. 83–120). In short, a wave, known as *traveling wave*, travels up the cochlea (Békésy, 1960, pp. 424–425) to the very point where the stimulus frequency and the BM's resonance frequency match (Yost, 2007, p. 97). The organ of Corti and TM are tilted across their widths by the traveling wave, effectively engaging in a lateral shear movement which bends the stereocilia laterally on upward movement (into the scala vestibuli) or medially on downward movement (Gelfand, 2018, pp. 101–102).

The process of converting mechanical vibrations (i. e. sound) into neural information is called *mechanoelectrical transduction* (Gelfand, 2018, p. 103). The resting position of the stereocilia is upright, leaving ion channels open to a moderate degree resulting in spontaneous activity. Lateral bending opens the ion channels, depolarizing the hair cell via influx from the positively charged endolymph. Medial bending thus closes the ion channels completely leading to hyperpolarization (Gelfand, 2018, p. 103). The ion channels are forced to open and close in synchronicity to the BM movement, resulting in an excitation pattern *phase locked* to the stimulus frequency (Gelfand, 2018, pp. 138; Müller, Frings, & Möhrlen, 2019, p. 519). *Phase locking* is reported for frequencies

up to 5 kHz (Gelfand, 2018, p. 141; Yost, 2007, p. 128). The IHC transmit the sound to the neural system while the OHC act as an optimizer (Yost, 2007, p. 112). The OHC manipulate the BM vibration by changing their own length. They ride the BM much like we ride a swing (Müller, Frings, & Möhrlen, 2019, p. 520). Stretching in phase locally amplifies the vibration while stretching out of phase attenuates it. By shortening the peak along the BM, frequency selectivity is enhanced and by amplifying the peak, the signal-to-noise ratio is increased (Iwasa, 2010, p. 179).

Pitch perception

When concerning with pitch perception at the physiological level, what is usually meant is frequency coding. Frequency coding is based on two complementary mechanisms. The first one is *place coding*. The tonotopic spreading of frequencies across the BM has a two important implications: (1) every frequency resonates at a specific and unique point along the BM. (2) the nerve fibers located at that very spot practically specialize to the one frequency resonating at their site (Müller, Frings, & Möhrlen, 2019, p. 519). All fibers have a frequency they react best to, their *characteristic frequency* (CF). Sensitivity decreases with 25dB/octave to lower and 100db/octave to higher frequencies. This threshold curves are called *tuning curves* (Gelfand, 2018, p. 138).

Since frequencies are spatially spread and every frequency excites different fibers, the fact that a certain fiber is active implies that a frequency is active. In the piano analogy it means every key is assigned a certain pitch and seeing someone striking a certain key bears unequivocal pitch information even without hearing anything (Müller, Frings, & Möhrlen, 2019, p. 519). Tonotopy is robust and available throughout the entire auditory range (Moore, 1993, p. 93). It's also maintained throughout the auditory pathway up to the auditory cortex strengthening the notion it might bear some considerable advantages (Müller, Frings, & Möhrlen, 2019, p. 523). On the downside, frequency resolution is obviously limited to the displacement width on the BM. Place coding cannot explain the frequency resolution of the human ear thus suggesting other mechanisms might be involved (Moore, 1993, p. 93).

The second mechanism is *periodicity coding*. It relies on the phase locking of the neural responses to the stimulus-evoked BM vibration. The inter-spike intervals (ISI) of neural response patterns correspond to the period of the stimulus (Yost, 2007, pp. 126–129). The period is the reciprocal of the frequency. Thus, the neural response contains precise frequency information converted to the time domain. The strong relation of the CF and the phase-locked responses of the fibers are further endorsed by the fact that fibers respond in their CF even to clicks (Gelfand, 2018, pp. 139–144). The periodicity pitch has two advantages: (1) it is very accurate and (2) it could explain phenomena like the so called *residue pitch* (Schouten, 1940, p. 290). The disadvantage is the upper limit of phase locking at roughly 5 kHz, which however agrees with the finding that pitch chroma is discernible for frequencies up to 5 kHz (Gelfand, 2018. p. 300).

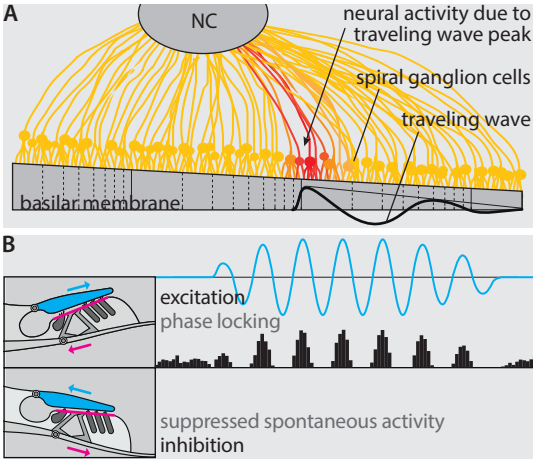


Fig. 4: (A) Tonotopy as basis of place coding. Due to hard wiring, the activity of certain cells bears frequency information. (B) Phase locking as the basis of periodicity coding. Left inserts show the shear movement bending the stereocilia. Excitation on upward movement locks the neural activity (black) to the stimulus (cyan), inhibition suppresses any activity.

Most likely, both, place coding and periodicity coding contribute to frequency coding and thus pitch perception (Gelfand, 2018, pp. 142–143). Up to 5 kHz, periodicity coding dominates. Above that limit, place coding takes over. In agreement with that, above 5 kHz we experience an abrupt deterioration of tonal sensitivity. We are unable to discern

musical intervals, don't get a grasp of melodies and, as stated above, pitch chroma is not heard above 5 kHz (Gelfand, 2018, p. 300; Moore, 1993, p. 94). Fortunately, most relevant musical and everyday sound sources produce fundamentals well below 5 kHz (Moore, 1993, p. 89), so those limitation shouldn't bother us too much.

References

Blauert, J. (1999). *Spatial hearing. The psychophysics of human sound localization*. Cambridge, MA: MIT Press.

Fairchild, M. D. (2013). *Color appearance models* (3rd ed.). Chichester, GB: Wiley.

Gelfand, S. A. (2018). *Hearing. An introduction to physiological and psychological acoustics* (6th ed.). Boca Raton, FL: CRC Press.

Iwasa, K. H. (2010). Electromotility of outer hair cells. In Fuchs, P. A. (Ed.), *The ear. The oxford handbook of auditory science* (Vol. 1, pp. 179–212). New York, NY: Oxford UP. https://doi.org/10.1093/oxfordhb/9780199233397.013.0006.

Kemp D. T. (2010). Otoacoustic emissions and evoked potentials. In Fuchs, P. A. (Ed.), *The ear. The oxford handbook of auditory science* (Vol. 1, pp. 93–137). New York, NY: Oxford UP. https://doi.org/10.1093/oxfordhb/9780199233397.013.0004.

Moore, B. C. J. (1993). Frequency Analysis and Pitch Perception. In Yost, W. A., Popper, A. N., & Fay, R. R. (Eds.). *Human Psychophysics. Springer Handbook of Auditory Research* (Vol. 3, pp. 56–115). New York, NY: Springer.

Müller, W. A., Frings, S., & Möhrlen, F. (2019). *Tier- und Humanphysiologie: Eine Einführung* [Animal and human physiology: An introduction] (6th ed.). Heidelberg, Germany: Springer. https://doi.org/10.1007/978-3-662-58462-0.

Paulsen, F., Waschke, J. (2011). *Sobotta. Atlas of human anatomy. Head, neck and neuroanatomy* (15th ed.). Munich, Germany: Urban & Fischer.

Remington, L. A. (2012). *Clinical anatomy and physiology of the visual system* (3rd ed.). Oxford, UK: Butterworth-Heinemann.

Rogers, K. (Ed.) (2010). *The Eye. The Physiology of Human Perception*. New York, NY: Britannica.

Rosowski, J. R. (2010). External and middle ear function. In Fuchs, P. A. (Ed.), *The ear. The oxford handbook of auditory science* (Vol. 1, pp. 49–91). New York, NY: Oxford UP. https://doi.org/10.1093/oxfordhb/9780199233397.013.0003.

Rowe, M. H. (2002). Trichromatic Color Vision in Primates. *Psychology 17*(3), 93–98. https://doi.org/10.1152/nips.01376.2001.

Schouten, J. F. (1940). The perception of pitch. *Philips technical review 5*(10), 286–294.

Schünke M., Schulte E., Schumacher U. (2009). *Prometheus. Lernatlas der Anatomie. Kopf, Hals und Neuronanatomie* [Prometheus. Teaching atlas of anatomy. Head, neck and neuroanatomy] (2nd ed.). Stuttgart, Germany: Thieme.

Yost, W. A. (2008). *Fundamentals of hearing. An introduction* (5th ed.). San Diego, CA: Elsevier.

Impetus and challenges of synesthetic music painting

Michael Haverkamp

People who observe synesthetic colors and forms while listening to music often try to communicate their own experience by means of painting or use of other media. Various artists and designers refer to synesthetic phenomena as a basis for their ambitious approaches to multimedia arts (Ricco, 2009; Steen, 2013; Van Campen, 2013; Layden & Söffing, 2018). Such artistic transformations of synesthetic perception draw interest from non-synesthetes and scientists who seek insight into these phenomena.

Is it already possible to communicate inner visions to other individuals in an appropriate manner? Which challenges need to be met and which boundaries are in place? And how can artistic value be achieved when the artwork requires creative additions and transformations rather than precise depictions of subjective content? Obviously, synesthetic art needs to deliver more than simple decal pictures of the artist's inner vision.

Figure 5 outlines the principle processing pathways of auditory and visual processing in a very simplified manner in order to discuss the key questions. The sensory processing depends on basic physiological processing and Gestalt formation (Bregman, 1990). Due to the complexity of auditory processing the perceived content can neither be simply

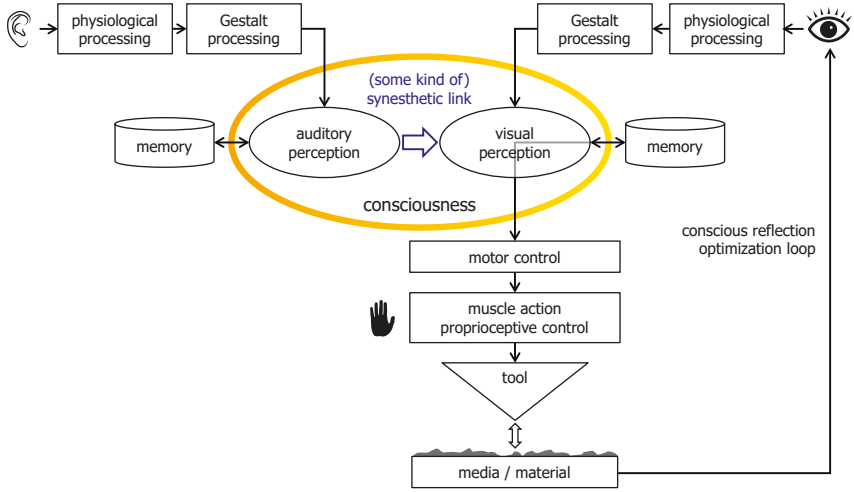


Fig. 5: A simplified process chart of auditory-visual synesthetic art. Auditory stimulation triggers visual synesthetic sensation. This is translated into muscle activity for tool handling, which manipulates the material. Comparison of the artwork with the imagination is done continuously within the optimization loop.

derived from a musical score nor from physical measurements of sound. Therefore, it is already complicated to precisely describe the stimuli of auditory-visual synesthesia (Haverkamp, 2019). One aspect is the specific holism of hearing, which appears even on the lowest levels of signal processing. As an example, non-linearity of the ear generates additional tones (difference tones), which modify the timbre of combinations of tones with adjacent frequencies, according to the frequency difference (Zwicker, 1990). The resulting specific sound of various intervals is not less than the crucial base of human interest in music.

While it is clear that synesthetic painting can only refer to auditory signals which pass the lower levels of physiological processing, psychoacoustic properties and principles of Gestalt formation essentially influence the content of musical images. In order to approach the challenges of synesthetic music painting, it is thus crucial to gain a basic understanding of psychoacoustics. Basic concepts such as spectral and

temporal masking, tonality, harmonics, formants and Gestalt principles help to approach a closer understanding of the final stimuli which are available to trigger visual perception (see e.g. Roederer, 1973; Moore, 2003).

Besides genuine synesthesia, other types of cross-modal interactions such as correspondences and associations (iconicity) influence visual perception. Without detailed questioning of the individuals who draw synesthetic pictures it is nearly impossible to distinguish those different processes from synesthesia in the narrower sense. Specific features of images, however, point in the direction of genuine synesthesia. The absence of any correlating features (correspondences) or iconic elements may be seen as a clue. Abstract forms and strictly individual colors point towards genuine synesthetic connections.

A further challenge of depicting subjective content depends on the individual's ability to control the artistic activity in a manner that carries the inner vision onto a medium, like a canvas. Motor control abilities contribute to this task, as does the interaction of tool and material. Each medium requires specific treatment, which naturally has an influence on the final result (Haverkamp, 2018). With respect to the specific limitations of materials and techniques, the depiction will require simplifications and transformations. Furthermore, the inner vision can depend on memorized content. In this case it is quite unclear how it relates to the initial perception. Usually, the result of artistic activity is observed and refined via an optimization loop. It is thus unclear how the visual appearance of the artwork may in turn influence the inner vision during the revision process.

A bunch of further questions arises regarding the image formation and technical execution: Shall an exact transformation of each tone be used or instead a free intuitive elaboration? Is it reasonable to use low speed analysis of music recordings or information taken from the music score?

Herewith it is proposed that each approach needs to face the challenge of meaningful simplification. As in all types of artistic work, it is not possible to circumvent the influence of material and techniques on

the result. Furthermore, we might ask what can be concluded regarding the impact of the music style and era of compositions, and the art style used for the visualization itself.

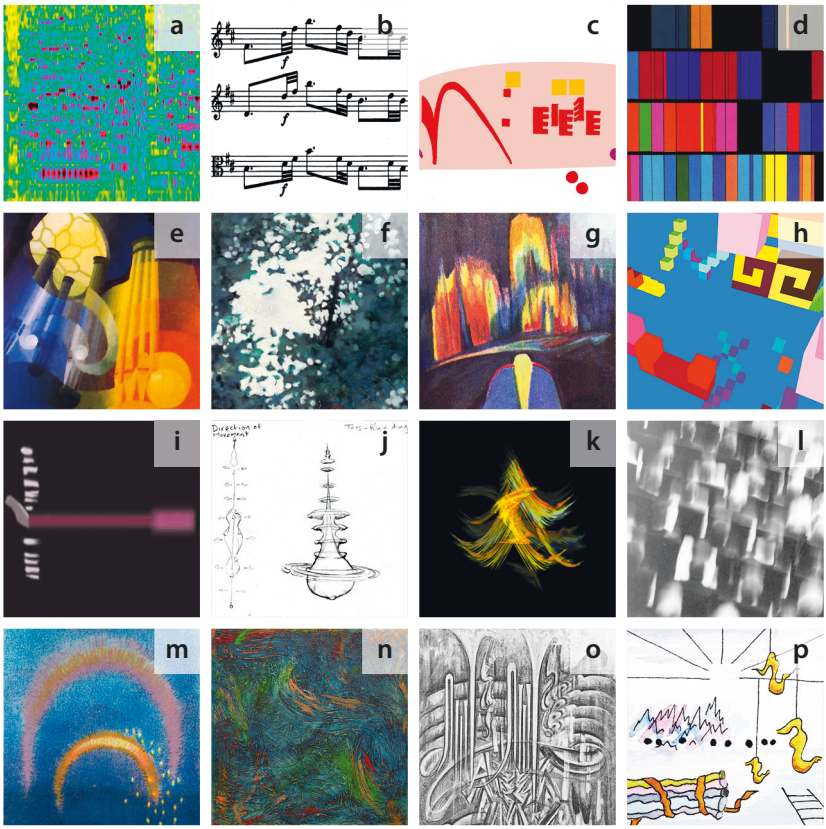


Fig. 6: Examples of visualizations of music and sound, as an approach for classification; a–b: physical sound analysis and music scores; c-d: systematic and mathematical concepts (Rainer Wehinger, Luigi Veronesi); e–h: visualization based on iconic content & correspondences, with supposed contributions of genuine synesthesia (Charles Blanc-Gatti, Ninghui Xiong, Hans Kohn, Michal Levy); i–l: synesthetic depictions of single tones and simple sounds (Matthias Waldeck, Timothy B. Layden, Alexandra Dittmar, Matthias Waldeck); m–p: representation of complex music patterns (Heinrich Hein, Carol Steen, Hugo Meier-Thur, Michael Haverkamp).

Synesthetic art needs to be distinguished from pedagogic approaches, such as musical graphics (e.g., Sündermann, 1981). Concepts based on mathematical equations and algorithms, as well as on associative and symbolic correlations also need to be rated differently.

Figure 6 provides a set of examples of visualizations of music and sound. Images can be derived from physical data (a–d) or show a mixture of presumably genuine synesthetic elements with correspondences and associations (e–h). An example of the pedagogical approach to musical graphics is shown in (g).

Genuine synesthetic depictions can refer to single elements of music and sound (i–l) (Layden & Söffing, 2018), or to complex musical structures (m–p) (Anschütz, 1927). All creators of the pictures (i–p) described their synesthetic perception in detail—the same applies to (f). Complex musical structures may require simplifications and a free arrangement of basic synesthetic forms (o–p). Besides drawing pictures, an appropriate visualization can also be found by selecting images from a set of photographs (l).

Overall, it is evident that synesthesia can be the base of sophisticated art. It needs to be understood, however, that this requires creative transformations and successive artistic development. In the case of genuine synesthesia, forms and colors usually do not occur in harmonious or meaningful combinations. Instead, results of surveys indicate that these elements exist independently of each other. The brain does not care about harmonious color combinations, associative content or color symbolism when generating synesthetic phenomena. The resulting inner vision appears to be highly idiosyncratic and cannot be easily understood by other individuals. Therefore, the application of common criteria to the artistic quality of synesthetic art may fail or lead to negative assessments if an artist simply tends to reproduce their own sensations. Moreover, synesthetic painting of sounds and music requires aesthetic modifications rather than showing precise reproductions, simple "copies" of the subjective imagination.

Finally, any interested reader, whether synesthete or not, is encouraged to gain their own experience with music painting, following Johannes Itten's idea of "subjective experience and objective rationale as pathways to the arts".

References

Anschütz, G. (1927). Untersuchungen über komplexe musikalische Synopsie (Sonderfälle Max Gehlsen, Hugo Meier und Dr. H. Hein). In Anschütz G. (Ed.), *Farbe-Ton-Forschungen* [color-tone-research] (Vol. 1, pp. 67–209). Leipzig, Germany: Akademische Verlagsgesellschaft.

Bregman, A. S. (1990). *Auditory Scene Analysis. The Perceptual Organization of Sound. A Bradford Book*. Cambridge, MA: MIT Press.

Haverkamp, M. (2018). Hugo Meier-Thur – Synesthesia and Life in Black and White. In *Proceedings of the 6th International Congress on Synesthesia, Science and Art* (pp. 109–118). Alcalá la Real, Spain.

Haverkamp, M. (2019). How Does What We Hear Sound? The Qualia Problem in Acoustics. In *Proceedings of the 23rd International Congress on Acoustics ICA* (pp. 1418–1425). Aachen, Germany.

Layden, T. B. & Söffing, C. (2018). Synaesthesia – A Secret Language? Continued Artistic Research on the Shape of Sounds. In *Proceedings of the 6th International Congress of Synaesthesia, Science and Art* (pp. 83–88). Alcalá la Real, Spain.

Moore, B. C. J. (2003). *An Introduction to the Psychology of Hearing*. Amsterdam, Netherlands: Academic Press.

Ricco, D. (2009). Synesthetic Aspects in the Visual Communication of the Music: Mental Imagery and Graphic Representation. In *Proceedings of the 3rd International Congress of Synaesthesia: Science and Art*. Granada, Spain.

Roederer, J. G. (1973). *Introduction to the Physics and Psychophysics of Music*. New York, NY: Springer.

Steen C. & Berman G. (2013). Synesthesia and the Artistic Process. In Simner, J. & Hubbard, E. M. (Eds.), *The Oxford Handbook of Synesthesia* (pp. 671-691). Oxford, UK: Oxford UP.

Sündermann, H. & Ernst, B. (1981). *Klang-Farbe-Gebärde, Musikalische Graphik*. Wien: Anton Schroll.

Van Campen, C. (2013). Synesthesia in the Visual Arts. In Simner, J. & Hubbard, E. M. (Eds.), *The Oxford Handbook of Synesthesia* (pp. 631–646). Oxford, UK: Oxford UP.

Zwicker, E. & Fastl, H. (1990). *Psychoacoustics. Facts and Models*. Berlin, Germany: Springer.

Abstracts

Personal Insights I: Visual artists

The exploration of sound shape synesthesia and painting collaboratively designed sound

Timothy B. Layden

My visual experience of sound has been a defining aspect of my thirty-year art practice. Even before I was aware of the concept of synesthesia, I created drawings of my experience of sound as shapes. I have strong childhood memories of sound and shape as a singular perceptive experience. As a university art student, I found that there was a field of study into the neurological condition of synesthesia. With this discovery I immediately became aware that this condition was part of my own neurological make up.

I freely investigated my experience of synesthesia through visual art and went on to do a postgraduate and doctorate in fine art researching it from theoretical, historical and practical art perspectives, as well as my own experience of it (Layden, 2005). In this I found that there was a broad breadth of experimentation in art, science and philosophy wherein speculation regarding the crossing and mixing of sensory experiences occurred. It appeared to me that there was a strong subjective bent to most of these results; even those that seemed to be rooted in legitimate empirical investigation seemed to result in personal points of view. At the same time, there appeared to be evidence of sensory mixings in outlying neurological conditions causing individuals to have lifelong cross-sensory experiences with a great deal of consistency.

As a personal post-doctoral project, I conducted an in-depth study of my own synesthetic experiences by creating a series of audio recordings of sounds that provoked strong synesthetic responses from me. In this I captured a set of shapes, textures, movements and colours I experienced with particular sounds. I went on to use the results of these experiments to create a series of artworks entitled *The Shape of Sounds* (figure 7).

Fig. 7: *Three Elements*, oil on canvas, 2010, from *The Shape of Sounds* series.

In 2009 I met fellow artist, musician and synesthete Christine Söffing (see next abstract by Söffing: *Music-to-color-synesthesia in the painted picture*), with whom I went on to conduct further research into the shape of sounds that we each experienced, as well as those of other synesthetes and non-synesthetes alike. We asked participants to draw specific sounds to discover whether we could find consistent correspondences in the resulting shapes of their drawings. We discovered quite strong correspondences between our own drawings and were able to make connections between the responses of a range of participants that fell into four categories: synesthete/artists, synesthete/non-artists, non-synesthete/artists and non-synesthete/non-artists. Although our number of participants was not large enough to come to any conclusive results, we did find that the first group, synesthete/artists, had interesting results with notable correspondences (figure 8). This may imply that it is not only the particularities of sensory experiences but also visual communication skills that allowed

for these outcomes; it is possible that more correspondences would be found if participants in our experiments were able to communicate their experiences with more clarity (Layden, Söffing, & Schmidtke, 2015).

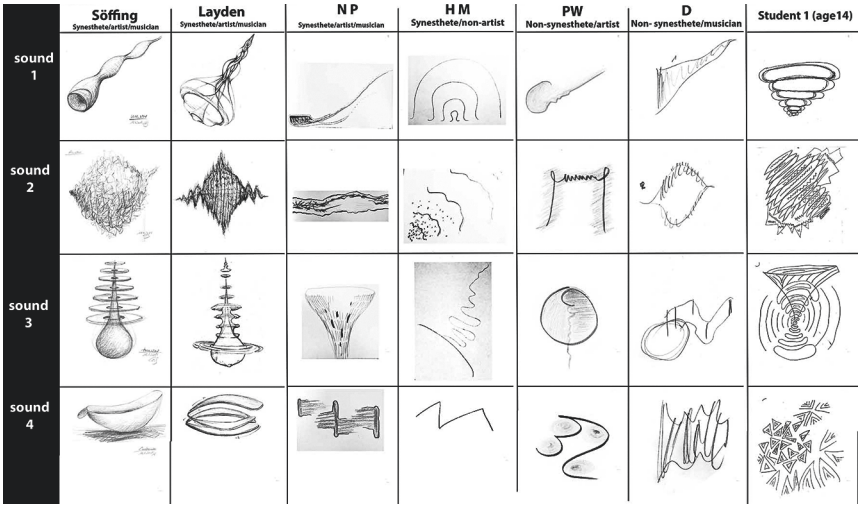


Fig. 8: Comparison of responses to four sounds.

As a personal reflection on these results I found that over time, the more that I engaged in the practice of recording my visual experiences of sound by means of drawing and painting, the more intense and detailed the experiences became.

This brought to mind the idea that it is not merely the perception of sensory input that provokes certain aspects of the sensory experiences but also the level of awareness one places upon sensory experiences. By this I do not want to say that things only happen to us when we make ourselves actively aware of them but rather that much of what we experience can be missed by our conscious mind if our attention is distracted or disinterested.

In 2017, I gained a new opportunity to indulge further in research and exploration of sound-shapes. I had been developing soundscapes

for over a decade as a source for visual artistic experimentation. It had been my practice to seek out and create particular sounds that provoked certain shapes, movements and colours to compose drawings and paintings that I developed in a planned way.

In 2017, I engaged in a collaborative sound project wherein I would not be able to dictate the results. I worked with fellow artist Gary Blake, who suggests he has a sympathetic understanding of the synesthetic experience, which he often works from. Our musical collaboration was to be known as Algae Magnet. Gary would take the sounds that I created, manipulate them and layer new sounds on top of these. We agreed to work primarily from experimental improvisations. Although this began with the aim of creating a purely sound/music based art. I was struck by the unexpected nature of many of our outcomes and the resulting visual responses I got from them. The project soon developed audio visual outputs. These initial experiments did not represent the synesthetic experience of the sounds with precision but created an uncanny sensation of coincidental correspondences.

With the aim of our first album of music, I explored the visual elements of our compositions directly onto a canvas. Listening to hours of complex sound, I sought to discover a gestalt of my visual experience. Being that many of the soundscapes we were creating were thickly layered in a way that I had not previously experienced, I felt unfamiliar with the way the shapes and textures I was experiencing interacted with one another. Much of what I saw manifested as a decomposition of more familiar shapes that created a texture. This often appeared to be undergoing a process of corrosion and decay. Within this texture were more pristine shapes. To create an overall picture, I attempted to capture the transitional state of this experience. The resulting image appears to be a careening collision of shapes that twist and tear at each other surrounded by exploding debris charged with luminous force.

References

Kottlow, M., Praeg, E., Luethy, C., & Jancke, L., (2011). Artists' Advance: Decreased Upper Alpha Power while Drawing in Artists Compared with Non-Artists. *Brain Topography, 23*(4), 392–402. doi: 10.1007/s10548-010-0163-9.

Layden, T. B. (2005). *Aportaciones teóricas y prácticas sobre la sinestesia y las percepciones sonoras en la pintura contemporánea*. Universidad de Barcelona.

Layden, T. B., Söffing, C., & Schmidtke, K. (2015). *Comporando las formas de sonidos: Una investigación artística* [Comparing the Shape of Sounds; an Artistic Investigation]. In Day, S. A., Córdoba Serrano, M. J. de, Riccò, D., López de la Torre Lucha, J., Jewanski, J., & Galera Andreu, P. A. (Eds.), *Actas V Congreso Internacional de Sinestesia: Ciencia y Arte. (Alcalá la Real, 16.–19. Mai 2015)* (pp. 259–268). Jaén: Instituto de Estudios GiennensesArtecitta Foundation, Granada.

Music-to-color-synesthesia in the painted picture: Does every sound have a distinct colored shape and will be represented 1:1 in a painting?

Christine Söffing

Every time when I want to show how a sound looks like, I have to paint this single sound. For a piece of music I have to paint a picture with all the sounds on it. But the sounds are like moving sculptures in time and space. They appear like a sculpture garden. When I hear the sounds at the same time, I see them at the same time. The colored sculptures disappear with the sound.

Normaly in a piece of music there are some sounds, then the next ones are overlapping or with some silence in-between. It is like staying in the night in a sculpture garden with a flashlight, illuminating some sculpture groups here and there. After some time, when doing this for a while, you remember the sculptures on there positions. To paint a piece of music I have to hear this piece again and again, to remember the positions of the coulored sound sculptures. But the sounds are

moving, so the sound sculptures do. That´s why in a painted picture I can show a sequence of the piece like one picture of a film or the most impressing soundsculptures (figure 9).

Fig. 9: Synesthetic picture, triggered by listening to Alexander László, Sonatina für Klavier und Farblicht op. 11, movement No. 1, oil on canvas, 60 × 80 cm, 2004.

Fig. 10: Monteverdi, oil on canvas, 60 × 60 cm, 2005: the red-orange shape shows the voice of a woman singer surrounded by some male voices.

How does this work? Will each sound be converted 1:1 into a colored shape or are the colors or shapes aesthetically changed in the picture?

In this talk I will present two sound examples and I will show exactly how the „music-to-color-transformation" is working in the process from listening the first time till the very end of the process: the painted picture. A first example is the 'László-Project': Alexander László´s Sonatina op. 11 - the blue sounds. A second example is a vietnamese instrument, the *Dan Bao*, with his bright pink sounds.

References

Layden, T. B., Söffing, C., & Schmidtke, K. (2005). Comparando las formas sonidos: Una investigación artística. In Córdoba Serrano, M. J. de, Day, S. A., Julia López de la Torre, L., Riccò, D., & Jewanski, J. (Eds.), *Actas del V Congreso International de Sinestesia: Ciencia Y Arte*. Granada, Spain: artecittà.

Söffing, C. (2009). Farben hören – Töne fühlen. Eine synästhetische Klang-Installation. In *Transfer. Beiträge zur Kunstvermittlung. Nr. 7. DAS UNIVERSUM NEBENAN. NRW-Modellprojekt. Stipendien KWW-Kunst-Wissenschaft-Wirtschaft. Schöppinger Forum der Kunstvermittlung. Schöppingen*.

Söffing, C. (2006). Wenn das Leben grau erscheint, lege ich mir rot-orange-gelbe Musik auf & Die Musik klingt eindeutig blau. In Jewanski, J., & Sidler, N. (Eds.), *Farbe – Licht – Musik. Synästhesie und Farblichtmusik* (pp. 104–109 & 411–414). Bern, Switzerland: Lang.

Particles of sound

Michael Haverkamp

Since the days of my childhood, I have felt that the connections between music and the fine arts are essential. While listening to music, I see forms and colors which are somewhat correlated to the timbre and progression of the music. This also motivates me to play music: free, improvised music on the saxophone and baroque music on flutes. Furthermore, in my main profession, I deal with multisensory perception, sound engineering and design. In memory, music I have heard accumulates in a quasi-static cloud of sound. This corresponds to a still picture into which the individual synesthetic phenomena seen during listening are integrated. Thus, I try to realize depictions of my synesthetic experience through my graphic works, bearing in mind that the result will never be a precise reproduction of perceptual content. Within these synesthetic pictures, however, I try to reflect my spontaneous perception. In my perception, each tone and each sound shows visual aspects. It is thus impossible to depict all of these aspects. Particles of sensation are used instead to focus on the main facets.

The project *Six Little Images of Six Little Symphonies* includes paintings which use synesthetic imaginations as basic elements of artistic configuration. It is based on subjective experiences evoked by listening to the chamber symphonies of Darius Milhaud (1892–1974).

Darius Milhaud composed his brief *Symphonies de Chambre* between 1917 and 1923. Each symphony consists of three movements. The instrumentation varies between mixed chamber orchestra (1-3), tentet of strings (4), tentet of wind instruments (5), and vocal quartet in combination with oboe and cello (6). Those colorful pieces imply a revolution of symphonic composition, in radical contrast to the history of symphonic music from the 18th to the beginning of the 20th century. During those centuries, the development of symphonies showed a continuous increase in instrumental and temporal effort. A summit was reached with Anton Bruckner's and Gustav Mahler's symphonies. Mahler's 8th *Symphony of a Thousand* premiered in 1910. It has a duration of some 80 minutes. *Eine Alpensinfonie* by Richard Strauss premiered in 1915, requiring an optimum number of 129 instruments and a duration of around 50min for performance. Milhaud's pieces contribute to a sharp turnaround, leaving the inflated effort of mammoth orchestras far behind. This is in line with other composers like Arnold Schoenberg and Anton Webern. Even Igor Stravinsky tried to reduce the scope of instruments and duration of symphonic music with his *Symphonies of Wind Instruments*. Later on, Milhaud composed 12 symphonies within which he himself returned to a more typical orchestral extent.

With total durations of four to eight minutes, Milhaud's chamber symphonies are extremely short. All pieces are performed on a small number of instruments. Only no. 6 includes voices. The main motifs sound folk-like with frequent use of folk dance rhythms. Musical patterns, however, transcend traditional tonality to form bi- and polytonal structures as well as modal soundscapes. The first auditory impression, however, is misleading: the little symphonies appear to be highly complex, with surprising changes of timbre and contrapuntal details.

Fig. 11: Images related to the six chamber symphonies by Darius Milhaud, 8 × 8 cm, watercolor, pencil, ink on paper, 2018.

The depictions shown in Figure 11 are based on fragments of my synesthetic imagination. They occur while listening to a recording of the soloists and chorus of the *Capella Cracoviensis*, conducted by Karl Anton Rickenbacher in 1991 (CD 1). The use of different instruments provides a rich variation of timbres. In my impression, this causes a variety of colors, forms and spatial configurations. Even for these short pieces, it would be impossible to precisely transfer the music into an image note by note. Furthermore, such a proceeding would not fulfil artistic demands on the creative treatment of daily life experience. Therefore, the pictures use fragments of my impression as base elements. The forms are freely arranged in a new environment, thus interacting within an artificial spatial configuration. Everything is subject to simplification and compression. The minimalism of the images thus corresponds to the apparent simplicity of the symphonies.

Dmitri Shostakovich was one of the most distinguished composers of the Soviet Union. Besides producing a substantial number of works of chamber music, concerts, and film music, he composed fifteen symphonies (CD 2), some of which he gave programmatic titles related to the origins and ideology of the Soviet Union (2: *The First of May*, 3: *To October*, 11: *The year 1905*, 12: *The year 1917*) and the Second World War (7: *Leningrad*, 8: *Stalingrad*). Two symphonies include a choir for the last movement (2, 3), while two others are genuine vocal symphonies that mainly comprise orchestral songs (13: *Babi Yar*, 14: untitled). The many interactions of the composer and his work with the political conditions, Josef Stalin's cultural policy, and existential struggles during the war have been the topic of many academic discussions and shall not be addressed further at this point. Although the general conditions of his life were restricting, Shostakovich created an extensive scope of multifaceted music, which continuously changes from the massive involvement of the full orchestral resources to intimating soli and chamber music. He intentionally modeled his music on the symphonic work of Gustav Mahler and he became the most prominent successor of the Austrian composer.

The complex instrumentation of Shostakovich's symphonies causes an overwhelming richness of sound textures, colors and movement. For this reason, it is particularly suited to stimulating synesthetic phenomena, especially for synesthetes with a pronounced connection to timbres of colors. I thus started a project to depict some of my impressions related to excerpts of the symphonies. Shostakovich also contributed to operatic music. Again, his music impresses by means of colorful instrumentation and visionary motifs (Haverkamp, 2020).

The tone symbolism of the tenth symphony offers the unique opportunity to combine synesthetic images of tone-to-color relations with grapheme colors.

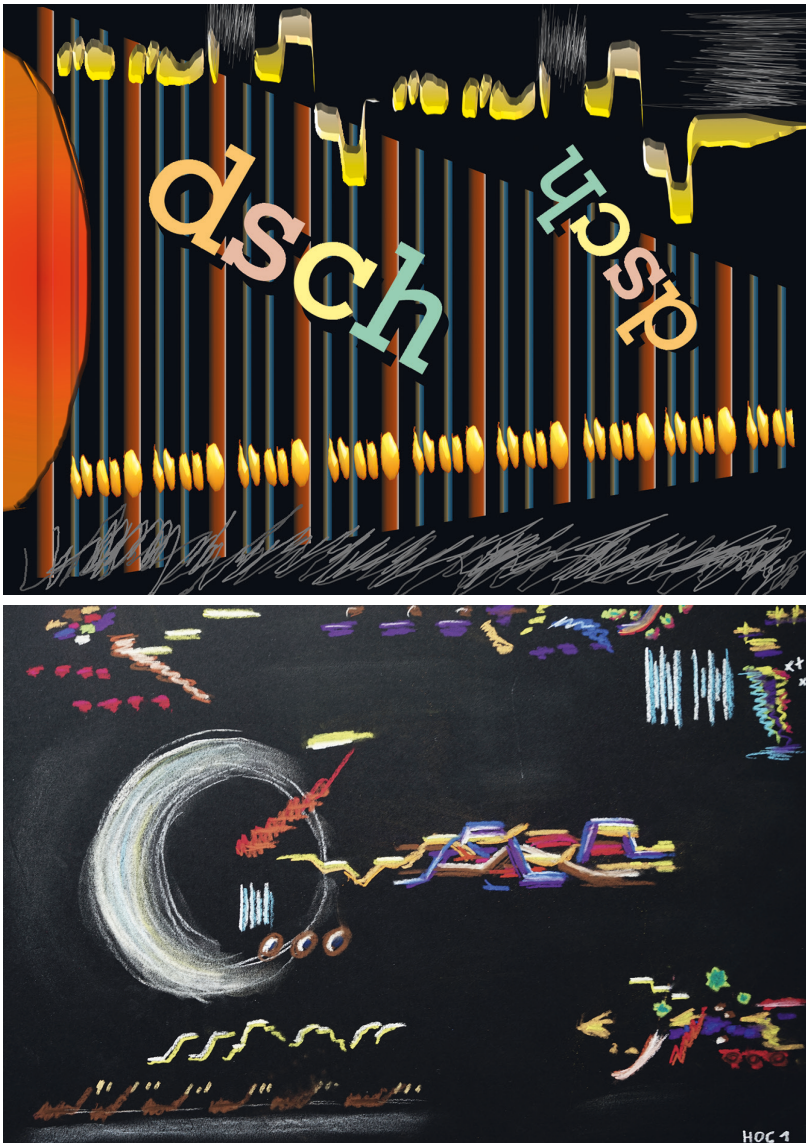


Fig. 12: Images related to music by Dmitri Shostakovich. Top: Symphony No. 10 op. 93, third movement ~7'20"–7'28". 30 × 42 cm, print on paper, 2019. Bottom: Prelude of the opera *The Nose* (НОС). 21 × 29 cm, pastel crayon on paper, 2020.

Figure 12 (top) shows my approach to a rhythmic section of the third movement. Shostakovich codes the initials of his name into a music motif, which comprises the tones D-Es-C-H, with reference to western European writing. At the top of the graphic, this motif can be seen twice as yellow dotted forms. The other forms show the rhythmic structure of the music. If I consciously translate the DSCH motif back into the letters that it symbolizes, these letters immediately appear on my inner monitor with colors corresponding to the effect of color-grapheme synesthesia.

Figure 12 (bottom) shows a sketch related to the prelude of the opera *The Nose* (op. 15, CD 3) with brief music particles played by a large number of solo instruments.

References

CD1: Dmitri Shostakovich. *The Complete Symphonies*. Various Orchestras, Mariss Jansons. Warner Classics, 2006.

CD2: Darius Milhaud. *6 Petites Symphonies/3 Opéras-Minutes*. Capella Cracoviensis, Karl Anton Rickenbacher. Koch Classics, 1992.

CD3: Dmitri Shostakovich. *The Nose* (нос), op. 15. Mariinsky Orchestra, Valery Gergiev. Mariinsky Label, 2009.

Haverkamp, M. (2020). Synesthetic painting related to Symphonies by Dmitri Shostakovich. In Sidoroff-Dorso, A., & Day, S. A. (Eds.), *Proceedings of the International Congress Synaesthesia: Cross-sensory Aspects of Cognition across Science and Art, Moscow/Russia, 2019*. In preparation.

Personal Insights II: Synesthete Musicians

Benefits of and distractions due to multiple synesthesias in my attempts at compositions

Sean A. Day

I have experienced musical timbre to visual, flavor to visual, and odor to visual synesthesia since I was four years old. My family was very musical, and my music-related synesthesia pushed me towards music and composition at a very early age. I was composing pieces by the time I was 13 years old. When I first entered university, I majored in Music Composition. For many, many reasons, I changed majors to Anthropology during my second year. But one of the reasons was the increasing difficulty I faced reconciling my synesthesias with the results of my attempts at composing. Put simply, the best-advised orchestral combinations, as per authorities such as Nikolai Rimsky-Korsakov's treatise, usually produced ugly or at least boring synesthetic visuals, while the most attractive synesthetic colors were produced by instrument combinations that would put P. D. Q. Bach to shame!

Compounding—and confounding—all of this, many of the synesthetic colors I see for flavors and odors are nearly the same as those I see for the sounds of instruments. Thus, a particular instrument's sound will make me inadvertently think of certain foods; or vice versa. Get a couple of instruments playing together, and it can produce very odd ideas of flavor combinations; or, likewise, a pizza, sandwich, or bar drink can make me think of new orchestral combinations.

Over the years, I have tried to come to terms with these synesthetic factors, as an amateur-level composer; but I am simply unable to ignore them. This paper explores some of the compositions I am currently working upon, looking at reasons behind certain instrumental choices, and some of the fun and/or complications I face, by use of examples from some of my scores which are still 'works in progress'. I provide some comparison with the techniques and ideas used by other composers, synesthetes and non-synesthetes alike, such as Duke Ellington, György Ligeti, Michael Torke, and Frank Zappa.

Walking Down the Street: The sequel

Jasmin Sinha

2006 was the year of the *2nd International Conference on Synesthesia* in Hanover, Germany. It was the first time that I, a genuine synesthete, attended a synesthesia conference, and it was also the first time ever I presented a talk on synesthesia. Since 2006, my primary goal was 'translating' my synesthesiae in a way which can be understood by fellow synesthetes, non-synesthetes, and researchers. I am hoping that tangible visualizations of my individual synesthetic perceptions will contribute to a greater understanding of the mechanisms in synesthetic perceptions.

As a child or young adult, I never had any formal musical training. In 2006, I was not able to read sheet music. Despite this, I have always been able to "see" the internal structure of any given music piece, allowing me to reproduce it simply by listening closely to it.

In 2006, I wanted to rehearse the song *Walking Down the Street* (*The Real Group*, 1998) with my a cappella ensemble. The challenge: there was no sheet music available. But I was aware of my colored hearing ability: for me, each vocal part (SSTBB) in the song had its own specific and personal color and texture. So, I set out to exploit my synesthetic perception to note down the score (using software to make up for my lack of notation skills).

In Hanover, I presented the result of this experiment: a 5-voice score, including its visualization: each voice was rather soft and furry and had a specific color. The texture in the outside world which comes closest to this turned out to be knitting wool. In Hanover, I showed my model of the song, with each vocal part represented by a thick rope made of colored furry wool.

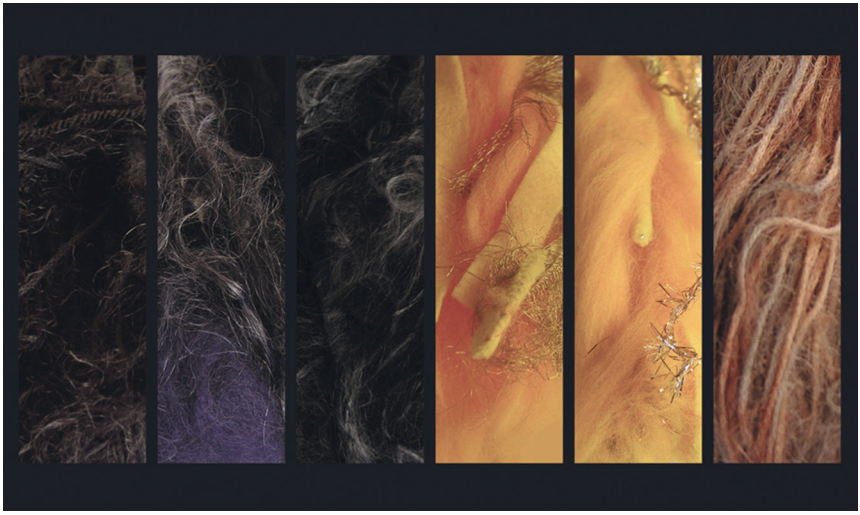


Fig. 13: *Walking Down the Street*: Visualization of *The Real Group* vocals (SSTBB) as well as the "fog" around the thick "sound rope", representing the overall acoustic perception while not focusing on any individual voice. From left to right: Bass—Baritone—Tenor—Soprano 2 (slightly less golden than Soprano 1)—Soprano 1—"Fog".

The voices of *The Real Group* singers are not easy to distinguish. E.g., the sopranos both have very bright and 'sunny' voices. And the voices of bass and baritone are not very loud. Due to their low pitch, they are quite difficult to be heard individually. In addition, the piece contains some jazzy vocal improvisations. I activated my colored hearing deliberately and visually followed each single voice through the entire song,

note by note, bar by bar, by focusing on the specific color of the voice concerned as well as texture, pitch, rhythm, and synesthetic position in space related to pitch and rhythm.

This approach turned out to be the solution for analyzing the piece: while both soprano voices were sunny yellow, one of them contained more golden particles than the other. The three male voices (TBB) each had a slightly different shade of anthracite/black. At the end of the process, I had managed to transcribe the entire piece into sheet music, ready for use by my music group (SSTBB had turned into SSATB). Unfortunately, the score was never performed because the group split up.

Fourteen years later, the moment for the sequel had arrived: In February 2020, the *Luxembourg Jazz Voices* performed my 2006 arrangement of *Walking Down the Street* at an A Cappella festival in Ettelbruck (Luxembourg, 1st Feb 2020).

In 2019, in preparation for this concert, I reviewed the score significantly. But this time, I was applying two tools.

1) I applied my recently acquired non-synesthete solfege skills. They enabled me to cross-check and correct the work I had produced back in 2006. I found some cardinal rhythmical mistakes, which were of course corrected. But the pitch of each single note was correct. Also, the chords that resulted from the notation of five individual melodies turned out to make sense from a jazz harmony point of view.

2) Furthermore, like in 2006, I made use of my colored hearing ability for reviewing the score and adapting it to the *Luxembourg Jazz Voices.* My fellow singers' voices have other color and texture characteristics than the original voices; also, the overall color scheme now looks different. The voice of our bass is brighter than that of *The Real Group* bass, grey-brown. Soprano 1's shade of yellow is lemon, less gold than soprano 1 of *The Real Group*, with a matte finish like yellow chalk. The voice of Soprano 2 looks like golden-brown liquid honey and is shiny. And the new Alto voice is a red-brown burgundy shade of red.

My new non-synesthetic solfege skills have proven to be highly useful as quality control tools. But the solfege knowledge alone would 'not' have enabled a note by note analysis, especially not in the improvisation

part. For the creation of sheet music, including noting down the improvisations note by note, my synesthetic ability of colored hearing was the crucial key success factor, clearly outweighing the application of music theory.

This exercise has provided evidence that my synesthesia can indeed play the role of a golden thread in my synesthetic life (Dittmar, 2009: see the book's title).

References

Dittmar, A. (2009). *Synesthesia. A "Golden Thread" through Life?* Essen, Germany: Die Blaue Eule.

Jalkéus, M. (1998). Walking Down the Street [Recorded by *The Real Group*]. *On One For All* [visual album]. Lidingö, Sweden: Gazell Records.

Exploring mirror sensory synesthesia through music: Can a contemporary composition reveal the mirror-touch experience?

Concetta Abbate & Carolyn 'CC' Hart

Research conducted by Michael Banissy and Jamie Ward (2007) has concluded that mirror-touch synesthesia is a distinct form of cross-sensory perception that correlates with heightened empathic ability. Findings by Ward and Banissy (2015) suggest that mirror-touch-synesthesia (MTS) specifically involves shared self–other body representations, and can be construed in terms of over-extension of the bodily self into others, or as difficulties in the control of body-based self-other representations. Can a contemporary musical composition reveal the mirror sensory experience and the enhanced empathy that is paired with this neu-rocognitive difference? A series of dialogues were conducted in the autumn of 2018 between Concetta Abbate, a composer, vocalist, and violinist, and CC Hart, a mirror sensory synesthete who has synesthesia-for-pain, mirror-proprioception, and mirror-touch. Hart provided a narrative of her mirror sensory synesthesias and the ways in which

this trait has both enhanced and challenged her interpersonal relationships. Abbate used that narrative to create a composition which seeks to draw connections between the profound emotional empathy felt by the artist and that of a mirror-touch synesthete. The instrumentation of the composition utilizes a simplistic outline of harmony and motif using primarily 5 string violin, drums, and highlights of woodwinds. The lyrics were composed through a process Abbate calls "word painting", which juxtaposes seemingly unrelated words and perspectives to draw a variety of unexpected responses from the listener. The goal of this approach is to allow space for the listeners to actively imbue their own meanings onto the work, thus challenging their own empathetic ears.

At the close of our talk, participants will have the opportunity to hear a live performance of a selection from Abbate's album *Mirror Touch*.

Fig. 14: Abbate-Hart_figure: *Orb*, oil painting by Ecuadorian-American artist Dorothy Rojas, for the album *Mirror Touch* by Concetta Abbate.

References

Banissy, M., & Ward, J. (2007). Mirror-touch synesthesia is linked with empathy. *Nature neuroscience, 10*(7), 815–816. doi: 10. 815-6. 10.1038/nn1926.

Ward, J., & Banissy, M. J. (2015). Explaining mirror-touch synesthesia. *Cognitive Neuroscience, 6*, 118–133. doi: 10.1080/17588928.2015.1042444.

Colored hearing of two guitar concerts: comparative results

Clara Soto

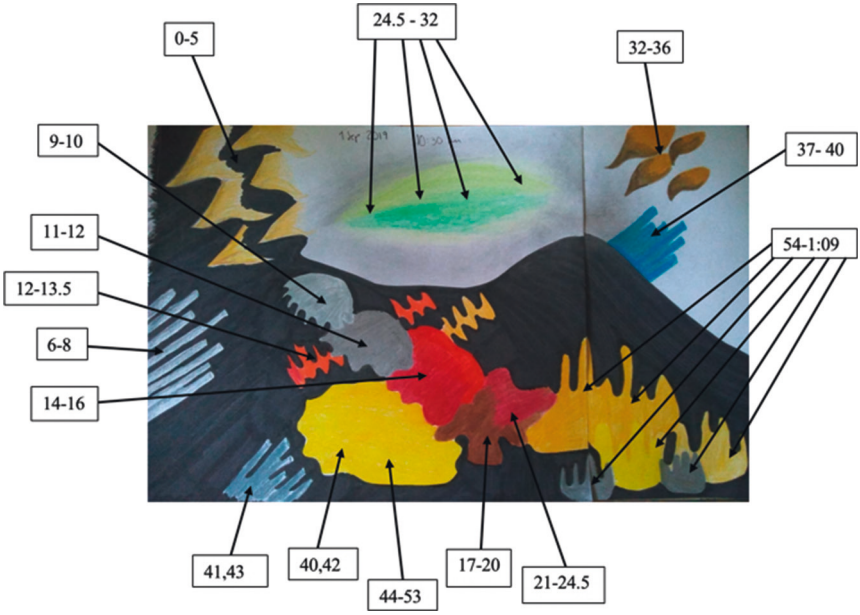
Colored hearing is one of the many modalities that synesthesia has, and happens when the sound acts as a color-inducing stimulus, achieving an automatic sensory union. For example, when listening to a note, you can instantly 'associate' it with a specific color, the idiosyncrasy of this association lies in the individual perception of each synesthete, which is in accordance with your personal history, context and psychology.

The objective of this investigation is to deepen into the colored hearing, so the state of the matter was made by compiling note-color taxonomies of different artists, such as Alexander Scriabin, Olivier Messiaen, Wassily Kandinsky, etc. In the search for a standardized way of classifying colored hearing, I made my own note-color taxonomy based on my own synesthetic perception. However, in a previous investigation it was discovered that the same figures or colors are barely perceived when listening to isolated notes, than when listening to the complete musical piece.

For example, with the color grapheme, each letter is associated with a specific color; but, at the time of forming words that acquire a complete meaning, the colors change. That means there is a dominant color among the others, like in the video of Cadena (2013). Helena Melero (2015, p. 17) interviewed two synesthetic girls, both with grapheme-color, among others, as colored hearing. In the interview, the word "Synesthesia" is orange for Euridice Cabañas, because for her, the letter "A", according to her perception, is outstanding in the word. Unlike Estefanía Romero, who states that "Synesthesia" is green because, from

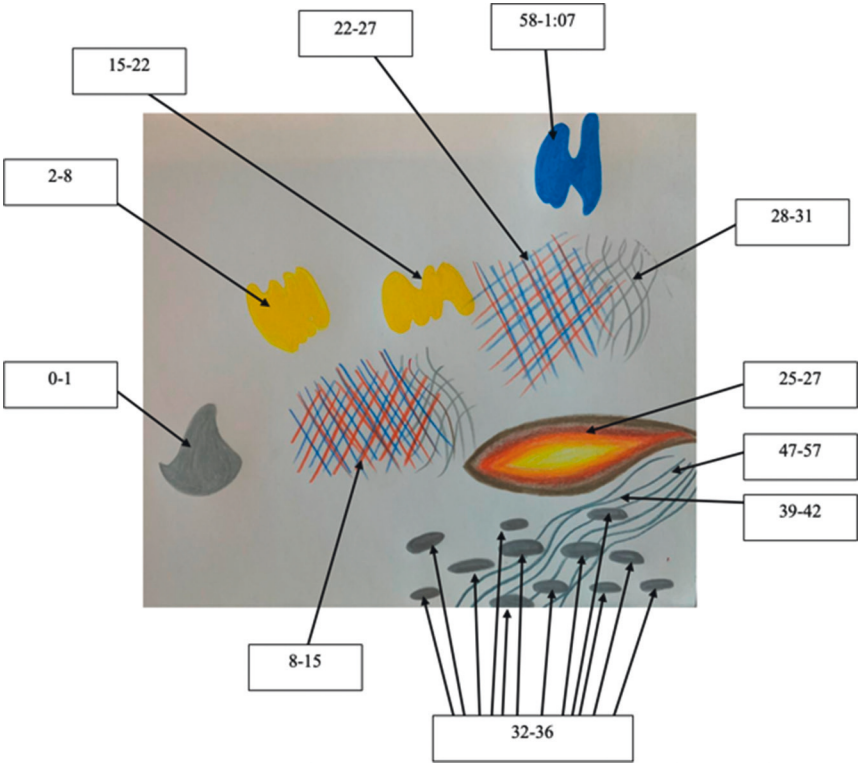
her synesthetic perception, the letter "E" is green and, when the whole word is repeated, it turns to green. From my own personal perception, the word is yellow because "S", "I" and "T" are yellow. A musical piece, specifically a concert for orchestra and solo instrument, being a sound mass made with different instruments, textures, timbres and moments cannot be limited to being perceived as a color decoding, but as a homogeneous landscape.

In the image, the same musical fragment is shown, first decoded with a color note taxonomy, then the resulting image is shown just being heard in the same fragment. The taxonomy and decoding were done under the standards of my own synesthesia, so similarities would be expected, but they did not appear. It is not the same to listen to isolated notes, and automatically assign them a color, as to listen to a mass of sounds and perceive the whole musical panorama.



That is why, for the present investigation, the taxonomy of the note-color was left behind, since it aspires to take the visible synesthetic

perceptions that the music awakes in the closest way to how they are perceived/seen through the "auditions" (illustrations of synesthetic perceptions) and, for this, a taxonomy of note-color would not be enough. So, only the auditions (the seconds or minutes were indicated below) were analyzed. To specify each illustrated musical moment, the images show fragments of the following guitar concerts: *Concierto del Sur* (1941) by Manuel María Ponce, *Concierto No. 4 de Toronto* (1987) by Leo Brouwer, *Concierto de Aranjuez* (1939) by Joaquín Rodrigo, and the Cadenza from the concert (1951) by Heitor Villa-Lobos. Using the images, videos were made in collaboration with visual artists, thus bringing to the physical world perceptions in real time.



The synesthetic eye seeks to broaden the musical perception in spectators and publicize this way of perceiving music. C., another person with musical synesthesia, was asked to listen to the pieces mentioned above without being shown any previous illustration of the previous auditions. When comparing the researcher's auditions with this person, similarities were found, so comparative tables were made, because, although synesthesia is an idiosyncratic phenomenon, it is interesting to find similarities in the auditions, such as the 'Klüver forms' that appear in different mental states like synesthesia. Heinrich Klüver (1897–1979) made a taxonomy of the forms; four classifications are honeycomb, cobwebs, tunnels and spirals. Studying this phenomenon, it is easier to discover people with synesthesia, because they would appear in their illustrations. In the case of C., these forms are very evident.

In the comparisons, the similarities of the listenings were found in figures and lapses. C. enumerated moments and, when comparing them with the listenings, some figures coincided in the movements of the silhouettes. It would be important to replicate this practice in more people with musical synesthesia to make comparisons with a larger population. With this, we could approach understanding the cerebral expression of colored hearing.

References

Alicia Callejas, J. L. (2012). *Sinestesia. El color de las palabras, el sabor de la música, el lugar del tiempo*, pp. 196–201.

Bragança, G. F. F. (2010). Parámetros para el estado de la sinestesia en la música. *Per Musi*, pp. 81–86.

Cadena, SER (2013). *Sinestesia, cuando el dolor es amarillo y la música se ve en colores* [Sinestesia. When the pain is yellow and the music is seen in colors]. Available at: https://www.youtube.com/watch?v=YXRx8iyxZPo&t=1s.

Del Estal, E. (2017). *Sinestesia y la Utopía de la Obra Total*, pp. 2–4.

Melero, H. (2015). *Sinestesia, bases neuroanatómicas y cognitivas*. Tesis doctoral.

Ouellette, J. (2018). *A math theory for why people hallucinate*, avaliable at: https://www.quantamagazine.org/a-math-theory-for-why-people-hallucinate-20180730/.

Peacock, K. (1985). Synesthetic perception: Alexander Scriabin's color hearing. *Music Perception*, 2(4), 483–500.

When audio is always visual

Milja Vanhalen

As an Ethnomusicologist and Musician / Composer / Music librarian / VJ who has many different forms of neurological synesthesia, sound and audio doesn't ever exist without visual form. That is why speaking about aural experience, in my case (in everyday and professional settings), is lacking something, if we speak about it in so-called neurotypical settings.

When visual aspect of the sound is always present, it has effect on my everyday life, musical and visual work, unintentionally or intentionally. I began to document, draw and speak about my synesthesia because I wanted to understand it better and share my experience for others to understand. One of my projects, which I introduce here, is a music / visual blog which I began when I wanted to combine my passions of sharing information about music, sounds and synesthetic experience. This is a combination of music journalism and sound diary: If I go to a concert or listen to new music, I draw there or after it, write about my experience and introduce music to people. It is like making constant translations between audio, visual and words. None of them are complete without the others. Also, when I make music, I am usually after certain colors. When doing VJ-ing, I try to visualize the synesthetic experience in video form.

I also aim to begin to do academic research about synesthesia. Having an ethnomusicological background, I concentrate on audio experience, sound environment and music research. I would like to introduce my projects and discuss them with other participants. I would like to find place to begin my PhD with this subject in the future.

Reference

Vanhalen, M. *Music / Visual Blog*, https://musicolourist.wordpress.com.

Music-Color Synesthetes: Case Studies

A red symphony out of the canvas: Exploring the neurophenomenological dimension of music-color/form and music-touch synesthesias

Helena Melero

Music-color synesthesia is one of the most well-known modalities of synesthesia and several psychological, artistic and neuroscientific studies have explored its characteristics. Nonetheless, little is known about its heterogeneous neurophenomenology (e.g., different inducers for different people, tone vs timbre, different levels/dimensions of synesthetic inducers in the same person, different characteristics of the concurrents…) and the co-occurrence of other synesthetic experiences in response to sound, such as painful and pleasurable touch. In this talk, I will present a) a neurophenomenological description of my personal experiences as a neuroscientist and music-color/form and music-touch synesthete (among other modalities), b) some pieces of the artistic work I develop using my synesthesia (including paintings and musical compositions), and c) neuroscientific hypotheses about the neural bases of these phenomena that may help us reorient the neurocognitive models and guide future research.

Amy Beach: Synesthesia and a comparative analysis of colored composition

Maris Loeffler

This thesis examines the relationship between synesthesia, key-color association, and colored composition using the musical works of the American composer Amy Beach (1867–1944). A biographical overview is provided to frame the observable onset and characteristics of Beach's synesthesia in early childhood. I include additional noted childhood sensitivities, including enhanced startle response, perfect pitch, melodic memory, and connections to nature, to provide a more complete profile and psychological predisposition in relationship to synesthetic identification. The four pieces presented are analyzed directly from Beach's scores using music theory. Analysis was conducted to evaluate for compositional colored elements outside of Beach's key-color associations using dynamics, key changes, format, thematic movement, accents and overall mood and tone. The aforementioned assessment provides the given hypothesis that additional colored elements are distributed throughout the compositions distinct from key-color associations. The compositions include the following: Ballade op. 6 (1894), *Waltz*, from *Children's Album* op. 36, No. 3 (1897), *Phantoms*, No. 2, from *Four Sketches* op. 15 (1892), and *March* op. 36, No. 4, from *Children's Album* (1897) composed in the colors violet, white, green and red respectively.

Reference

Loeffler, M. (2013). *Synesthesia and a Comparative Analysis of Colored Composition*. Bachelor of Science and Bachelor of Arts, The Faculty of the Music and Psychology and Child Development Department, California Polytechnic State University, San Luis Obispo. Retrieved February 25, 2020, from https://digitalcommons.calpoly.edu/musp/39/.

The reflection of synesthesia in the work of four musicians: Joyce Yang, J. J. Sechan, Ben Wolfe, and Aaron Jay Kernis

Greta Berman

During my more than forty years as a professor of art history at Juilliard, I have encountered numerous composers and performers who not only have synesthesia, but whose compositions and performances have been strongly informed by it.

For this paper, I would like to propose case studies of four musicians: Grammy nominated pianist Joyce Yang, silver medalist in the *Cliburn Competition*, 2005; J. J. Sechan, principal bassoonist for the *Colorado Springs Philharmonic*; Ben Wolfe, jazz bassist, composer, and faculty member at Juilliard; and composer Aaron Jay Kernis, a *Pulitzer Prize* and a *Grammy Award* winner.

All of these musicians possess synesthesia to varying degrees. I have known two of them as students, and one as a colleague; and I have had extensive interviews with them. I suspected the fourth, Aaron Jay Kernis, of having synesthesia when I first heard his music. When I asked him if he was synesthetic, he replied, "Yes, of course,"—as if I were asking about the weather.

Joyce Yang has consistent colored days of the week: Monday is red; Tuesday is colorless; Wednesday is lime yellow; Thursday is "boring, like the color of a tree trunk"; Friday is blue; Saturday is a neutral, light gray; and Sunday is black. Likewise, Yang has colors for most keys. She memorizes her music by making colored diagrams. In a 2013 joint interview, Sechan and Yang agreed that they use their synesthesia to program their concerts. Sechan says that "people pair Piazzolla with Villa-Lobos because they are both Spanish, but this is wrong! You must pair things with similar textures instead. Schumann paired with Rachmaninoff is an absurdity! But Philip Glass and Schubert have similar textures. They frame the same motion in different ways." Yang tries, when she can, to include the entire color spectrum in her programs.

All four synesthetic performers and composers see forms in motion when they hear or write music. Yang, Sechan, and Wolf have been very specific about those forms.

The names of many of Kernis's compositions have color titles. This is not coincidental. He has written that his synesthesia informs the chords he chooses. They evoke internal color sensations. He is also influenced by the personal qualities of the musicians for whom he writes, demonstrating an empathic quality common among synesthetes. Indeed, we now know more about mirror-touch synesthesia, which could be a related phenomenon.

Ben Wolfe sees colors and forms in music. His colors are not always consistent; but, for him, all pitches have shapes and colors. For example, *C#* has brown-ness. A *D flat* 7th chord has a very particular sound and range. It is dark in color, but bright in timbre. Like Kernis, he sees chords as opposed to separate notes. And he can't imagine anyone not seeing/hearing this!

An in-depth study of these four musicians sheds light not only on these particular individuals, but it also demonstrates commonalities and differences among musician synesthetes, in general.

Translating chromesthesia for non-synesthetes

Selma A. Espino, McKay A. Bloxham, Spencer A. Lee, & Scott A. Bailey

The present project is part of a case study of a synesthete, JK, whose forms of synesthesia have not been formally assessed. Among JK's self-reported forms of synesthesia are music-color (chromesthesia), sound-color, grapheme-color, mirror-touch, and emotionally-mediated face-color in which the colors appear as aura-like 3D surrounds of the targets (commonly people, but also non-human animals and inanimate objects). JK's experience of chromesthesia and several other forms of synesthesia is consistent with Ward's (2019) notion of extreme synesthesia.

JK stood out in audio engineering school because of synesthesia. JK sees and creates visual representations of music using a variety of visual media. JK reports experiencing music in layers, and that the experience of audio-induced color-layer experiences contributed to rapid learning of audio engineering principles. Possessing chromesthesia was interpreted by JK's teacher and clients as a key asset, leading to JK's being requested as a production agent while still a student.

JK uses the app Procreate to craft digital artwork. Procreate is software that was designed for Apple® products that permits artists to work in layers, and has facilitated JK's development of layered representations of her experiences with others' music.

In addition to translating music into visual art, JK writes lyrics spanning a range of sub-genres under the broad heading, popular music. JK commonly encounters stimuli for lyric development in everyday living. The present project is an attempt to capture how a chromesthete's use of a visual art platform can be used to track the experience of transforming a rhythm track into a song with lyrics.

For Study 1, a rhythm (drum) track was created. The drum track has 16 measures consisting of a simple 4/4 beat, with two contrasting fills every eight measures. The pattern for the non-fill measures (1–7, and 9–15) is a repeated rhythm involving a sixteenth note bass pattern beginning on beat one, a snare on beats two and four, and a closed hi-hat that opens on the upbeat of beat three. Measure 8 contains a fill between the bass, snare, high tom, and middle tom; the Measure 16 fill is rhythmically similar, but ends on an upbeat for potential looping.

Following novel auditory exposure to the rhythm, JK reported visual perceptions of the beats from the drum track with the hues yellow, green, purple, and blue appearing during the non-fill tracks, and the fill beats having the colors yellow, purple, light blue, plus two reds. JK's digital drawing of the visual perception associated with the audio beats was based on a single listening to the 16 bars. Although the full track had 16 measures, JK's visual representation is a condensed set of seven hued shape clusters (see Figure 18).

JK's representation of the auditory experience of listening to the rhythm track is presented in Figure 18, below. Salient features of the drawing include that the hued portions are discrete, non-overlapping structures, though there are intentionally created hue shifts within some of the lines that constitute some of the abstract shapes in the drawing. Unlike JK's drawings of more complex songs, the present example did not require much layering to create the visual representation. Also, in JK's other visual representations of songs there is not usually obvious direction or organization in the image; by contrast the patterns in the present image are structured such that are readily identifiable even to non-chromesthetes, albeit the beats are represented in two vertical columns rather than in rows as one might anticipate given that JK is a Westerner whose native language is English. The fact that JK does not sight-read music may account for the non-traditional representation of the beats in columns rather than rows.

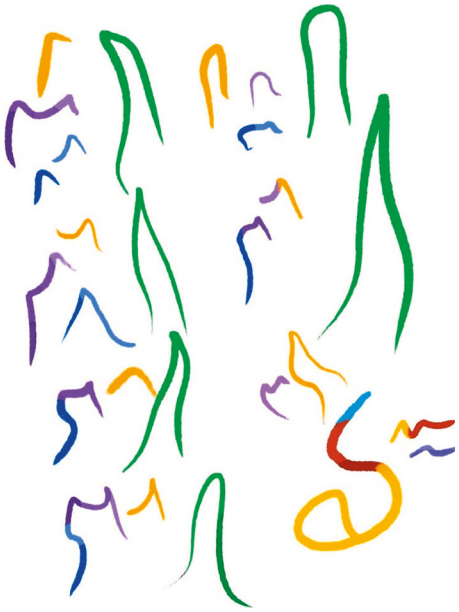


Fig. 18: This figure is the digital art created by JK while listening to the drum track for Study 1. The measures are readily identifiable as clusters of hued shapes in a repeating pattern represented in two columns. Note that the fill for Measure 16 is represented at the bottom of the second column.

Having finished drawing the beats in Procreate, JK interpreted the image for the researchers. Each color corresponds to a different drum tone (e.g. closed hi-hat vs. open hi-hat). Figure 19 shows the pattern for the beats in Lines 1 and 2

(Part a), with Lines 3 and 4 (Part b) being duplicates of Lines 1 and 2 save for the use of hue-modified notes that map closely onto JK's reported visual perceptions of the beats' hues. The uncolored (a) and colored (b) scores represent the same four measures; those measures map onto Measures 5 –8 of the full score.

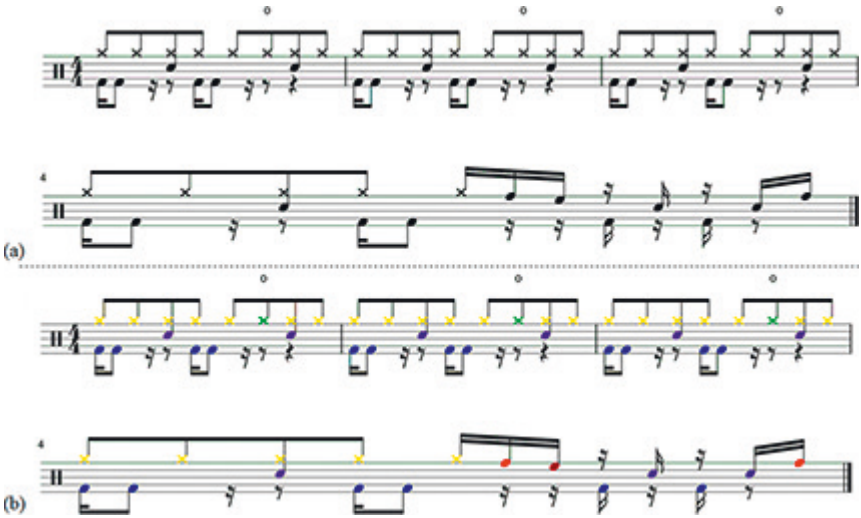


Fig. 19: Part (a) (Lines 1 and 2) is musical notation for Measures 5–8 of the novel auditory stimulus. The full length stimulus included two repetitions of eight measures, with the fills in Measures 8 and 16 differing slightly. Part (b) is the same notation as indicated in Part (a), but the hues for the beats, as reported by JK, supplant the black from Part (a) to give the reader a sense of the correspondence between the beats and specific hues.

At the time of this writing, there are no further data. However, JK has been charged with creating lyrics while attending to the beats. The aim of the broader project is to have JK sing the lyrics with the beats accompaniment, and then draw during playback a representation of the combined beats and sung lyrics, with a core question concerning how the drawing of the audio experience with lyrics added will compare to the original visual representation. Subsequent studies involving additional visual art will be included in the conference presentation.

Reference

Ward, J. (2019). *Extreme synesthesia*. Paper presented at the annual meeting of the International Association of Synesthetes, Artists, and Scientists in Moscow, Russia.

Konstantin Saradzhev's music-related development as a bell-ringer and music theorist as determined by his microtonal pitch-to-color/shape synesthesia

Anton V. Sidoroff-Dorso

Konstantin K. Saradzhev's music perception manifested as complex synesthetic correspondences between microtonal pitch identification as inducers and multicolored spatial concurrents (Tsvetaeva, 1977; Tsvetaeva & Saradzhev, 1988). Arguably, this type of music-related experience, to a great extent, determined his choice of professional activity which was predominantly focused on the instrument that was capable of giving him the richness and depth of experience-based cognition and art-making (cf. Cytowic, 2002; Ward et al., 2008). Due to his meticulous discrimination of multilayered pitch tones he preferred ringing bells to all other music instruments that he considered restrictive. Over his lifetime, his physiologically pervasive, psychologically overwhelming experience resulted in multiple phenomenological, personal and behavioral individual differences (cf. Glasser, 2016; Starcheus, 2012).

Many of Saradzhev's creative ideas regarding the art of bell ringing and his project of designing a secular, concert belfry are reported in Anastasia Tsvetaeva and his brother Nil Saradzhev's memoir essay about Komnstantin Saradzhev (Tsvetaeva, 1977; Tsvetaeva & Saradzhev, 1988) and developed in Saradzhev's two incomplete manuscripts—the autobiographic *My Music Worldview* and the theoretical *Music-Bell*, both survived only in fragments (Blagoveschenskaya, 1988; Ivanov, 2015; etc.). According to the sources, Saradzhev's many forms of synesthesia were music-related and pitch-based with the most prominent variety experienced in response to hearing (and performing) bell

tolling, clanging and chiming in the form of glowing, volumetric "tree-like structures" (Tsvetaeva & Saradzhev, 1988). Based on these subjectively detected "signatures," Saradzhev was able to consistently identify and attribute a detailed synesthesia-induced profile of technical characteristics to individual bells and, collectively, bell-towers in Moscow.

Fig. 20: Konstantin K. Saradzhev (1900–1942), 1925 (public domain).

Konstantin Saradzhev had a culturally refined upbringing as well intense music background and education as both his parents were prominent professional musicians and his siblings were also professionally involved in music later in life. His father Konstantin (too) S. Saradzhev (Russianized version of the Armenian surname Saradzhyants) was a professor of the Moscow Conservatory and later in his live occupied the position of director of the Yerevan Conservatory (Armenia) and his mother who died when Kotik (domestic name for Konstantin) was little, was Sergei Rachmaninoff's student, a skillful pianist herself. It was very early in childhood that Kotik develop an idiosyncratic keenness on bell-ringing and similar sounds. His most precious personal possession was his collection of bells and empty perfume bottles and he, along learning piano and violin, started composing his own bell music pieces (Tsvetaeva & Saradzhev, 1988; cf. the Nussbaumer brothers in Jewanski et al., 2013).

Saradzhev's unique synesthesia-embedded sensitivity was able to develop well beyond possession of perfect pitch to drawing his creativity on more acute, microtonal sound-pitch discrimination. The limited tonal capabilities of traditional music instruments made Saradzhev to embrace the bell with its harmonic variations and smooth tonal transitions as the ultimate choice for music-making and music theory (Vanechkina, 2000). His further music development as a musician,

composer, music theorist and philosopher and his avid social activity was centered around the bell. He developed his own, very unique style of performing, was an acclaimed virtuoso bell-musician and gave regular bell concerts at one of the Moscow churches while the political climate of the 1920s in Russia was becoming more oppressive against religious practices (Lukyanov, 1988).

Fig. 21: The church of St. Maron the Syrian Hermit in the 1980s (left) and after renovation in the 2010s (right). Konstantin Saradzhev considered the set of bell in the bell-tower of the church as a perfect selection and used to play his "harmonizations"—highly original, virtuoso musical bell-ringing compositions—in the Moscow of the 1920s.

While Russian churches were inevitably losing their bells in the war of ideologies, Saradzhev's aspirations were to assemble a secular, concert belfry which made him a "bell protection activist" supported by many of the cultural and music elite of then Soviet Russia (Blagoveschenskaya, 1985). Ultimately, clerical bell-ringing was legally banned altogether which lead to subsequent remolding of church bells, or selling them abroad. This brought him as an expert bell-tuner accompanying a set of purchased bells to Harvard University where his dreams were materialized as a belfry at Lowell House that was an assembly of the bells secured from Russia through acquisition by Chicago industrialist Charles Crane in 1930. Although initially considered as damaging and amateurish, which was the reason to expatriate him back to Russia,

Saradzhev's assemblage of the belfry was assessed as nearly perfect by other invited curators of the Lowell House bells (Ericsson, 1984; Lukyanov, 1988; Batuman, 2009).

Saradzhev's synesthesia was an object of study by physiologists, psychologists and musicians by the methods of that time. A consistency test-retest of sorts was administered on Saradzhev by the famous Russian neuropsychologist Nikolai Bernstein who asked the synesthetic musician to write his music experience of various color stripes. Over an extended period of time the test was repeated and yielded identical unprompted results (Tsvetaeva, 1977). Besides music, Saradzhev's synesthesias were associated with attributing musical characteristics to the personalities of the people he communicated with as well as other visually perceived objects (i.e. gems, crystals, glass, metals [cf. Sacks, 2001]). His own personality sounded as pure "D".

Saradzhev's extreme synesthesias and related hypersensitive music perception did not come without certain impediments for the cognitive, affective, and behavioral aspects of his musical and personal development. Saradzhev's "worldview" was centered around mystical "universal harmonization," all-music genuine hearing abilities (that he called "universal pitch") through the entirety of your existence—"sounds produced not only by a vibrating object but by any thing." (cited in Rumyantsev, 2003). Because of not infrequent misunderstanding that he poignantly experienced, he dropped out of the formal music education program at the music conservatory, got oftentimes emotionally detached from contemporary academic performers and peer musicians, and formally distanced himself from music traditions even beyond expert understanding and acceptance. In Saradzhev's unfinished and fragmentally abandoned book "Music-Bell" he describes his abilities and reasoning as ineffable "because I have never encountered anyone with such a pitch as mine… in this day and age I am lonely because I was born much ahead of time!" (Saradzhev cited in Tsvetaeva & Saradzhev, 1987).

Historically, despite these tensions, Saradzhev's music-related synesthesias enabled him to record in complex music notation the overtone lines (sound specters) of the 317 largest bells of the Moscow monasteries,

churches and cathedrals which made his work a monumental contribution to the history of Russian traditional music and himself a prominent figure in Russian campanology (Blagoveschenskaya, 1977, 1985). Such an intricate, persistent, intense and subjectively meaningful integration of congenital synesthesia, personal achievement and cultural value puts Konstantin Saradzhev on an equal footing with other great synesthetic musicians and composers such as Franz Liszt, Nikolai A. Rimsky-Korsakov and Olivier Messiaen.

References

Batuman, E. (2009). The Bells. *The New Yorker*, 27 April. p. 26.

Blagoveschenskaya, L. D. (1977). Sound specters of the Moscow Bells. *Cultural Heritage. New Discoveries. Annual journal*, 35–52.

Blagoveschenskaya, L. D. (1985). K. K. Saradzhev's project of a secular concert belfry. *Kolokola (Bells) (collection of articles)*, Vol. 1. Moscow: Nauka.

Cytowic, R. E. (2002). *Synesthesia: A Union of the Senses* (2nd ed.). Cambridge, MA: MIT Press.

Ericsson, J. (1984). *Lowell House Zvon*, Harvard University Cambridge, MA; cited in R. Ogryzkov (hierodeacon Roman). (2011). *Siberian Zvon*, 5 (December).

Glasser, S. (2016). Synesthesia and prodigiousness: the case of Olivier Messiaen. In McPherson, G. E. (Ed.), *Music Prodigies* (pp, 453–470): Oxford: Oxford UP.

Ivanov, O. (2015). *1701 or 1692 or… Some Considerations of K. Saradzhev's Unique Capabilities of Music Pitch*. Retrieved December 20, 2019 from https://snowman-john.livejournal.com/tag/сарадж%20к.к.

Jewanski, J., Simner, J., Day, S. A., & Ward, J. (2013). The beginnings of an interdisciplinary study of synaesthesia: Discussions about the Nussbaumer brothers (1873). *Theoria et Historia Scientiarum, 10*, 149–176. doi: 10.2478/ths-2013-0008.

Lukyanov, R. (protoiereus) (1988). The Bells of the Danilov Monastery at Harvard University. *Russian Renaissance (Russkoye Vozrozhdenie), 42*, 54–68.

Rumyantsev, S. Yu. (2003). *A Book of Silence. Sound Imagery of City*. St. Petersburg: Dmitry Bulanin Publishers.

Starcheus, M. C. (2012). *Musician's Personality*. Moscow: Tchaikovsky Moscow State Conservatory.

Sacks, O. (2001). *Uncle Tungsten: Memories of a Chemical Boyhood*. New York: Vintage Books.

Tsvetaeva, A. I. (1977). The Tale of the Moscow Bell Ringer. *Moscow* (journal), (7), 129–171.

Tsvetaeva, A. I. & Saradzhev, N. K. (1988). *Maestro of Magic Bell-ringing*. Moscow: Muzyka.

Vanechkina, I. L. (2000). About the "Color Hearing" of K. Saradzhev. *Proceedings of the International Conference Prometheus-2000* (pp. 101–104). Kazan': Fan.

Ward, J., Thompson-Lake, D., Ely, R., & Kaminski, F. (2008). Synaesthesia, creativity and art: What is the link? *British Journal of Psychology, 99*, 127–141.

Synesthetic features of creativity: Krzysztof Penderecki

Svetlana Konanchuk

Russian scientist Bulat Galeyev called synesthesia a natural conscious ability to correlate objects of different modalities, an inter-sensory association developed in culture and socially determined. Synesthesia is a special way of encoding information in the figurative and symbolic language of a work of art, including musical and pictorial, etc., by means of imaginative means and stylistic devices, the components of which acquire the ability of harmonious combination through interspecific associations gravitating to the integrity of perception of the surrounding reality (Galeyev, 1992).

Today, the synesthetic analysis of musical texts is becoming a necessary part of analytical approaches to the study of the works of contemporary composers; for example, Krzysztof Penderecki (1933–2020)—one of the largest representatives of the Polish musical avant-garde. Sonorism is one of the basic aesthetic principles of modern music, which has established itself as a category of musical thinking. Sonoristics, increased interest in the timbre of sound, sophistication of orchestral colors, dynamics of form, and romantic expression are

clearly expressed in the work of Penderecki (*Passion for Luke* for soloists, reciter, three mixed choirs, a choir of boys and an orchestra; *Crying in memory of the victims of Hiroshima*, etc.). The paramount importance of sound texture, timbre, rhythm, articulation, the revival of the principles of microchromatics and ecmelia, the increasing role of percussion instruments, and the splitting of sound are the specifics of not only sonarism, but modern music in general; not only in classical, but also jazz, rock and pop music.

In an interview at the *XIV Competition: P. I. Tchaikovsky*, Penderecki spoke about his musical work, which manifests bright synesthetic abilities. "When I conduct my works, I can try to bring certain elements of the composition to the ideal image formed in my imagination. […] I always start compositions with form—not with a theme, but with a graphic sketch of the entire work. Only then do I fill in all the white spots. So from the very beginning you can know what the work will look like". Creating the opera *King Ubu*, the composer abandoned the traditional musical notation and drew triangles, arrows, squares on paper, explaining it this way: "I just see music." Penderecki emphasizes that he sees all sounds in a color that changes depending on his sensations. The color palette creates in his imagination a sound polyphony, clearly reflected in the notes of the musical text. "You can say that I color it," the composer explains. "The color of each sound changes depending on my sensations. I use color to record musical text." And another statement by Penderecki in connection with his music for the Wajda film *Katyn*: "The tones of my music for this film are rich, saturated, mostly dark, with an abundance of shades, not at all monochrome".

"If I hear the trumpets, it should be red, and horn—for example, orange. However, I often have associations between the sound of certain instruments and a color. Strings are usually associated with green for me. Sonoristics in my view is connected with color, but not as clearly as Scriabin's […]. I don't want to put forward any theories, this is for my private use. When I make sketches, I associate it with color, so that I can remember that, for example, there should be brass instruments here…" (An exclusive interview with Krzysztof Penderecki, 2011).

The high skill of Penderecki is combined in his works with complex experiments and synesthetic techniques. For example, *Crying in memory of the victims of Hiroshima* is a work of incredible emotional intensity, it does not have melody or harmony, but there are bright, expressive synesthetic sound effects that replace each other. In the work of *Fluorescence*, the composer adds the sound of a saw, the sound of a typewriter, and a siren to the sound of the orchestra. After avant-garde writings, Penderecki showed another facet of talent. He turned to church music and created *Stabat Mater*, *Passion for Luke*, *Matins*, *Other Cherubs* and several other works for the choir, as well as the opera *Black Mask* and much more. The architectonics of sonorism is manifested in Penderecki in a new articulation and new forms of codification of the text, based on non-traditional methods of sound production in the vocal and instrumental spheres, specific graphic drawings and symbols. For example, Penderecki first builds the architectonics of the entire work, drawing its graphic sketch.

Studying the architectonic properties of sonorism in Penderecki's compositions allows us to create new ideas about the organization of complex musical sound and color images that are subordinate to the principles of dynamic development and synesthesia.

We can draw analogies of sonoristics with the aesthetic principles of Wassily Kandinsky, who compared painting with music and noted that abstract art is a means of extracting pure sound, understood as a Platonic 'idea', but in a more irrational sense. "Sound" for Kandinsky is able to reveal the spiritual content of each real phenomenon, but only in an abstract form. Just as in sonoristics, "sound" is an indivisible part of the cosmos, the highest "harmony of the spheres".

References

Galeyev, B. M. (1992). Problemy sinestezii v ehstetike [Problems of Synesthesia in Aesthetics]. In *Sovremennyj Laokoon. Ehsteticheskie problemy sinestezii* (pp. 5–9). Moscow, Russia: MGU.

An exclusive interview with Krzysztof Penderecki (2011).
Retrieved December 6, 2019, from http://muzcentrum.ru/news/2011/07/8714-xiv-chaikovsky-competition-penderetsky-interview.

Hearing color: How synesthesia constructs intimacy in Eric Whitacre's *Alleluia*

Samantha Kelly

In the context of music perception, synesthesia refers to the involuntary, idiosyncratic correspondence between different tonalities and colored photisms that, when experienced and utilized by composers, serves to underlie the former in a visual modality (Peacock, 1985). Prominent synesthetic composers such as Oliver Messiaen and Alexander Scriabin have underscored color as an essential element of music. However, the literature regarding synesthesia is often preoccupied with what/whom qualifies as synesthesia/a synesthete and its ultimate subordination to the music itself. Apart from tangential discussions of theosophy and various symbolic associations, the emotional dimension of synesthesia and its inherent significance as a distinctive component of, not an addendum to, the experience of music is hardly recognized. Additionally, rather than ascribing affective qualities such as timbre and texture to different colors, Messiaen, Scriabin and other authors cite pitches and keys as the primary sonic stimuli that produce color in synesthetes (Cook, 1998). My approach to synesthetic musical experience bridges this gap by drawing attention to the central role of these affective qualities in color production, in addition to the uniquely intimate, bodily significance of synesthetic connection to music.

Synesthesia's automatic, idiosyncratic nature strongly implies that the pathway between auditory stimulus (music) and psychic sensation of color bypasses secondary conscious reflection of the language or symbolic associations of a piece. Rather, the semiotic 'grain' of the music is responsible for synesthetic color production. I adopt this term from D. Robert DeChaine to encompass the textures, tones, timbre, and

other sonic productions that elude precise definition or, more explicitly, those that body the music forth (2002). As I argue, these granitic elements also directly incorporate themselves into the body of the listener by clearing the liminal space between the senses, thus forging emotionally-charged, synesthetic connection to music. To demonstrate this effect, I study Eric Whitacre's choral composition *Alleluia*, a piece with only one repeated lyric and several 'shifts' between different color palettes (or combinations of synesthetically-produced colors), specifically the sunset palette with hues of orange, pink, and gold and the water gradient palette with varying shades of blue. Through analysis of both structural elements of the score, such as chord progressions and major/minor constructions, and granitic elements, I conclude that the former do not sufficiently account for changes in color perception. Rather, modifications of such non-signifying elements as rhythmic inflection, timbre, and texture effectuate the production of new colors, and thus can be considered the principal architects of sound-color correspondence. Further, the immediate, unintentional fusion of mind, body, and the senses forged from this synesthetic connection to music evokes intimate emotion by creating a space that is both intensely bodied in its deep connection to the self and disembodied in its ability to construct a different 'world' of color. Through the insertion of color into the cleared, emotionally-charged liminal space, my body itself is transformed into an instrument, an intensely vulnerable, yet spiritual experience. The photisms produced by music are not, then, a mere similarity to the primary melodic experience. Through the insertion of music's granitic or 'bodied' elements into the body of the musician or listener, synesthesia constructs a wholly different, intimate relationship to music that lends new significance and emotional power to the piece at hand.

References

Cook, N. (1998). *Analysing Musical Multimedia*. New York, NY: Oxford UP.

DeChaine, D. R. (2002). Affect and Embodied Understanding in Musical Experience. *Text and Performance Quarterly, 22*(2), 79–98.

Peacock, K. (1985). Synesthetic Perception: Alexander Scriabin's Color Hearing. *Music Perception, 2*(4), 483–505.

How synesthesia is used to obtain AIDA: The role of synesthesia in branding female musicians

Elke Hager

Synesthesia as part of a musician's brand: "You have to be unique, and different, and shine in your own way" (Lady Gaga, 2020). This quote from Lady Gaga perfectly puts the crucial factors of artists' branding in a nutshell. To gain attention, interest, desire and action—being summarized as AIDA—the artist needs an interesting, ideally somewhat mysterious personality. Due to its rare occurrence, synesthesia not only exerts fascination and can give the impression of a musician's genius, but also seems to be a perfect topic for drawing attention to the musician. The versatile applicability of synesthesia to communicative activities makes this phenomenon a valuable element of a musician's branding. The aim of this article is to investigate how female musicians incorporate synesthesia into their artistic identity and thereby shape their brand.

Method: The impact of synesthesia on a musician's branding is measured by analyzing the hits that are shown in February 2020 when entering the artist's name into search engines like Google the first time without any further keyword and a second time combined with synesthesia. To avoid the influence of cookies, the retrieval is made on a device where no previous research concerning synesthesia has been made before. Due to Pop-business being extremely short-lived, only impacts on the first three pages are used as indicators. In addition, official biographies published via the artists' Wikipedia articles and official Facebook-postings not older than six months (September 2019 to February 23, 2020) are taken into consideration. Four female artists, often referred to as synesthetes, are selected as objects of investigation: Lady Gaga, Lorde, Tori Amos and MARINA (and the Diamonds).

Lady Gaga: Although there are some videos of interviews in which Lady Gaga talks about synesthesia, it is not actively used for her branding. This aspect is supported by the facts that neither googling Lady Gaga without reference to synesthesia shows any hits in relation to this phenomenon nor is it mentioned in her Wikipedia article or her official Facebook account. Most of the hits on Lady Gaga's synesthesia displayed by search engines are generated either by journalists or by users who discuss whether or not she has it. It can therefore be said that synesthesia is not used as part of the core brand, but only as added value that satisfies the fans' need for deeper knowledge of their idol. Synesthesia seems to be used as a kind of secret that fans discuss while looking for evidence and sources for their assumptions (Wolfie, 2016). In this case, gaining AIDA by synesthesia is mainly controlled externally by mass media and social media users.

Lorde: Although Lorde's synesthesia in not mentioned in her Wikipedia article, Facebook account or website, it has a great impact on her branding. Search engines retrievals for Lorde and synesthesia provide links to first-hand information such as videos and interviews about her synesthesia. Since the artist describes and explains this condition in several interviews, it can be assumed that she would like to use it to create her unique image. When promoting her album Melodrama, she speaks of synesthesia as part of her creative process and emphasizes that she does not write her songs by using the usual rules, but by seeing colors (Weiner, 2017). In particular, the song Green Light is said to have been influenced by synesthesia. Lorde herself uses synesthesia in the AIDA process to create a special image of her creativity.

Tori Amos: As with the artists mentioned above, synesthesia is not addressed on Tori Amos' website or in her Facebook account, but only in her Wikipedia-article. In interviews, she reports not only of a color-music synesthesia, but also a form-music one (Möllmann, 2012) and says that when she walks through the streets, she sometimes hears geometric structures that form the basis for a song. It is striking that the artist's name alone is enough to get search engine hits related to synesthesia, but, when combining Tori Amos and synesthesia, the result

is fairly weak, as she is mostly only mentioned as one of several synesthetic artists. More recently, Tori Amos no longer appears to be using synesthesia to induce AIDA, but is shifting her positioning to political issues such as feminism.

MARINA (and the Diamonds): The case of MARINA is similar to what has been written about Tori Amos. Synesthesia is mentioned in Wikipedia, but not in her social media activities. But, in contrast to Tori Amos, the combination of synesthesia with the artist's name shows significantly stronger results with links to interviews in which she talks about her synesthesia. As part of the release of her second album *Electra Heart*, in 2012, MARINA took up synesthesia as the central theme in several interviews (MARINA, 2012); but, in 2015, during the promotion for her third album *FROOT*, Marina admits in an interview that she is tired of answering questions about synesthesia (Lancaster, 2015). In 2018/2019, she presents her album *LOVE + FEAR* and rebrands herself from *Marina And The Diamonds* to MARINA in order to be perceived more as a natural person than an artificial figure. She positions herself as a political artist (Sliskovic, 2019). Synesthesia no longer plays a central role in obtaining AIDA.

Conclusion: A comparison of the four female artists shows that synesthesia offers the potential to obtain AIDA and was used to design the musicians' brand. As a rare condition, it can be useful to add an extra value to the promotion of songs and albums; but, more recently, political issues such as sexual orientation, sexual harassment, and feminism have become more important for female artists' branding.

References

Lady Gaga (February 23, 2020). Retrieved February 23, 2020 from https://www.grammy.com/grammys/artists/lady-gaga.

Lancaster, B. (February 2, 2015). *Trust Your Gut: An Interview With Marina and the Diamonds.* Retrieved February 23, 2020 from: https://www.rookiemag.com/2015/02/marina-and-the-diamonds/.

MARINA. (January 5, 2012). *Marina and The Diamonds Interview: She is Seeing Colors. Inside The Story*. Retrieved February 23, 2020 from https://www.youtube.com/watch?v=k1nhTQ1WLoc.

Möllmann, A. (October 12, 2012). *Tori Amos im Interview, Teil 2*. Retrieved February 23, 2020 from https://www.vip.de/cms/tori-amos-im-interview-teil-2-927048.html.

Sliskovic, D. (April 19, 2019). *Marina im Interview: „Ich hatte mit meiner Musikkarriere schon abgeschlossen"*. Retrieved February 23, 2020 from https://www.musikexpress.de/marina-im-interview-ich-hatte-mit-meiner-musikkarriere-schon-abgeschlossen-1232205/.

Weiner, J. (April 12, 2017). *The Return of Lorde*. Retrieved February 23, 2020 from https://www.nytimes.com/2017/04/12/magazine/the-return-of-lorde.html.

Wolfie. (2016). *Does Gaga have synesthesia?* Retrieved February 23, 2020 from https://gagadaily.com/forums/topic/179981-does-gaga-have-synesthesia/.

Music and Synesthesia: History – Theory – Empirical studies

What color is a flute? Timbre-color synesthetes in the 19th century: A compilation and evaluation

Leonardo Capanni & Jörg Jewanski

Timbre-color synesthesia as a subform of colored hearing is a neglected issue inside of synesthesia research. In the appendix of Ferdinand Suarez de Mendoza's monograph *L'audition colorée* (1890), a list of 134 known inducer-color synesthetes is provided, which is the most complete one of the 19th century up to today.

Fig. 22: Ferdinand Suarez de Mendoza (1852–1918), reproduced from Carnoy, H. (1903). Suarez de Mendoza. In H. Carnoy (Ed.), *Dictionnaire biographique international des écrivains, des artistes, des membres des sociétés savantes du clergé, du monde diplomatique, politique et administratif* […] (Vol. 2, pp. 132–141). Paris: Chez l'auteur.

Out of this group, 54 had the ability of colored hearing; some of them (the exact number is difficult to get for several reasons)

had timbre-color synesthesia. Although Suarez de Mendoza's list is not complete and some of his attributions are questionable, his compilation is a good starting point for a more complete one. In our historical research—we both specialize in research on synesthesia in the 19th century—we can enlarge Suarez de Mendoza's list a lot. We are compiling as many timbre-color synesthetes from the 19th century as possible. For this, we refer to the sources, which are mainly in Latin, German, English, French and Italian. Evaluating these sources, our questions are: Can we systemize timbre-color mappings in synesthetes? Is there an accumulation of specific colors to specific musical instruments? And, if so, is there also an influence of the pitch in which the instrument is mainly played? What's about colors for the human voice? Is there a difference in color mapping for male or female voices?

References

Suarez de Mendoza, F. 1890. *L'audition colorée*. Paris, France: Octave Doin.

Jewanski J, Day, S. A., & Ward, J. (2009). A colorful albino: The first documented case of synesthesia, by Georg Tobias Ludwig Sachs in 1812. *Journal of the History of the Neurosciences, 18*, 293–303. doi: 10.1080/09647040802431946.

Jewanski J., Simner, J., Day, S. A., & Ward, J. (2011). The development of a scientific understanding of synesthesia from early case studies 1849–1873. *Journal of the History of the Neurosciences, 20*, 284–305. doi: 10.1080/0964704X.2010.528240

Jewanski, J. (2013). Synesthesia in the nineteenth century. Scientific origins. In Simner, J. & Hubbard, E. M. (Eds.), *The Oxford Handbook of Synesthesia* (pp. 369–398). Oxford, UK: Oxford UP.

Jewanski, J., Simner, J., Day, S. A., Rothen, N., & Ward, J. (2020). The 'Golden Age' of Synaesthesia Inquiry in the Late Nineteenth Century (1876–1895). *Journal of the History of the Neurosciences, 29*(2), 175–202. doi: 10.1080/0964704X.2019.1636348.

Jewanski, J., Simner, J., Day, S. A., Rothen, N., & Ward, J. (2019). The Evolution of the Concept of Synesthesia in the Nineteenth Century as Revealed Through the History of Its Name. *Journal of the History of the Neurosciences*. doi: 10.1080/0964704X.2019.1675422.

Capanni, L. (under review). *'La voix rouge'. Critica e genesi del concetto di sinestesia nel contesto francese del XIX secolo* ['The red voice'. Critique and Genesis of the Concept of Synaesthesia in the French Context of the XIX Century]. Diss. Parma – Paris 1.

Jewanski, J., Simner, J., Day, S. A., Rothen, N., & Ward, J. (2020). Recognizing Synesthesia on the International Stage: The First Scientific Symposium on Synesthesia (at The International Conference of Physiological Psychology; Paris, 1889). *Journal of the History of the Neurosciences*. doi: 10.1080/0964704X.2020.1747866 (in print).

Music-color synesthesia: A sensorimotor account

Caroline Curwen

Background in synesthesia research. Music-color synesthesia or simply 'colored-hearing' is an umbrella term commonly applied to various types of synesthesias that are elicited on hearing sound. Musical inducers may be broadly categorized into four groups comprising compositional style, timbre, tonality, and pitch (tone) (Peacock, 1985). Developments in synesthesia research are beginning to address the historical assumption that synesthesia operates under a single mechanism. Notwithstanding the general automaticity and consistency that characterizes synesthetic experiences, some forms of music-color synesthesia may not be so very different to normal cognition and may simply be an attempt to understand abstract concepts such as music unfolding overtime (van Leeuwen, Singer, & Nikolić, 2015).

Background in philosophy. Having never been without their synesthesia, synesthetes are often surprised to discover that not everyone experiences music in the same way they do. For these individuals, it just forms part of their normal perception. Perhaps the question we should be asking is not, 'what is it like to have synesthesia' but, 'what is it like not to have synesthesia?' With this in mind, perhaps more weight can be given to the notion that a phenomenon such a music-color synesthesia should not be viewed as a completely different and odd phenomenon

but examined in the context of the development of research in music cognition. If looked upon this way, we must consider the colors and shapes experienced in music-color synesthesia as a fundamental part of the phenomenal character of musical experience, or the 'what it is like' to hear music, for synesthetes (Chalmers, 1996; Nagel, 1974; Shoemaker, 1994).

Aims. The aim of this paper is to discuss how research in enactive music cognition might support a sensorimotor account of some forms of music-color synesthesia, arguing that music-color synesthesia should not be regarded as a separate and distinct condition within the confines of synesthesia, but as an extension of general music cognition.

Main contribution. Recent empirical and theoretical work in music cognition moves away from cognitivist accounts, rejects representationalism, and embraces a more embodied standpoint (Schiavio et al., 2017; Schiavio et al., 2019). Such an embodied and enactive perspective may improve our understanding of the phenomenon of synesthesia. Historically, synesthesia has been examined as a separate condition from normal perception and cognition. However, growing evidence suggests that synesthesia could simply be an ability developed by some to support the understanding of abstract concepts such as music unfolding over time, similar to general non-unique cognitive processes (van Leeuwen, Singer, & Nikolić, 2015). If certain forms of music-color synesthesia do show parallels to general music cognition, can it be demonstrated that they are similarly embodied and interconnected with the environment? This paper describes how the role of embodied and enactive perception in general music cognition may be extended to some forms of music-color synesthesia, and how music-color synesthesia might be better understood as a sensorimotor phenomenon, offering a radically different perspective on this form of synesthesia than is commonly provided. Music-color synesthesia is not just about perceiving colors on hearing a tone or sound. In some forms, it has been shown that it can be elicited from concept alone (Ward, Tsakanikos & Bray, 2006; Simner, 2012) and is often accompanied by shapes and textures. It is from this perspective that a skillful engagement with the environment

and relevant sensorimotor contingencies may be identified. An argument is made for how the attributes of 'bodiliness' and 'grabbiness' (Hurley & Noë, 2003) might be found in a sonic environment, and how music listening might be perceived as an 'act of doing' (Clarke, 2005; Krueger, 2011; Reybrouck, 2005).

Implications for musicological interdisciplinarity. In recent research, it has become more apparent that it is important to take into consideration that synesthesia is not just one single condition to be explained under a 'one for all' mechanism (Simner, 2012). Music-color synesthesia offers an opportunity to examine how some forms of synesthesia may have developed as an extension to normal perception and cognition. Future research in music-color synesthesia should follow similar research avenues to those in general music cognition, which may lead to a testable theory that can account for the way the extra qualia experienced in music-color synesthesia appears the way it does.

References

Clarke, E. F. (2005). *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning*. New York: Oxford UP.

Hurley, S., & Noë, A. (2003). Neural Plasticity and Consciousness 1. *Biology and Philosophy, 18*(1), 131–168.

Krueger, J. W. (2011). Doing things with music. *Phenomenology and the Cognitive Sciences, 10*(1), 1–22. doi: 10.1007/s11097-010-9152-4.

Nagel, T. (1974). Philosophical Review What Is It Like to Be a Bat? *Source: The Philosophical Review, 83*(4), 435–450. www.jstor.org/stable/2183914.

O'Regan, J. K., & Degenaar, J. (2014). Predictive processing, perceptual presence, and sensorimotor theory. *Cognitive Neuroscience, 5*(2), 130–131. doi: 10.1080/17588928.2014.907256.

Peacock, K. (1985). Synesthetic perception: Alexander Scriabin's color hearing. *Music Perception, 2*(4), 483–506.

Reybrouck, M. (2005). Body, mind and music: musical semantics between experiential cognition and cognitive economy. *Revista Transcultural de Música*. doi: 10.1007/s10516-004-6679-4.

Schiavio, A., van der Schyff, D., Cespedes-Guevara J., & Reybrouck, M. (2017). Enacting musical emotions. Sense-making, dynamic systems, and the embodied mind. *Phenomenology and the Cognitive Sciences, 16*, 785–809. doi: 10.1007/s11097-016-9477-8.

Schiavio, A., van der Schyff, D., Gande, A., & Kruse-Weber, S. (2019). Negotiating individuality and collectivity in community music. A qualitative case study. *Psychology of Music*, *47*(5) 706–721. doi: 10.1177/0305735618775806.

Seth, A. K. (2014). A predictive processing theory of sensorimotor contingencies: Explaining the puzzle of perceptual presence and its absence in synesthesia. *Cognitive Neuroscience, 5*(2), 97–118. doi: 10.1080/17588928.2013.877880.

Shoemaker, S. (1994). Phenomenal Character. *Noûs, 28*(1), 21–38.

Simner, J. (2012). Defining synaesthesia. *British Journal of Psychology, 103*, 1–15. doi: 10.1348/000712610X528305.

van Leeuwen, T. M., Singer, W., & Nikolić, D. (2015). The merit of synesthesia for consciousness research. *Frontiers in Psychology, 6*(1850), 1–7. doi: 10.3389/fpsyg.2015.01850.

Ward, J., Tsakanikos, E., & Bray, A. (2006). Synaesthesia for reading and playing musical notes. *Neurocase, 12*(1), 27–34. doi: 10.1080/13554790500473672.

Chromesthesia influences on musically inspired immersive experience design

Annika R. Johnson, Elise N. Gray, Lance J. Radtke, & Scott A. Bailey

Problem. Music-color synesthetes (chromesthetes) have distinct, consistent color experiences connected to musical tones, notes, pitches, and timbres. When hearing music, chromesthetes spontaneously evoke idiosyncratic, organic in origin, color activation that enhances their otherwise fully intact (normal) auditory experiences. Chromesthesia is likely the result of enhanced structural brain connectivity (Zamm et al., 2013), perhaps resulting from activation of the V4 region of the visual cortex (Rouw et al., 2011), a bilateral band of tissue in the ventral visual pathway that is involved in attending to visual stimulus features including color (Simner & Hubbard, 2013). Non-synesthetes, by contrast,

do not experience color activation as result of hearing music in the absence of unchanging visual information, and experience color associations, if at all, as result of associative memory triggers.

From the development of pop-up experiential museums and Instagram-able immersive art installations, to the redesigning of brick-and-mortar shopping centers, present day institutions and businesses struggle to stay relevant. This backdrop provided an opportunity to frame a creative thinking task for participants who were charged with designing immersive, music-inspired experiences.

The objective of the present experiment was to determine whether chromesthetes and non-synesthetes (controls) diverged in the use of abstract descriptions, tangible descriptions, extent of conformity, and length of discussion when translating music into imagined multi-sensory immersive experiences.

It was hypothesized that chromesthetes would not be as influenced by their partner's experiences, showing persistent support for their own original ideas, while controls were hypothesized to be more likely to yield to their partners' ideas. It was further anticipated that chromesthetes would produce more discussion when generating immersive ideas compared to their non-synesthete counterparts.

Method. Participants were 35 English speaking adults ages 18-35. (Female n=21, Male n=14) Participants were from two groups: self-identified chromesthetes (n=13) and controls (n=22). Participants listened to 30-second music clips from eight different genres: Afrobeat, Electronica, Flamenco, Indie Rock, French Jazz, K-pop, Rap, and Scandinavian Metal. Lyrics for half of the songs are in English; the other half have non-English lyrics. Vocalist sex was balanced across the songs. All songs had low relative total Spotify streams in attempt to reduce participant familiarity with them. The range of languages was selected in attempt to control for words being confounded for synesthetes who have word-color associations, and for all participants who may base their ideas on the connotations of words. Participants worked in pairs (typically two chromesthetes or two controls at once; one synesthete

was paired with a non-synesthete confederate who pretended to experience chromesthesia) listening to the same 30 second segments of the music samples played over speakers.

Following each clip, participants spent between 0:35 and 2:55 (minutes: seconds) discussing ways in which, with limitless budgets, the music could be used to inspire immersive five minute "walkthrough" experiences. The experiences were to be described via color, shapes, objects, values, or anything else needed to illustrate the participants' ideas. After hearing one another's descriptions, participants were asked whether they would add anything from the other participants' experiences. Post-listening conversations and oral responses were recorded for subsequent analyses.

Results. Independent samples t-tests comparing chromesthetes to non-synesthetes were performed on the dependent variables of Abstract Descriptions, Tangible Descriptions, and Conformity. All differences indicated as statistically significant met at least the at the $\alpha = .05$ criterion.

Analysis of the Abstract Descriptions data revealed statistically significant differences between the chromesthetes and the non-synesthete controls for all eight song clips, with chromosthetes making more use of abstract ideas and descriptions than their non-synesthete counterparts. The two groups differed significantly on their use of Tangible Descriptions for seven of the eight song clips, with the non-synesthete control participants reliably making more use of tangible references. For three of the genres, non-synesthetes demonstrated more incidents of conformity than the chromsthetes, with no other differences occurring for the conformity variable.

In addition to the statistical analyses summarized above, qualitative representations were created by one non-synesthete and one chromesthete for one of the song clips in order to convey the contrasting abstractness of their representative descriptions. These are presented in Figure 23, below.

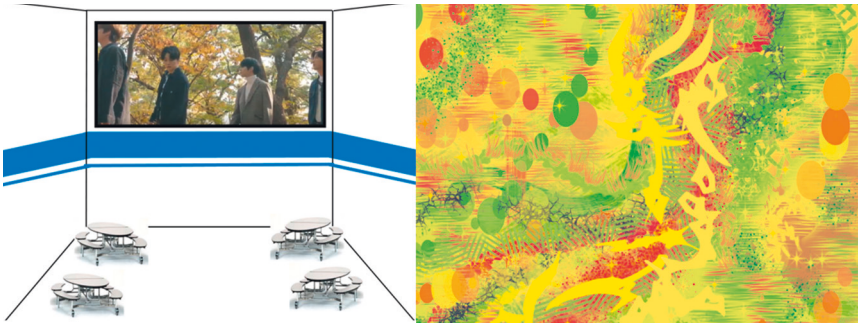


Fig. 23: Pictures representing the differences in how a non-synesthete (left panel) and a chromesthete (right panel) translated their experiences after listening to COMPASS by Golden Child, the K-Pop song selected for this experiment. Note that the depictions were created after participating in the experiment proper.

Comparing the left and right panels of Figure 23, the viewer may immediately notice contrasting use of tangible items and abstraction. These are representative of the ways in which the walkthrough experiences were described by non-synesthetes and chromesthetes, respectively. One of the chromesthetes requested the source information for the eight clips and shared representations for each of the clips. These have been combined and are presented collectively as Figure 24, below.

Fig. 24: One chromesthete's representation of music-inspired immersive art installation rooms.

Conclusions. Chromesthetes described their experiences in more abstract language than their non-synesthete counterparts. Non-synesthetes were more likely to be

influenced by their partners' experiences, whereas the chromesthetes were unlikely to conform. A point of interest not represented in the data is that multiple chromesthetes described the K-Pop song as mainly white with pops, bubbles, or blooms of pastels.

Take-home messages from this experiment include: 1) chromesthetes and control participants differed considerably in how they engaged the tasks in the experiment, 2) presenting participants with unfamiliar musical stimuli resulted in greater diversity of what may be labeled creative thought among chromesthetes versus controls, and 3) understanding features of synesthetes' information processing and creativity may be facilitated by recording their imaginative ideas in both audible descriptions and visual art.

References

Rouw, R., Scholte, H. S. & Colizoli, O. (2011). Brain areas involved in synaesthesia: A review. *Journal of Neurophysiology, 5*, 214–242. doi: 10.1111/j.1748-6653.2011.02006.x.

Simner, J. & Hubbard, E. M. (2013). Synesthesia in school-aged children. In Simner, J. & Hubbard, E. M. (Eds.), *Oxford Handbook of Synesthesia* (pp. 64–82). Oxford, UK: Oxford UP. doi: 10.1093/oxfordhb/9780199603329.001.0001.

Zamm, A., Gottfried, S., Eagleman, D. M., & Loui, P. (2013). Pathways to seeing music: Enhanced structural connectivity in colored-music synesthesia. *NeuroImage, 74*, 359–366. doi: 10.1016/j.neuroimage.2013.02.024.

An experimental feedback model of musical development for synesthetes and absolute pitch possessors

Solange Glasser

Synesthesia and absolute pitch (AP) are two uncommon cognitive conditions that reflect increased neuronal connectivity and have been anecdotally reported to occur together in individuals. What both conditions require are involuntary and stable mappings between perceptual and verbal representations. Yet, while these two conditions share

many commonalities, and have been conjectured to be two sides of the same coin, the experiences of synesthetes and AP possessors remain highly idiosyncratic.

This presentation therefore addresses the question: when the lens is drawn right back, is there a common experiential mechanism underlying these highly individualistic reports? The analysis draws on new insights gained from the lived-world experiences of synesthetes and AP possessors collected during the author's PhD studies.

Participants recruited for this study (n=35) comprise a self-identified sample across music students and staff of the Melbourne Conservatorium of Music, University of Melbourne. Three forms of data collection were used for this study: an online questionnaire, semi-structured interviews, and synesthesia and AP battery tests. Drawing on the complexity of the data collected, the results of this study suggest an experiential feedback model (EFM) of musical development that can be used to elucidate how the brain functions as an information processing system. This speculative theoretical model will be illustrated and expounded, and I conjecture that, while it can be used to describe the unique participant sample of this study, it can also be applicable to the musical development of non-synesthetes or AP possessors.

Synesthetes and AP possessors form a distinct and exceptional group, yet they experience the same degree of within-group variation as would be expected in the non-synesthete and non-AP population. They are therefore both unique, and the same. For synesthetes and AP possessors, however, there is a greater complexity of information processing at an experiential level. Ultimately, the unique perceptual experiences of these people develop longitudinally into enhancements in creative cognition, including visualization, concept formation, categorization, and memory.

My research suggests that, over time, synesthesia and AP can substantively modify the identity and worldview of possessors, resulting in considerable behavioral changes, including both enhancements and impediments. The findings have implications for broader understandings of the specific features of synesthesia and AP. The EFM is intended

as an assumption to generate further research, as what this study has highlighted is that there is still much more to uncover about the lived-world experiences of people with synesthesia and AP.

What happens to the color perception of timbre-color synesthetes if the timbre diminishes or changes step by step?

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In comparison to grapheme-color synesthesia, music-color synesthesia is still a relatively neglected issue. Within music-color synesthesia, timbre-color synesthesia is a subform. In collaboration with the University of Sussex, a research group at the University of Vienna is going to conduct an online empirical study with timbre-color synesthetes. This study has two parts:

a. The influence of missing partials on the color sensation: In this experiment, for five instrumental sounds of the same pitch, more and more partials are removed in five steps (starting with the fundamental). Participants are asked to assign colors to each of these stimuli. This aims at answering the following question: Up to which point can the specific color perception for each timbre be conserved? We hypothesize that the intensity of the color will fade in addition to the color perception changing as soon as the strength of the partial tones is reduced in the formant areas.

b. The influence of timbre morphing on the color sensation: Five different instrumental sounds with the same pitch are morphed into another sound in five steps. This aims at answering the following question: In which way does the color sensation change when gradually transforming the sound from one instrumental timbre to the other? As for this, we hypothesize that the color sensation will change accordingly, becoming a mixture of the two colors which correspond to each of the respective instrument timbre components.

We already recruited 16 timbre-color synesthetes (9 f / 7 m) from Austria/Germany. An additional pool of probands from Great Britain will be added. The study has started in February 2020.

Color-music by Scriabin and Messiaen: Revealing the phenomenon of synesthesia

Konstantin Semilakovs

Alexander Scriabin and Olivier Messiaen belong not only to the most influential composers of the 20th century but are also known for their attempts to merge music, particularly harmonies, with colors. These synesthetic concepts were often treated as a marginal phenomenon—too exceptional and idiosyncratic to be of any relevance to 'normal' perception of music and music-making.

However, considering that Scriabin and Messiaen lived at different times and were influenced by different musical traditions, their color-music concepts had surprisingly much in common: both composers used independently from each other a similar basic structure for their color-chords and both reported on a strong relation between the perception of consonance and color.

In a music-psychological study carried out in 2019 with 46 musicians and non-musicians in Vienna and Scotland, we tried to find out if also wider groups of humans perceive Scriabin's and Messiaen's chords as 'colored' and consonant. Further, our study aimed to understand if this particular harmonic structure could be a critical factor for the perception and association of color in classical compositions.

Our findings could help musicians to better recognize color passages in works by Scriabin and Messiaen, enable them to perform in a literally more 'colored' way, and could provide a deeper understanding of the artistic goals the composers tried to achieve by their color-music.

Exploring the contemporary listening experiences of synesthetes

Solange Glasser, Amanda E. Krause, & Margaret Osborne

The purpose of this research was to investigate the contemporary listening experiences of synesthetes. In particular, we were interested in finding out how synesthetes access and experience music, and whether their listening practices are related to their synesthetic experiences. Music listening engenders a variety of individual experiences that are based on the interaction of both emotional and cognitive processes. The experience of listening to music, therefore, depends not only on the situation and context within which the listening occurs, but also on the specific cognitive style of the listener. Two general cognitive styles have been identified by Baron-Cohen (2009) in his Empathizing-Systemizing Theory. This study, therefore, investigates the impact of cognitive style on music listening practices, and considers the potential multimodal experiences that are linked to these practices. Participants recruited for this study (n= 319, including synesthetes and a non-synesthete comparison group) comprise young adults aged 18-35. Participants were asked to complete an online questionnaire, and respond to questions including: demographics (e.g., age, gender, personality), musical background, preferences, cognitive style, and synesthesia. Cognitive style was measured using the short version of the Music-Empathizing-Music-Systemizing Inventory (MEMS Inventory; Kreutz, Schubert, & Mitchell, 2008), while synesthesia was tested using items from the Synesthesia Battery (Eagleman et al., 2007; Glasser, 2018). In this presentation, we will discuss the findings of the study and their implications for synesthetes, as well as offer suggestions for future directions in music psychology and synesthesia research. This study is the first of its kind to collect data from synesthetes concerning their music listening cognitive style and their contemporary listening experiences. In so doing, it furthers our theoretical understanding of

the relationship between cognitive styles and synesthesia, as well as broadening our understanding of the effect of synesthesia on musical choices and preferences.

References

Baron-Cohen, S. (2009). Autism: The empathizing-systemizing (E–S) theory. *Annals of the New York Academy of Sciences, 1156*, 68–80. doi: 10.1111/j.1749-6632.2009.04467.

Eagleman, D. M., Kagan, A. D., Nelson, S. S., Sagaram, D., & Sarma, A. K. (2007). A standardized test battery for the study of synesthesia. *Journal of Neuroscience Methods, 159*(1), 139–145.

Glasser, S. (2018). *The Impact of Synaesthesia and Absolute Pitch on Musical Development*. PhD Dissertation, University of Melbourne, Australia.

Kreutz, G., Schubert, E., & Mitchell, L. A. (2008). Cognitive styles of music listening. *Music Perception, 26*(1), 57–73. doi: 10.1525/mp.2008.26.1.57.

Pseudosynesthesia – Crossmodal correspondences – Associations – Music and Visual Arts

In defense of musical 'pseudosynesthesia'

Maiko Kawabata

The literature on synesthesia in music has mainly focused on 'idiopathic' or developmental synesthesia; e.g., where colored hearing is innate, as in the case of Olivier Messiaen or (putatively) Alexander Scriabin. As John Harrison and Simon Baron-Cohen (1997) pointed out, however, "there has been a tendency to use the term synesthesia to describe instances in which people discuss a 'mixing of the senses'". They thus dismissed the use of metaphor (a voluntary, not involuntary, response) or the use of association (e.g., when children learn the alphabet from books with letters in different colors) as 'pseudosynesthesia'.

This paper argues that 'pseudosynesthesia' is valid, inherently interesting, and worthy of study from a musical and music-historiographical vantage point, in contrast to perspectives offered in psychology, psychiatry, or psychopathology. In musicology, it may be more productive to approach 'pseudosynesthesia' positively as a real phenomenon, rather than negatively, as fake synesthesia.

Many professional classical musicians today (full disclosure: myself included) associate certain keys with certain colors—not because we are synesthetes, but because of what Marks (1982) and others have called cross-modal matching. For instance, in my experience, many performers consider the key of D-flat major 'chocolatey'—with some distinguishing a high D-flat as milk chocolatey from a low D-flat as dark

chocolatey. This aligns with research (Marks, 1982; Ramanchandran, 2001) showing that non-synesthetes correlate across modalities, such as brightness with loudness or high pitches and darkness with dullness or low pitches (significantly, this seems to be the case across cultures).

Historically, too, there is ample evidence of cross-modal key-color matching in written documents. Numerous eighteenth-century to early nineteenth-century music theory treatises (Vogler, 1779; Knecht, 1792; etc.) explained that sharper keys were brighter and stronger while flatter keys were duller. Some keys were known for special characteristics; e.g., E major, with four sharps (perhaps the sharpest key in common use at the time), which elicited comparisons with the color yellow or gold, often by association with fire.

No research has to date been undertaken examining any correlations between historical key-color characteristics and those found among musicians today. My presentation will therefore sketch out the groundwork for future research testing the following hypothesis: is key-color cross-modal matching in contemporary musicians historically conditioned? I will investigate the prevalence of key-color cross-modal matching, the role it plays in the daily lives of classical musicians from rehearsal to the stage, and attempt to pinpoint its origins. My research method will combine data collection through interviews at a music conservatoire with documenting conversations in my professional life as an orchestral violinist (thus involving an auto-ethnographical element). The associations musicians have with keys, how we talk about keys, ultimately underpin not only our language, but our reality—to evoke an idea established in George Lakoff and Mark Johnson's now classic study *Metaphors we live by* (1980). Moreover, these metaphors are shared and reinforced by a 'speech community'. These broader implications provide further reasons strengthening the case for the study of 'pseudosynesthesia'.

Symbolist composer Alexander Scriabin: Reception history and his synesthesia: Music analysis for Sonata No. 9 and Préludes op. 74

Svetlana Rudenko

The figure of the Russian symbolist composer Alexander Scriabin has held a mysterious fascination to this day. At the turn of the 20th century, the Russian Mystic Symbolist movement was in full bloom, and Scriabin was hailed as a prophet. It was his life's ambition to create a multisensory drama *Mysterium*, capable of transforming the consciousness of the human mind through an act of musical theurgy. By inserting a color organ in his poem *Prométhée*, he wanted to make harmony more evident with colored light. Scriabin developed a new approach to the principles of harmony by considering a broader concept of temperament and was a precursor of Arnold Schoenberg's twelve-tone serialism and Olivier Messiaen's modes of limited transpositions. As a synesthete, in addition to his sound-color associations, Scriabin had extraordinary sensitivity to overtones, his possible source of other cross-sensory associations, and was an outstanding master of piano pedal as a pianist performer. His late piano miniatures, opp. 71, 73, and 74, are considered to be sketches for the *Preparatory Act of Mysterium* (Morrison, 2002), Scriabin's final unfinished multisensory drama. The Russian Yavorsky/Dernova Dual Modality system of analysis is of assistance in describing harmonic structures, alongside some references to Heinrich Schenkerian's analysis, common in Europe, the Octatonism principal, applied by Roberts in the US, and even the Atonal approach by Baker, demonstrated in Sonata No. 9 as a test composition. A 4D model of musical–space synesthesia, developed by Svetlana Rudenko in collaboration with John Dingliana, Trinity College Dublin, demonstrates the composer's possible synesthetic feeling of musical texture. Finally, the principal of music analysis based on the archetypes of musical texture, developed by Garcia, could be utilized as guidance for art visualizations of musical compositions and mapping

the development of dramaturgy. The author considers art visualization of music analysis / Cognitive Musicology as a new methodology of delivering abstract musical content to a wide audience.

References

Rudenko, S., & Dingliana, J. (2017). *4D Visualisation of Musical Texture, A. Scriabin Op. 57 No. 1*, https://www.youtube.com/watch?v=LbmnmWFp1yE.

Rudenko, S., & McDonnell, M. (2019). *Alexander Scriabin Sonata No. 5*, https://vimeo.com/337354023.

D'Annunzio and Scriabin

Luigi Verdi

The life and works of Alexander Scriabin and Gabriele D'Annunzio show many singular analogies. The poet was born in 1863, and the musician in 1872, with nine years separating them and in completely different geographical and cultural contexts; yet their lives seemed to develop in parallel, marked by the same influences and by similar ideals, perfectly in tune with the symbolistic climate of the end of the 19th century. From the portraits available and from a few descriptions, we know that they also looked like each other as regards their appearance and gait (figure 25 and 26).

Plechanov describes Scriabin as an "elegant, harmonious and delicate feminine figure" (cit. after Bowers, 1969, p. 30), and D'Annunzio himself describes his juvenile image in the *Notturno* in these terms: "the forehead is smooth under thick masses of hair. The eyebrows are outlined with such purity that they give something inexpressibly virginal to the melancholy of the big eyes" (D'Annunzio, 1916, ed. 1987, p. 115). Although their field of action was different, D'Annunzio, according to his own assertions, aspired to solve poetry in music all through his life; similarly, Scriabin always tended to illustrate his music with poetry. Yet, it is not proved that the two artists met personally, nor that the musician read something by D'Annunzio, even if the poet was translated into

Russian by Jurgis Baltrušaytis, a brotherly friend of Scriabin's. There is also little chance that D'Annunzio knew about Scriabin's writings, which at that time did not circulate except in Russian. Yet he might have known about Scriabin's aesthetic theories, which his several disciples used to spread in Europe. What is certain is that, from the moment he heard his music, he became passionately fond of it.

Fig. 25: Gabriele D'Annunzio (1863–1938).

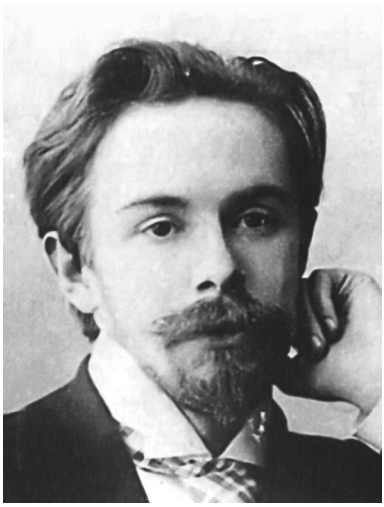

Fig. 26: Alexander Scriabin (1872–1915).

Let us therefore clarify the circumstances under which D'Annunzio's interest in the work of the Russian composer was born. As is well known, the poet risked losing his sight due to an air raid accident that forced him to be motionless in bed for a few months, in the *Casetta Rossa* in Venice. The *Notturno* was born, written for the most part under conditions of complete blindness, fixed with a trembling hand on some lists of paper, the syntax reduced to the essential. The resulting language is fragmentary, all interwoven with unpredictable analogies and transitions into the surreal, isolated words in their original sound in a rhythmic flow without limits.

In these particular circumstances, D'Annunzio manifested an almost vital need for music. The frequent visits of some young musicians who performed music for him relieved the weight of his physical suffering. Among them was the young pianist Giorgio Levi, with whom D'Annunzio formed a solid friendship; so much so that, in subsequent years, he made some dedications to him, calling him "the detector of Scriabin", "the consoler of the inert blind man", "the rhythmic companion of soul". In a letter of 1924, Giorgio is "a deep and mysterious music detector, the transmitter of the spells of Scriabin" (Damerini, 1961, p. 846).

The language of the *Notturno* was thus born in harmony with the character of Scriabin's music. Its fragmentation is very close to certain movements of the last compositions of the Russian musician, to certain sudden flashes not linked by a logical thread, to certain rhythmic upsurge immediately calmed, to the appearance of motifs fused into one another and connected by a mysterious and underground tone.

In *Prometheus*, Scriabin had tried, and D'Annunzio could not ignore it, to fuse light and sound together by means of a special keyboard to which each key corresponded to a color. This experiment had a wide resonance in the cultural life of the time, and is inspired, among other things, by a writing by the Russian poet Konstantin Balmont: *Svetozvuk v prirode. Svetovaya simfoniya Skryabina* (Light and Sound in Nature and in the Color Symphony by Scriabin) (1917).

All of the *Notturno* by D'Annunzio is punctuated by visual hallucinations that seem to arise from the sounds. A suggestive paragraph is entirely dedicated to the visual and psychic sensations suggested to the poet by listening to a Scriabin prelude. The atmosphere of the Venice lagoon, with its orthodox and almost oriental reflections, offers an ideal setting. Still inspired by the music of Scriabin, D'Annunzio wrote between 1917 and 1920 four "musical imaginations" (D'Annunzio, 1916, ed. 1987, p. 150) which were later included in the 1921 *Notturno*. The protagonist of the fourth musical imagination is the composer himself: six verses all different, in prosody free, evoke with words of "torrid admiration" (Gavazzeni, 1940, p. 265) the figure of the Russian musician.

D'Annunzio's long homage to Scriabin cannot be put generically on the same level as the many similar compositions written by the poet in honor of so many musicians (Giuseppe Verdi, Vincenzo Bellini, etc.). As we believe we have shown, in fact, the motivation for the interest in Scriabin is much deeper than a simple celebratory circumstance. Perhaps, if the composer had lived longer, his relationship with the poet could have borne even greater fruit.

References

Bal'mont, K. D. (1917). *Svetozvuk v prirode. Svetovaya simfoniya Skryabina* (Light and Sound in Nature and in the Color Symphony by Scriabin). Moscow: Kontsertnaya biblioteka Kusevitskikh.

Bowers, F. (1969). *Scriabin. A biography of the Russian composer*. Tokio & Palo Alto: Kodansha Int.

Damerini G. (1961). D'Annunzio inedito. *Quaderni dannunziani, 20–21*.

D'Annunzio, G. (1916, ed. 1987). *Notturno*. Milano: Treves; ed. Milano: Mondadori.

Gavazzeni, G. (1940). Quel che rimane di Scriabin. *La rassegna musicale, 13*.

The colors of musical instruments: An intercultural comparison on timbre-color mappings with non-synesthetes in Austria/Germany and in Madagascar

Jörg Jewanski, August Schmidhofer, & Christoph Reuter

In 2018, Christoph Reuter, Jörg Jewanski, and some more scientists from Austria and Germany, conducted an empirical study about timbre-color mappings in non-synesthetes. In this study, 40 subjects were tasked to assign sounds produced by 10 different orchestral instruments taken from the *Vienna Symphonic Library*. Each instrument was played at three different pitches and in two types of articulation. The colors were presented as a color matrix. For each sound, listeners were asked to choose three colors that match best with the instrument's timbre from their point of view. Among other things, our findings

Fig. 27: Two participants, concentrating very heavily.

indicated an association between low-pitched sounds and darker colors (especially brown), whereas high-pitched sounds were more often associated with lighter colors (especially orange or yellow). At the same time, the primary colors red, blue and green were chosen less frequently than orange, yellow or brown. Additionally, color choices seem to be more dependent on pitch than timbre. Our results were presented under the title *Colors and Timbres* at the annual conference of the *Deutsche Gesellschaft für Musikpsychologie* (German Society for Music Psychology) (DGM) in Giessen, Germany, in 2018.

Fig. 28: The first group of participants filled out the questionnaire.

In February 2020, Jörg Jewanski, August Schmidhofer and Christoph Reuter repeated this study with people from Madagascar (figure 27 and 28) and compared the results with the ones from the study from 2018. This is first time such an intercultural comparison was done. We were interested in the question of whether timbre-color mappings are learned by culture or if they are cross-cultural.

Listen to the taste of music: Mapping sound and wine in crossmodal composition

Jo Burzynska

In the 19th century novel, *Against Nature*, Joris-Karl Huysmans imagines a mouth organ, on which its protagonist plays symphonies on his palate from its collection of liqueurs, each matched to the sensory qualities of a musical instrument. Now that the universal nature of many correspondences between sounds and tastes has been confirmed, such audio-gustatory mixology needs not be confined to fiction, or idiosyncratic synesthetic experience. In this paper, I explore how these shared correspondences can spill from the decadent drinks cabinet to be used as a tool for the non-synesthete composer in multisensory works. This investigation also examines whether the results may be received by synesthetes and non-synesthete in different ways. The practical basis for its discussion is the creative *Crown Range Signature* project (2018), through which I sought to harness sensory correspondences between sound and flavor. This music and wine composition included the development of a novel 'oenosonic' system, which can be used to make mappings between sound/musical characters—such as pitch, timbre, and tempo—and wine characters such as acidity, astringency, fruit, and body. The system applies understandings of contemporary studies into crossmodal correspondences and the findings of my own doctoral research that investigated such connections using artistic and empirical methodologies. In order to discover how the perceptual, emotional, and conceptual correspondences of the *Crown Range Signature* composition

were perceived and interpreted by a wider audience, feedback on the multisensory experience was collected using a small group study. This procedure was repeated with a confirmed synesthete, the Sydney artist Nina Norden—whose synesthesias include sound patterns triggered by flavor—to highlight differences and overlaps in synesthete and non-synesthete reception of this multisensory work. The *Crown Range Signature* project indicated that audio-gustatory mappings such as those imagined by Huysmans do not work against nature but can indeed be mapped to create audio-gustatory symphonies on the palates of the wider population.

From synesthetical ear training to creativity of consciousness

Svetlana Malakhova

The phenomenon of synesthesia, which is characteristic of every person, is discussed. The manifestation of synesthetic tendencies in musical art is considered in the example of the Lithuanian composer and artist Mikalojus Konstantinas Čiurlionis. The possibilities of practical application of the effects of synesthesia in the musical and educational process are revealed.

In the last century, the phenomenon of synesthesia was considered by scientists as a rare and outlandish manifestation of an involuntary fusion of the work of two or more sensory systems. However, modern statistics suggest that one out of several hundred people has synesthesia (Baars and Gage, 2014). According to some data, the most common type in the world is grapheme-color synesthesia (Day, 2016); according to others, the musical-color form of synesthesia is the most common in Russia (Sidoroff-Dorso, 2019). Thus, synesthesia is inherent in each of us, and not just in selected musical geniuses of the level of Nikolai Rimsky-Korsakov or Alexander Scriabin. The phenomenon of synesthesia in each person is manifested individually, because

synesthesia is associated with an emotional state; in particular, under the influence of music, which has the ability to express the perception of the external world in visual forms and color.

In musical art, synesthetic tendencies appeared at the level of style and direction in the era of impressionism. The desire for a new art, for the synesthesia of art, was expressed in the interpretation of music as 'sound painting', and in the visual arts appeared 'music of the picture' and the 'magic chord'. Blurring the boundaries between different types of art, flowing from one type to another, music to painting, painting to music, allowed the piece of music to compensate for the lack of objectivity. These tendencies were manifested in the 'cathedral art' of Scriabin, the 'musical painting' of Čiurlionis, the 'stained glass' multi-color music of Olivier Messiaen, etc.

A striking example of the synesthete artist is Čiurlionis. As a composer, he created about four hundred musical works, including two major symphonic poems, an overture, cantata for choir and orchestra, two sonatas, several cycles of variations for piano, a string quartet, and works for choir. Čiurlionis the artist painted over three hundred paintings; besides that, he tried himself in literature, poetry, and journalism (Loseva, 2018). In the works of Čiurlionis, the parallelism of painting and music can be traced. The symphonic poem *The sea* is supplemented by a cycle of paintings, the *Sonata of the Sea*, consisting of three paintings Allegro—Andante—Final. To the symphonic poem *In the Forest* was painted *Music of the Forest*. Simultaneously with the piece for piano *Autumn*, Čiurlionis wrote a poem *Sonata*, dedicated to autumn. Among musical paintings, there are various symphonies, fugues, and sonata cycles—*The Sonata of the Sun*, *The Sonata of the Stars*, *The Sea Sonata*. In the mature period of creativity, Čiurlionis's painting is based on musical forms, and plastic forms embody the logic of musical development. The work of Čiurlionis the painter was called "music on an easel" (Landsbergis, 1971). Thus, in the personality of Čiurlionis, art and intellect were combined, connecting music, painting and poetry into a single whole.

In modern scientific research, musical synesthesia is not limited to 'color hearing'. M. Karaseva developed a method for the development of synesthetical ear training for applying the effects of synesthesia in the musical educational process (Karaseva, 2018). If synesthesia means the ability to translate sensations received through one channel of perception (in this case, auditory) into a sensory reaction that is expressed through another channel (visual, tactile, etc.), then different connections of submodalities are possible. In the process of working on extracting submodalities in the perception of a sound fragment, Karaseva uses three main sensory modalities: visual, auditory, kinesthetic. The development of a sense of synesthesia involves 'listening to oneself'; i.e., a high degree of concentration of sensations. This practice develops the functions of the right hemisphere of the brain. Unexpected associations that arise as a result of the synesthetic approach increase creative, non-standard solutions in the processes of sensory information processing. There is a harmonization of the hemispheres, because basic European education is aimed at developing the functions of the left hemisphere (written and verbal information, teaching logical thinking, etc.). This approach promotes the development of performing skills among musicians and creative rich-shaped perception among listeners.

Znamenny chant as a synesthetic phenomenon

Alisa Timoshenko

Old Russian writing and Znamenny chant are two integral aspects of Gospel words' embodiment—its visualization and sounding. These arts have captured the essence and characteristics of ancient Russian church culture. The teaching of both arts required a special state of mind in which prayer, concentration and contemplation are combined. The image of the letter in calligraphy and the sound model of the hook

(kryuk) in the Znamenny chant is assimilated by repeated reproduction, repetition, recording of the visual-motor-intonational outline of the elements.

As noted by Maxim Brazhnikov, Znamenny chant belongs to the neuma type and its signs/banners (znamya) indicate not only sound pitch but also timbre and internal and external chant gestures. Each separate sign possesses a large information capacity. It is perceived by the subconsciousness as a clot of multimodal sensations. The terminology of Znamenny chant and its semiography are analyzed from the point of view of perception of the sign as a complex of multimodal sensations.

Much of the associative field of the person of this time remains unclear to modern consciousness. Many meanings and values are lost forever. But, according to Paul Florensky, the symbolic nature of Christian worship has so far preserved the properties of a complex synthesis of arts, which involves the entire complex of sensations—visual, tactile, auditory and olfactory.

Light-musical associations are the basis of the register division of the Znamenny chant sound field. There are four main registers, called "dark" (glum) (this is, very conditionally,—register below C first octave—a certain zero level, called a "line" [storka]), "simple", "light"/"bright" and "thrice light" (tresvetly). On the basis of this principle, a classification of a large group of banners—arrows, hooks, clauses, sticks, fita, etc., are also constructed.

The etymology of these concepts is rooted in the Christian concept of the Trinity in the manifestation of the indivisible ("simple") light, which came to Russia in the 11th century from the Greek Church tradition (ontological-epistemological category, according to Dionisy Areopagit). In the late 16th century vocal Azbuka, the term "four-light" (chetverosvetly) appeared, which at first glance violates the logic of the Christian trinity. But this term served rather pragmatic performance purposes—an indication at a higher pitch level of the hook execution, above the thrice-light one.

Interestingly, the glum register, which unites a fairly large range of sounds and is practically mastered in singing practice better and earlier, nevertheless did not have the internal differentiation that the higher light register mastered later. It is indirectly related to the features of Christian Russian aesthetics: oppositional dark world images in Church Slavonic texts are written without details, a large number of metaphors and comparisons.

A rather wide range of terms reflects the connection with the motor-kinetic component, which many scientists put forward as being at the center of any synesthesia. According to Brazhnikov, many terms contain indications of "actions that need to be performed in order to achieve a particular technical or sound effect in singing". From a modern point of view, this group of terms is the most "picturesque", colorful, but also the least understood. Regarding what the singer should "do" with his voice, the interpretation says: "set foot", "to play a little", "to twitch a little", "pull out", "kick out", "push", "hold", "shake", "shake a little", "put", "bark", "rumble", "puff" , and, finally, "twist", "screw out" and "hiccup".

At the same time, Brazhnikov, with a certain degree of irony, notes: "It is very difficult to explain what it means to 'shake three times', since it is not known what should be done in order to 'shake' at least once". Before us is a complex set of articulation techniques that existed in the tradition, have been fixed with the help of internal kinesthesia, transmitting the work of the vocal apparatus—the muscles of the larynx, the articulation apparatus. The fixation of the types of the voice kinesthesis in its various nuances—trembling, shaking, crushing, stretching, swinging etc., together providing a vivid colorful timbre side of the Znamenny chant—is also reflected in the external rigidity of the kinetics of the golovschik—choir conductor. Compound terms adjoining them, reflecting the movement of the voice, its speed and tempo—voice-treading (glasostupanije), voicerunning (glasobezhanije), voicewriggling (glasoizvitije), greyhound/rapidity, greyhoundfluid (borzotechne), etc. A large group of terms, indicating hooks, litters, signs, appeals to metaphorical visual associations—a spider, magpie leg, a filly, a

snake, "two in a canoe", etc. These strange pointers, incomprehensible to modern perception, obviously serving as kinds of "knots for memory", due to their bright, metaphorical, playful imagery, had a mnemonic function and served to remind of numerous configurations of hooks and their varieties.

As we can see, multimodal approaches allow us to see in phenomenon of Znamenny notation the reflection of the specifics of the Christian worldview and human artistic consciousness in Russia of the 12th-17th centuries, through the embodiment of synesthetic images, models and codes that have formed the culture of this period.

References

Brazhnikov, M. V. (2002). *Russian singing paleography*. St. Petersburg: RIAH.

Brazhnikov, M.V. (1972). *The Old Russian Theory of Music. Based on manuscript materials of the XV-XVIII centuries*. Leningrad: Music.

Bychkov, V. V. (2017). *Byzantine aesthetics. Historical view*. Moscow – St. Petersburg: Center for Humanitarian Initiatives.

Dictionary of the Russian language of the XI-XVII century, retrieved from http://ru-eval.ru/hist/xi-xvii/Vol18pot/15.pdf.

Florensky, P. A. (1993). *Iconostasis: Selected Works on Art* (pp. 283–307). St. Petersburg: Mifril, Russian Book.

Music and word: The views of Russian theorists on versification in the context of synesthesia

Nina Nikolaeva

This report on the context of synesthesia gives an overview of theoretical works on versification, which substantiates the commonality of two artistic languages, music and poetry, and clarifies the category of musicality in relation to poetry.

The first among Russian poets who marked the internal connection of music and words was the great Mikhail Lomonosov, the author of the first influential poetics in new Russian literature. In addition to melody,

the scientist and poet paid special attention to the euphony of the verse, attributing special importance to sound, emphasizing that the pronunciation of each letter can cause various kinds of inter-sensory associations (Lomonosov, 1952, p. 241). As Abram Gosenpud pointed out, expressing views on the common areas of music and poetry, Lomonosov was in many ways polemicizing with the ideas of the novel *The Niels Klim Underground Journey*, by Danish writer Ludwig Golberg (Gosenpud, 1975, p. 215). This controversy is also interesting in the synesthetic aspect.

In the era of romanticism, Athanasius Fet, one of the most synesthetic Russian poets, spoke with special force about the unity of music and poetry. In his theoretical works and letters, the concept of 'musical lyrics' was formulated, in which the substantive role is played by the substantiation of the meaning of sound, musicality, in the transmission of visual and tactile associations. The orientation toward associativity allowed Fet to "express the unspeakable", to embody "elusive excitements, and precisely in the word" (Florensky, 1990, p. 169).

The ideas of Fet about the 'music' of the verse were further developed in the theoretical considerations of the Russian symbolists Andrei Bely, Konstantin Balmont, Vyacheslav Ivanov and others, in whose poetry a musical and, therefore, synesthetic, code defined the semantic content.

The Russian futurists attached special importance to the sound. Alexander Tufanov called his theoretical work *To zaumi: Phonical music and the functions of the consonant phoneme.* In it, he calls sounds "sound movements", and his poems "musical works". Justifying their theory of abstruseness, or the theory of 'art of the future', the futurists simultaneously formulated their synesthetic concept. One of the striking examples of its embodiment can serve as the first futuristic opera, *Victory over the sun*, created by Velimir Khlebnikov, Aleksei Kruchonykh, and Mikhail Matyushin. Viktor Shklovsky gives his assessment of abstruse language in an article of 1924, *On poetry and abstruse language*. He considers this language, which manifests itself most often in a hidden form, as one of the properties of poetry in general, which seeks primarily to arouse emotions with the sound and pronunciation side of a word (Shklovsky, 1919, p. 21).

In 1910, Osip Mandelstam's poem *Silentium* was published, with its famous line "And, word, return to music". The element of music nourished the consciousness of Mandelstam (Lurie, 1995, p. 196), and this, of course, was reflected both in his poetry and in theoretical articles. Speaking about poetry, the poet argued that the sound image appears before the image, expressed in verbal form: "Not a single word is yet, but the poem already sounds. It is an internal image that sounds, it is its sense that the poet hears" (Mandelstam, 1990, p. 171). Hence, his poems have a special intermodal associativity, designed to preserve and convey the integrity of the internal image.

Summing up, we can say that the theme of musicality in relation to poetic works has its own history of development, revealing various aspects of its understanding. But the synesthetic approach directly reveals the inner connection of music and words, defining the special semantic-expressive imagery and the special musicality of the poetic text.

References

Gosenpud, A. A. (1975). Lomonosov and Golberg about music. In Serman, I. Z. (Ed.), *Russian literature of the XVIII century and its international relations: collection 10*. Leningrad, Russia: Nauka.

Fet, A. A. (1982). *Essays* (with a comment by A. E. Tarkhova). Moscow, Russia: Art.

Florensky, P. A. (1990). At the watersheds of thought. Thought and language. 3. The antinomies of language. In Florensky, P. A., *Essays* in 2 Vol. (Vol. 2), Moscow, Russia.

Lomonosov, M. V. (1952). A brief guide to eloquence. The first book, which contains rhetoric, showing the general rules of both eloquence, that is, oratorio and poetry, composed in favor of those who love verbal science. In Lomonosov, M. V., *Complete works. Vol. 7: Works on Philology 1739–1758.* Moscow and Leningrad, Russia: Publishing house of the USSR Academy of Sciences.

Lurie, A. (1995). Osip Mandelstam. In *Osip Mandelstam and his time*. Moscow, Russua.

Mandelstam, O. (1990). Word and culture. In Mandelstam, O., *Essays* in 2 Vol. (Vol. 2: Prose). Moscow, Russia: Khudozh.

Tufanov, A. V. (1924). *To zaum: Background music and functions of consonant phonemes*. St. Petersburg, Russia: Ed. auth.

Shklovsky, V. (1919). On poetry and abstruse language. In *Poetics Collection of articles on the theory of poetic language*. St. Petersburg, Russia.

Musical art and synesthesia: Synergy between smell, color and sound in music

Iluminada Pérez Frutos

The present article studies the synergy between Art and Science and between Music and Science. The composer links, in her work, the senses of sight, smell and hearing, in an attempt to enter the viewer's world of feelings and emotions. The research focuses on the development and study of the correlation between the sense of smell and its relationship with the rest of the arts.

The theoretical and scientific basis for this research is the crucial role played by the sense of smell in mammals. Smell, the most primitive and most 'ignored' sense by human beings, plays an important role in the process of perception and connection with reality, and in learning processes of the emotional memory. Contrasted studies demonstrate the dynamism of the brain structure when it is subjected to sensory stimuli. Hence, every smell plays a key role in learning and vital emotions.

Any contemporary plastic, literary, scenic, and specifically musical work of art can be studied from a perspective that joins the scientific and artistic perspectives, using as a common base odoriferous stimulation.

Visual Music: From Color Organs to Abstract Films

Color sings too: The emancipation of color and its role in the development of a visual music expression in 20th century art

Maura McDonnell

A visual music form of artistic expression is rooted in the color tone analogies of antiquity. Comparing the quantities of phenomenon by an analogical method was a way of doing science (Jewanski, 1999). Isaac Newton's empirical experiment on the refraction of light was also based on this analogy. He was able to replicate the conditions by which an analogical relation between colors and tones could be proven mathematically. However, it was the inventiveness of the various inventors, artists and musicians thereafter that facilitated a new type of approach to color as a phenomenon that was capable of being a new content in itself—akin to a new subject matter for a visual art that had appealing aesthetic, affective and artistic qualities in themselves. As visual art moved towards examining music for its potential to provide new forms and means of expression for visual art, color had a new purpose in art. It was capable of being without natural form; it could be spatial, rhythmic and mobile. Colors could be referred to as sounds and thus were being conceived of as having sonic qualities. What are these sonic qualities—how can a color sing. This paper will examine and compare some examples of artists and their works, at the beginning and end of the twentieth century, whose approach to color facilitated what some observed as the sonic qualities of color. Examples from the author's

own visual music practice will be also be included. Some conclusions for the linkages between color and music in these artworks will be made regarding how such developments contributed to the emergence and development of a visual music expression between visual art and music and in visual music artworks.

Reference

Jewanski, J. (1999). What Is the Color of the Tone? *Leonardo, 32*(3), 227–228.

The first Australian color organ by Alexander Burnett Hector (1912)

Joshua James Berger

Speculative relationships between color and auditory tone have been explored by theorists since at least Antiquity. Indeed, the search for a harmonizing relationship between the classical facets of phenomenology—i.e. the modalities of sensation: touch, sight, hearing, taste, and smell—and even more abstract concepts ranging from the infinitesimal to the infinite (figure 29) (Hector, 1920) have been tied up in the religion and spirituality of cultures all over the globe (Jewanski, 2010a).

With the advent of Science, these theories have increasingly become more systematic and linked to various forms of empirical measurements. The example par excellence is the Newtonian color coding scheme; Newton assigned his Aristotelian derived ROYGBIV colors for the light spectrum to the intervals within a Dorian scale (Jewanski, 2010a). Isaac Newton, however, was importantly circumspect when introducing this scheme. He noted that these correspondences were merely a suggested analogy that 'I have not yet studied sufficiently myself' (Hector, 1922), despite advancing it in his seminal work *Opticks* (1704). Regrettably, others were less explicit with their reservations, and the introduction of empirical measurements often belied the fact that these theories are arbitrarily founded (figure 30 and 31) (Hector, 1920).

The next paradigm to affect this research venture was born from technological advances. In 1723, Louis-Bertrand Castel began developing the first noted implementation of a practical device to visualize a specific color-tone relationship: a color-organ he named the *clavecin oculaire*. Castel's invention quickly inspired analogues across continental Europe. Throughout the 18th and 19th century, the potential therapeutic effects of such color-music displays begun to be touted. Further advancements to these devices were related to technical advancements such as their electrification (Jewanski, 2010b). Despite the notably strong preponderance of strict color-tone correspondence used for these apparatuses, some theorists began toying with the idea of free color play. By the early 20th century, the color-organ had become a true world-wide phenomenon, and not even 'the tyranny of distance' (Wierzbicki, 2012) could exempt its spread to the far side of the world: Australia.

In 1912, the Scottish-Australian immigrant and chemical engineer Alexander Burnett Hector (1865–1958)—a classical admix of the religious scientist—completed his initial letter of patent in a series for the first Australian color organ. His application states "This invention relates to the improvements in the production of color music, that is to say in the production of color simultaneously with music; the colors having certain mathematical relation to the musical notes produced and form certain color harmony in a certain mathematical relation to the musical harmony produced" (Patent No. 29615, 1912).

So far, the literature has characterized his intention for this endeavor as to demonstrate strict correspondence between color and tone, where "the striking of a note must mean the striking of its own color equivalent, and that color or color shade only" (Scholes, 1938), to provide "fixed color-tone correlations through complex calculation" (Jewanski, 2010b), and "reflections on the 'natural' color scale" (Wierzbicki, 2012).

In the context of the aforementioned literature, his letters of patent, and in the light cast from some of Hector's original colored drawings—that have been held in private collection and which have been recently bequeathed to the Mitchell Library, State Library of New South Wales (2018)—it seems increasingly clear that the organ was his practical

attempt to meet his religious and civic duties through his scientific acumen. This presentation explores Hector's stated aims and underlying motivation for his theories and color-organ.

Fig. 29: The Principal of Relativity (Expanded) by Alexander Burnett Hector.

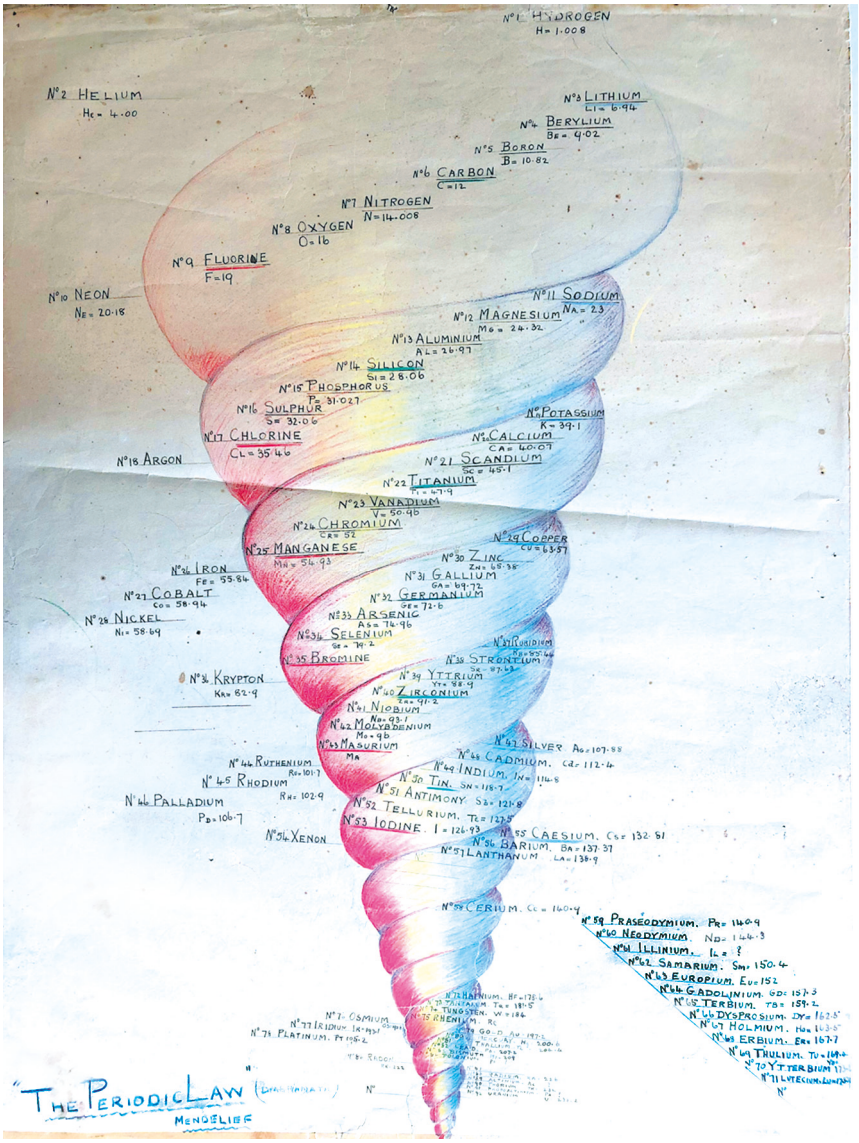

Fig. 30: The Periodic Law; Mendelief by Alexander Burnett Hector.

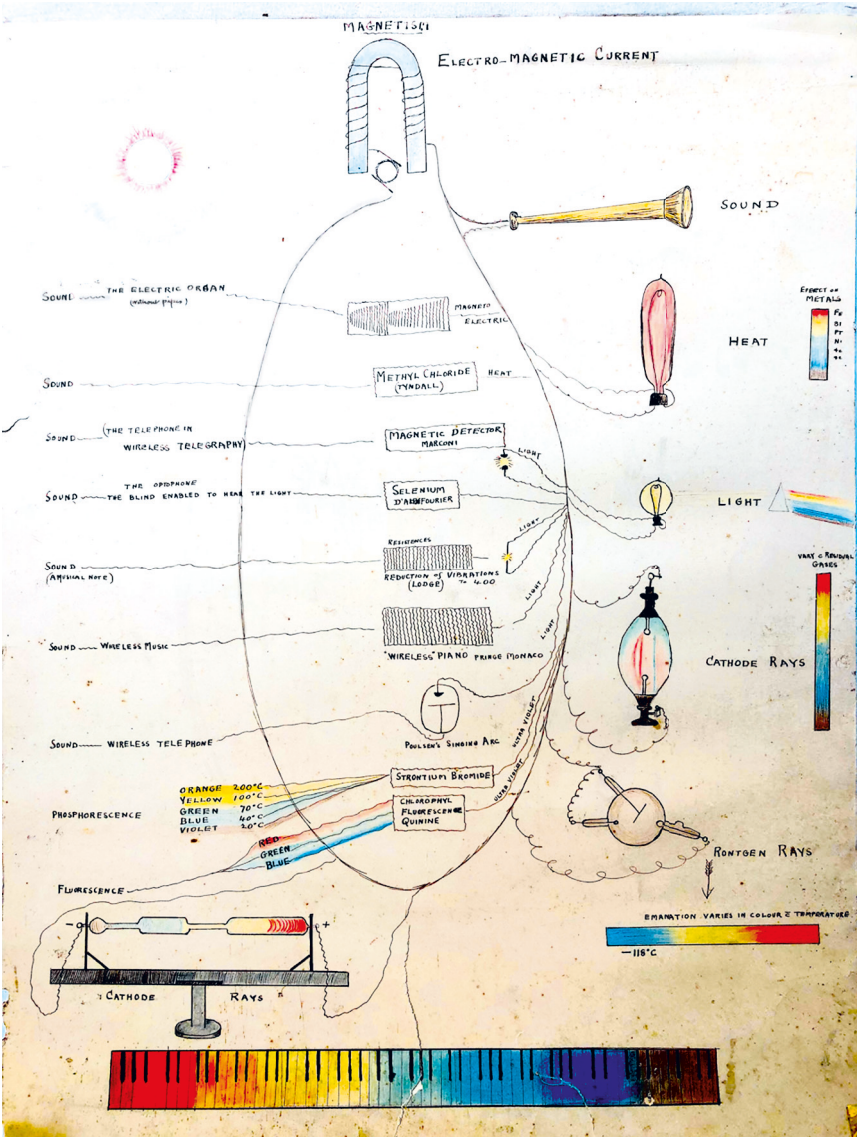

Fig. 31: Magnetism by Alexander Burnett Hector.

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References

Hector, A. B. (1912). Patent No. 29615. Great Britain: Great Britain Patent Office.

Hector, A. B. (1920). Alexander Burnett Hector designs and drawings related to his "colour music" invention, ca 1910–1920s. Sydney: Mitchell Library, State Library of New South Wales. Retrieved from https://primo-slnsw.hosted.exlibrisgroup.com

Hector, A. B. (1922, February). Color Music; Producing the Octave. *The Sydney Morning Herald*, p. 7.

Jewanski, J. (2010a). Color-tone analogies. In Daniels, D. & S. Naumann, S. (Eds.), *See This Sound. Audiovisuology Compendium* (pp. 339–347). Cologne: König.

Jewanski, J. (2010b). Color organs. In Daniels, D. & Naumann, S. (Eds.), *See This Sound. Audiovisuology Compendium* (pp. 77–87). Cologne: König.

Scholes, P. (1938). Color and Music. In *The Oxford Companion to Music*. Oxford: Oxford UP.

Wierzbicki, J. (2012). Shedding light on the color music of Sydney's Alexander B. Hector. *Musicology Australia, 34*(19), 81–99. doi: 10.1080/08145857.2012.681622.

1925: Ludwig Hirschfeld-Mack's *Colour-Light-Plays* as visual music?

Peter Stasny

In the summer of 1925 Ludwig Hirschfeld-Mack released a self-published brochure under the title *Farbenlicht-Spiele – Wesen, Ziele, Kritiken* in which he summarized the latest developments of his *Farbenlichtspiele* (Colour-Light-Plays) at that time in technical-media-reflexive, aesthetic and pedagogical terms. This brochure documented the preliminary climax of a development that had begun in 1923 in the experimental

climate surrounding the stage workshop, the theory of form and the festive culture of the Bauhaus in Weimar, a year in which the expressionist initial phase of the school was largely overcome in favour of a reorientation towards a unity of art and technology under the influence of constructivism. Even the external presentation of the brochure conveys "something of the effort for scientific systematics and precision that increasingly determined the basic aesthetic research at the Bauhaus from 1923 onwards and had an effect on Hirschfeld-Mack, especially through Kandinsky and Moholy-Nagy" (Stasny, 2000, p. 95).

Right at the beginning of the brochure Hirschfeld-Mack leaves no doubt about the origin of the new medium from the concerns of painting: Indirectly, he says, the *Colour-Light-Plays* "followed the need to increase colour form surfaces, which illusionistically simulate movements and tensions in the painted picture in their relationships and relations to one another, to actual movements. (Hirschfeld-Mack, 1925, p. 2) To use "acoustic aids" to clarify and intensify the "temporal-rhythmic sequence" of colour-form events seemed to him to be indispensable with regard to the musical accompaniment in silent films: "The temporal sequence of a movement is easier and more precisely understandable through an acoustic than through an optical structure." (Hirschfeld-Mack, 1925, p. 6) In her embedding of the *Colour-Light-Plays* in the context of the media reflection of the avant-garde in the Weimar Republic, Anne Hoormann allows the psychologist Ernst Pöppel to have his say on this in a comment: "The eye, compared to the ear, is a relatively inert organ in terms of time. One of the reasons for this is that […] the conversion of light energy into impulses […] into brain language is based on a relatively slow chemical process, whereas the conversion of acoustic energy into brain language happens much faster." (Pöppel, quoted by Hoormann, 2003, p. 161)

Hirschfeld-Mack shows this necessary interaction of optical and acoustic components in his brochure using the first three bars of a notation whose structure is reminiscent of an orchestral score. Only one of the horizontal system lines is reserved for the music, the rest shows the entries and the course of the various design components and technical

devices. The gradual emergence and rise of a form to its full extention is recorded in the acoustic analogy of the gradual development from a single tone to multi-sound. It should be emphasized that the term musical in this context refers primarily to movement as rhythm, a circumstance that emerges from the non-printed, handwritten parts of the score in the form of a shortening of note values. "For the light projection during these first three bars, white light is provided in the score, whereby further development, as indicated by the title *Three-Part Colour Sonatina*, would have been dominated by the colours ultramarine and green". (Stasny, 2000, p. 99)

However, the colour attribution "ultramarine green" is purely related to the overall visual event and remains without tonal correspondence. Hirschfeld-Mack describes the aesthetic phenomenon resulting from the realization of his colour-form-tone scores by means of a specially constructed projection housing and the use of moving coloured light sources in lexical conciseness as follows: "A play of moving yellow, red, green and blue fields of light, developed in organically determined gradations from darkness to the highest luminosity. (Hirschfeld-Mack, 1925, p. 1) His setting: "A transparent screen" (Hirschfeld-Mack, 1925, p. 1), because the control of the lighting apparatus was located behind it, invisible to the viewer. Hirschfeld-Mack classified "Colours, forms, music" under "Means of design": "In angular, sharp, pointed forms; in triangles, squares, polygons or in circles, arcs and waveforms; up, down, sideways in all possible gradations of rhythmically controlled movement, elements of the play of coloured light are led to the artistically planned, orchestral representation. The musical elements created with and interwoven into the play appear connected with the mixtures and overlapping of colours and forms". (Hirschfeld-Mack, 1925, p. 1)

When the brochure was published, Hirschfeld-Mack and his team had perfected and performed the *Colour-Light-Plays* in several German cities and in Vienna since their premiere in 1923 during the Bauhaus Week in Weimar. In the face of numerous positive reviews, Hirschfeld-Mack felt compelled to assume whether "painting was still the strong binding and expressive entity that it was [in past art epochs, P.St.] for the

whole, or has it been replaced by a new means of expression for pictorial and pictorial design - by the moving light image?" (Hirschfeld-Mack, 1925, p. 3) According to the reactions described above, the willingness of a mass of people who had been influenced by the medium of film to renounce representational content as the aim of art in favour of pure colour and formal experience seemed to have been more given in the medium of the play of light than in the medium of traditional painting.

Particularly in reaction to the performances in Leipzig and Berlin in 1925, contemporary critics vacillated between two poles of classifying the new phenomenon. One was the abstract film that had just emerged, the other the *Colour Light Music* based on the phenomenon of synesthesia. In 1927, László Moholy-Nagy was sharp-sighted and critical in his book *Malerei Fotografie Film* (Painting Photography and Film), in which he put the experimental dynamics between these poles in a nutshell: "Wanting to merge the problems of the optical-kinetic with the problems of the acoustic-musical, as Hirschfeld-Mack and Alexander László did" (Moholy-Nagy, 1986, p. 20) he considered, however, to be a mistake compared to the physically based *Optophonetics* of a Raoul Haussmann. However, he failed to recognize that Hirschfeld-Mack, according to the thesis of this contribution, was primarily concerned with acoustic support of visual rhythms and not with linking individual tones, sounds and musical harmonies with certain colour perceptions, as was characteristic of Alexander László's synesthetically based Farblichtmusik (Colour Light Music), for example (cf. Jewanski & Sidler, 2006). Accordingly, this presentation may be understood as a demarcation from the central theme of the conference, because the *Colour-Light-Plays* are not synesthetically based coloured light music but rather acoustically supported light kinetics consisting of coloured form elements.

As an independent art form, they were also discussed in the context of a radically materialistic interpretation of *Absolute Art* on the occasion of the repeat of the Berlin matinee *Der absolute Film* of 1925 in Hannover through a controversial lecture by Friedrich Vordemberge-Gildewart (cf. Mank, 1993, p. 83). Nevertheless, it can be shown that, as kinetic dramas of colour and form, they were closer to the spiritualist-universalist

direction of the Weimar Bauhaus around Johannes Itten, Paul Klee and Wassily Kandinsky than to the desubjectivised aesthetics of Constructivism promoted by Moholy-Nagy, especially through the specific medium of light, temporarily prone to late expressionist poetry by Albert Talhoff and the experience of the mystical and of occult (cf. Stasny, 2000, pp. 106ff.).

References

Hirschfeld-Mack, L. (1925). *Farbenlicht-Spiele. Wesen, Ziele, Kritiken*. Self-published.

Hoormann, A. (2003). *Lichtspiele. Zur Medienreflexion der Avantgarde in der Weimarer Republik*. Munich: Fink.

Jewanski, J. & Sidler, N. (Eds.) (2006). *Farbe – Licht – Musik. Synästhesie und Farblichtmusik*. Bern: Lang.

Mank, Th. (1993). Die Kunst des Absoluten Films. In Gehr, H. (Ed.), *Sound & Vision. Musikvideo und Filmkunst* (pp. 62–87) (exhibition catalogue). Frankfurt: Deutsches Filmmuseum.

Moholy-Nagy, L. (1986). *Malerei, Fotografie, Film*. Gebrüder Mann (Original work published 1927).

Stasny, P. (2000). Die Farbenlichtspiele. In Hapkemeyer, A. & Stasny, P. (Eds.), *Ludwig Hirschfeld-Mack. Bauhäusler und Visionär* (pp. 94–112) (exhibition catalogue). Ostfildern-Ruit: Hatje-Cantz.

Symphony of the light: Tone painting and color harmony in the practice of silent film music

Maria Fuchs

In the course of the Americanization of German culture after the Second World War, the Ufa Palace at the Zoo in Berlin was also rebuilt in 1925, following the example of American premiere cinemas. In contracting for the services of Ernö Rapée, the Ufa also wanted to introduce the 'new' American methods of film exhibition in Berlin. Rapée was one of the most distinguished cinema conductors in the USA at the beginning of the 1920s. During his stay in Berlin, he brought lots of changes

in the German film exhibition standards. He introduced, for example, artistic prologues and piano concerts played on four grand pianos by eminent pianists. However, Rapée also brought innovations to German cinemas, above all in the field of lighting effects. To entertain the mass audience according to American ideas, he combined so to speak tone painting with color harmony in order to achieve a potentiated effect of the music.

The lighting effects were originally invented by Samuel L. Rothafel, the American manager and impresario of the silent film palaces of New York City and other US capitals, by chance, when he wanted to make his cinema orchestra aware of the change to minor by pressing a small red button. From this moment on, it was only a few steps to the idea of making the various lighting effects accessible to the public, which Rapée imported and perfected in Berlin's cinema palaces. This paper aims to reconstruct the intermedial relationship of moving image, music and lighting effects by using the example of silent film music accompaniment.

References

Fuchs, M. (2016). *Stummfilmmusik. Theorie und Praxis im 'Allgemeinen Handbuch der Film-Musik' (1926)*. Marburg: Schüren.

Windisch, A. K. (2014). Riesenfeld, Rapée & Roxy: How the Symphonic Orchestra Conquered Broadway's Movie Theaters. In Parker, J. & Poole R. J. (Eds.), *Austria and America: Cross-Cultural Encounters* 1865–1933 (pp. 73–94). Zürich, Switzerland: Lit.

Melnick, R. (2012). *American Showman: Samuel 'Roxy' Rothafel and the Birth of the Entertainment Industry, 1908–1935*. New York, NY: Columbia UP.

Vladimir Baranoff-Rossine, Grigory Gidoni, Léon Theremin: Experiments in the field of sound/light/choreography (1920–1930)

Olga Kolganova

The article explores the activities of Vladimir Baranov-Rossine (Ukraine, Russia, France) Grigory Gidoni (Lithuania, Russia) and Léon Theremin (Russia, USA) in the field of light/color, music and dance synthesis.

Baranoff-Rossine's 'optophonic' (color-visual) concerts were performed in 1924 in Moscow at the Bolshoi Theater and at the Theater of Vsevolod Meyerhold (figure 32). The artist presented to the public the possibilities of the optophone, the instrument he invented. Music and dance were accompanied with a light/color track projected on the screen. The author himself played the optophone. His concerts were held with the participation of the *Vera Maya Choreography Group* as well as the *Dramatic Ballet Studio*, staged by Lydia Redega. One of the concert posters announced the "transformation of music into visual images".

Fig. 32: Poster of the color-visual concert of Vladimir Baranoff-Rossine, April 18, 1924. From the archive of the Baranoff-Rossine family, Paris.

In 1928, the *First evening of art of light and color* (figure 33), conceived by Grigory Gidoni, took place in the main conference-hall of the USSR Academy of Sciences in Leningrad. The coupling of light/choreography, along with the correlations of light/music, light/recitation, and light/architecture, were the components for his concept of the "New art of light and color". The light concert was accompanied by light-color arrangements, performed by Gidoni on the apparatus he invented. Unlike Baranoff-Rossine's optophonic arrangements, the light-color transcriptions by Gidoni were not projected on the screen. According to the characteristics of the device indicated in one of the artist's patents, the screen should have been transparent.

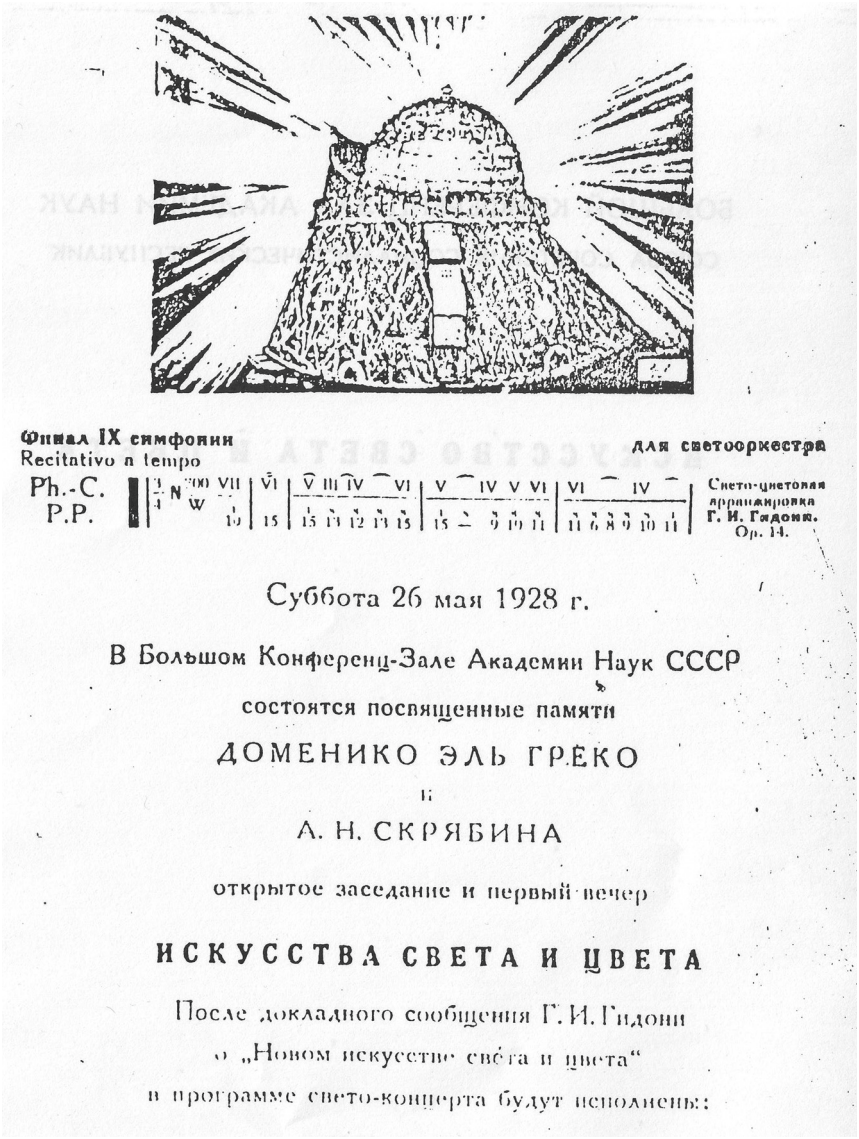
The famous Leningrad dancers Taisiya Troyanovskaya and Mikhail Mikhailov gave life to the choreography part. Pyotr Tchaikovsky's *Adagio*, the *Pizzicato* from Alexander Glazunov's ballet *Raymonda*, as well as the piano composition *Quasi Valse* op. 47 by Alexander Scriabin, were accompanied with the light-colored and choreographical spectacle. Gidoni dedicated an ex-libris image to Troyanovskaya in 1931, probably as a sign of gratitude for participating in his light-choreographic projects. Also, Joseph Pasteur—another participant in the "First evening" who, during the light concerts, used to help Gidoni on the technical side—became dedicatee of an ex-libris by Gidoni. A copy of the program of the "First evening" was preserved in Mikhail Zalivadny's personal archive, which he provided at the request of Bulat Galeyev when he met with Pasteur in the 1980s.

It is not possible to effectively ascertain whether Gidoni and Baranoff-Rossine personally met or knew each other. In the documents we found, there is only one statement by Gidoni concerning the work of Baranoff-Rossine. In some notes forwarded by Gidoni to the Members of the Russian Academy of Sciences on the subject of *The new art of light and paint obtained by electric energy*, the artist defined the experiments presented by Baranoff-Rossine as "childish" and "only compromising the task". However, Gidoni considers as unsuccessful all the research addressed to the matter, "starting from those made in America in 1908, ending with the possibilities of the László's light-colorful piano". In

his opinion, that research was all based on the principle of projected light; that is, it implied the installation of a screen. Developing his theory of the "Art of Light and Color", Gidoni was encouraged and inspired by Scriabin's idea, which, in his words, aimed to "ensure that the entire hall during the performance of the music was flooded with waves of light and paint in a naturally varying intensity and color, and this 'symphony light-paint' was supposed to not flow on any screen, rather to somehow permeate the entire being of the listener, enhancing the sound perception, acting in parallel with the latter". Gidoni designed an electric light-orchestra apparatus called *Photo Chromo Piccolo Primo* to realize this vision.

Baranoff-Rossine and Gidoni were passionate about optophonic art and the art of light and color for many years: they invented light-color apparatuses and received patents for them; conducted shows and concerts; wrote the rationales for their inventions; they tried to organize institutions that were in line with their ideas—the Optophonic Institute (1926), the Optophonic Academy (1927), the European Optophonic Center (1941) in Paris [Baranoff-Rossine], the Institute for the Study of Light and Paint at the USSR Academy of Sciences (1926), the Laboratory for the Art of Light and Colors, as a part of the Laboratory of General Acoustics of the Physical-technical Institute (1931) in Leningrad [Gidoni].

The director of the Physical-technical Institute, Abram Ioffe, supported projects blending science and art. Since 1919, at his invitation, Léon Theremin worked at the Institute and also conducted experiments with sound, color, and movement. In the 1920s/1930s, he worked on the 'terpsiton' tool, which was close to the theremin in its technical characteristics. This instrument was an invention of a different design and intention than Baranoff-Rossine's and Gidoni's light-color instruments. The main idea of terpsiton was to transform the movements of a dancing performer into sound. In addition, automatic color tracking was used.



Финал IX симфонии для светооркестра

Recitativo a tempo

Ph.-C.
P.P.

Свето-цветовая аранжировка Г. И. Гидони. Op. 14.

Суббота 26 мая 1928 г.

В Большом Конференц-Зале Академии Наук СССР

состоятся посвященные памяти

ДОМЕНИКО ЭЛЬ ГРЕКО

и

А. Н. СКРЯБИНА

открытое заседание и первый вечер

ИСКУССТВА СВЕТА И ЦВЕТА

После докладного сообщения Г. И. Гидони

о „Новом искусстве све́та и цвета"

в программе свето-концерта будут исполнены:

Fig. 33: Fragment of the program of the *First evening of 'Art of Light and Color'* by Grigory Gidoni, 1928. From the personal archive of Michail Zalivadny, St. Petersburg.

Despite some differences in the aforementioned inventions, they all sought to create a kind of synthetic act combining light/color, sound and dance. However, they did not just look for the coexistence of different art types, but attempted to consciously outline new ways for their interaction.

References

a) in Russian (translated here)

Gidoni, G. I. (1924). *Device for producing the light scenery on a transparent screen: A patent for an invention № 527*. http://patentdb.su/3-527-prisposoblenie-dlya-polucheniya-svetovykh-dekoracijj-na-prozrachnom-ehkrane.html.

Kolganova, O. V. (2017). The first evening of 'Art of Light and Color' by G. Gidoni. *Operamusicologica. Scientific journal of the Saint Petersburg Conservatory, 34*(4), 72–94.

Kolganova, O. V. (2017/18). Light-and-Sound Instruments by V. Baranoff-Rossine and G. Gidoni. In Maciewskij, I. V. & Kolganova O. V. (Eds.), *Aspects of Organology*, (11), 229–239.

Sarabjanov, A. D. (2002). *Vladimir Baranoff-Rossine*. Moscow.

b) in English

Jewanski, J. (2010). "I gradually recognized that the best music for my films is something that is not music at all but a tapestry of sound". The vision of Oskar Fischinger and Alexander László in 1935/36 about a new kind of visualizing music. In Vanechkina, I. et al. (Eds.), *Galeyev Readings. Materials of the scientific-practical conference ('Prometheus' - 2010)* (pp. 95–103). Kazan: KSTU.

Multimedia technologies for the composer's synesthetic experience expression

Elena Fatianova

Electronic music opens up great opportunities for composers to implement bold creative ideas, to experiment with sound, and to involve various channels of perception while creating and performing a composition. In the mid-twentieth century, the Soviet inventor of the ANS synthesizer, Yevgeny Murzin, actively participated in the development of electroacoustic music movement in Russia, attracting outstanding composers into his project so they could work with a unique instrument. Alfred Schnittke, Stanislav Krejci, and Edward Artemiev composed and recorded music using ANS sounds.

Edward Artemiev discovered ANS's artistic possibilities immediately after graduation from the Moscow Conservatory. The composer was captivated by the new means of timbre expressiveness of the instrument. Artemiev's creative approach during this period consists of a new synesthetic method of 'drawing' sound as a way of modifying its spectrum. ANS's sounds were encoded using logical parallels between sound and light, with results not unlike modern spectrograms.

According to the inventor, the composer's work with ANS resembles artists' work with an easel. This unique instrument directly connects musical images with the visual ones. If necessary, the author can also draw performance parameters. For example, agogics, performance modulation, and dynamics.

Apart from working on ANS and Synthi-100 synthesizers, Artemiev was familiar with testing the spherical screen—an imitation of the celestial vault—within the walls of the Moscow Electronic Music Studio's experimental hall. That way, he carried out Alexander Scriabin's concepts and also employed the first prototype of multichannel sound system. Thanks to the invention of the 'stereophone', electronic music has developed its unique means of aesthetic impact—the ability to create artificial sound fields.

It was the ANS's unusual way of creating compositions that inspired Artemiev to develop his distinctive way of visualization and saving electronic scores. As he was working with the outstanding Russian film director Andrey Tarkovsky on *Solaris* (1972), creating its original musical score, the composer was able to convert traditional notation into its graphical representation for all the electroacoustic pieces in the film. He used color for improved clarity of interpretation.

As the *Solaris* soundtrack needed to implement the director's 'Symphony of noises' concept, it was heavily focused on the richness and variety of timbre. Therefore, a number of transformation techniques were involved in developing the 'sound objects'. Artemiev designed complex sound structures that included various 'sound textures' marked by different colors within the score. These were electronic, concrete, instrumental, choral sounds, and noises transformed during playback and recorded on tape as samples.

The sound material for *The First Hari Apparition* was recorded on the ANS synthesizer, consisting of 'color noise' and sine tones, piano clusters, fragments of choral singing and whispering, consonances of wind and string instruments, and the timbre of temir-komuz. Most of them were modified by changing the speed or reversing the direction of the tape playback, both consecutively or layered and mixed together, with constantly 'floating' dynamics (those techniques were indicated in the score via colored arrows). Additionally: "The usage of recording and overlaying with a half- or quarter-tone shift techniques add to the perception of 'internal vibration' of monolithic sound systems" (Suslova, 1994, p. 169). Such layers helped construct the surreal space of the film.

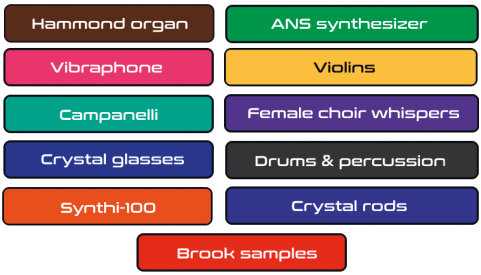


Fig. 34: Eleven color-marked sound textures of Artemiev's *The Second Hari Apparition* in *Solaris* (1972).

The recording of piano clusters performed in six octaves simultaneously was slowed down and its attack segment was cut off. As Artemiev describes the process: "Its [piano's] sound was output gradually, its speed was properly adjusted. Many overtones appeared at once, the strings were buzzing filling the entire space. It wasn't obvious the piano was producing the sounds, because we only determine the nature of the sound by its attack" (Fatianova, 2018).

The Second Hari Apparition features a rather different approach. Its score consists of eleven color-marked sound textures (figure 34).

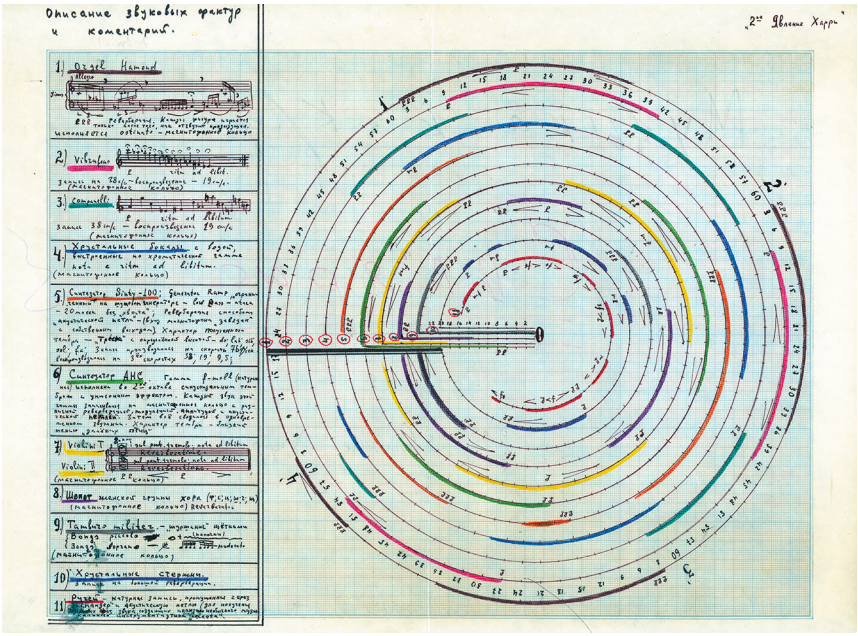


Fig. 35: Artemiev's graphic layout of the electroacoustic score for *Solaris* (1972).

The author calls the graphic layout (see figure 35) of the electroacoustic score "a tape ring" (note that it's not a loop and is only played one time), explaining his choice by saying, "A linear score would be simply gigantic. And I needed to see everything at once" (Fatianova, 2018). Thus, the

score captures the final stage of the work, visually displays the spatial and temporal organization of all the compositional elements that sound unanimously. "This concept is naturally and organically connected to the nature of the screen action—both depicted and happening behind the scenes—projected onto the tense internal state's expression of the movie protagonist, Chris Kelvin, onto the scene's atmosphere sonification" (Suslova, 1994, p. 176).

Choosing such unusual creative means, the composer could establish a distinct link between the action on screen and the accompanying audio track. Unfortunately, as Artemiev himself noted, those exclusive and innovative methods of score implementation haven't been required by any other film directors for any of their projects—their core ideas didn't require such an advanced realization.

Artemiev was so immensely fascinated by the artistic possibilities of electronic music allowing one to create original sounds, spatial positioning, and managing of entire sound complexes, that he carried this passion throughout his life. Currently, the composer writes for an extended symphony orchestra exclusively, formulating his creative credo, "My standpoint is: the world that surrounds us—technologies allow us to accumulate, synthesize, and emulate it all. So, to me, privileged sounds don't exist. A symphony orchestra, a violin, a synthesizer, or a guitar, the chirping of grasshoppers—they all constitute one world, which God has given us. Now, the technologies allow us to include it all into our compositions" (Fatianova, 2018).

When I asked Artemiev, why don't most people fancy academic electronic music, why don't they take it seriously and even reject it, the composer answered laconically: "They don't *feel* it" (Fatianova, 2018). He's perfectly integrated himself into the modern times, when computer music technologies thrive, and, as his views and techniques have matured, Artemiev continues to compose and stage grandiose projects. He constantly talks about the approach of the mysterium, which may embody and unite all kinds of arts and make use of the pioneering computer technologies, including the augmented reality objects.

References

Fatianova, E. (Dec. 18, 2018). *Interview with Edward Artemiev* (unpublished).

Murzin, E. A. (2008). *The Origins of Electronic Music. About the Nature, Principles of Aesthetic Perception and Ways of Development of Electronic Music and Color*. Moscow: Composer.

Suslova, L. V. (1994). *The Practice of Electronic Music Research: The Case of Edward Artemiev's Art*. Ph.D. (Arts). Moscow.

Yegorova, T. K. (2006). *Edward Artemiev's Musical Universe*. Moscow: Vagrius.

Tearing down light art's musical scaffolding: From color organs to art galleries

Ralph Whyte

Describing a new electronic art of light and color in 1912, Alexander Wallace Rimington wrote that "musical methods should be regarded as merely the scaffolding upon which the first arch is thrown across the chasm of the untried". In this paper, I consider the musical 'scaffolding' in the practices, instruments, and writings of three light-art practitioners from the early twentieth century (Rimington, Mary Hallock Greenewalt, and Thomas Wilfred). Previous literature on these figures' art and technologies tends to frame their work in terms of audiovisual synthesis, describing it as "synesthetic" art or as a presage to later forms of "visual music" (e.g. Shaw-Miller, 2013; Mollaghan, 2015). Paying close attention to these artists' rhetoric in published and unpublished writings, I argue against these characterizations on the basis that they overlook these artists' desire for an independent light that no longer relied on a musical parallel, even as I question the extent to which they realized this desire.

These three artistic pioneers were in dialogue with each other's work, and each navigated differently the challenge of remediating light art in terms of music. Rimington believed his color organ would enable the emergence of a new color art once audiences' "color sense" was sufficiently developed, but the musical keyboard that served as an interface

for his instrument demonstrated influence from the common analogy between the color spectrum and the musical octave. Greenewalt's rejection of color-tone analogies was reified in her light instrument (the *sarabet*). She abandoned the musical keyboard in exchange for slide and pedals that prioritized subtle control of luminosity rather than rapidly changing colors. Wilfred performed on an instrument (the *clavilux*) that, like Greenewalt's, abandoned any musical resemblances. Since he performed usually in silence and since his work was increasingly exhibited in art galleries rather than concert halls over his career, it might seem that that Wilfred fulfilled the mutual ambition of these three artist-inventors for a genuinely medium-specific light art; however, I demonstrate music's abiding influence to Wilfred's conceptualization of his work and how the music-light analogy affected contemporaneous and subsequent reception of all three artists.

References

Shaw-Miller, S. (2013). *Eye hEar. The Visual in Music*. Farnham, Surrey and Burlington: Ashgate.

Mollaghan, A. (2015). *The Visual Music Film*. Basinstoke, Hampshire: Palgrave MacMillan.

The first visualization as a film of Scriabin's *Prométhée*, directed in 1964 in Russia by Bulat Galeyev: Principles of his interpretation

Rustem Sakhabiev & Anastasia Maximova

During the last 100 years, many attempts realized the luce-voice in Alexander Scriabin's *Prométhée* (1911) in different ways. The first one created as an experimental film (*Prométhée*, 1964) was directed in Kazan, Russia, at the Prometheus-Institute (today: Prometheus-Fond) by Bulat Galeyev (1940–2009). He was the head of the institute for nearly four decades and had coined its artistic and scientific direction. Altogether,

Galeyev directed 12 experimental films between 1964 and 1993. This film series started with the visualization of *Prométhée*, which is unpublished and was recently restored by the Prometheus-Fond (figure 36 and 37).

Fig. 36: Still from Galeyev's film *Prométhée* (1964), 0'18.

Fig. 37: Still from Galeyev's film *Promethée* (1964), 6'43.

In 1980, the Austrian musicologist Josef-Horst Lederer found a similar (but slightly different) structure in the parts of *Prométhée*'s sonata form and the form which results from the order of the colors. Other authors developed different schemes (Gleich, 1963; Förster, 1964; Peacock, 1976; Germerdonk, 1995; Mirka, 1998; Sabbagh, 2001; Lobanova 2002, 2004). Our questions are as follows: Does Galeyev's visualization follow the musical structure? If so, is his musical analysis—as reflected in the structure of his film—different from the analysis of other authors? How do the film's colors correlate with the descriptions Scriabin has given in the score? In his film *The small tripych* (1975), based on the composition with the same title by the Russian composer Georgij Sviridov, Galeyev's chosen colors and colored forms reflected the musical structure of the music but are overlaid by an artistic level (Sakhabiev, & Jewanski, 2018). Had he used a similar concept even in his first film? How is the spatial localization of the colored forms chosen by Galeyev? Do they follow principles of crossmodal correspondences (Spence, 2011, 2019)? The genesis of the film can be reconstructed with the aid of unpublished documents from the Prometheus-Fond.

References

Gleich, C. von (1963). *Die sinfonischen Werke von Alexander Skrjabin*. Bilthoven: Creyghton.

Förster, H. (1964). *Die Form in den symphonischen Werken von Alexander N. Skrjabin*. Unpublished Diss. University Leipzig.

Peacock, K. J. (1976). *Alexander Scriabin's Prometheus: Philosophy and Structure*. Diss. University of Michigan.

Lederer, J.-H. (1980). Die Funktion der luce-Stimme in Skrjabins op. 60. In *Alexander Skrjabin*, ed. O. Kolleritsch, 1–16. Graz: Universal (= Studien zur Wertungsforschung 13).

Germerdonk, K. (1995). *Sinfonie und Poeme. Philosophische Grundlagen einer gattungsgeschichtlichen Wechselbeziehung im Werk Skrjabins*. Unpublished Diss. University Cologne.

Mirka, D. (1998). Colors of a mystic fire: Light and sound in Scriabin's 'Prometheus'. *The American Journal of Semiotics, 13*(1–4), 227–248.

Sabbagh, P. (2001). *Die Entwicklung der Harmonik bei Skrjabin*. Hamburg: Sabbagh.

Lobanova, M. (2002). Zahlen, Mystik, Magie. Neueste Erkenntnisse zu Skrjabins ‚Promethée'. *Das Orchester, 50*(1), 6–13.

Lobanova, M. (2004). *Mystiker – Magier – Theosoph – Theurg: Alexander Skrjabin und seine Zeit*. Hamburg: Bockel.

Spence, C. (2011). Crossmodal Correspondences: A Tutorial Review. *Attention, Perception, & Psychophysics, 73*, 971–995. doi: 10.3758/s13414-010-0073-7.

Sakhabiev, R. & Jewanski, J. (2018). Светомузыкальный фильм Булата Галеева ‚Маленький триптих' (1975 год). Художественный эксперимент с синестезией [The light-musical film 'The Small Triptych' (1975), by Bulat Galeyev. An artistic experiment with synesthesia]. In *Вопросы музыкальной синестетики: история, теория, практика*, ed. N. P. Kolyadenko, 70–79. Novosibirsk: State Conservatory.

Jewanski, J., Sakhabiev, R. & Maksimova, A. (2019). *Synästhesieforschung am 'Prometheus' in Kazan', Russland. Eine Bibliographie der 18 Kongressberichte 1967–2015*. Kassel: Kassel UP.

Spence, C. (2019). On the Relative Nature of (Pitch-Based) Crossmodal Correspondences. *Multisensory Research, 32*(3), 235–265. doi: 10.1163/22134808-20191407.

Audiovisual hallucinations in the synesthetic films of Jordan Belson and James Whitney

Henry Balme

In the late 1940s, there arrived a new generation of experimental filmmakers who made abstract films in California, such as Jordan Belson, Harry Smith, and James Whitney. Anticipating trends of the bourgeoning counterculture, they variously drew inspiration from Eastern religions, esoteric teachings, meditation practices, and their personal experiences with psychedelics.

Belson's *Allures* (1961) and Whitney's *Lapis* (1965) can be interpreted as simulations of hallucinations experienced during trance states, which leads me to characterize these films as synesthetic. To borrow from Richard E. Cytowic (2018), we can distinguish between different types of "acquired" synesthesia, such as a "drug-induced" type, and one instigated in "meditative states." I argue that these films attempt to convey synesthetic hallucinations produced by the brain during altered states of consciousness. In doing so, I follow William Wees (1992: 141), who characterized Whitney's *Lapis* as a "vast metaphor of neural activity in the visual system of the brain. Its sequences of crystallizing and dissolving mandalas are like spacial-temporal maps of brain cells firing during the process of meditation."

Although evocative, Wees's statement is emblematic of a larger malaise that has afflicted the study of visual music: ocularcentrism. Despite having soundtracks, the music is rarely discussed by film scholars (Youngblood 1970/2020; Sitney 1974; Moritz 1977; Wees 1992). Some scholars, such as William Moritz, have even gone as far as claiming that films like *Lapis* "can be enhanced without the music" (1977).

By contrast, I argue that the soundtracks actually enhance the experience of the films. *Lapis* was initially conceived as a silent film, but a soundtrack—Hindustani classical music by Ravi Shankar and Alla Rakha ("Raga Jogiya" from *Ragas & Talas*, 1964)—was later added as a sonic pendant to the India-inspired imagery. The cyclical form of the raga music is replicated on a visual level by slowly revolving

circular mandalas. In contrast to Whitney, Belson often crafted his own soundtracks. The music for *Allures* was co-written by Belson, along with with sound-artist Henry Jacobs. It uses a multi-sectional form, during which he brings Western instruments (piano, harp) in dialogue with Eastern ones (singing bowl) and subjects them to techniques and procedures derived from electro-acoustic music (tape-delays, reversing, reverberation, etc.). These influences are complemented on a visual level by moving geometrical imagery (circles, spirals, etc.). *Allures* is a stellar example in which image and sound blend so seamlessly together that they form an inseparable whole, so much so that Belson himself characterized the film in synesthetic terms: "you don't know if you're seeing it or hearing it" (Belson in Youngblood 1970/2020, p.158).

In summary, my argument is two-fold: Firstly, I propose that synesthesia provides an adequate hermeneutical framework that can illuminate the turn "inward" of visual music films during the early '60s, emblematized by filmmakers' desire to communicate hallucinations experienced during altered states of consciousness. Secondly, I argue that these hallucinations are not, as usually stated, visual, but audio-visual, and I do so by discussing the films in terms of image-sound relations. I therefore hope to bring this paper into fruitful dialogue with broader issues of synesthesia and multimodality germane to the conference theme.

References

Cytowic, R. E. (2018). *Synesthesia*. Cambridge, MA: The MIT Press.

Moritz, W. (1977). *William Moritz on James Whitney's 'Yantra' and 'Lapis'* [Unpublished manuscript]. Center for Visual Music, Los Angeles.

Sitney, P. A. (2002). *Visionary Film: The American Avant-Garde, 1943–2000*. Oxford: Oxford University Press.

Wees, W. C. (1992). *Light Moving in Time: Studies in the Visual Aesthetics of Avant-Garde Film*. Berkeley, CA: University of California Press.

Youngblood, G. (1970/2020). *Expanded Cinema* (2nd ed.). New York, NY: Fordham University Press.

Video (Games) Killed the Music Hall Star: A history of multi-modal and cross-sensory music performance

Kenny McAlpine

Alexander Scriabin's symphonic work *Prométhée* is perhaps the best-known example of color music, an approach to composition that attempts to correlate music and light to create powerful and emotive multi-modal audio-visual works.

Although evidence suggests that Scriabin was not a synesthete, his systematic approach to sound-color association and his vision for the work suggests that he attempted to provide his audiences with a genuine synesthetic experience in which the auditory and visual components of his composition fused to provide a singular, cross-sensory point of focus. Scriabin used the piano keyboard of a color organ to trigger colored light from a notated score. However, due to technical difficulties at its premier, the color organ was omitted. Scriabin's vision was never realized effectively during his lifetime, and arguably it never has been.

The issue was not just that the technology limited the execution of Scriabin's work, but rather it shaped and constrained the way he even conceived of it: the technology limited what the work might be, not just how it was performed. Instead, it was the emerging technology of film, and the experimental work of Hans Richter and others, that offered a tantalizing glimpse into a new abstract world of music, form and color.

This paper explores the emergence of color music as an expressive artform in the early twentieth century and the impact of screen media on the form. It explores the notion that film, by providing audiences with a window into a temporal world of synchronous light and sound, provided a more controllable platform for multi-modal expression than did live concert performance: the editability of film gave directors a level of systematic control that was just not possible in the physical space of the concert hall.

The paper argues that emerging technologies, like John Hoppe's *Mobilux*, a device that allowed for live-in-camera composition of colorful abstract shapes synchronized to music, and the work of Frank Barsyk at

Boston's WGBH, brought color music to a mass audience and demonstrated the importance of interactivity in creating meaningful sound-color associations on screen. Interactivity links the filmic expression of color music directly to other forms of music visualization, including VJ-ing, which emerged in the discos of Chicago and New York in the 1970s, and videogaming, particularly through the demoscene, an underground digital arts subculture that was dedicated to the production of complex sound-color artworks using videogame hardware.

The paper concludes by looking forward to the opportunities provided by virtual and augmented realities (VR and AR respectively), which, at their best, engage and excite multiple senses simultaneously to create compelling simulated environments that are designed expressly for human interaction. As such, they represent significant platforms for extending traditional screen media to provide an immersive sensory way of exploring synesthetic performance: freed from the constraints of the physical world and the need to replicate the function and sensation of sensory cues within it, VR and AR can be designed specifically to create vivid, immersive multi- and cross-sensory experiences that would not otherwise be possible.

MuVi. An international project on synesthesia and visual music

María José de Córdoba Serrano & Dina Riccò

The paper presents the international MuVi project—video and moving image on synesthesia and visual music—started in 2007 thanks to the collaboration between the *Artecittà Foundation*, the University of Granada and the Politecnico di Milano.

MuVi is an exhibition, and editorial, project that was created in conjunction with the organization of the *II International Synaesthesia Conference: Science & Art* (Granada, 2007) with the aim of giving perceptible, extensive (and synesthetic) feedback to the theoretical contents addressed in the conference.

MuVi—acronym for Musica Visiva ("Visual Music")—has collected video projects with a call for kinetics works, an invitation to artists, musicians, designers, performers, academic authors, professors and students of universities, academies and conservatories to submit any kind of digital "moving image", only visual or audio and interactive kinetic projects.

Alongside synesthesia, the central theme of the project is visual music, understood in a lata meaning, as any sort of kinetic audio or video representation that springs from music. The relations between visual and auditory, that we found in the collected works, show a great variety of combinations: they are the result of synesthetic perceptions (visual as mental image suggested by music); the result of research on the analogies between visual and musical languages (rhythm, tone, texture, colour, etc.); they can be expressed by abstract or figurative languages not necessarily supported by a narrative plot.

The paper analyzes the video products participating in the five editions—MuVi (Granada, 2007), MuVi2 (Granada, 2009), MuVi3 (Almeria, 2012), MuVi4 (Alcalá la Real, Jaén, 2015), MuVi5 (Alcalá la Real, Jaén, 2018)—making a mapping of the current concept of visual music which examines, in addition to design choices, aesthetic and synesthetic, the disciplinary approach and geographical origin.

International diversity is a great merit of the scientific project: the participants are for the most part coming from the countries that have organized the event—Spain and Italy—that alone pick up around half of the videos, but the participation is broadly international, Europe, United States, and even from New Zealand.

The latest edition, MuVi5, is characterized by the increased awareness of the relationships of video designed on music, as well as the high compositional and technical complexity of the solutions, undoubtedly facilitated by the evolution of audio/video software that facilitates new aesthetic experiments.

The solutions are inevitably varied, and even in the prevalence of visual compositions at a high level of abstraction, in which figures that

do not have immediate reference to the represented reality dominate, the "sensorial rendering" of visual translation ranges from organic texture to compositions based on basic geometrical figures.

Comparing the works, we note in fact this expressive axis that finds at its extremes, on one side, the organic (material) and, on the other, the geometric simplification (graphic), then the dominance of the materiality (water, earth, surfaces, etc.) opposed to the rigor of geometry based on figures in rhythmic sequence or organized in texture.

The applications are predominantly for desktop video enjoyment; but there are cases in which environmental and architectural immersion is required which, using video mapping technologies, creates suggestive illusionistic effects.

Authors who deal professionally with visual music dominate and, as we can read in the biographies, have rich exhibition experience in internationally known events and festivals. We believe that one of the merits of the initiative is also to be recognized in having chosen to invest and leave a record of the work done. From what is known to us, MuVi is the only visual music festival that regularly collects and prints in book and DVD format, the selections of the participating videos, documenting and relating a total of about 130 videos with the respective groups and authors, some of whom are faithful since the first edition (see archive in: http://muvi-visualmusic.tumblr.com). Recently MuVi was selected by the *ADI Design Index 2019*, a prestigious award in the field of Design.

References

Riccò, D., & De Córdoba, M. J. (Eds.) (2007). *MuVi. Video and moving image on synesthesia and visual music*. Milano: Edizioni POLI.design (Book + DVD).

Riccò, D., & De Córdoba, M. J. (Eds.) (2009). *MuVi2. Video and moving image on synesthesia and visual music*. Granada: Ediciones Fundación Internacional Artecittà (e-book in DVD).

Riccò, D. (2012). *Visual Music. Sistemi di rappresentazione cromatica cinetica / Visual Music. Kinetic Chromatic Representation Systems*. *DIID* (53), 58–65.

Riccò, D., & De Córdoba, M. J. (Eds.) (2012). *MuVi3. Video and moving image on synesthesia and visual music*. Granada: Ediciones Fundación Internacional Artecittà (Book + DVD).

Riccò, D., & De Córdoba, M. J. (Eds.) (2015). *MuVi4. Video and moving image on synesthesia and visual music*. Granada: Ediciones Fundación Internacional Artecittà (Book + DVD) (e-book).

Riccò, D., & De Córdoba, M. J. (Eds.) (2018). *MuVi5. Video and moving image on synesthesia and visual music*. Granada: International Foundation Artecittà Publishing (Book + DVD) (e-book).

Synesthesia and Digital Perception 2019: The visual music scene and multisensory sound-based practices in Brazil

Sérgio Basbaum

It is not possible to separate human cognition development from human cultural development (Durt, 2017). In the specific case of synesthesia, it suffices to notice that it would be impossible to experience grapheme-color synesthesia in an illiterate society to realize the many aspects in which the relations between synesthesia and culture are still undiscussed. With the concept of "digital perception" (Basbaum, 2005, 2012), I have tried, since the early 2000', to shed a light over the way digital culture is shaping our modes of perception, and the cultural forms that emerge as a result of such on-going media-ecology changes. One of the most noticed aspects of digital culture, since its early days, is the emergence of more active spectatorship and multisensory cultural forms, among them VJing and many Visual-Music practices that found their sets in contemporary urban culture. The present work aims to examine some of the groups which are practicing visual-music performance in contemporary Brazilian scene, the works of [:a.cinema:] (Dino Vicente, Rodrigo Gontijo, Sérgio Basbaum), *Telemusik* (Dudu Tsuda, Marcus Bastos), *Felipe Merker & Alessandra Bochio*, *Clássicos de Calçada* (Tatiana Travisani, Deco Zido), and relate them to other forms of multisensory practices in contemporary technological culture.

The connection of art forms to specific cultural contexts can be devised in an interesting timeline. In his classical work, *Perspective as symbolic form* (1927), Erwin Panofsky (1991) showed how emerging cultural forms and their meaning as structures respond and correspond to the needs of expression and understanding of a specific hermeneutical context. A few years later, in his visionary essay *The Work of Art in the Age of Mechanical Reproduction*, Walter Benjamin explicitly connected aesthetics, technology and cultural changes, showing the extent by which photography responded and shaped perceptual changes in society, thus expanding the reach of Panofsky's thesis. Benjamin's and Panofsky's insight have a lasting heritage in cultural theory. They can be related to 1960s Marshall McLuhan's media-theory, and will find an extreme formalization on Vilém Flusser's ideas about photograph as a step to a digital culture shaped by a symbiotic relation between humans and their apparatuses (Flusser, 1998). A few years later, Lev Manovich has written an essay named Database as a symbolic form (1999), explicitly evoking Panofsky, proposing to interpret emerging cultural forms of the 1990's, videogames and websites, "new media objects", suggesting that these forms embodied strategies of making sense of the world related to technical possibilities of digital technology: narratives (videogames, algortythms) and collections of items (websites, databases).

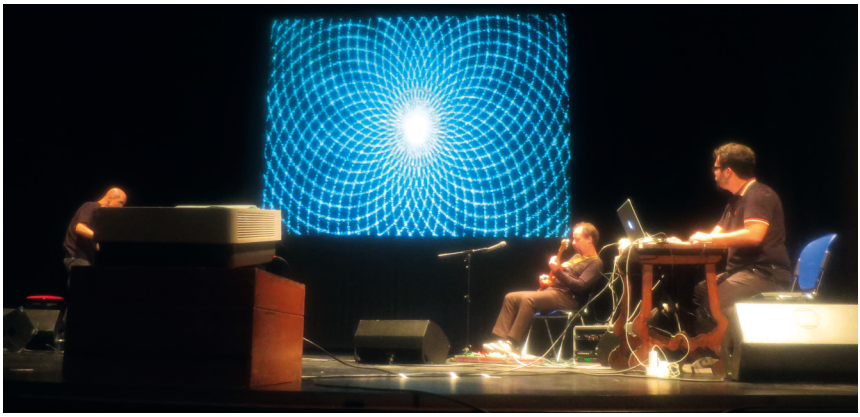


Fig. 38: [:a.cinema:], performance in Alcalá la Real (Jaén), 2015, photo: Jörg Jewanski.

One of the ways to interpret the growing importance of performance art in the context of digital culture is thinking of it as a symbolic form that allows ephemeral, non-repeatable situations, a practice which emerged in the cultural circuit as denying the lasting, unchanging, material art object, which becomes an archeological piece, a trail of history, a memory, an archive document to be eventually re-signified through the years. Performance substitutes conventional art forms for an embrace of the growing acceleration, in the post-post-modern narrative crisis, calling for immersion in the moment, volatility, ephemerality, presence. The classical, detached subject is surpassed by the need to integrate environment, audience and artists in an unique relational context of meaning making, establishing an opened but specific aesthetic experience ritual as cultural form. All those observations may help a starting approach to a growing scene of audiovisual performative works which are being produced in Brazil (and elsewhere), and which aim audiovisual fusion as performative experimental cinema, or Live-Cinema. By refusing the conventional audiovisual finished product, these works also detach themselves from sensory specialized conventional art practices, in which senses are, in the best case, hierarchically casted. The emergence of multisensorial artworks since the 1960s, parallel to the growing power of digital technology over our daily lives is part of the constitution of what I have named, since 2003, digital perception, with its many synesthetic appeals.

These highly opened, improvisational performance works also involve a high level of risk of failure, or error, which challenges the audience expectation for immersive spectacle, also a trademark of contemporary digital culture. So, these works here described dialogue, in the audiovisual arena, both with the heritage of performance art and its challenge to conventional art object on one hand, and the expectations of spectacle inherited from conventional cinema and videoart spectatorship. In a culture dominated by a deluge of Flusserian technical images and all kinds of infosensations, risk is a territory of discovery and innovation -- something both history of art and history of science

can show us remarkably. That it may happen in open, audience watched context, is also coherent with a culture characterized by full, uncontrolled transparency in every level.

While conventional audiovisual works have mainly established the primacy of image over sound, making the audiovisual context a situation in which images lead; or, in the rock and pop music scene, images supposedly are meant to boost the effect of band performance and the music over audience, in these live-cinema works, interaction between music and image by performers, plus the interaction between group and circumstance, results in audiovisual forms in which the heritage of music forms becomes more relevant: images become another voice in a polyphonic audiovisual situation, and that's why such works usually claim the status of Visual-Music, a tradition which has usually been related to synesthesia. From this, one may speculate, for example, about a new theory of multisensory tonalism, based not only in the games between consonance and dissonance, which were so important to the development of Western music tradition, but on a game of stability and instability, as transitory states, shaping the dynamics of a performed piece. Interestingly, such game of transitory metastable states is precisely the way by which György Buzsáki (2008) describes oscillatory patterns dynamics of the brain: audiovisual performance, then, embodies and gives material expression to a metaphor of brain processes, by bringing together image and sound in the register of Visual-Music.

References

Basbaum, S. (2005). *O primado da percepção e suas consequências no ambiente midiático*. Tese de doutorado. São Paulo: Pontifícia Universidade Católica.

Basbaum, S. (2012). Sinestesia e percepção digital. *TECCOGS* (6), 245–265. http://www4.pucsp.br/pos/tidd/teccogs/artigos/2012/edicao_6/9-sinestesia_e_percepcao_digital-sergio_basbaum.pdf.

Benjamin, W. (1969). The Work of Art in the Age of Mechanical Reproduction. In *Illuminations*. New York: Schocken Books.

Buzsáki, G. (2008). *Rhythms of the brain*. Oxford: Oxford UP.

Durt, C. (2017). Consciousness, Culture, and Significance. In Durt, C., Fuchs, T., & Tewes, C. (Eds.), *Embodiment, Enaction, and Culture - Investigating the Constitution of the Shared World*. Cambridge: MIT Press.

Flusser, V. (1998). *Ensaio sobre fotografia – para uma filosofia da técnica*. Lisbon: Relógio d´Água.

Flusser, V. (2007). *O mundo codificado*. São Paulo: Cosac Naify.

Manovich, L. (1999). Database as Symbolic Form. *Convergence: The International Journal of Research into New Media Technologies, 5*(2).

Towards a 'Live Synesthetic Visualization'? Considerations in artistically visualized sound

Umut Eldem

The concept of live audio visualization and related techniques are incredibly commonplace in today's art and media world. Due to technical accessibility, many art music and popular music performances use generated light, lasers, and projections that follow the beat or other modalities of the performed music. However, there still exists a gap between the perceived aesthetic multi-sensory quality of live visualizations and that of pre-made videos, created to reflect the qualities of music visually. This gap is mostly due to the fact that most live visualization techniques rely on translating a single musical parameter (for example, the beat, pitches, chord types, etc.) into a single visual parameter (brightness, color, etc.), usually making use of mathematical correspondences. In this lecture, I will introduce the problem of 'Live Synesthetic Visualization'—a possible live visualization method that would take the qualities of synesthesia as a starting point of translating multiple modalities of musical information, instead of mapping singular mathematical correspondences. The experience of shapes of different sizes and visual movement, along with the experience of color, is existent in certain cases of sound-color 'strong synesthesia'. There also exists a correlation between synesthesia and crossmodal associations, to a certain degree, within the parameters of pitch height, timbre, brightness,

and visual shape. Taking these correspondences and the qualities of synesthesia as a starting point, it can be possible to construct flexible live visualization tools that are both multi-modal (having multiple musical elements corresponding to multiple visual elements), perception-based (instead of mathematical correspondences), and intuitive, creating new and interesting possibilities of creating audiovisual artwork.

The lecture will introduce examples of historical visualization methods from the development of color organs to existing software. The possible tools for such a multi-modal visualization will be discussed, and audiovisual examples derived from such methods will be presented. Such a discussion will hopefully create new perspectives for people from both artistic and scientific principles.

Through Landscapes is a piece for piano and keyboard that will be composed and performed for the 2020 Vienna *Music and Synesthesia* conference. Consisting of multiple movements, the starting point of the piece is the representation of multiple musical textures and landscapes through visual means. Each movement is based on a different 'landscape', containing different colors, shapes, and textures. To achieve this, a live visualization tool programmed on Max/MSP is used in the performance. Through the different notes, chords, and textures, the shapes and the visuals on the screen move, change, and respond to the music in real-time. The performer uses both musical tools (piano, keyboard) and visual tools (keyboard, computer) to create an audiovisual performance. As such, the hope is that the resulting performance becomes more integrated by means of multi-sensory representation, as they originate from the same source, the performer.

Appendices

The authors

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Concetta Abbate is a New York City based violinist and composer. Abbate creates original art songs inspired by natural science, folk tales, poetry and everyday objects and sounds. She was a visiting composer in residence at TAKT gallery in Berlin, both in 2014 and 2016, and a composer in residence at the *Rauschenberg Foundation* in 2019. As a performer, she regularly plays violin and sings with a variety of ensembles in the New York area. She founded the Teacup Music School in 2015, where her trained therapy dog Pepper assists her in teaching music composition classes to children of all ages.

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→ *Exploring mirror sensory synesthesia through music: Can a contemporary composition reveal the mirror-touch experience?*, pp. 61–63

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In 1996, Scott A. Bailey got a PhD in Behavioral Neuroscience from Kansas State University. Since 1994, he teaches at Texas Lutheran University, Seguin, since 2008 as a Professor of Psychology, since

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→ *Translating chromesthesia for non-synesthetes*, pp. 72–76
→ *Chromesthesia influences on musically inspired immersive experience design*, pp. 96–100

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Henry Balme is a PhD candidate in music history at Yale University. His dissertation, entitled *Visual Music: Conceptions of Music in Abstract Film, 1921–64*, investigates a genre of experimental film born from the cross-pollination of abstract painting and music in early twentieth century. His research interests pertain to audiovisual culture; dance; experimental film; intermediality; music and painting; music video; synchronization; synesthesia; and visual music.

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→ *Audiovisual hallucinations in the synesthetic films of Jordan Belson and James Whitney*, pp. 150–151

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→ *Synesthesia and Digital Perception 2019: The visual music scene and multisensory sound-based practices in Brazil*, pp. 156–160

Joshua Berger

Joshua Berger BSc (Adv) is a medical student at the Sydney Medical School and final year Doctor of Philosophy candidate—co-supervised within the School of Psychology—studying synesthesia. His thesis research broadly investigates whether substantiating synesthetes' concurrent percepts can be of benefit. In particular, he is investigating the general effects of a Digit-Color Calculator

amongst grapheme-color synesthetes completing calculation tasks. Berger is supported by patient supervisors John Watson, Irina Harris, Karen Whittingham, and Zoe Terpening.

→ *The first Australian color organ by Alexander Burnett Hector (1912)*, pp. 126–131

Greta Berman

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→ *The reflection of synesthesia in the work of four musicians: Joyce Yang, J. J. Sechan, Ben Wolfe, and Aaron Jay Kernis*, pp. 71–72

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→ *Translating chromesthesia for non-synesthetes*, pp. 72–76

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→ *Listen to the taste of music: Mapping sound and wine in crossmodal composition*, pp. 115–116

Leonardo Capanni

Leonardo Capanni is completing his PhD in history of philosophy at the University of Parma, in joint supervision with the University Paris 1 Panthéon-Sorbonne. Before that, he studied philosophy and aesthetics at the University of Florence. His research mainly dealt with the history of the concept of synesthesia, particularly in France and Italy, and in relationship with the establishment of a "science" of psychology. In June 2018, he won a *Vinci Fellowship* to support his research. He has published reviews in journals such as *Lectures and Aisthesis*, and presented his talks in meetings in Greece, Paris, Birmingham, and Le Mans.

→ *What color is a flute? Timbre-color synesthetes in the 19th century: A compilation and evaluation*, pp. 91–93

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https://directorio.ugr.es/static/PersonalUGR/*/show/a379d261bda6e2c88f6def471e64e1cd

→ *MuVi. An international project on synesthesia and visual music*, pp. 153–156

Caroline Curwen

Caroline Curwen is a PhD candidate at the University of Sheffield in England. Curwen's research examines how the role of embodied and enactive perception in general music cognition may be extended to some forms of music-color synesthesia, and how music-color synesthesia might be better understood as a sensorimotor phenomenon. Synesthesia presents challenges to established philosophical theories and highlights how our experiences of the world often differ somewhat from one individual to another. Curwen's cross-disciplinary approach to music-color synesthesia research offers the opportunity to gain a better understanding of the processes of general consciousness and cognition from person to person.

→ *Music-color synesthesia: A sensorimotor account*, pp. 93–96

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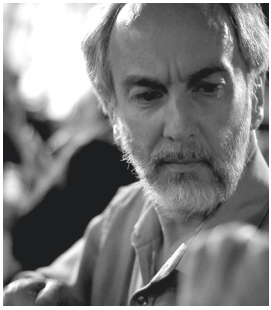
→ *What happens to the color perception of timbre-color synesthetes if the timbre diminishes or changes step by step?*, pp. 102–103

Sean A. Day



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→ *What is synesthesia?*, pp. 17–24
→ *Benefits of and distractions due to multiple synesthesias in my attempts at compositions*, pp. 57–58

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Umut Eldem is a composer, musician, and researcher. After receiving his Bachelor's diploma in Composition at the Mimar Sinan State Conservatory, he has continued his Master's studies in the Royal Conservatoire of Antwerp. In the same institution he has done his Post-graduate research. He has given lectures on his research of synesthesia, and had his works and installations combining sound and colours performed in Belgium, Turkey, Italy, Romania, Luxembourg, and Russia. He is currently a PhD researcher in the Royal Conservatoire of Antwerp, and musical director of the theatre collective *Mixed & United*.

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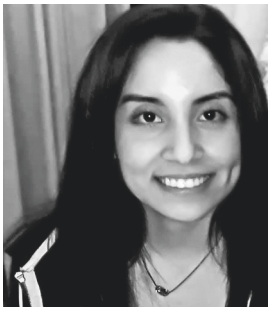

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Elena Fatianova

→ *Multimedia technologies for the composer's synesthetic experience expression*, pp. 142–146

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→ *Symphony of the light: Tone painting and color harmony in the practice of silent film music*, pp. 135–136

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→ *What happens to the color perception of timbre-color synesthetes if the timbre diminishes or changes step by step?*, pp. 102–103

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→ *An experimental feedback model of musical development for synesthetes and absolute pitch possessors*, pp. 100–102

→ *Exploring the contemporary listening experiences of synesthetes*, pp. 104–105

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→ *How synesthesia is used to obtain AIDA: The role of synesthesia in branding female musicians*, pp. 86–89

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→ *Exploring mirror sensory synesthesia through music: Can a contemporary composition reveal the mirror-touch experience?*, pp. 61–63

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→ *Impetus and challenges of synesthetic music painting*, pp. 35–41
→ *Particles of sound*, pp. 51–56

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Jörg Jewanski received his doctorate in musicology in 1996 with a study on color-tone theories, published in 1999. Since then, he has published numerous articles and books on the interrelationships of the arts and on synesthesia, including *Farbe – Licht – Musik* (2006), *Musik und Bildende Kunst im 20. Jahrhundert* (2009), *V Congreso Internacional de sinestesia, ciencia y arte* (2015) and *Synästhesieforschung am 'Prometheus' in Kazan', Russland* (2019). He has written over 100 articles for the new edition of the encyclopedia *Die Musik in Geschichte und Gegenwart*. He is currently researching the history of synesthesia with an FWF grant at the Institute of Musicology at the University of Vienna.

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→ *What color is a flute? Timbre-color synesthetes in the 19th century: A compilation and evaluation*, pp. 91–93
→ *The colors of musical instruments: An intercultural comparison on timbre-color mappings with non-synesthetes in Austria/Germany and in Madagascar*, pp. 113–115

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→ *Chromesthesia influences on musically inspired immersive experience design*, pp. 96–100

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→ *In defense of musical 'pseudosynesthesia'*, pp. 107–108

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→ *Hearing color: How synesthesia constructs intimacy in Eric Whitacre's Alleluia*, pp. 84–86

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→ *Vladimir Baranoff-Rossine, Grigory Gidoni, Léon Theremin: Experiments in the field of sound/light/choreography (1920–1930)*, pp. 137–141

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→ *Synesthetic features of creativity: Krzysztof Penderecki*, pp. 81–84

Amanda E. Krause

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→ *Exploring the contemporary listening experiences of synesthetes*, pp. 104–105

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Timothy B. Layden is a visual artist, musician, writer and art educator. Born in Seattle, Washington, USA, he has worked in the USA, Mexico, Italy, Japan, Spain and the UK. He received a B.A. in Fine Arts from the University of the Americas in Mexico, Puebla, Mexico, in 1995, and a Doctorate in Fine Arts with research on interdisciplinary arts and synesthesia at the University of Barcelona, Spain, in 2005. Currently, he works in England as a teacher and an artist, developing projects related to art, science and synesthesia as an active member of the *Artecittà Foundation*, the *UK Synaesthesia Association* and the *IASAS*.

→ *The exploration of sound shape synesthesia and painting collaboratively designed sound*, pp. 45–49

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→ *Translating chromesthesia for non-synesthetes*, pp. 72–76

Maris Loeffler

→ *Amy Beach: Synesthesia and a comparative analysis of colored composition*, p. 70

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Anastasia Maximova studied history and philology at the University of Kazan, Russia, and in Mainz, Germany, where she received her Dr. phil. degree in 2000. Since 2009, she is the director of the Prometheus-Center in Kazan, has presented the activities of the Center at festivals in Moscow, Karlsruhe and Paris, and directed synesthesia conferences in Kazan in 2010, 2012 and 2015. In 2019, together with Jörg Jewanski and Rustem Sakhabiev, she published the monograph *Synästhesieforschung am 'Prometheus' in Kazan', Russland. Eine Bibliographie der 18 Kongressberichte 1967–2015*.

→ *The first visualization as a film of Scriabin's Prométhée, directed in 1964 in Russia by Bulat Galeyev: Principles of his interpretation*, pp. 147–149

Svetlana Malakhova

→ *From synesthetical ear training to creativity of consciousness*, pp. 116–118

Kenny McAlpine

→ *Video (Games) Killed the Music Hall Star: A history of multimodal and cross-sensory music performance*, pp. 152–153

Maura McDonnell

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→ *Color sings too: The emancipation of color and its role in the development of a visual music expression in 20th century art*, pp. 125–126

Helena Melero

Helena Melero, Ph.D. in Neuroscience, is the founder and director of Synesthesia Lab Madrid. She is a neuroscientist and specialist in the optimization and application of neuroimaging techniques (MRI) as tools for evaluation and treatment in neurological and psychiatric diseases. As a postdoctoral researcher, she has published her scientific work in high impact journals such as *Neuroimage*, *Experimental Brain Research*, *Human Brain Mapping*, *Journal of Neurology*, *Chemosensory Perception*, and *Integrated Computer Aided Diagnosis.* Her multiple synesthesias allow her to develop artistic work in several domains, such as musical composition, dance, poetry and painting.

→ *A red symphony out of the canvas: Exploring the neurophenomenological dimension of music-color/form and music-touch synesthesias*, p. 69

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→ *Music and word: The views of Russian theorists on versification in the context of synesthesia*, pp. 121–124

Margaret Osborne

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→ *Exploring the contemporary listening experiences of synesthetes*, pp. 104–105

Iluminada Pérez Frutos

→ *Musical art and synesthesia: Synergy between smell, color and sound in music*, p. 124

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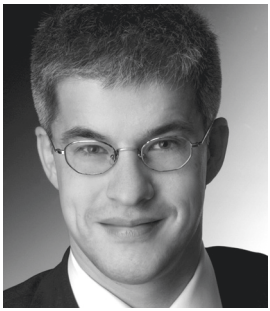
→ *Chromesthesia influences on musically inspired immersive experience design*, pp. 96–100

Christoph Reuter



Christoph Reuter, born in 1968, studied musicology, German philology and educational science at the University of Cologne, where he received his doctorate in 1996 and habilitated in 2002. After scholarships (GrFG, DFG), assistance and lecturer periods (University of Cologne, University of Vienna, University of Music Franz Liszt Weimar), as well as activities in media and publishing houses (e.g., Schott Music International (Mainz), b.i.b. International College (Hanover), IAMP solutions (Cologne)), he became a professor for Systematic Musicology at the University of Vienna in 2008 (since 2016, head of institute). His research interests include musical acoustics, psychoacoustics, music psychology, sound analysis/synthesis and music-informatics.

https://musikwissenschaft.univie.ac.at/ueber-uns/team/reuter/

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→ *The colors of musical instruments: An intercultural comparison on timbre-color mappings with non-synesthetes in Austria/Germany and in Madagascar*, pp. 113–115

Dina Riccò

Dina Riccò is an associate professor at the Department of Design, Politecnico di Milano. She has a degree in Architecture (1990), and a Ph.D. in Industrial Design (1997). Since 2007, she has participated in organizing the international conference *Synaesthesia: Science and Art*, promoted by the *ArteCittà Foundation*; she is also director of the parallel event *MuVi*, devoted to visual music. Overall, she has written over 100 publications. Among her key publications are *Sinestesie per il design* (1999), *Sentire il design* (2008), and *Synaesthesia: Theoretical, artistic and scientific foundations* (with María José de Cordoba, Sean A. Day et al., 2012 [Spanish edition] and 2014 [English edition].

http://muvi-visualmusic.tumblr.com/
http://www.sinestesie.it

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Svetlana Rudenko

www.svetlana-rudenko.com

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Rustem Sakhabiev

Rustem Sakhabiev was born in Kazan, Russia. He attended a music school in his hometown, and a military music college in Moscow. Afterwards, he studied flute at the University of Münster, Germany, Department Musikhochschule, where he received his Master of Arts degree in 2016. He attended synesthesia conferences in Kazan' and Almería. In 2019, together with Jörg Jewanski and Anastasia Maximova, he published the monograph *Synästhesieforschung am 'Prometheus' in Kazan', Russland. Eine Bibliographie der 18 Kongressberichte 1967–2015*.

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August Schmidhofer

August Schmidhofer is an assistant professor at the Institute of Musicology, University of Vienna. He studied musicology and psychology in Innsbruck and Vienna and received his doctorate with a dissertation on xylophone playing in Madagascar. Before joining the University of Vienna, he worked as an ethnomusicologist at the Phonogrammarchiv of the Austrian Academy of Sciences. Schmidhofer's main research interests center on musical ethnography, ethnohistory, music and trance, and archivistics. Schmidhofer has carried out extensive field research in Madagascar, Uganda, Malawi and Mozambique.

https://musikwissenschaft.univie.ac.at/ueber-uns/team/schmidhofer/

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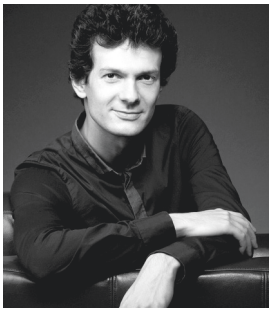
Konstantin Semilakovs



Born in Riga, pianist Konstantin Semilakovs is laureate of the First Prize of the International Piano Competition in Porto, Portugal and prize-winner of the Competition for Young Pianists Ettlingen, Germany. After teaching positions at the Nuremberg University of Music and University Mozarteum Salzburg, he was 2018 appointed professor of piano at the University of Music and Performing Arts Vienna. In addition to his artistic and pedagogical activities, he is researching the phenomenon of synesthesia and 'colour' in classical music of the 20th century (especially in the compositions of Alexander Scriabin and Olivier Messiaen) within his doctoral programme at the University of St Andrews, UK.

www.semilakovs.com

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Saleh Siddiq is a university assistant in the field of Systematic Musicology at the Department of Musicology of the University of Vienna, completing his doctorate on the psychoacoustics of musical timbre. He studied Musicology in Vienna concluding with an emphasis on the physiology of hearing and psychoacoustics. Since then he researches and teaches in the field of psychacoustics and music psychology

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https://musikwissenschaft.univie.ac.at/ueber-uns/team/siddiq/

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Anton V. Sidoroff-Dorso

Anton V. Sidoroff-Dorso is an *International Association of Synaesthetes, Artists, and Scientists* (IASAS) founding board member, Moscow-based linguist and psychologist. He studied for a post-graduate degree (Candidate of Sciences) at Moscow Pedagogical State University, with a dissertation on individual differences in people with synesthesia. Author of *Synaesthesia Quotient* and a related test battery. In 2011, founded the *Russian Synaesthesia Community* (synaesthesia.ru). Since 2012, he serves as the *Artecittà Foundation*'s international coordinator and a member of its international *Synesthesia Journal* editorial board. He adapted the Russian version of the *Synesthesia Battery*, and has participated as a key speaker in multiple events and documentaries on synesthesia. He was the international coordinator of the 2019 Moscow *IASAS International Synaesthesia Conference*.

→ *Konstantin Saradzhev's music-related development as a bell-ringer and music theorist as determined by his microtonal pitch-to-color/shape synesthesia*, pp. 76–81

Jasmin Sinha

Dr. Jasmin Rani Sinha is a German linguist, project manager and coach. Since 2006, she has lived in the multi-lingual border region of Belgium, Luxembourg, working as Grants Officer at the University of Luxembourg. Sinha has been investigating synesthesia from an inside perspective for almost two decades. She strives to "translate" her genuine synesthetic perceptions, making them understandable to a non-synesthetic world. She has founded the publishing house SYNAISTHESIS, focusing on synesthesia topics, and she is a coach for high sensitivity, giftedness and synesthesia.

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Christine Söffing

Christine Söffing is an artist and synesthete, based in Neu-Ulm, Germany. Since 2010, she is the artistic coordinator of the Center for Music & Art at Ulm University and head of the group *Experimental music & art* (EMU). In 2012, she organized the conference *Synaesthesia with Children, Creativity and Learning*, in Ulm. She uses her synesthetic color and shape perception of sounds and scents for her work in experimental music, compositions, films and sound-scent-art-installations.

www.synaesthesiewerkstatt.de

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Clara Soto

Clara Soto was born at Celaya, Guanajuato, Mexico. She studied classical guitar at the Celaya Conservatory of Music and won participation at the International Guitar Festival of Querétaro in 2014. She received a Bachelor's Degree in Arts Teaching at the Autonomus University of Queretaro, and a Master's Degree at the University of Guanajuato. In 2019, she attended the *Congress on Social and Educational Inclusion* that was held in Bilbao, Spain, and gave a presentation about *Design of a synesthetic tool in the augmentative system for musical appreciation in people with two hearing abilities*.

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Peter Stasny

Peter Stasny, Mag. art. Dr. phil., born in Salzburg. He studied art education, art history and philosophy in Vienna and Melbourne. In 2005 he was a founding member of the New Design University, Private University of the Creative Industries, St. Pölten; there lecturer for art and design history; exhibition curator; 2003–2007 visiting professor at the University of Art and Design Linz for methods of art appreciation; 1983–1987 and 1996–2005 and since 2010 lecturer for art and cultural history at the HLA Herbststraße in Vienna. Publications on art education, art history of the Bauhaus and Classical Modernism as well as on Austrian contemporary art.

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Alisa Timoshenko

Alisa Timoshenko is a musicologist and Senior Researcher of the Organology Department, Russian Institute for the History of Arts. She graduated from the faculty of conducting and composing, Petrozavodsk Conservatoire (1996), graduate school of the RIHA (1999). Her areas of scientific interests are the history of Russian organology, the Silver Age in Russian culture, and Russian church music.

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Milja Vanhalen

Milja Vanhanen received a Master of Arts in Ethnomusicology. He is a music information specialist and a musician. His many synesthesias include colored hearing and have affected his way of understanding the world. Music and the visual world have always been a big part of his life.

→ *When audio is always visual*, pp. 67–68

Luigi Verdi

Luigi Verdi was born in Rome. He graduated in Composition, Band Instrumentation, Choir and Orchestra Conducting. He has written musical compositions from chamber to orchestral genres, performed at festivals and in concerts. Verdi published several books: *Organizzazione delle altezze nello spazio temperato* (1998), *Caleidocicli musicali* (2010) as well as articles and monographic essays such as *Kandinskij e Skryabin: realtà e utopia nella Russia pre-rivoluzionaria* (1996), *Aleksandr Nikolaevic Skryabin*

(2010), and *Franz Liszt e la sua musica nel cinema* (2014). Verdi is Professor of Composition at the Santa Cecilia in Rome.

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🌍 www.sussex.ac.uk/profiles/92444/research

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Music and Synesthesia

Jörg Jewanski, Sean A. Day, Saleh Siddiq, Michael Haverkamp,

and Christoph Reuter (Eds.)

Synesthesia is a remarkable phenomenon: it unites scientists and artists, scholars and laymen, as well as different disciplines such as neuroscience, psychology, musicology, art history, philosophy, and linguistics. It is 'the' interdisciplinary issue par excellence. This book provides the abstracts of a scientific-artistical conference "Music and Synesthesia" in Vienna, scheduled for July 3–5, 2020, with participants from different countries inside of Europe, from North, Central, and South America, and even from Australia.

Synästhesie ist ein bemerkenswertes Phänomen: Es vereint Wissenschaftler, Künstler, Fachleute und Laien sowie verschiedene Forschungsfelder wie Neurowissenschaften, Psychologie, Musikwissenschaft, Kunstgeschichte, Philosophie und Sprachwissenschaften. Es ist ‚das' interdisziplinäre Thema schlechthin. Diese Buch sammelt die Abstracts einer wissenschaftlich-künstlerischen Tagung zu Musik und Synästhesie in Wien, geplant vom 3. bis 5. Juli 2020, mit Beiträgen aus verschiedenen Ländern Europas, Nord-, Mittel- und Südamerikas, und sogar aus Australien.

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