

## REGARDING TYPES OF SYNESTHESIA AND COLOR-MUSIC ART

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Congenital synesthesia is a neurological condition in which stimuli to one sensory input mode produces perception in one or more additional modes. There are over 55 different types of synesthesia. This article focuses on types of synesthesia involving music as the «inducer» and for which some visual aspect is the resulting «concurrent». There are at least ten different types of «music to color» synesthesia. So, which type(s) do we use for visual additions to a musical piece in light-music? There are two main factors involved: the colors, and the speed at which they appear. What we seek is actually significantly different than an accurate depiction of real neurological synesthesia. For our light-show, we are better off not to try to duplicate any synesthete's actual set; we would do better to create an artificial set of colors.

### ТИПЫ СИНЕСТЕЗИИ И ЦВЕТО-МУЗЫКАЛЬНОЕ ИСКУССТВО

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Врожденная синестезия это неврологическое состояние, при котором стимулирование одной сенсорной входной моды вызывает ощущение в одной или нескольких других модах. Существует около 55 различных типов синестезии. В данной статье рассматриваются типы синестезии, включающие музыку в качестве «индуктора» и для которых определенные визуальные аспекты являются сопутствующим результатом. Есть, по меньшей мере, десять различных типов синестезии «музыка-цвет». Итак, какой тип (типы) мы действительно используем для визуального добавления к музыкальной пьесе в свето-музыке? Здесь играют роль два фактора: сами цвета и скорость их изменения. То, что мы ищем, на самом деле существенно отличается от аккуратного описания реальной неврологической синестезии. Для нашего светового представления, мы не должны пытаться репродуцировать какое-то действительное состояние синестезии; скорее, нам лучше создавать некоторое искусственное сочетание цветов.

On back towards the start of this year (2008), I was contacted by Roman Borys, of the Gryphon Trio, a chamber music group based in Toronto, Canada. The trio was planning to do a presentation of Olivier Messiaen's *Quatour pour la Fin du Temps*, to premier in June, and Mr. Borys was seeking my advice in creating a light show accompaniment. He stated that there were three related issues that he and his lighting technicians were dealing with: On the one hand, they wanted to portray synesthesia as accurately as possible, as per what a real synesthete such as Messiaen

would actually see when hearing the music. On the other hand, they wanted something that could actually be produced via laser, screens, projecting into fogs, and other current standard lighting tricks. And, yet again, they wanted something that would be pleasing to the audience, and that the audience could follow and comprehend. Accuracy, however, was of prime importance to Mr. Borys.

Humans start out as «unisthetes», with just one sensory mode of perception which processes all modes of sensory input. As a child grows, by age 6 months or so, the senses start to separate and modularize; this is assisted, in part, by myelination [see 12, pp. 224–242; 7]. Congenital synesthesia is a poly-genetically based neurological condition in which stimuli to one sensory input mode, such as hearing, produces perception not only in that mode but also in one or more others, such as vision or smell. Thus, for example, a synesthete may not only hear music, but also see music; or not only smell a perfume but also hear it. This is caused by mutated genes on various chromosomes, such as perhaps chromosome 16q [6], creating a situation where neural pathways in the brain do not myelinate properly, which result in a different than normal level of inhibition of feedback along certain neural connections. Essentially, with a synesthete, certain neural lines stay young, never completely growing up.

There are easily over 55 different types of synesthesia [see 3, pp. 11–33; 4], such as touch sensations also producing the perception of taste, or odors producing not only smell but also auditory perceptions. One of the most common, by far, involves printed letters and numbers (graphemes) being perceived as having added colors. However, for this article, we are focusing just on those types of synesthesia which involve music as the «inducer» of the resulting synesthetic perception, and, within that set, only with those types for which some visual aspect is the resulting «concurrent».

There are at least ten different types of 'music → color' synesthesia. The most frequently heard of, and probably the most frequently dealt with by artists, involves each note of either an eight note scale (such as the white keys on a piano) or a twelve tone scale (the conventional chromatic scale of Western music) being associated with a color. Jazz guitarist Tony DeCaprio, for example, has this type [5]. DeCaprio uses his synesthesia as a

tool for improvising jazz solos, by exploring modulating from one color pattern to another, which results in modulating from one key or modality to another.

Whereas 'grapheme → color' synesthesia is so common, it is not surprising that another type of music-related synesthesia involves the letter names of musical notes, such as 'A', or 'C', or 'E'. Here, the synesthete is extending colors for letters to colors for musical notes. György Ligeti had this type of synesthesia [10], but rarely if ever used it as a tool in any of his compositions, apparently having little interest in it.

A variant on the type that deals with individual musical notes would involve absolute pitch, where each and every discernable difference in pitch frequency takes on a specific color. Scottish pianist and composer Joseph Long has this type. He claims that he has only played around with it as a compositional tool a few times, for some of his early compositions, but sees little use in it towards creating his preferred styles of composition [11].

Related to synesthesiae based upon musical notes or pitches, we also have a type based upon the key the music is in, such as the key of Bb or of f# minor. This type is not infrequent; composers Nikolai Rimsky-Korsakov [17, pp.842–845] and Amy Beach [2; 9] had it, as does Michael Torke and pianist Hélène Grimaud.

Yet another type of music related synesthesia involves the chord structure, such as whether the chord is based upon its tonic note or is an inversion. Olivier Messiaen had this type as an element of his synesthesia. For Messiaen, it became a main component in how he structured some of his most noticeable compositions [13; 15]. Messiaen also had another permutation of synesthesia. Different musical modes, such as music in the Aeolian, Dorian, or Lydian scale, each had its unique synesthetic color. Composer Michael Torke also has this type involving modes. Messiaen used this synesthetic aspect in many of his compositions. Torke used it only in some of his early compositions; most noticeably perhaps *Ecstatic Orange*, where Torke's intent was to move through different shades of orange, created by the key (E major), via moving through different modes, which each tinged the base orange a different shade, such as "burnt orange" or "carrot". However, the entire piece as a whole never modulates away from the initial key, thus maintaining the color orange throughout.

Each one of the different shades of orange is notated in the score for the piece at the point where the mode shifts [16; 14].

A type I am very familiar with, since I have it myself, is where the distinct timbre of each different musical instrument creates its own unique synesthetic color, such as the sound of a piano producing blue, and the sound of a saxophone producing purple. Composers Leonard Bernstein and Duke Ellington had this type, as does drummer Elvin Jones. Bernstein apparently did not use his synesthesia much at all, or at least not to a noticeable extent, in shaping any of his compositions. Ellington, on the other hand, did use his synesthesia towards shaping many of his compositions, since he would feel that a certain piece required a certain color shade and thus a specific soloist; this would, in turn, force the shape of the composition, since what the required solo instrument was would then force the range and scope of the melody and its accompaniments [see 8]. Drummer Elvin Jones, on the other hand, uses his 'timbre → color' synesthesia to determine the structure of his solos, as it influences which percussion instrument he moves to next based upon what color he wants to see next [see 1].

You could also have the situation where an entire piece of music, as a whole, produces its unique synesthetic color. For example, Debussy's «Claire de lune» might be a certain shade of rose, and Bach's «Tocatta and fugue in d» might be a very specific shade of red. Pianist Hélène Grimaud has this type along with her other type. Similarly, the set of works of different composers could each take on their personal synesthetic colors, such that, say, Scriabin's music is lavender and Mahler's lime green. Likewise, we could have the situation where different genres each have their unique color, such that, say, ballet music is dark blue, «cool» jazz is bright orange, and "heavy metal" rock is mauve.

Finally, we have the situation of all sounds, regardless of whether they are musical or not, creating synesthetic perception. This, for example, is what Jean Sibelius had.

So, which type(s) do we use for visual additions to Messiaen's *Quatuor*? There are two main factors involved: the colors, and the speed at which they appear. First, let's address the colors. One of the essential things about actual neurological synesthesia is that the synesthete does not get to choose what color is associated with which musical aspect. It is all

predetermined by "hard-wiring". Thus, there is no correlation between pleasant sounds and pleasant colors. Nor, necessarily, do the colors range evenly throughout the spectrum. Basically, you just get what you get and are stuck with it, whether you like it or not! Thus, for example, you could have a synesthete whose total set of synesthetic colors for music is almost completely only drab browns and grays, with just a few rare instances of a couple of shades of red and of green; this case example would in no way be rare or unusual. So, if we want to base our light-show's color scheme on that of an actual synesthete's, chances are that we are going to end up with a very imbalanced spectrum of colors, with a lot of washed out and drab colors, and with many if not most colors not correlating well with the conventionally accepted color(s) that would go with the music. The only composers I know about whose color sets worked well (that is, corresponded well) with the music they were creating were Ellington, who had a lot of synesthetic shades of blue and purple which worked well for his jazz and «blues» music, and Messiaen, who had a very broad range of colors that encompassed well those of stained glass and of earth tones (as per the canyons of Utah).

So, put simply, for our light-show, we are far better off not to try to duplicate any synesthete's actual set. It would probably not, for example, be wise to try to reduplicate what Messiaen himself would have synesthetically seen for his music. We would do better to artificially create a set of colors which ranges across the spectrum, and perhaps also ranges in brightness and saturation. However, we also need to carefully take into consideration the culture of the audience we are presenting the light-show to, as it would be to our benefit to have the colors correspond correctly to traditional pre-established culturally set color symbolisms. An audience would rather see what it expects to see for correspondences between music and color. This, however, results in the need for a different set of color correspondence, and thus a different light show, as you move from culture to culture; the traditional color symbolisms of the Japanese, for example, are radically different than those of the Desana Tucano or the Maoris.

Now let's look at speed. For actual synesthetes, music-related synesthesia involving notes is far more common than other types involving, say, timbre or keys. However, for most music, if we base our light show's col-

ors on a set for the musical scales (thus, say, 12 separate colors of the chromatic scale), we end up with a rapid blur of colors that moves far too fast for the audience to follow, and which just becomes a headache-inducing nuisance. I have seen such light-music shows created by synesthetes trying to depict their perceptions; they are extremely unpleasant. On the other hand, if we go with basing the colors on the key or the mode, we could very readily find ourselves with pieces that maintain just the same one color throughout their entire duration.

So, what we need to do is to analyze each piece we intend to color, separately and in its relationship with other pieces we want to color, looking at all of the aspects of music listed above (that is, notes; keys, timbre, etc.), and decide which aspect changes at a time rate that the audience can work with. That time rate would call for a color change (very) roughly between every five second to, say, two minutes. If the colors change too fast, such as two or three times per seconds, that could be aggravating; likewise, if the colors do not change fast enough, things can get boring.

So, "Liturgi de cristal", in which all four instruments play, could be based upon the chords played by the piano, against colors based upon timbre for the other three instruments, although the colors would move very fast. We could try to base the "Vocalise" on the keys or modalities, but, again, building it like the previous movement might work better. For the third movement, «Abîme des oiseaux», a slow-moving clarinet solo, basing the colors on notes of the chromatic scale works best. For the «Intermède», since the violin, clarinet, and violoncello are all playing the same notes in unison, notes and timbres will not work; key or modality might work better. For the fifth movement, «Louange à l'Éternité de Jésus», we could work with the colors for the individual scalar notes of the violoncello against colors for the chords played by the piano. And so on.

To recapitulate, although we might try to create a «synesthetic» entertainment by combining colors and music in some paradigm of associations, what we seek is actually rather significantly different than an accurate depiction of real neurological synesthesia. And, if we emulate and attempt to imitate actual synesthetes' perceptions with our light-shows, we

will most likely end up only with something of value for educational or research purposes, but which will hold little of value for a general audience.

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## SYNESTHESIA AND COLOR-LIGHT MUSIC. AN INTERDISCIPLINARY PROJECT IN ZUERICH

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Prepared by an international conference in 2002, a combined artistic and scientific project took place at the Conservatory Zuerich, Switzerland, in 2003/04, named *FarbeKlangSynthese* (ColorSoundSynthesis), or *Synesthesia and Color-light-music*. In this paper the results of the project are presented.

## СИНЕСТЕЗИЯ И ЦВЕТОВЕТАВАЯ МУЗЫКА. МЕЖДИСЦИПЛИНАРНЫЙ ПРОЕКТ В ЦЮРИХЕ

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Подготовленный для международной конференции в 2002 г., объединенный художественный и научный проект был представлен в Консерватории Цюриха, Швейцария, в 2003-2004 гг., под названием Цветозвуковой Синтез или Синестезия и Цветосветовая-музыка. В данной статье рассказывается о результатах этого проекта.

In 2003 and 2004, at the Conservatory Zuerich, Switzerland, a combined scientific and artistic project took place that was entitled *Synesthesia and Color-light music*. The starting point for the project was a so-called 'Farblightflügel', a color-light organ, which the pianist Natalia Sidler had developed (Fig. 1). This color-light organ has little in common with a normal piano apart from the basic piano shape and keyboard. The instrument projects colors in three simultaneous modes. In the first, which operates on a foreground level, each musical tone produces its own color. For practical reasons, seven colors and seven tones inside an octave were chosen for this mode, in keeping with the piano keyboard, the point of departure. The colors become brighter in higher octaves and darker in lower ones. The second mode produces a background color, in keeping with a scheme whereby seven colors, ordered by brightness, are spread over the entire keyboard. The third mode, which functions on the basis of timbre, shapes and modifies the color forms in the foreground. Natalia Sidler defined it by spreading seven timbres over the keyboard in an intuitive way. Synesthesia occurs in that every timbre generates a picture based on her own synesthesia, with elements suggestive of basins, string, or high sounding bells (Fig. 2a-c). The color-light organ's very design is thus