

Creating Visuals for Classical Music: Cognitive Musicology via Cross-Modal Associations

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Abstract

There are various approaches to music analysis and visualization of musical structures. Cognitive Musicology is a relatively new field using computational tools to reflect on musical content and structures. Musical texture is the DNA of musical composition, created by complex set of elements such as rhythm, melody, and harmony accompaniment. Musical texture is also an inducer of cross-modal associations. Bulat Galeev, Professor of physics and philosophy, noted that cross-modal associations are “a normal process in musical thinking” [1]. The fact is that, together with audio stimuli, other areas of the brain, which are responsible for processing visual, tactile and olfactory experiences, also become involved in music listening or musical performance. Cases of synesthesia broadened our understanding how the sound and music could be perceived [2, 3, 4]. Sensory awareness allows us to investigate the process of musical consciousness and imagery in music. This paper offers an example of music analysis based on archetypes of musical texture, which is suitable for methodology of visualisation by cross-modal associations. The Art image and animation is assigned to each archetype and reflecting on symbolic content of the composition. Chosen test pieces are A. Scriabin’s Preludes op. 74 and Sonata N5. This type of music analysis and visualization is an empirical evidence of how consciousness is subjective and at the same time can relate to everyone’s emotional experience.

Index Terms: cognitive musicology, synesthesia, cross-modal associations, classical music, archetypes of musical texture, art visualisation, consciousness

1. Introduction

1.1. What elements of musical language should be taken for the basis of visualisation?

Advances in digital technology and data visualization allow scientists to develop multiple ways for presenting data including multi-modal (combining text, image, video, bio-signals, etc.) and interactive interfaces (e.g. virtual reality, immersive technology), but in relation to music this has not been fully explored yet. Visualization of music poses a challenge, what elements of musical language should be taken for the basis of computational analysis? Different researches select different elements of music for visualisation. Further is a brief examples to visualization of musical structures. Jia Li investigates pitch range and tendency [5]: “Viewing pitch usage in modern music on a graph can amaze an audience. The visual patterns are more obvious than in classical music.” For example, Figure 1 shows a huge contrast of pitch range within a composition. This piece is for harpsichord by György Ligeti, written in 1968. The composer wanted to compose a piece “that would be a paradoxically continuous sound, something like *Atmosphères*,

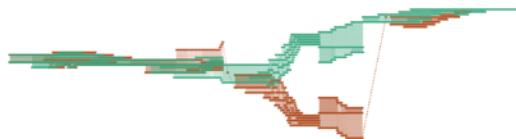


Figure 1: *Visualization of pitch range and tendency. This figure was copied from (Li, 2016), “Ligeti: Continuum for Harpsichord”.*

but that would have to consist of innumerable thin slices of salami. Ligeti’s earlier works used a technique known as micro-polyphony. Rather than using large orchestra, this piece uses extremely rapid activity by a dense, rich stack of pitches with a solo instrument to create the impression of continuous sound and a monolithic image.” [5].

Jonathan Foote and Matthew Cooper proposed methods of visualizing music by its acoustic self-similarity across time, rather than absolute acoustic characteristics. They take “repetitive similarities, such as repeating notes or motifs, which show up as a checkerboard patterns: a note repeated twice will give four bright areas at the corner of square.” [6]. In their music visualization, Bach’s Prelude No.1 in C-major, Temper Clavier, would look like that: “34 notes are visible as squares along the diagonal. The repetition time can be seen in the off-diagonal stripes parallel to the main diagonal, as well as the repeated C note at 0, 2, 4, and 6 seconds.”

Winnie Wing-Yi Chan posed the question: “how to create informative and insightful visualization from which users without musical background not only see the sound visually, but also understand the structure of music semantically and be able to identify the musical elements effectively.” [7]. Chan suggested to follow principle of the Isochords by Tonnetz and 3D Music Visualization with MIDI data file as input [7]. I suggest art visualization of music by archetypes of musical texture and cross-modal associations, applying principles of Cognitive Musicology and subjective experiences of the performer.

1.2. Musical narrative and archetypes of musical texture

Contemporary music after 1830 is a complex and very often has symbolic or programmatic content. (For example, Berlioz Symphonie Fantastique, Liszt Faust Symphony, etc.). To understand and to be fully aware of musical narrative it requires additional knowledge of the style, epoch and harmonic language. The emotional content is not only joy, sadness or nostalgia, but has a lot of symbolics. For example, Wagner’s system of leitmotivs, Der Ring des Nibelungen. A. Scriabin (1871-1915) was a symbolist composer synaesthete whose life ambition was to create multisensory drama Mysterium serving the Symbolism



Figure 2: *Prelude op. 74 No. 1 Dual Mode F sharp – C major*

and Theosophy of spiritual awakening. He inserted color organ (part Luce) into the score of symphonic poem Prometheus “to make the harmony moves more evident” [8] and his harmonic language reinterpreted dissonance of altered dominant chords into “tender”, “dazzling” sounds [9]. For music analysis of Scriabin’s One-movement Sonata form, Susanna Garcia offered basic six archetypes of musical texture, reflecting on philosophical beliefs of the composer [10]. Rudenko extended the library of archetypes for music analysis of late piano miniatures [11]. Further is the description of music analysis of musical texture for art visualization by example of Preludes op. 74 and Sonata N5.

2. Complexity of music analysis in Scriabin’s compositions

2.1. Historic research

New approaches to harmonic analyses of Scriabin’s work have been shared and puzzled over in both East and West. In the West, Schenkerian analysis was applied to Scriabin’s compositions. Baker suggested even Fortean analysis was appropriate, considering Scriabin’s late compositions atonal [12]. Richard Taruskin challenges Baker’s approach, suggesting that his concept of atonality is as loose as his definition of atonality is rigid, as oceanic as the other is restricted [13]. It is merely a negative definition, as Baker candidly admits. Whatever does not conform to the Ursatz is “atonal”. Taruskin suggests using octatonic and symmetrical modes to explain the harmonic language of Scriabin. Roberts’s research on Russian Modernists has uncovered wide usage and even a tradition of whole tone, octatonic, and symmetrical scales in contemporaries of Scriabin. However, research by Philip Ewell [14], published in 2012, points on specifics of Russian theory thoughts and wide influence on composers of the time through Sergei Taneev (1856-1915) who taught composition in Moscow Conservatory. By examining systems of the Russian music theorists Yavorsky, Sergei Protopopov and Yuri Kholopov, he proved necessary the rethinking of American views on octatonism and the specifics of their application or not to works of Russian composers. Yavorsky’s Dual modality and Dernova’s Departure/Derived Dominants, opened the ‘secret operating system’ of Scriabin in 1948 and her work “Garmoniya Scriabina” was published in 1968. Susanna Garcia described the six most common gestures archetypes in relation to One-movement sonata form of Scriabin and pointed out that “Scriabin repeatedly conjoined certain types of expressive language with specific musical gestures thus creating a body of musical symbols consistent throughout... the late works” [10]. According to Simon Morrison, Preludes op. 74 are considered to be piano sketches for Scriabin’s final multisensory drama Mysterium, to which the composer wrote verbal text.

2.2. Two Preludes op. 74, A. Scriabin

Figure 2 shows the Five Preludes op.74 (1914): No.1, Douloureux, dechirant. The key is Dual Mode: F sharp/ C major. Yavorsky’s Dual Modality (dvazhdy lady) method was applied here to connect two scales or modes a tritone apart. These two scales form a row of twelve notes, while at the same time it is a chromatic scale, which fits into Robert’s symmetrical group of scales. In this prelude, C major combined with F sharp major to form the chromatic 12 note scale. Scriabin reached this structure through an harmonic respelling of the dominant seventh in the key of F sharp (Dernova’s Departure Dominant) equating it to a second inversion of the altered Dominant seventh in C major (Dernova’s Derived Dominant). The notes of those vertical chords spelled horizontally giving a chromatic 12-note scale, the Yavorsky Dual Modality. That answers the question of key in Scriabin’s later compositions after 1910 when the evolution from Tonality was complete: It is a dual key. A Tonic-Dominant-Tonic structure is still present, except that the Tonic is expressed by Dominant-structure chords, and Tonic and Dominant are a tritone apart. In the archetype Chord of Mystical Unity, the famous altered Prometheus chords are pitch centers which demonstrate Scriabin’s movement to different keys. This is important for performers in order to follow the atmospheric change implicit in changing key color. Scriabin consistently uses Dominant-Tonic relations though the distance between them became altered to a tritone.

The archetypes used in Prelude No. 1:

1. The Eternal Feminine, top melodic line, marked in red in the score.
2. The Longing theme, middle layer, chromatic crawling of the voice, marked in green.
3. The Disturbing rhythms, marked in brown, semiquavers with the tritone in the middle of the passage.
4. The Connecting element is the Notion of Mystical Unity marked with a blue line.

Figure 3 demonstrates the mapping of archetypes of musical texture by colors.

The altered Dominant chord, with bass B sharp in C major, ‘resolves’ to the altered Dominant chord with the bass F sharp. In reality it is the same chord through enharmonic spelling: the tritone A sharp to D double sharp in the dominant of F sharp major, can be respelt enharmonically as B flat to E in the inversion of C major Dominant seventh. Figure 4 demonstrates art image by cross-model associations of the performer (author of this paper).

No. 2, Très lent, contemplative: Archetypes of musical texture in Prelude op. 74, No. 2, Lullaby, as follows:

1. The Eternal Feminine (red)
2. Crawling chromaticism of ‘Dark Shadows’ (purple)
3. Lullaby accompaniment (green)
4. The Mystical Unity chord (light blue)

Figure 5 demonstrates the mapping of archetypes of musical texture in the score of prelude op. 74, No.2.

Although this prelude has characteristics of a lullaby, it is actually more akin to a cradle song of death. The Eternal Feminine Archetype, both ‘mother and seducer’ [15] is described by a Dominant organ pedal (bass F sharp throughout) - again using the C/F sharp major polarity. As Kenneth Smith points out: “the fundamental point is that the Eternal Feminine - the figure



Figure 3: A. Scriabin, op.74, Prelude No. 1. The score with marked archetypes of musical texture.

of maternity, seduction and love - now becomes the figurehead of Death. At an early stage, symbolist philosopher Ivanov himself had forged this link, for instance in his poem: "There she, on the sad clearing, Waits alone for him above the grave, Sitting motionless in the mist." [15]. If Ivanov revelled in the primordial chaos he found in Tristan and Isolde's chromatic lines, he would doubtless have approved of the Prelude op. 74, No. 2, in which semitone motion saturates the voice-leading almost entirely. Skryabin's own testimony supports a double reading of this chromatic line and tonic pedal as agents of both death and erotic seductive tension. Playing the prelude to Boris de Shloezer, Scriabin sets the psychological scene: "Listen to the simplicity, and yet how complicated psychologically" (...) he elaborated specific features: "and here is fatigue, exhaustion – the chromatic descending line. See how this short prelude sounds as if it lasts an entire century? Actually it is all eternity, millions of years..." [16]. When discussing the piece on another occasion with Sabaneyev, he played it twice, demonstrating that 'the same crystal can reflect many different lights and colours'. Sabaneyev describes how, the second time, the piece lost "every trace of caressing Eros which once shadowed it". Upon mentioning this to Skryabin, the composer whispered, "Yes... it is death now. It is death like the appearance of the Eternal Feminine which leads to the Final Unity. Death and Love. I call Death 'Sister' in my Prefatory Action, because there must be no trace of fear about it. It is the highest reconciliation, a white radiance." [16]. As Kenneth Smith states: "This kind of Schopenhauerian pessimism, associated with the death-drive was the hidden secret behind Skryabin's last years, a secret which registers the crushing realization of his failure to complete his theurgic mission on earth." [15]. Smith continues: "A touchingly emotional passage, strategically ignored by Skryabin's devotees, was found by communist philosopher Anatoly Lunacharsky amongst the composer's papers". It runs:



Figure 4: Art image association by Rudenko on op. 74 Preludes



Figure 5: A. Scriabin, Preludes op. 74, No. 2, Archetypes of musical texture

"So, I (Scriabin) realized that I was mistaken. If I recognized that the spirit created the whole world and he lives in all I's, then I am not alone. It is necessary to change everybody's view of the world in order for it to be changed. I am not able to do something that will make stones break away from the roadway and fly into the air, although I have power over my fantasy." [15].

3. Cognitive Musicology via cross-modal associations on A. Scriabin, Sonata No. 5

3.1. Art animated video demonstrating the dramaturgy of music archetypes

Figure 6 is a photo of live performance with visuals. Music Analysis and Piano performance by Svetlana Rudenko. Visuals and animation by Maura McDonnell (<https://vimeo.com/337354023>). Synaesthetic art by Timothy Layden, Svetlana Rudenko, images associated with epoch of symbolism and composer's time, by Mikhail Vrubel, Jean Delville. Composer's own words and music analysis led to the selection of images associated with archetypes of musical texture. Svetlana Rudenko, as a performing pianist assigned art images to archetypes of musical texture according to cross-modal associations on musical narrative. Maura McDonnell animated the art images and synchronised it according to live performance.

Scriabin's epigraph to Sonata: "I call you to life, oh mysterious forces! Drowned in the obscure depths Of the creative spirit, timid Shadows of life, to you I bring audacity."

Image – Archetypes of musical texture:

1. Notion of Mystical Unity - 'mystic' chord (art image of particles symbolising the beginning of Universe/ consciousness awakening)
2. The Divine Summons: fanfare motive (art image by Jean



Figure 6: Photo from the Concert with visuals: live performance. A. Scriabin. Sonata No. 5, op. 53. IASAS 2019 Museum of Moscow

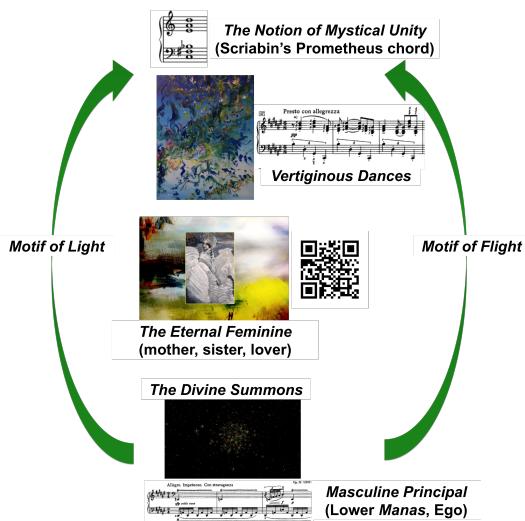


Figure 7: The dramaturgy of archetypes of musical texture in Sonata No. 5, op. 53, A. Scriabin, diagram. The concept was presented at ASSC 2019 Consciousness studies conference.

Delville, which Scriabin selected for the Prometheus score cover)

3. The Eternal Feminine (art image Queen Swan by Mikhail Vrubel, symbolist painter)
4. Motive of light
5. Vertiginous dances (art by artist-synaesthete Timothy Layden, painted live during the performance at Trinity College Dublin concert 2019 [17])

Figure 7 shows the map of musical texture in Sonata No. 5.

3.2. Music consciousness – The theory of the predictive brain

Awareness of sensory ‘embodied’ experiences in music broaden our understanding of perception and cognition, build emotional intelligence and influence the performance itself. As Eric Clarke pointed: “The physical actions in performance - whether of the hands, or the whole body - might be thought of as lying on a continuum from ergonomics to choreography.” [18]. Awareness of cross-modal associations expand our musical imagina-

tion and mental ability, as Freya Bailes said: “the phenomenon of musical imagery - defined as the conscious awareness of an endogenous, internal representation of music.” [19]. Visualisation of musical narrative according to cross-modal associations demonstrates both cognitive musicology by design and how brain produces the abstract representation of emotion and music into conscious awareness. The brain interprets outside information according to the experience, learned before, or one’s beliefs, or illusions, as Andy Clark states: “Our brains are predictive by nature, and they constantly run internal models of the world we live in. (...) those predictions are in fact so powerful that they can directly influence our own perceptions — what we hear and what we see are not reflections of objective reality but tainted with expectations.” [20]. The visualisation of music described above brings the hypothesis that similar to predictive processes the brain tries to transpose experience from one sensory modality (ex. audio) to secondary cortex (ex. visual or touch) to complete the whole picture of ‘imagined’ reality. According to Anil Seth: “Theoretically, ‘predictive coding’ or ‘Bayesian brain’ approaches stand to advance our understanding of the neural basis of conscious perception. These approaches model perception as a process of (possibly Bayesian) inference on the hidden causes of the ambiguous and noisy signals that impinge on our sensory surfaces” [21]. During the time of professional training, musicians gain significant data of music experiences and emotional associations. The imagination and subjective experience of the musician-performer is a trustful source as his/her brain gives the best visual guess or feeling response according to collected professional knowledge. Those subjective insights into music and feelings are invaluable for the spectator who possibly does not have the same level of experience in music.

4. Conclusions

Future perspectives: this form of visualisation by archetypes of musical texture allow to follow the dramaturgy of the musical narrative and could serve as methodology for art visualisations on cross-modal associations of musical texture for classical music compositions. Cognitive Musicology can be explored in applications to expose the narrative content of the classical music to a wider audience by producing engaging informative multi-sensory experiences. This type of visualisation is particularly suitable for contemporary music analysis where emotional content is a complex. Perhaps the visualisations described in this paper could be considered for development of Bayesian probabilistic model for analysis of musical texture in other music compositions.

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