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Peculiarities of Pitch Audiation in the Explorations of Sound Quality

Abstract. Sound quality is one of the essential articulatory components of contemporary art-music. It is a widely discussed, albeit still a largely secretive dimension. Terms "sound quality" and "timbre" are often used interchangeably, however this leads to a rather narrow view towards this issue, as the scope of qualitative articulations in contemporary art-music often expands to other musical parameters, such as loudness, rhythm, and even pitch. Pitch is the primary object of this paper, as its potential for qualitative articulations is a largely undiscussed topic, which can prove to be useful for both composers and researchers.

In order to unravel the nature of qualitative articulations in such compositions, we propose a cognitive approach towards the musical parameters and the phenomenon of sound quality itself. We discuss the parameter of pitch as a perceptual phenomenon, analyze the different ways it can be processed in our perceptual apparatus and different types of teleology that could be consequently produced.

The analytical approach based on the interactions of *Gestalt* principles, that we employ here to study the organization of sound quality, proves to be a reliable tool, as we approach the implementations of pitch articulation from horizontal, vertical and diagonal perspectives, discuss their syntactic relations and cognitive effects. We analyze qualitative articulations of pitches in a handful of excerpts from the compositions by Johannes-Maria Staud, Mathias Pintscher, Ondrei Adamék, Toshio Hosokawa, and the author of this paper.

Keywords: audiation, pitch, sound quality, timbre, cognition, perception, contemporary music, composing.

When I first started my composition classes we had a group lecture on music theory tailored specifically for composers. One day our professor pressed down a C-major chord and asked: "How do you develop from here? Is it a theme, or is it harmony?" To my surprise, the opinions differed significantly. As for myself, I did not want any development of this at all, as I thoroughly enjoyed listening to the slight alterations between string vibrations of a sustained chord.

As illustrated by this example, pitch, despite being one of the most obvious and the most established parameters throughout the history of Western music, can be interpreted/perceived by composers in a variety of ways. It may as well loose its dominance in the hierarchy of musical parameters and assume a supplementary role. This is especially evident in the new music that has a strong emphasis on sound quality but still features well-pronounced pitch articulations. This could be said about the oeuvre of such composers like Johannes-Maria Staud, Mathias Pintscher, Ondrei Adamék, Toshio Hosokawa and many others including myself. However, the role of pitch is easily overlooked when analyzing such music. This is mainly due to a plethora of seemingly more important qualitative aspects that are encoded in these hyper-detailed scores. This article aims to correct (at least to a modest extent) this iniquity by focusing on qualitative aspects of pitch in the scores of aforementioned composers.

What is pitch and how is it related to sound quality?

When discussing the phenomenon of sound quality, one rarely concerns himself with the parameter of pitch. In fact, it is often being polarized as being opposite to the qualitative aspects of the piece. We are not going to rival this opinion here, but rather expand on it by discussing pitch as a perceptual phenomenon in order to reveal its qualitative aspects.

The controversy of relations between sound quality and pitch indeed lies in the perceptual domain. Pitch, According to Bob Snyder (2000), along with harmony and rhythm are the primary musical parameters. Word "primary" here distinguishes their ability to have fixed proportional relationships that can be quantifiable in a scalar way and recognized when they reoccur during the composition. Secondary musical parameters – tempo, loudness and timbre – on the other hand, cannot be identifiable as being "different by the same amount" if separated in time, nor can they be measured in scalar units (Snyder 2000: 195–200). Secondary parameters are not being perceived as concrete values, but rather as perceptual abstractions, relations of which are perceived only by subjectively comparing different values of the same parameter.

Sound quality is a very broad notion that defines various characteristic aspects of the sound. It is mostly rendered via subjective expressions such as *bright, dark, harsh, soft, loud, mellow, intense* etc. It is a concept that is determined by the correlation of pitch, duration, loudness, and various aspects of timbre[1]. It determines and

[1] Such as brightness, harmonicity, attack quality, spectral flux etc.

describes subjective characteristics of a given tone, passage, texture or any other perceptual unit. Sound quality depends on various aspects, such as timbral attributes of the instrument and/or register, playing technique, sonoricity (*harshness* or *softness*) of sounding pitch intervals, temporal dissonance (as defined by Stockhausen; 1959) and countless of other variables[2], however timbre and loudness appear to be the most prominent among them. In this regard the sound quality despite being shaped by all primary and secondary parameters as a whole is being perceived as a secondary one.

Sound quality, as a perceptual phenomenon is heavily related to the sound processing in the human brain and all the auditory apparatus. According to Andrew D. Lyons (2003), many areas of our brain merge sensory information. For example, rhythmic and pitch interval tasks activate the linguistic part of the brain in the left hemisphere. On the other hand, pitch and timbre tasks activate areas near the visual cortex which is associated with visual mental imagery. This area is at the back of the brain and includes parts of both hemispheres. Timbre and melodic outlines (contours) are, however, associated with the right hemisphere, suggesting spatial manipulation of mental images (Lyons 2003: 36–37). This ought to be a significant discovery for the field of music theory, as it shows that our cognitive system processes musical parameters not only as fixed acoustic objects, but tends to alter that processing depending on the context of surrounding elements. This suggests that if pitch can be processed by different parts of the brain depending on the particularities of sound quality, then it can assume different roles in the hierarchical system of sound parameters. We can assume that when music is putting a high emphasis on its qualitative aspects, pitch tends to be subjugated to other parameters, such as timbre. Thus pitches may gain certain traits that could shift their audiation closer to the way we would normally audiate secondary musical parameters.

Paradigms of pitch articulation

Notions of **schemata of order** and **schemata of order-relation** stated by Michel Imerty (1985) become groundwork for this paper. They describe different types of syntactical relations between musical objects. According to Imberty, **schemata of order** are formed by simple successions and juxtapositions and embrace both proximate and distant relations (increase, decrease, repetition and imitation). **Schemata of order-relation**, on the other hand, involve the organic relations that enable the establishment of relations between temporally-adjacent elements (theme, variation of the theme, syntactical or rhetorical relations, etc.) According to Imberty, schemata of order-relation are prevalent in tonal, and schemata of order – in atonal music (Imberty 1985, In: Deliège and Mélen 1997: 388).

In Western musical tradition pitch, as a primary musical parameter, has rather complex and very clearly defined relations with other pitches in both horizontal and vertical domains. However, when the composer shifts his/her focus to the qualitative aspects of the sound and starts developing relationships between different sound qualities, the hierarchical dominance of pitch starts being compromised. As pitch becomes subjugated to other parameters it as well tends to absorb their audiative traits, i.e. pitch starts being treated as one of many denominators of a particular sound quality rather than as a primary teleological object of musical events. It is worth noting that similar subjugations are not exclusive to the parameter of pitch. Rhythm (another primary parameter), despite often being very elaborate in such music, frequently suffers the same kind of subjugation. The complexity (or sometimes *hyper*-simplicity) of rhythmic structures oftentimes oversteps our cognitive capabilities, which causes certain rhythmic structures to be perceived more as specific sound qualities than as a set of temporal relations.

Thus said, the hierarchical relations between primary musical parameters in sound quality-oriented music tend to lose the vast majority of "absolute" syntactic values. Syntactic relationships here become far less elaborate than in tonal music. This is also evident in the terminology that is being used to describe them. If the use of linguistic analogies (phrase, sentence, syntax, etc.) in order to describe the relations in tonal music has proven to be the most convenient, we are much more comfortable resorting to the visual ones when it comes to discussing sound quality-oriented music. The use of such terms as "textural shapes", "sound sculpting", "gestures", "colors" or "contours" became a *de facto* standard in contemporary music. Teleological interactions between such visual analogies are (in comparison with syntactical ones) rather basic and are most comfort-

[2] You can find a more thorough discussion about articulation of sound quality via different parameters in my previous publications (Maslekovas 2014; 2015; 2017).

ably analyzed by employing *Gestalt* principles[3], which (again) originate primarily from a visual domain. This indicates that syntactic relationships in such music lean towards schemata of order[4].

Operating the pitches

As we analyze the possibilities of operating pitches in any kind of music, we can group them into three different categories according to the dimension that is prevalent when the operations are taking place; in other words, according to the dimension that bares the cognitive ties between different pitches. This way we can distinguish **horizontal**, **vertical** and **diagonal** operations. These three types of operations may be employed by a composer regardless of the above-discussed paradigms. However their roles and manifestations differ quite substantially depending on the enact paradigm. Therefore, we are going to discuss them (however putting a greater emphasis on schemata of order) in this following chapter.

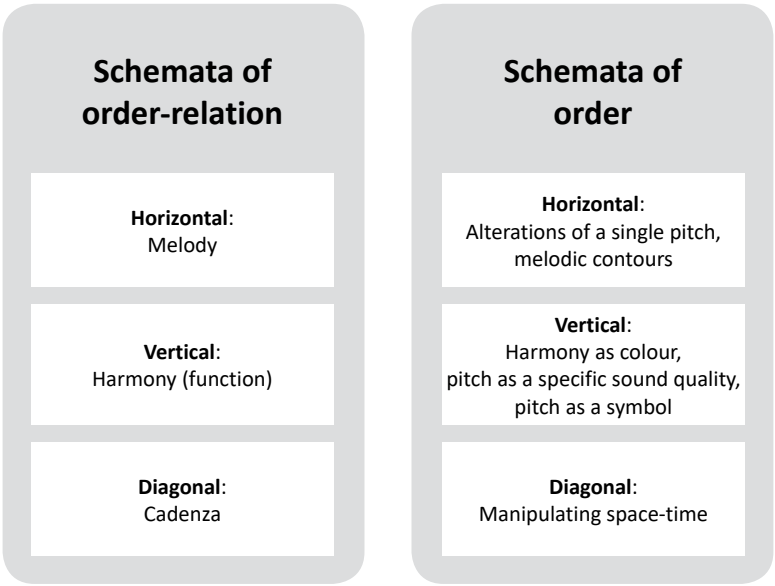

Figure 1. Horizontal, vertical and diagonal pitch operations in regard with schemata of order-relation and schemata of order

When schemata of order-relation are considered, horizontal pitch operations are the ones that produce motifs, melodies and various linear objects of melodic origin. These are linear successions of pitches that produce linguistic-like "meanings", which are created by interactions between hierarchical roles of each individual pitch. Vertical operation here refers to harmony that is creating patterns of tension and release due to the same hierarchical relations.

As for schemata of order, **horizontal** operations can take a very different direction. When sound quality becomes a central piece of the composition, even the smallest alterations may become of a great importance; even those that might be considered an afterthought in a conventional repertoire. A great example would be *vibrato* – a technique traditionally attributable to the interpretation of music, as an element mostly depended on the choice made by a performer. However, when it comes to articulation of the sound quality, these tiny pitch alterations might be employed as the main, thoroughly controlled element, as we see in the excerpt from Penderecki's *Threnody for the Victims of Hiroshima* (Figure 2), where entire texture is based only on different alterations of *vibrato*. This example shows that the composer is not interested in clearly perceivable pitches, but rather employs them as constructive components in order to create a fluctuating shape of multiple pitch alterations. The end result alludes to those string vibrations of a sustained C-major chord that I referred to in the introduction of this paper. One can consider it as a much exaggerated reconstruction of this acoustic phenomenon.

[3] Namely similarity, proximity, good continuation, common fate.

[4] This comparison is made with only the parameter of pitch at the lowest hierarchical level in mind. However, when considering higher hierarchical levels that I refer to as sonoric structures (sound quality versus another sound quality) one can find traits of both, *order* and *order-relation* paradigms. In my previous publications I refer to it as the hierarchy of dimensions (Maslekovas 2014).

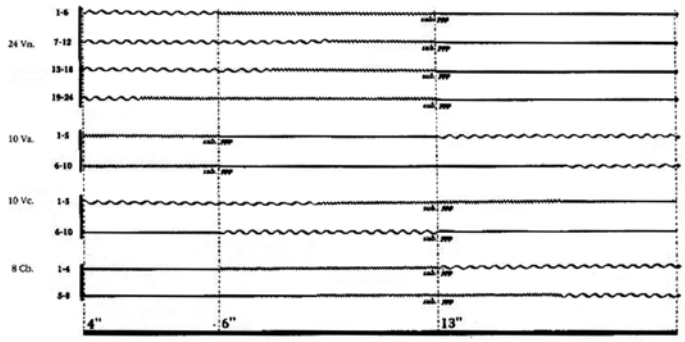

Figure 2. Constructive use of vibrato in *Threnody for the Victims of Hiroshima* by K. Penderecki

Here we can make an observation that discernibility of individual pitches and their relations is an unwanted occurrence in sound quality-oriented music. This explains an outrageous use of another previously-considered trifle and purely decorative pitch articulation technique – *glissando*. Sliding between different pitches it blurs or even erases perceptual boundaries between different pitches. The importance of *vibrato* and *glissando* in sound quality-oriented music is very much related to a psychoacoustic phenomenon to which Snyder refers as "perceptual noise". Our perceptual apparatus tends to reduce the amount of information that it is receiving and thus categorize units (for instance, pitches) into abstract ranges of variables. For example, there is a certain amount of deviations in frequency that would still be considered as the same pitch or interval, albeit slightly out of tune. There are also certain thresholds that, if properly implemented, can make the pitch sound ambiguous[5]. This reduction of information helps the brain to interpret pitch intervals as linguistic syntax[6]. However, introducing a heavy amount of "perceptual noise" weakens this syntactic potential and helps qualitative aspects to emerge. If we look at the excerpt from *Chamber Nôise I* for double bass and cello by Ondrei Adamék (Figure 3), we can not only see an absurd amount of glissando, and a pretty elaborate use of vibrato but also a number of timbral alteration techniques (such as transitions from ordinario to sul ponticello, various plucking techniques, pressure alterations, etc.), severe loudness articulations and many other small details. All these elements are used as a perceptual noise that turns what would otherwise be considered as melodic contours into articulated noise.

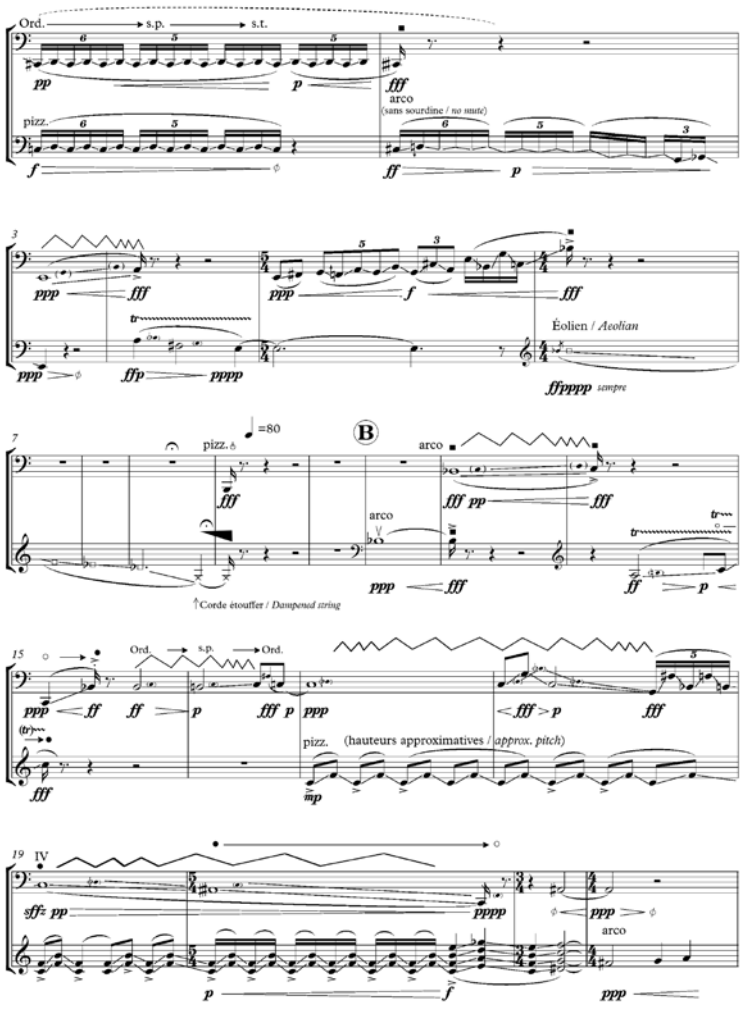

Figure 3. Horizontal pitch articulation turning into perceptual noise in *Chamber Nôise I* for double bass and cello by Ondrei Adamék

5 Perhaps the most iconic manifestation of these phenomena can be found in jazz music and it is called "the blue note".

6 See more: Snyder 2000: 135–158.

Melodic contours (sometimes referred as melodic outlines) *are the most memorable characteristics of non-tonal melodies* (Dowling and Harwood 1986: 133–134). The key difference between them and linear structures of schemata of order-relation is that pitch sequences that shape melodic contours do not necessary originate from a melodic source. They do not form a "meaningful" syntax between intervals due to the lack of tonal center, thus they are not being perceived as a cohesive "narration" but rather as abstract shape – contour. As we can see in the excerpt from Toshio Hosokawa's string quartet *Silent Flowers* (Figure 4), there is a number of small individual melodic outlines. We can see that pitch articulation-wise these contours have very few components and are unable to create any hierarchies within themselves. However, they feature distinct shapes and qualitative attributes that group them into two categories, which we will picturesquely call "gliding leaps" and "chromatic passages". They do not possess any particular "meaning" per se, but they create syntactical relations throughout the piece in the form of interactions between different textural shapes.

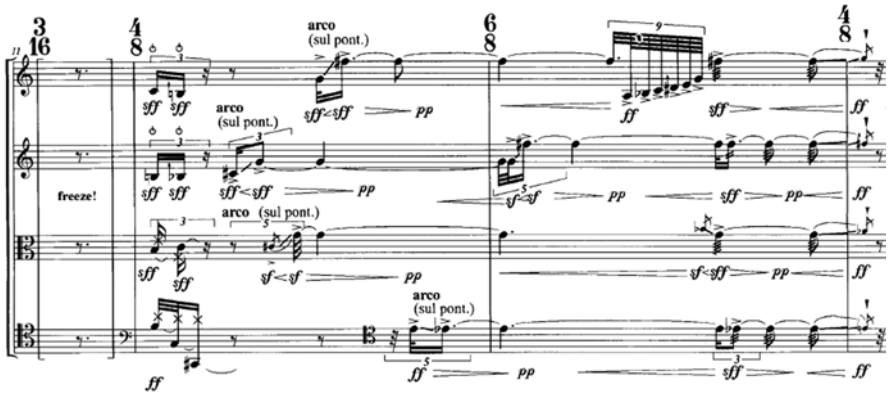

Figure 4. Melodic contours in *Silent Flowers* for string quartet by Toshio Hosokawa

We can observe, that these particular melodic contours are heavily related by timbral attributes, such as attack quality (accents, *pizzicato, col legno*), harmonicity (*sul pont.*) and articulation of loudness (*cresc./dim.*). These attributes help them to be perceived as particular sound qualities that indicate their **vertical** origin. The term "vertical" in this compositional approach is not equivalent to harmony. Rather, it indicates a distinct sound quality and its changes. This concept also includes a purely coloristic approach to harmony (e.g. piano pieces by Morton Feldman), but can also be applied to other objects that shape a particular sound quality.

If we take a closer look at the same excerpt from Hosokawa's string quartet (Figure 4), we can see that pitch articulation here has much bigger influence on a vertical dimension, rather than the horizontal one. The first structure, the abrupt chromatic passage, creates a cluster-like harmony and a degree of temporal dissonance (polyrhythmic aspect) that produces a very intense sound quality. Gliding leaps, on the other hand, create a gradual increase of intensity, expanding from unison to a dissonant chord. Linear (horizontal) teleology of pitches here creates distinct qualitative aspects of both "chromatic passages" and "gliding leaps", which helps us with grasping a dichotomy between those two textural types. Focusing on the qualitative differences between these two textural types forms teleology of a higher-level and brings it to the vertical domain, as it becomes a sequence of qualities, rather than a sequence of pitches.

Sound qualities of consonant and dissonant harmonic intervals can become very important factors in shaping the overall sound quality of the piece or articulating other parameters, such as timbre. It may as well become a significant constructional element, as it has the power to fuse or separate different timbres. If we look at the excerpt from *Sydenham Music* for flute, viola and harp by Johannes-Maria Staud (Figure 5), we can not only see pitches articulated as the melodic contour produced by harp (oval markings), but we can also notice certain elements in those contours that interact with other instruments and thus create additional textural layers. Flute and viola possess timbral attributes that are considerably different from the ones of harp (mainly due to different attack quality) and thus are being perceived as different textural layers – melodic outlines of harp (dashed markings) and soft sustained notes of flute and viola (dashed-dotted markings). However certain pitches in the harp part (A and C♯) interact with the other instruments via harmonic unison that alters the perception of flute and viola texture so it becomes a derivative of harp (thin dotted markings). Vertically implemented pitch articulation here acts as a fusing agent that helps consolidate different timbres and create a multidimensional texture.

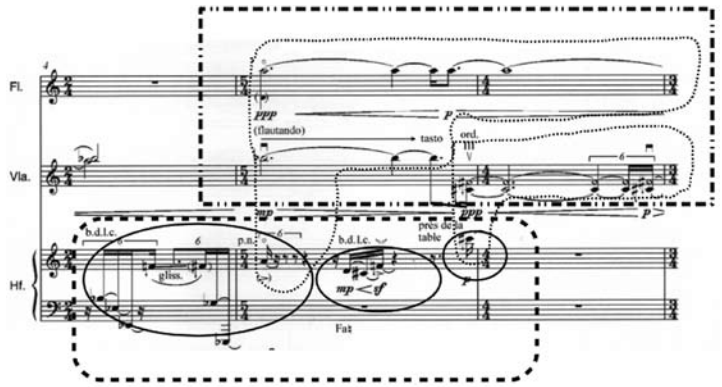

Figure 5. Harmonic unison as a fusing agent in *Sydenham Music* for flute, viola and harp by Johannes-Maria Staud

As an opposite case, we can look at the ending of my composition *Winter Calligraphies* for symphony orchestra (Figure 6). Here we can see bass clarinet playing D in the lowest register combined with the low E of bowed marimba. These two tones possess quite similar timbral attributes, as they both are soft, "wooden" and have a fair degree of white noise. If implemented in harmonic unison, these two tones would seamlessly blend together thus emphasizing the significance of the pitch. However this time they produce a certain sound quality that is designed to mimic and enrich the pitchless hum of a double base bowed on a tail piece, which is the foundation of the sound quality of this section.

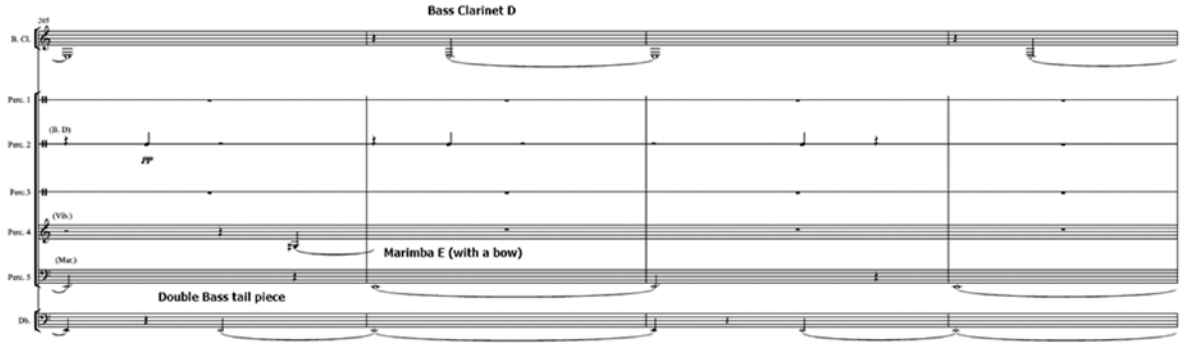

Figure 6. Harmonic dissonance as the enhancer of sound quality in *Winter Calligraphies* for symphony orchestra and mixed choir by Andrius Maslekovas

These examples allow us to uncover how a choice of (a) particular pitch(-es) for vertical implementation can help a composer to manipulate timbral attributes of different tones. It can help strengthen qualitative bonds between different timbres, unify a segment or a textural layer, or, in opposite, segregate similar timbres, emphasize their qualitative values and help create a unique sound quality.

Vertical implementation of pitch can also carry a symbolic meaning. A good illustration of that would be Penderecki's *Polymorphia*. As pointed out by Manos Panayiotakis (2017), the famous resolution of a micro-tonal cluster into the C-major chord (the last and perhaps the most significant event of the piece) not only serves as a major contrast point of the composition, but also as a symbol of tonal tonic. "The establishment of the triad – perceived as a tonic – follows at the very end of *Polymorphia* and leads to the perception that everything that was heard before was within the dominant harmonic area" (Panayiotakis 2017: 57). Panayiotakis further states that "The existence of a tonal, consonant sonic event – C major triad – generates a very powerful type of contrast, representing general consonance and dissonance, which brings back to mind the fundamental principles of the tonal harmony of the past, next to contemporary massive micro-tonal harmonic relationships. Along these lines, since there was no other consonant harmonic impression during the whole composition before the very end of the work, every dissonant sonority that sounded previously, however tensive, seems to function as a fundamental component of a long, gradually developed, abstract type of dominant, released into the final, non-abstract C major tonic triad" (ibid.). It acts as a symbol of tonality and all Western musical tradition. This evokes an interesting type of syntactical relations within this piece. On a small scale level it features relations attributable to schemata of order; however on a large scale level it creates a clearly

identifiable resolution that changes the perception attributable to schemata of order-relation. It creates a certain perceptual ambiguity: on the one hand it exploits the means of "the new music" and creates abstract visual-like perceptual ques, on the other hand, at the highest level of musical form it employs a very apparent syntactical que, which negates previous experiences. This ambiguity creates a very interesting audiative object – a resolution that is cleansed from its straightforward ordinary meaning and thus has gained abstract implications (e.g. a dichotomy between old and new, order and chaos, good and evil etc.). One can think of it as a transition from a sign to a symbol.

Perceptual ambiguity can occur not only between the types of schemata but also between the vertical and horizontal pitch articulations. It can create an interstitial auditory state between horizontal and vertical domains, which we would like to refer to as **diagonal**[7]. The term *diagonal* was first introduced by the famous French philosopher Gil Deleuze, when he made parallels between music by Pierre Boulez and the manner of literary works by Marcel Proust. It was described as *a manner in which noises and sounds detach themselves from the characters, places and names to which they are first attached in order to form autonomous "motives" that ceaselessly transform themselves in time, diminishing or augmenting, adding or subtracting, varying their speed and their slowness* (Deleuze 1986, In: Murphy 1998: 70). Deleuze refers to those elements as "blocks of duration", "ceaselessly varying sonorous blocks". He calls them diagonal in order to mark the fact that they are not reducible either to the vertical or horizontal values. In Western classical music this phenomenon would manifest itself in the form of candences – short episodes that carry both horizontal and vertical values.

When emphasizing the sound quality, the idea of simultaneous changes in horizontal and vertical domains can be materialized in a plethora of different ways that are offered by the articulation of timbre. However, if we only concern ourselves with pitch articulation in such structures, we can see that it creates another type of ambiguity, this time between two *Gestalt* principles, namely *Continuity* and *Common Fate.* If we look at the excerpt from my composition *Incantation of the Freezing Haze* for flute solo (Figure 7), we can see a downward falling melodic contour that ends with two leaps of major sevenths. The natural course of this outline would be a gradual descend B-B♭-F-E-E♭-D as is being dictated by the *Gestalt* principle of Continuity. However, when the last two notes are substituted with leaps to the same pitches of different octaves, it creates a parallel line that is perceived as moving to the same destination by *Gestalt* principle of Common Fate. These leaps disrupt the sense of directionality and replace it with a sense of spatial expansion. This alters musical time-space continuum and creates a unique sound quality, which can be sculpted into a variety of over time expanding and diminishing shapes.

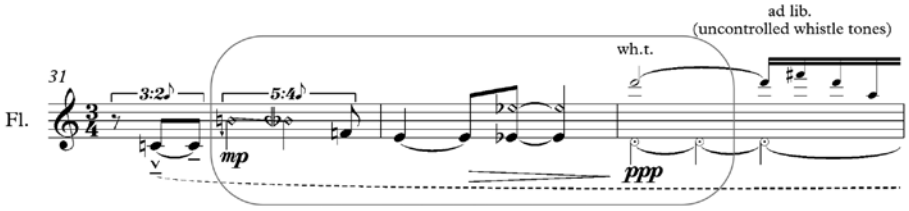

Figure 7. Diagonal structures in *Incantation of the Freezing haze* for flute solo by Andrius Maslekovas

Concluding thoughts

Analysis of the musical excerpts presented in this paper reveals that pitch audiation and, eventually, articulation in sound quality-oriented music does not rely on syntactic relations between pitch structures, but rather on visual imagery that helps sculpting the shape of the sound quality. Teleology in such musical works appears not to be based on the development of functional progress, but on interactions between different shapes, where pitch becomes a valuable asset of manipulating various qualitative aspects. This unfolds a very interesting aspect of audiation, where a certain musical parameter absorbs audiative traits that are intrinsic to another musical parameter. However this insight opens Pandora's Box of questions that are not being addressed in this paper: despite of the focus on pitch, which is being presented in this paper, one can assume that such relations may occur between various musical parameters. This leaves a lot of room for future explorations for both cognitive and creative points of view, as there is a lot of studies to be done regarding the sound processing in our perceptual apparatus, and a lot of out-of-the-box ideas to be generated in order to compose new, unique-sounding music.

[7] See more: Maslekovas 2015.

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Tono aukščio audijavimo ypatybės skambesio kokybės artikuliacijos kontekste

Santrauka

Tono aukštis – tai bene paskutinis skambesio parametras, apie kurį susimąstome minėdami skambesio kokybę. Negana to, esame linkę skambesio kokybės ir tono aukščio sąvokas pateikti kaip tam tikrą prieštarą. Nors tokia prielaida nėra neteisinga, straipsnyje mėginta šiek tiek išplėtoti skambesio kokybės ir tono aukščio santykių koncepciją, o aptariant tono aukštį kaip kognityvinį reiškinį gilintasi į kokybinius jo aspektus.

Įvairūs moksliniai tyrimai rodo, kad žmogaus smegenys yra linkę skaidyti ir jungti sensorinę informaciją. Tono aukštis priklausomai nuo konteksto gali būti apdorojamas įvairiose smegenų zonose, esančiose skirtinguose smegenų pusrutuliuose arba tarp abiejų pusrutulių. Įvertinus tyrimų rezultatus galima teigti, kad tono aukščio audiacija gali pasireikšti skirtingai: kaip lingvistinė sintaksė, kaip minčių vaizdiniai ar suvokiamos erdvės pokyčiai. Taigi priklausomai nuo skambesio kokybės ypatybių tonų aukštis gali atlikti skirtingus vaidmenis skambesio parametrų hierarchijoje.

Tono aukščio išstūmimas iš jam tradiciškai priklausančios dominuojančios hierarchinės pozicijos bene geriausiai atsiskleidžia naujoje muzikoje, kurioje daugiausia dėmesio skiriama skambesio kokybei (tembrui), tačiau tonų aukščio artikuliacija išlieka ryški. Puikių šios muzikos pavyzdžių galima atrasti tokių kompozitorių kaip Johannesas-Maria Staudas, Mathiasas Pintscheris, Ondrejus Adamékas, Toshio Hosokawa, taip pat šio straipsnio autoriaus kūryboje. Tonų aukščio operacijos šių autorių muzikoje yra visiškai kitų nei nuo seno vakarų muzikos tradicijoje įsigalėjusių intencijų išdavos, todėl čia jos turėtų būti traktuojamos kaip priklausančios kitai aukščio organizavimo paradigmai. Norint nustatyti įvairias tonų aukščio audijavimo alternatyvas, pasireiškiančias į skambesio kokybę orientuotoje šiuolaikinėje muzikoje, straipsnyje išanalizuoti minėtų kompozitorių kūrinių pavyzdžiai, aptarti jų sintaksiniai ryšiai ir kognityvinis poveikis.