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Vertical and Horizontal Sonoric Structures as Constructional Elements of Sonoristic Music

Annotation

Analysis of sonoristic music has always been a challenge for any musicologist, as it is a rather unique phenomenon of the 20th century music. This article aims to explain a few key aspects of analyzing musical form of sonoristic music using a cognitive approach. In this article we heavily rely on researches on the cognition of musical form by Irene Deliège and Marc Mélen and fundamental cognitive categories of horizontality and verticality. These are used in combine with the knowledge form musicology, acoustics and *Gestalt* psychology to define a methodology of analysis of form in sonoristic music. It encompasses the process of segmentation, principles of typologization of textures, attributes of vertical, horizontal and diagonal sonoric dimensions, issues with ascribing textures to any of theses dimensions, and determination of relations between the segments. Also as the examples of organisation of musical form are presented the excerpts of "Fünf Orchesterstücken" by Matthias Pintscher.

Keywords: sonoristic music, sonorism, cognition, cognitive psychology, *Gestalt* principles, verticality, horizontality, musical form, Matthias Pintscher.

Sonorism is a rather unique approach to the processes of composition as well as the perception of music. The primary goal of a sonorist composer is to create new auditory experiences. That is usually achieved by emphasizing the secondary parameters[1] of music because of their less determined cognitive differentiation. The parameter of timbre is often being used as a main variable in the construction of sounding objects. However, timbre is arguably the most complex parameter of music, which can manifest itself in a variety of ways (extreme registers, extended playing techniques, orchestration, etc.). As a secondary musical parameter, timbre cannot be differentiated in a scalar expression, what causes a significant indetermination of the sounding objects that are constructed in this timbre-centered manner.

A plethora of various sounding objects that are used in sonoristic music and inability to determine and categorize them as easily, as we do with the ones based on interactions between pitch and/or rhythm, leads into complex research of the perception of timbre, auditory scene analysis and other cognition studies. This research gives us a lot of valuable information about how these sound objects are perceived and processed within the brain. However these methodologies are more focused on explaining perceptual aspects of music than the principles of its organization and what limits the understanding of the compositional processes that are employed. This article aims to explain a few key aspects of the organization of sounding objects into a framework of a sonoristic piece (i.e. musical form). We will later refer to those sounding objects as sonoric structures.

1. A cognitive approach to a musical form in sonorism

As we have already mentioned, the goal of a sonorist composer is to create new auditory experiences, hence there is a close relationship between compositional intentions and the perception (unlike some other streams of 20th century music that focuses primarily on the structure with little or no concern to the resulting auditory experiences). That allows us to use studies like auditory scene analysis, timbre researches, etc. in combine with musicological theories to create a theoretical approach on the structural processes of sonoristic music.

One of the biggest issues of the cognition studies is that the vast majority of those are focusing on the sounding objects *per se*, which are being either extracted from a piece of music, or synthesized and presented in laboratory conditions. As has been argued by Deliège (1997), these sounding objects are "very brief stimuli of which the musical structure is very simple being conceived so as to vary one dimension (rhythm, melody…) while keeping others constant. As in any experimental science" (Deliège and Mélen 1997: 387) these

[1] As described by Snyder (2000), pitch, rhythm and harmony are considered to be primary musical parameters, because they can have relatively fixed proportional relationships between them, like the fixed proportions of a tuning system and the fixed proportions of a system of time intervals and durations. This makes it possible to identify patterns and their variations within a piece of music. With primary parameters, we can construct a number of different fixed conceptual categories, such as the pitch interval categories of a tuning system or a system of time interval categories, and both perceive and remember relations between these categories.

Secondary parameters (loudness, timbre, tempo) are aspects of musical sound that cannot easily be divided up into very many clearly recognizable categories. We tend to hear secondary parameters simply in terms of their relative amounts: we cannot recognize change in these parameters in terms of any but the most general categories, such as "much of" or "not much of," and "more of" or "less of." Secondary parameters are therefore generally used in music in simple increasing or decreasing progressions or in large contrasts (Snyder 2000: 195–196).

simplifications are based on a legitimate desire to control the variable. As a result, a lot of discoveries made in such experiments are not valid in real world experience and does not give us a lot of information about the cognition of musical form.

1.1. Schemata and hierarchies

One of the most significant papers on the cognition of musical form was prepared by Irene Deliège and Marc Mélen (1997). They are interested in the cognitive processes involved in attentive listening to a piece of music.[2] Their approach is similar to that of Imberty's (1981). The main principle lies in "the perception of qualitative changes, which is the basic principle of segmentation of the musical information. These changes accentuate the elements that confer directionality on the piece, which come to constitute the dynamic vectors that progressively take on the weight of the successive changes during listening. Simultaneously they determine the style and the global schema of the work, i.e. the macrostructure.[3] The organization of the segmentations, reiterated at different hierarchical levels, permits the structure of musical piece to be grasped." (Deliège and Mélen 1997: 388)

Two types of hierarchical organization are postulated according to the perceptual salience of the changes encountered: when changes are few but very clear, they lead to a strong hierarchy; when segmentations are numerous and easily perceptible but are all of similar salience, they result in a weak hierarchy. The notions of the **schemata of order** and **schemata of order-relation** are linked to these two types of organization: the **schemata of order** are formed by simple successions and juxtapositions and embrace both proximate and distant relations (increase, decrease, repetition and imitation). The **Schemata of order-relation** involve the organic relations that enable the establishment of relations between temporally-adjacent elements (theme, variation of the theme, syntactical or rhetorical relations). The **Schemata of order are more numerous within weak hierarchies – a situation often encountered in twentieth century works, while schemata of order-relation can give a rise to strong hierarchies, which are much more common in pieces from the tonal repertoire**. (Imberty, 1985 in: Deliège and Mélen 1997: 388)[4]

The approach postulated by Deliège and Mélen sees auditory scene analysis as a schematization process. It is a process of "reduction or even a simplification of the material to be perceived based on particular events picked up from the musical surface by the listener" (Deliège and Mélen 1997: 389). The musical surface is first segmented into sections of various lengths. The segmentation of a temporal flow is allowed by two key elements of Deliège's studies: the cue abstraction mechanism and principles of sameness and difference.

1.2. The cue and the process of segmentation

"A cue is a kind of conspicuous point that becomes fixed in memory[5] by virtue of its relevance and by repetition. What might constitute a cue depends on the cultural and historical provenance of a given piece" (ibid., p. 390). In Western music, since the 15th century until the end of common tonal practice cues are being abstracted primarily from motivic elements. However, in later periods these are more and more frequently substituted by other musical elements. In case of sonoristic music that would be characteristic timbre, orchestration, specific tessitura, certain cluster range or anything else that defines a specific sound quality of a certain sounding object.

Process of segmentation of information is essential in any perceptual domain. In case of music, the process of segmentation "assembles the sounds in groups on the basis of their temporal and/or acoustic properties" (ibid., p. 391). This procedure heavily relies on *Gestalt* principles, mainly the principles of proximity and similarity. However, Deliège proposes two principles that are even more general than proximity and similarity. These are the **principle of sameness** and the **principle of difference**. Using these two principles elements are attributed

2 By "attentive listening" they mean the situation in which the listener is devoting maximal cognitive resources to engage with the structure of the piece in an active listening process.

3 Term "macrostructure" is used in works by Kintsch and van Dijk (1978) in the context of text comprehension.

4 Lerdahl (1989) suggested that in atonal music hierarchies of alterations of tensions and relaxations should be replaced by hierarchies of salience of auditory events. Imberty (1991, 1993) extended this suggestion to any music, whether tonal or atonal; he proposes that perceptual organization must constitute a hierarchy of saliencies before it can be a syntactic functional hierarchy. Nevertheless, according to Imberty, in the cognition of tonal music perceptual stability coincides with structural stability in contrast to what happens in atonal music (Imberty 1991).

5 The notion of memory is used here in a very general manner however the authors are referring to a long-term memory which is responsible for grouping and associating events of the past. According to M. Viļums, it is the formal stage of memory which signifies and ties together musical structures that are exceeding short-term memory time-span (3–5 seconds A.M. thus being longer than phrases) into the aspects of musical form (Viļums 2001: 20).

to a given group "as long as they are not considered too different from the preceding elements (principle of sameness), although a certain degree of tolerance is accepted and the boundary between two groups will be established when a contrast is perceived between two regions" (principle of difference; ibid., p. 392).

It is suggested that the listener selects salient cues that are themselves incorporated in the groups rather than storing each group in his/her memory. These cues are abstracted from the musical surface because of their "special temporal and/or acoustic features" (ibid.) and contain invariants of the musical discourse, i.e. various deviations from the primary cues can be grouped together or separated on the basis of the principles of sameness and difference.

2. Sonoric field

While analyzing such auditory objects like the salience of musical surface, we find them strongly related to a musicological concept of sonoric field.[6] We will refer to sonoric field as the largest structure of sonoristic music which contains all the variations of sonoristic values[7] within the composition. From this point of view, each composition has its own sonoric field which is formed by the pitches, rhythms, timbres and formal processes that are used during the composition. Sonoric field is an abstract contour of the composition in which the qualitative and quantitative gradients are reflected. Maklygin points out three main criteria of sonoric field:

- Range, determined by pitch[8] and time;
- Width, determined by the interval between the highest and the lowest pitches;
- Density, determined by intervalic consistency and timbral characteristics. (Ценова и Маклыгин 2005: 400)

Knowing these three criteria allows us to render a visualization of the sonoric field (Fig. 1). This rendition illustrates: time span range from left to right, changes of width from the bottom to the top and textural/timbral/intervalic density by a color gradient.

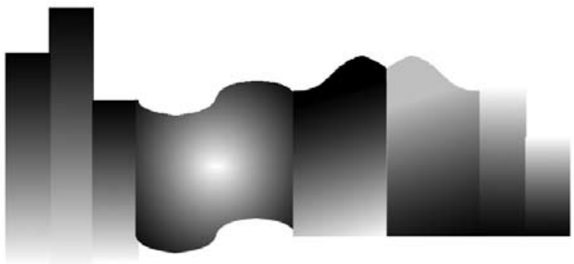

Fig. 1. Graphical visualization of sonoric field

This rendition brings us back to the music cognition studies. As we can see, it basically illustrates the salience of musical surface. The main benefit of linking the concept of salience of musical surface with the concept of the sonoric field is combining the criteria described by Maklygin with the segmentation procedure and cue abstraction mechanism to help us analyze the structural framework of sonoristic compositions.

Thus we can define the first step of the musical form analysis of sonoristic music. That is segmentation of the material into sections, which are defined by the principles of sameness and difference. It does not matter that the principles of sameness and differences are sometimes too general categories to define the segmentation. In those cases more specific *Gestalt* principles may be employed, namely proximity, similarity, good continuation and/or common fate. However, segmentation should not be based entirely on auditory experiences, but also on the score analysis. In contrast to pure cognition studies, our goal is not confined to name the aspects of cognition but also the principles of composing. In a lot of cases a certain amount of the cues that composer

6 There are more than a few different conceptions of the notion of sonoric field. One can argue that sonoric field could be understood as a philosophical hyper-structure existing in collective subconscious that encompasses all possible incarnations of sounding objects. In this case musical composition would be treated as fragment or rather a set of extracted fragments from The Sonoric Field, which is intriguing and promising, from the philosophical point of view. However, in this paper we will stick to this term as it is described by such authors like P. Boulez, Erkki Salmenchaara or A. Maklygin and treat it as the largest structure of sonoristic music which contains all the variations of sonoristic values within the composition.

7 Term by Chomiński *wartości sonorystyczne.*

8 The term pitch should by no means be understood as an absolute value. In sonoristic music this term can be treated in two ways: either as a description of a tone quality, which a timbral attribute or as a description of a relative range. Maklygin here is referring to the second case.

has intended to display are actually not being perceived due to slight miscalculations in orchestration, specific instrument issues not taken into account by a composer or a plethora of other factors including performance or audio recording issues. However, they are still functioning as a structural factor of compositional process that should be taken into account.

It is worth mentioning that sonoric field, as an entirety of the structural and auditory processes of the composition, is present in all music of any given style or time period. That is beautifully presented in research by Chomiński and his disciples, where compositions such as those of Beethoven or Brahms were analyzed from the point of view[9] of sonoric fields. However, there is a paradigmatic difference between the concept of sonoric field in Western classical and sonoristic music. Aside from being the entirety of structural and auditory processes, it becomes the source of music, i.e. it is the source and the result at the same time. Not only form the philosophical point of view but also as a conscious concept. Sonoric field in a sonoric composition is a materialization of the imaginary sonoric field that is conceived by a composer as a primary compositional impulse and serves as a prototype of a yet unborn composition. All the structural processes and attributes of the sonoric field are already encoded in that prototype and the composer is trying to achieve a result which would be as close to this prototype as possible. However, the prototype encounters a number of physical and mental transformations during the process of materialization, thus the primal shape of it is not traceable. Only one attribute of sonoric field keeps its original form from the stage of prototype until the final stages of materialization that is the dimensionality of sonoric structures.

2.1. Dimensions of sonoric field

The process of segmentation of sonoric field reveals a certain set of juxtaposed sonoric structures. The aforementioned criteria of range, width and density are very well suited to describe the shape of the sonoric field, but in a lot of cases they are too general to define the processes between or within the segments.

Hierarchical relations between these sonoric structures do not entirely fit the concept of schemata of order nor schemata or order-relation. There are no such attributes as theme, variation of the theme, syntactical or rhetorical relations, which are common to the schemata of order-relation. However some key elements of musical material and their invariants in further development can still be found (not in each and every case, but it is still present as a paradigm). They do not produce functional relations, e.g. tonic vs. dominant however the archetypical structure of thesis-antithesis is also present in a lot of cases.

It becomes obvious, that the hierarchical relations between these sonoric structures are a little more complicated than simple juxtaposition and the principles of schemata of order. On the other hand, these relations are way more basic than the ones embraced by schemata of order-relation and do not contain such large variety as that of the tonal music.

It would be the most accurate to describe it as the hierarchy of dimensions. Sonoric structures here are considered more as a process than an object. The main criteria of distinguishing the dimension of sonoric structure are the directionality of processes within the segment. As a result, sonoric structures are not being analyzed independently but in a context of other adjacent sonoric structures. In accordance to directionality of the processes we will refer to these structures as vertical, horizontal or diagonal (Fig. 2).

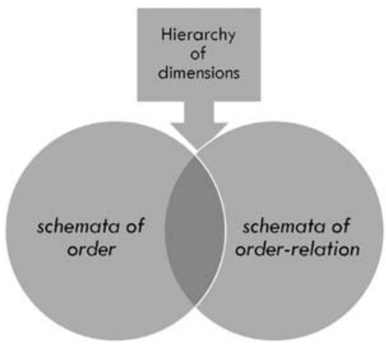

Fig. 2

9 Chomiński refers to the target of his research as a sonoristic layer, which is essentially equivalent to the term of sonoric field used in this paper.

2.1.1. Vertical and horizontal dimensions in sonoristic music

The concept of formation of horizontal and vertical structures is not new by any means. It was first mentioned by Chomiński. It is one of the five categories of formal issues in sonoristic music.[10] However, Chomiński's approach to horizontal and vertical sonoric structures is somewhat inconclusive. According to his theory, "clusters can be seen as a result of the transformation of a vertical structure into a horizontal one, which in effect completely destroys the harmonic factor. This kind of transformation, however, does not lead to a restitution of melodic qualities, for the new horizontal structure may swell, increase its sound mass or become a static sound block, i.e., acquire properties that are diametrically opposed to those of a dynamic, mobile melodic construct" (Chomiński 1968 in: Granat 2005: 829).

The biggest issue in Chomiński's approach is that he equates verticality and horizontality with respectively, harmony and melody. Verticality and horizontality are ones of the most fundamental properties of music. In fact, it is even more a cognitive term related to auditory scene analysis than a structural one. If we want to understand what the roles of verticality and horizontality in sonoristic music are, we should address those as cognitive phenomena first. We can perceive them as structural objects only after we distinguish their appearance in sonoristic music as auditory objects.

Verticality and horizontality are two fundamental categories, as described by Rosch (1975, 1978). Horizontality is to be understood as the spreading out of different exemplars within the same unit in which the category is still identifiable no matter how big of a deviation from the original model occurs. Verticality on the other hand specifies relationships between categories, which leads to the idea of hierarchy of subordinate levels.

Rosch defined three levels: the superordinate, the basic, and the subordinate levels. At the highest or superordinate level, the category is defined by its function. The intermediate or basic level contains the greatest number of specimens having common attributes. They belong to the functional category but remain independent from one another. The lowest level, the subordinate is made up of all imaginable variations of the specimens from the basic level.

According to Rosch, the notion of horizontality is exploited primarily in the listening process; however verticality is not nearly so obvious. The idea of basic level of in categorization in listening to music may be conceived of in terms of different cues being abstracted within the same work. Each of these cues will engender its own relationships of horizontality. They will each have their own function and create their own particular auditory image (Leipp 1977) yet share a common reference: the style of the work. The superordinate level may then be conceived as inhering in the referential value that each cue confers on a group within the mental representation of the work. The subordinate level is characterized by the relationships between patterns having analogous auditory images, which falls within the concept of horizontality.

It becomes evident that harmony and melody are just one of a few possible manifestations of verticality and horizontality respectively. Definition of horizontality made by Roch is so accurate and general that it perfectly fits the manifestations of this dimension in sonoristic music. The manifestation of verticality in sonoristic music is very close to what is described as a basic level of categorization. However, it does not matter if the relationship with horizontality might be weakened in purely vertical sonoristic music, meanwhile in cases where horizontal dimension is a clear priority, vertical dimension can manifest itself in a subordinate level.[11]

2.1.2. Vertical and horizontal sonoric structures

In order to define the dimension of sonoric structure, we have to identify the directionality of the segment of musical texture. The number of textural variations in sonoristic music is virtually endless. Plus, as mentioned before, sonoric structures should not be analyzed independently but in a context of other adjacent sonoric structures. Thus, it is almost impossible to strictly classify sonoric structures or textural models into vertical or horizontal.

[10] Chomiński distinguishes five categories of formal issues in sonoristic music: sound technology, rationalization of time, formation of vertical and horizontal sonoric structures, transformation of elements, and formal continuum (Chomiński 1961).

[11] It is not uncommon for a composer to have no intentions to exploit one of the discussed dimensions and focus exclusively either on vertical or horizontal dimension. In the first case scenario the most of the cues are being abstracted from the changes in vertical dimension, therefore horizontal musical dimension is being cognitively pushed to a background. In the second case, the majority of cues are being abstracted form the changes in horizontal dimension, therefore vertical dimension is being cognitively pushed to a background and becomes totally subordinate to the horizontal dimension. In any of these cases the dimension that is being cognitively pushed to a background despite being a permanent part of auditory field might not be a significant part of a compositional idea and/or structure.

Yet we can define the most general textural models in sonoristic music thanks to the classification by Maklygin (Ценова и Маклыгин, 2005). Maklygin classifies what he calls timbral-textural forms[12] according to:

• principle of time organization (continual, discrete or pulsing);

• the amount of components (single layered or multi layered).

Thus he distinguishes six main textural types:

• three pure types: dot, pointillist texture, line;

• three composite types: stain, flow, belt.

Let's look deeper into each of these textural types.

Dot is considered to be the main constructional element in other more complex sonoric structures as well as an independent sonoric structure itself. In the later case it usually presents vertical sonoric values with its timbral and/or articulational properties. However a few dots within a certain time span can present horizontal sonoric values as they might get affected by *Gestalt* principles, namely proximity, similarity, good continuation and/or common fate. The number of dots that occur simultaneously form stain. Stain is a typical sonoric structure that most often manifests itself as a cluster, which, opposing to Chomiński, in most cases possesses vertical sonoric values. That is mostly because clusters are dense sonoric structures. The intervalic density creates auditory image often described as a *field* which in most cases produces no cues in the horizontal dimension.

However, the gap between dot and stain is very narrow. It is difficult to strictly define, when does a dot become a stain and, perhaps, vice versa. Intervalic density and a sheer amount of tones forming the chord or cluster are ones of the main parameters describing the difference between dot and stain. However they might not be the deciding factors. There are a large number of cases when even whole scale clusters form an auditory image that is rather described as a dot than a stain. Cluster can be described by the same criteria as sonoric field (range, width, density). The parameter of range is crucial here, namely its aspect of time. It has been scientifically proven, that we need more time to process timbre, which is the main attribute of a cluster, than we need to process other parameters of music. It takes between 500 ms and 10 s for the brain to process timbre and characteristics of sound (Martin, 1999). There we can make a hypothesis that any cluster that is shorter in time span than 500 ms is perceived as a dot.[13]

Line, according to Maklygin, is "a continuous sounding of one pitch; a possible variation of this texture is a migratory line, e.g. glissando" (Ценова и Маклыгин 2005: 394). It is widely accepted to treat the term "linear" as synonymous to "horizontal"; however, the definition of "line" (at least the one by Maklygin) is somewhat arguable. First of all, because a single continuous pitch is not very common in practice of sonorictic music (not to mention it might as well be a non-pitched sound). Secondly, continuous sounding of one pitch (the same is applied to an interval, chord or cluster) in a prolonged period of time, does not create auditory cues in a horizontal dimension and is mostly distinguished due to its tone quality. In that case, a continuous sound creates an auditory image of field and falls into category of vertical sonoric structures.

In order to call a structure horizontal, it has to spread different exemplars within the same unit (Roch), i.e., the line has either to be migratory or create horizontal cues in relation to other adjacent structures. In the first case scenario, a migratory line can not only be a glissando-like continuous sound. It can as well take a form of a passage (Fig. 3) or a sequence of pitches/noises (Fig. 4) as long as they are affected by the *Gestalt* principles of proximity, similarity, good continuation and/or common fate, and form a single cognitive structure.

Fig. 3. A passage as a horizontal line in Ligeti's *Nouvelles Aventures*

[12] Тембро-фактурные формы (Ru.).

[13] However, not every cluster that meets the 500 ms benchmark automatically creates the auditory image of a field. In our opinion there is a threshold of time (that is yet to be determined) that has to be passed as a lot of clusters that last merely longer than the given 500 ms form a very uncertain auditory image that cannot be classified neither as *stain* nor as *dot*. These sonoric structures by themselves have neither vertical, nor horizontal sonoric values; their directionality is totally dependent on the adjacent sonoric structures and overall musical context of the piece.

The same goes for the second case: the adjacent linear structures should form a single cognitive process under stimulus of the same *Gestalt* principles. In this case, lines might not be migratory, but they can "spread different examples" while differing in duration as it is the only parameter left that can create horizontal cues.

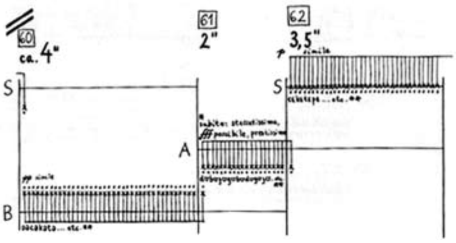

Fig. 4. Sequences of non-pitched sounds as horizontal lines in Ligeti's *Nouvelles Aventures* variating in the parameter of duration

The concept of **belt** in Maklygin's classification is rather unclear. He describes it as a conjunction of two identical lines and also mentions that in vertical expression it is a continuous cluster (ibid., p. 394). If we disagree with a statement, that a line is formed exclusively from a single sounding pitched or non-pitched sound, then a conjunction of two identical lines would not form another structure. Unless these structures are obviously and intentionally acoustically separated by a composer, employing differences in register, timbre, orchestration and other methods. In this case, belt within itself is a horizontal sonoric structure, but it most likely has vertical sonoric values in relation with the lines that are in conjunction to form it as it differs in a number of sound quality parameters such as timbre, velocity, and acoustic space. As we can see in the excerpt from the score of Ligeti's *Nouvelles Aventures* (Fig. 5) this is a monorhythmic passage which can be classified as a *belt*. However, the most of the instruments blend together and form a single passage. The only aspect that gives a cue of multiply sources that are employed in this texture is the timbre of the harpsichord.

Fig. 5. Monorhythmic texture in Ligeti's *Nouvelles Aventures*

In case of a continuous cluster, it falls into a category of vertical sonoric structures the same way as a single continuous line does. What is more, in this case, belt may become hardly distinguishable from stain. The only difference between those two textural types is their theoretical origin.

As for a torrent, which is described as a pulsating polyphonic conjunction of many voices (or layers) or pointilistic texture, they are both completely dependent on development of textural material. Torrent, which essentially is a multipolyphonic texture, might possess a large amount of horizontal cues that are brought by the movement of different layers. However its own dimension might induce vertical auditory experiences as its range, width and/or density might vary in a given period of time. Pointilistic texture, on the other hand, consists of various separated auditory events that by themselves bring vertical sonoric values. However this kind of texture tends to form a single structure that can gain any possible directionality.

Since we have already discussed the main textural types and their relation with horizontality and verticality, we can summarize the criteria based on which we can label a textural structure as vertical or horizontal. It should be pointed out that all aforementioned textural types can produce either vertical or horizontal sonoric values. Thus, their labels, as described by Maklygin, should be used only as a reference point to their appearance and not as a typology. Instead these textural structures should be grouped according to the sonoric values they produce/possess, which can be determined by following criteria:

- a textural structure produces/possesses vertical sonoric values in a given period of time if its cues are being abstracted form the shift in its range, width and/or density. These three criteria indicate changes in sound quality. This is the main criteria of vertical sonoric structures;
- a textural structure produces/possesses horizontal sonoric values in a given period of time if its cues are being abstracted form the shift in its integrity[14], duration and/or the frequency of a tone or cluster, to which we will refer in a simplified manner and label it as *pitch.* These three criteria indicate changes in continuity. These are the main criteria of horizontal sonoric structures.

2.2. Diagonal sonoric dimension

After we discussed the aspects of verticality and horizontality in the most common textural models we can see that these two fundamental categories are able to manifest themselves in each and every textural model. What is more, textures are able to shift from being perceived as horizontal, to a vertical auditory image. However, there is an interstitial auditory state between horizontality and verticality that sometimes manifests itself as an independent sonoric structure. We will refer to it as a diagonal sonoric dimension and the structures that produce it will be called diagonal sonoric structures.

Diagonal dimension in music is more a philosophical phenomenon. It is best described by Deleuze, when he makes parallels between music by Boulez and the manner of works by Proust. It is 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 presents the idea that such a variety is developed in the autonomous dimension of time. He calls it "a 'block of duration,' a 'ceaselessly varying sonorous block.' And the autonomous dimension, which is not pre-existent and is drawn at the same time as the block varies, is called a diagonal in order to better mark the fact that it is reducible neither to the harmonic vertical nor to the melodic horizontal as pre-existent coordinates" (ibid*.).*

Indeed, diagonal sonoric structures are not a mere mechanical combination of simultaneously sounding vertical and horizontal structures, they cannot be separated into horizontal and vertical components, i.e. it acquires its vertical and horizontal values not in a mechanical, but in a conceptual process.

Diagonal sonoric structures are very insular and integral. That is one of the reasons why they often manifest themselves as short episodes. They are also the structures of ascending or descending intensity. They reach their maximal or minimal intensity in a rather short period of time, what causes certain limitations in terms of their duration. The best illustration of diagonal structures in Western Classical music (as proposed by Deleuze) is a cadenza. It is a short episode that simultaneously caries vertical and horizontal auditory values.

In sonoristic music diagonal structures become more complicated as the terms of horizontality and verticality here are applied in a more general way than in tonal music. That causes a greater variation of factors causing the vertical and horizontal values within the structure. If we look at the example (Fig. 6) we can see a quasi-melodic line, but its sound quality is constantly changing: the first note (played by flute) is being played as usual, next three notes as harmonics and the following three – as whistle tones. Then the process is repeated while reducing the durations. This causes a constant timbral shift, as the harmonics are less intensive and have brighter timbre than regular notes, and whistle tones are even less intensive and have even brighter timbre than the harmonics.

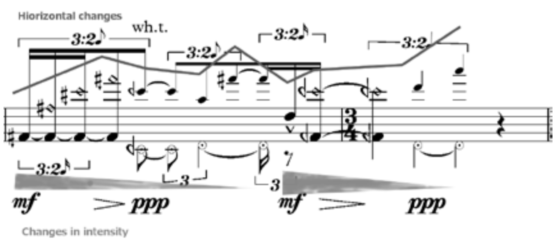

Fig. 6. Diagonal sonoric structures in *Incantation of the Freezing Haze* for flute by A. Maslekovas

[14] There are a number of formations that can fall into a concept of integrity. It could be such playing techniques as *vibrato*, *tremolo*, *frullato*, *bisbigliando*, trills of two independent pitches, rhythmical variations of a continuous sound, etc.

We can describe these structures using the following criteria. The direction of the diagonal which describes whether horizontal values of the sonoric structure are ascending or descending in terms of *pitch*. The amplitude which describes whether the intensity of sound quality is ascending or descending. It also shows the margins between the maximum and the minimum of intensity within the structure. The duration which indicates time that it takes for the sonoric structure to reach its maximal or minimal intensity.

3. Principles of structural organization

There are two principles of structural organization of sonoric structures: the discrete, and the composite. In the following chapter we will look at their most interesting manifestations in *Fünf Orchesterstücken* by Matthias Pintscher. The purpose of the following chapter is not to create or reveal any global manifestations of form in sonoristic music, but to exhibit the principles of structural organization which can be employed as prototypes in the process of analysis of other sonoristic compositions.

3.1. The discrete principle of structural organization

As the title suggests, the discrete principle of structural organization of sonoric structures focuses on exploiting a single dimension sonoric structures. The discrete principle of organizing horizontal sonoric structures may be applied in two ways. Either exploiting all possible variations of a single horizontal sonoric structure (e.g. line) which is often the case in pieces for solo instruments, either setting different (contrasting) sonoric structures (e.g. self-evidently different forms of lines) against each other. In the first case scenario the aspects of musical form would be decided by the principles of timbral kinesis which we are not going to discuss in this article as it is a broad subject that should be covered in a separate paper.

A good example of the second case scenario is the first movement of *Fünf Orchesterstücken* by Matthias Pintscher. The composition is based on interactions between two different forms of lines. Line No. 1 is synchronous long notes (Fig. 7) and line No. 2 is short passages of approximate duration of an eighth note (Fig. 8).

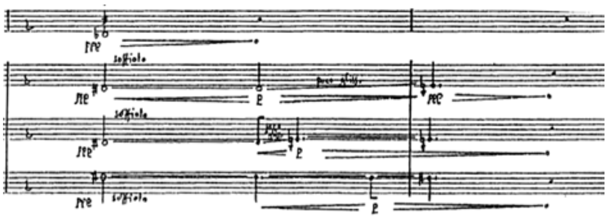

Fig. 7. Line No. 1

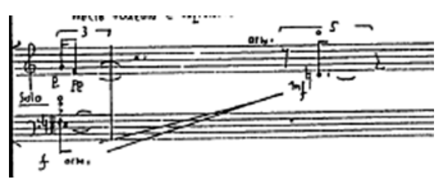

Fig. 8. Line No. 2

In the first section these two structures are exposed to each other and acquire attributes of the opposing structure. During this process structures No. 1A and 2A are formed. Structure No. 1A (Fig. 9) maintains duration and synchronous onsets from line No. 1 and acquires movement from line No 2. Structure No. 2A (Fig. 10), maintains short duration from line No. 2, but loses its movement. It also gains synchronicity from line No. 1.

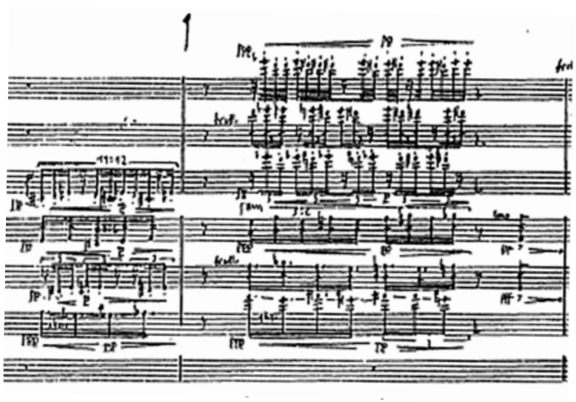

Fig. 9. Structure No. 1A

Fig. 10. Structure No. 2A

In the next section these four structures are being grouped by their kinship: structure No. 1 is grouped with structure No. 1A and structure No. 2 is grouped with structure No. 2A. First group (1–1A) is being exposed in bars 17–38 (Fig. 11) and the second group in bars 39–50 (Fig. 12).

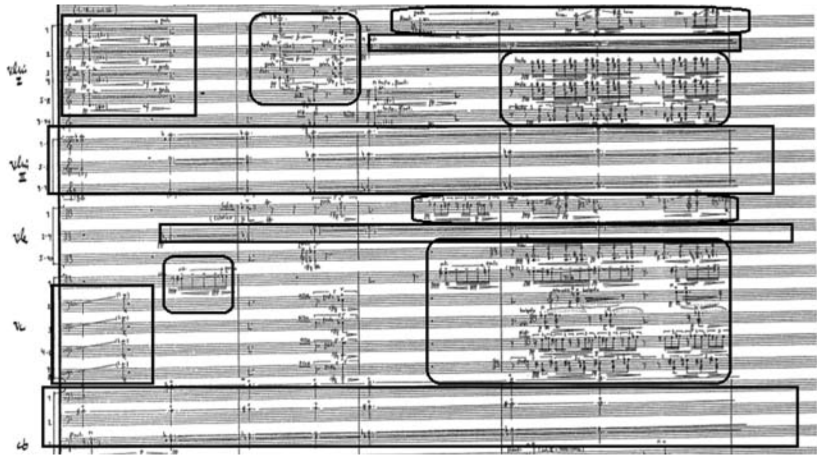

Fig. 11. Structures No. 1 (rectangle) and 1A (rounded rectangle)

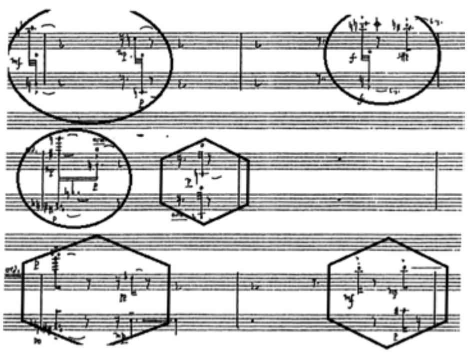

Fig. 12. Structures No. 2 (oval) and 2A (hexagon)

This leads to the third section, the climax of the first movement, where all of the structures are being stacked together into a massive texture (Fig. 13).

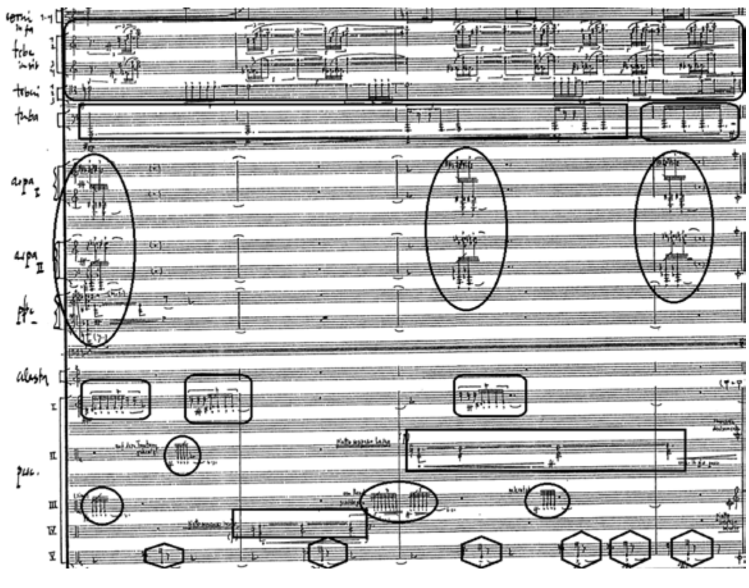

Fig. 13. Structures No. 1 (rectangle), No. 1A (rounded rectangle), No. 2 (oval), and No. 2A (hexagon)

The fourth and the final section is the biggest level of assimilation between all the textural models. Textural model No. 1 is being shortened and spread into tiny motives (Fig. 14). Thus auditory synthesis between two opposing structural models is achieved. There is such a high level of assimilation between the structures in the fourth section that it becomes almost impossible to distinguish them neither in auditory nor in analytical way.

Fig. 14. Assimilation between structures in the fourth section

All horizontal structural processes of the first movement can be summarized in the following scheme (Fig. 15) which reveals a heavy relation of structural organization and the principles of combinatorics.

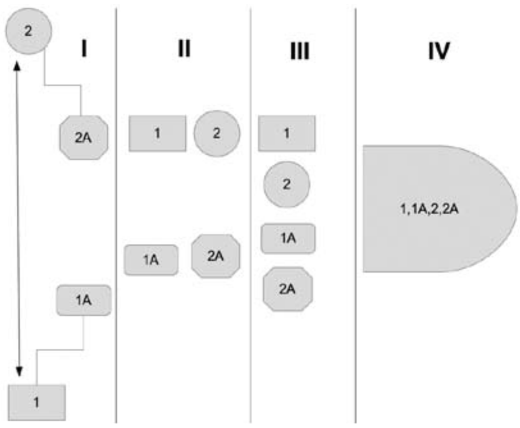

Fig. 15. Horizontal sonoric structures organized by the discrete principle of organization in *Fünf Orcherterstücken* by M. Pintscher

The discrete principle of organizing **vertical sonoric structures** is almost exclusively used in global changes of texture intensity. It is mostly due to the fact that verticality has an architectonic origin, i.e. it pervades all the auditory fields. Thus, setting multiply forms of vertical sonoric structures against each other is very limited, primarily for cognitive reasons.

One of the most beautiful examples of employing vertical sonoric structures as tools of manipulation of the global changes in the textural density is the second movement the *Fünf Orchesterstücken*. Here these *c*hanges are being exploited up to a very extreme degree (Fig. 16).

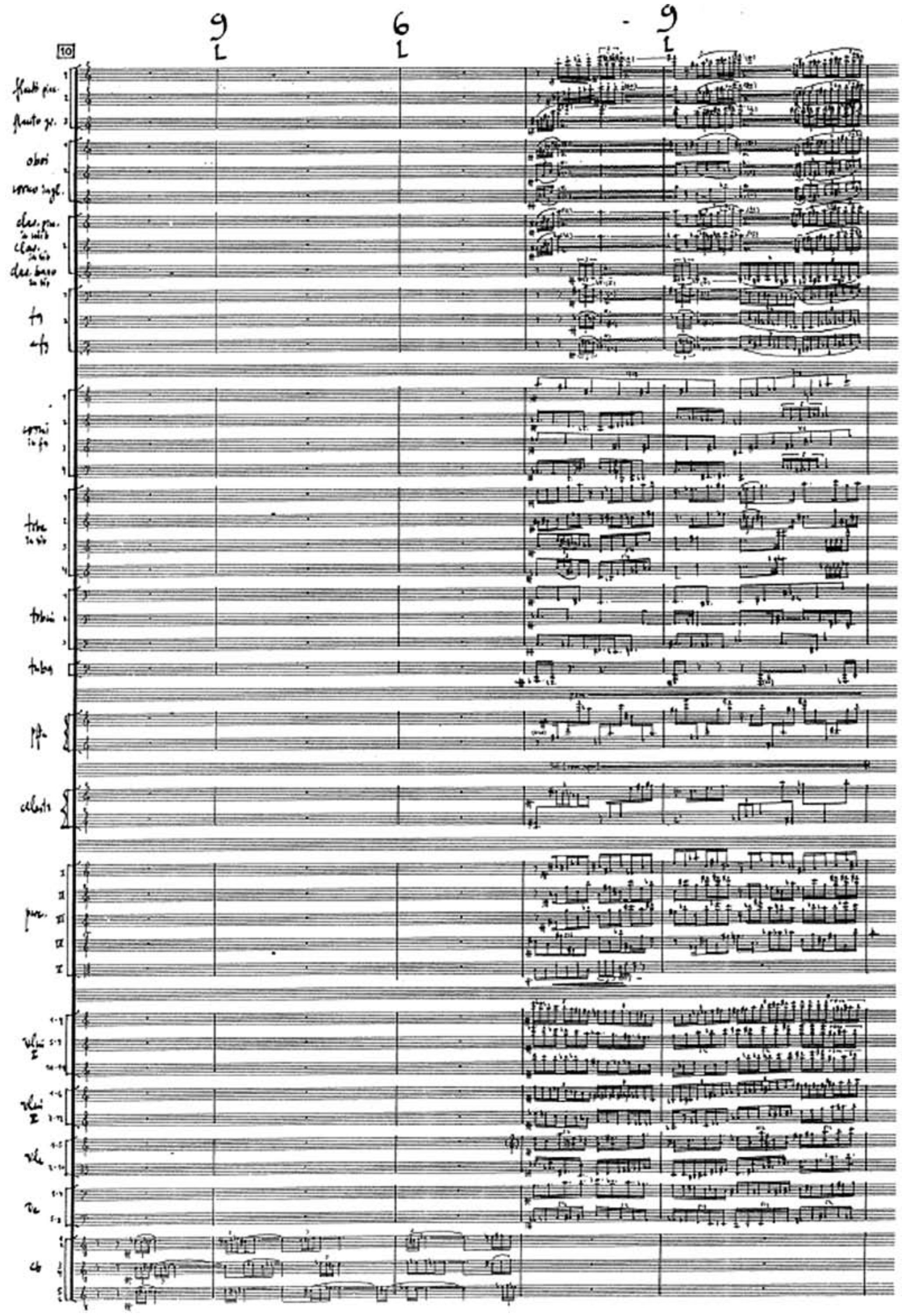

Fig. 16. Vertical changes in the texture of the second movement of *Fünf Orcherterstücken* by M. Pintscher

The main organizational principle of vertical sonoric structures in this movement is emphasizing the difference between maximal and minimal textural density of sonoric field. The entire structural process is encoded within the first section of the movement (bars 1–20). In the beginning maximal and minimal intensities are being exhibited in equal durations. After that the duration of maximal textural density is being gradually stretched in favor of the minimal. In this particular case the processes of vertical changes can be represented by a sheer number of the instruments that are employed in each bar of the first section (Fig. 17).

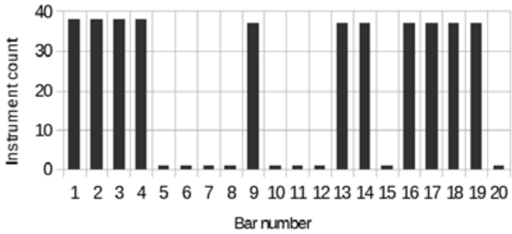

Fig. 17

In the next section (bars 24–49) a sort of balance between the minimum and maximum is being explored by creating a texture of fluctuating density. This is achieved thanks to a number of very rapid changes in quantity of employed instruments and avoidance of the usage of tutti or dramatically minimizing the orchestral mass (Fig. 18). It briefly reaches the density close tutti only in the last bars of the section. This section begins with a maximal textural density which is being reduced to reach the medium level.

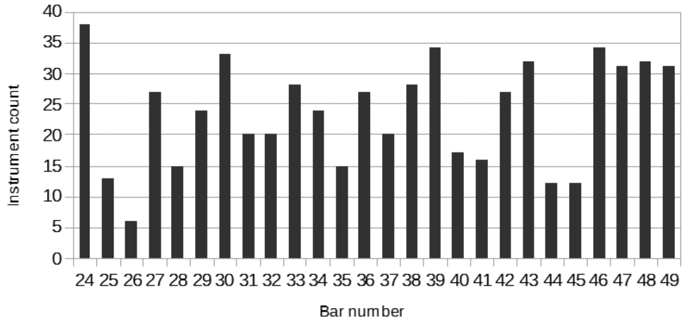

Fig. 18

In the third section (bars 50–61) the medium level of textural density is being achieved in an opposite way: starting from the minimal textural density in the bar No. 50, increasing it to the medium density during bars 51–58 and reaching maximal density in bars 59–61 (Fig. 19).

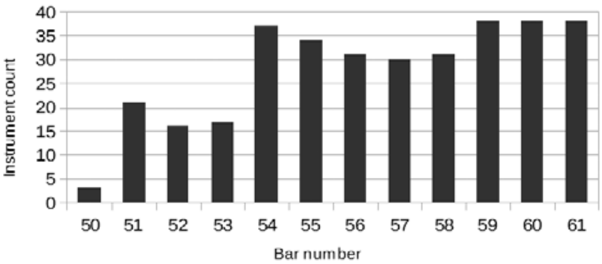

Fig. 19

This segment caries a very important auditory cue in a vertical dimension multiply glissandi in horn section (see Fig. 21). These glissandi are arguably the most impressive element in the entire piece and it becomes a new timbral characteristic of the maximal textural density as previously it was strictly associated with the timbre of orchestral tutti and a heavy load of percussion, while minimal density always manifested itself through the section of strings.

The fourth section of the piece (bars 62–74), which coincides with a golden section of the composition, disestablishes the contrasting nature of development of sonoric field. During this section sonoric field is no longer being developed as a sum of contrasts between minimal and maximal textural density and their assimilations, but rather as a consistent continuous process. The minimal textural density is being gradually increased until maximal tutti (Fig. 20). The section is repeated twice (as indicated by repeat marks in the score). This repetition creates an auditory image which can be described as two waves. This auditory image acts as a summarizing factor of the form, as it virtually fills the gap between heavily exposed contrast between orchestral tutti and the minimal textural density. It also establishes an alternative, non-contrasting, way of textural development.

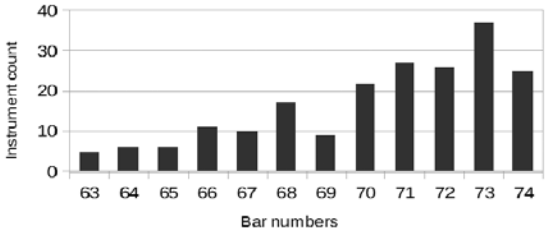

Fig. 20

The final section of the second movement serves as a peculiar coda. It is very similar to the third section; however it takes its model of textural development from the fourth section as it is being developed in a non-contrasting manner of continuous development. As this section is very similar to the third section, it takes one key timbral element from it – the glissandi in horn section (Fig. 21). It produces strong and memorable cues which, when repeated in the last section, consolidate themselves as new timbral attributes to the maximal textural density. Minimal textural density, on the other hand, also encounters a significant timbral transformation during this section. As it was primarily expressed via string section, it is now substituted with harps.

Fig. 21

It becomes evident that there are two schemata of structural organization employed in this piece: the scheme of manipulation of textural density which is illustrated in Fig. 22 and the schema of timbral development which is represented in Fig. 23. Scheme of manipulation of textural density is heavily related to the principles of combinatorics.

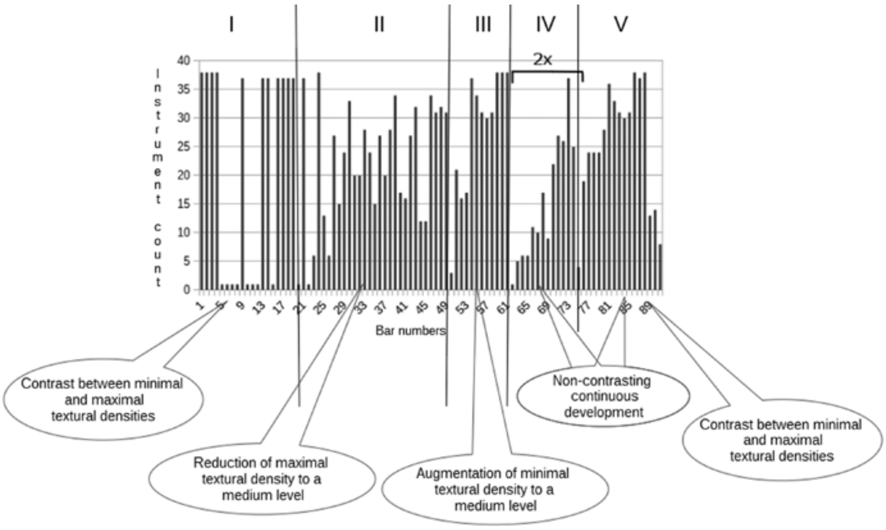

Fig. 22. Scheme of manipulation of textural density

Scheme of timbral development, on the other hand, is based on the cue abstraction mechanism and helps the musical structure to be grasped thanks to the changes in timbral attributes of minimal and maximal textural densities. As it is illustrated in the scheme (Fig. 23), minimal and maximal textural densities gain certain timbral attributes during the first two sections of the composition. These timbral attributes serve as cognitive cues, particular reference points for grouping textures according to *Gestalt* principles, as there are significant changes of timbral characteristics of maximal density during the third and fifth sections and in minimal density during fourth and fifth sections of the piece. The scheme reveals a number of cognitive ties that are formed throughout the piece and are mainly accumulated by the *Gestalt* principle of similarity.

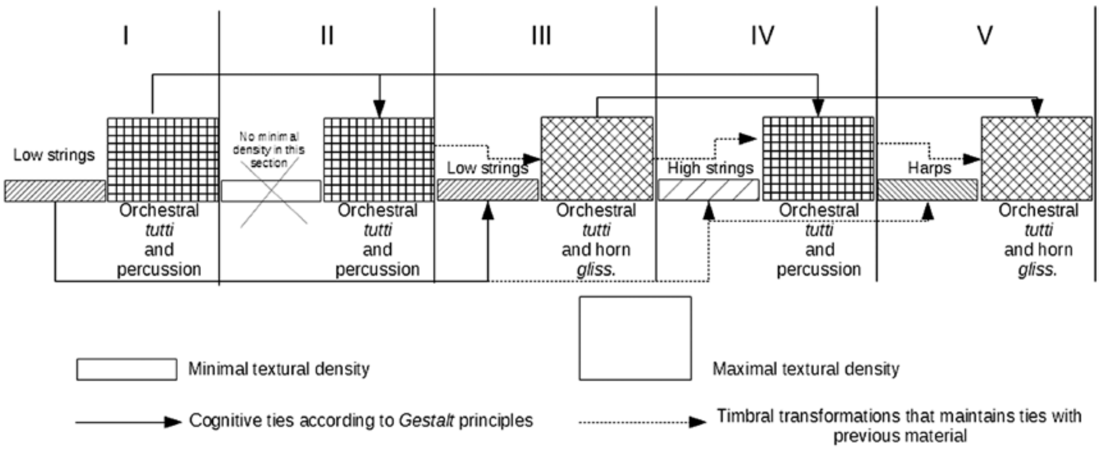

Fig. 23. Scheme of timbral development

3.2. The composite principle of structural organization

The composite principle of structural organization of sonoric structures focuses on exploiting sonoric structures of multiple dimensions. It can be applied in two ways: either setting vertical or horizontal sonoric structures against each other, which is somewhat analogous to a previously discussed juxtaposition of two lines, or stacking, multiply horizontal structures together to produce vertical sonoric values and turning them into vertical sonoric structures.

The latter case is interesting because it represents the auditory threshold between a perception of multiple horizontal structures and the perception of a single horizontal structure. As we will see, this is heavily dependent on *Gestalt* principles, especially proximity.

An excellent example of this case is the third movement of the *Fünf Orchesterstücken.* It is based on the same horizontal structures as the first movement discussed in chapter 3.1. We will keep their denotation as line 1 and line 2 their derivatives 1A and 2A are also present, however we will group them together for the sake of simplifying the explanation of construction. However, theses structures are being used in a different manner this time. They are stacked together to form vertical sonoric structures. Since there are two types of horizontal structures (line 1 and line 2), two generic types of vertical structures can be produced: the discrete (multiplication of a single horizontal structure), or composite (stacking two different sonoric structures together).

In the first section (bars 1–10) two horizontal structures are being exhibited one by one and in different layers of the texture (Fig. 24). This is done by exhibiting horizontal properties of line 1 while stacking the pieces of line 2 together into a vertical sonoric structure.

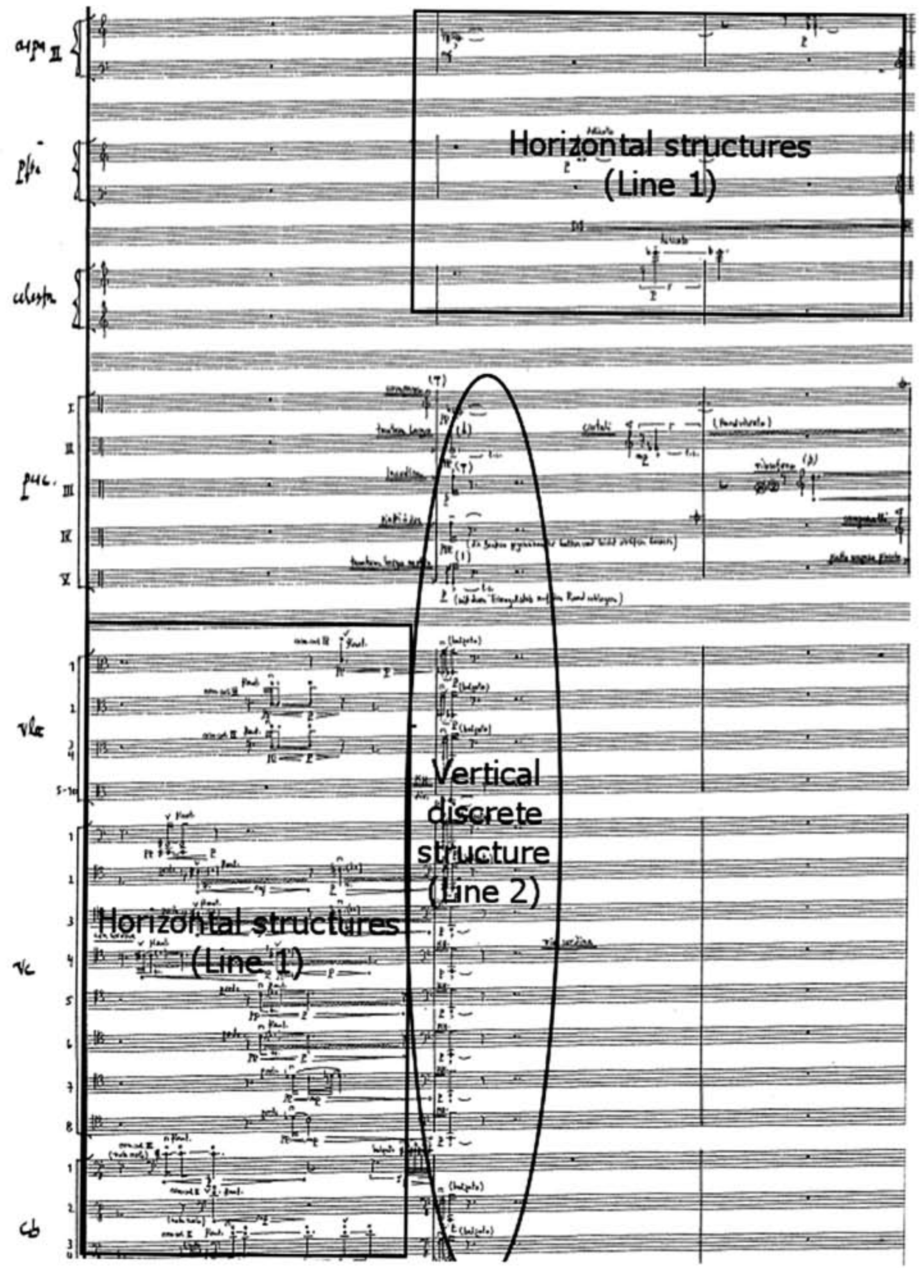

Fig. 24

In the second part of the first section (bars 10–15) the process is being reversed as the horizontal structures are being formed from line 2 and vertical structures – from deviations of line 1 (Fig. 25).

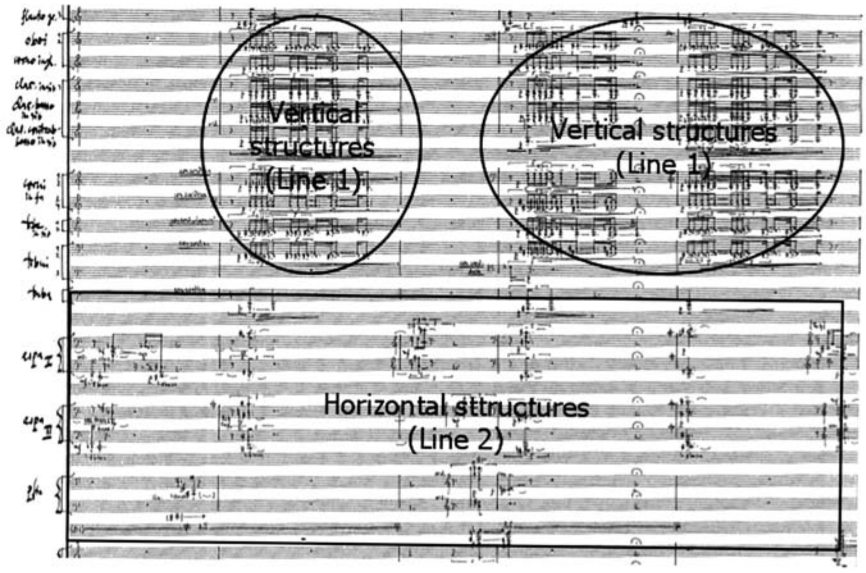

Fig. 25

In the next section (bars 15–23) the horizontal values of both structures are being exploited as well as these structures are being stacked together at the same time. During this process the amount of horizontal structures in the auditory field is being increased until the auditory threshold is being reached and a large amount of simultaneous events starts being conceived as a single process and it produces vertical sonoric values. Thus a vertical sonoric structure of a composite type is formed in a relation to horizontal sonoric values that were dominating before the reach of auditory threshold (Fig. 26).

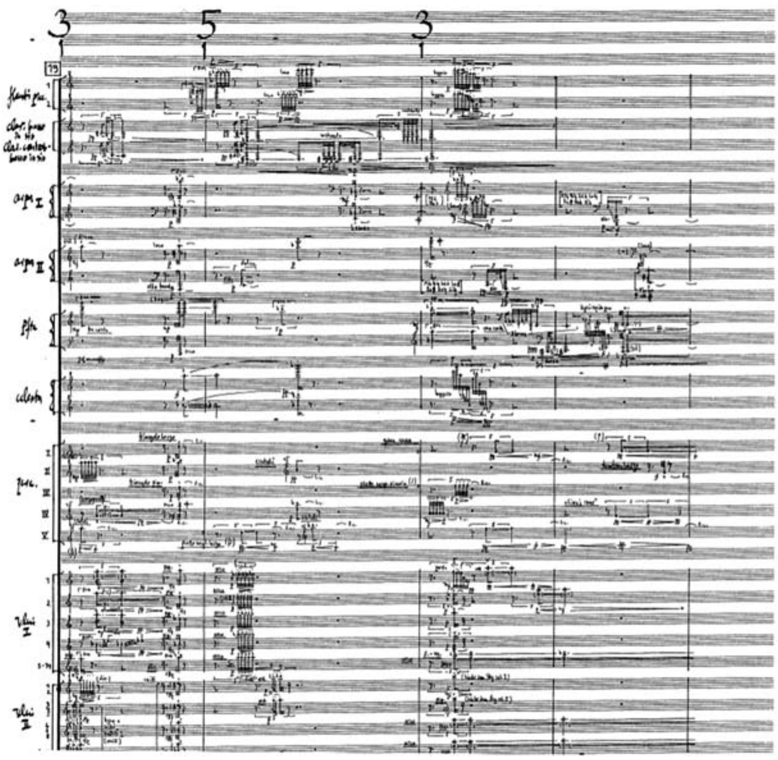

Fig. 26

In the third section both horizontal and vertical sonoric structures constructed from line 1 and line 2 are being demonstrated in turns (Fig. 27).

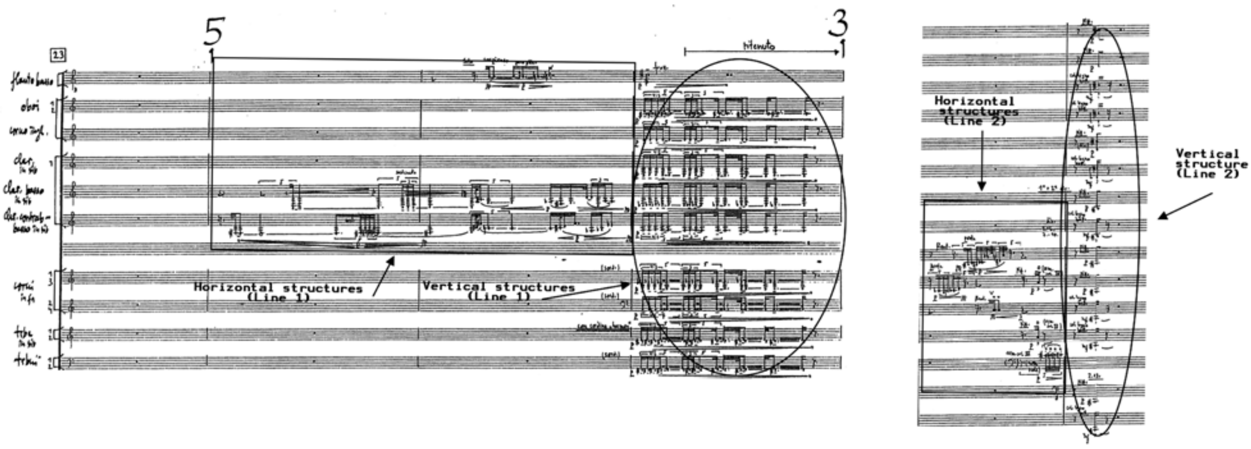

Fig. 27

The fourth segment (bars 42–61) is analogous to the second one as the structures are being stacked together and the amount of simultaneous events starts being conceived as a single process which produces vertical sonoric values. The only difference here compared to the second section is that the auditory threshold is not being reached exclusively by horizontal sonoric structures, as vertical strains of line 1 and line 2 are also being employed in this section.

In the fifth section we can see sonoric structures that are constructed from line 1 and line 2 being layered according to their dimensions. Therefore blocks of vertical and horizontal structures appear in succession (Fig. 28).

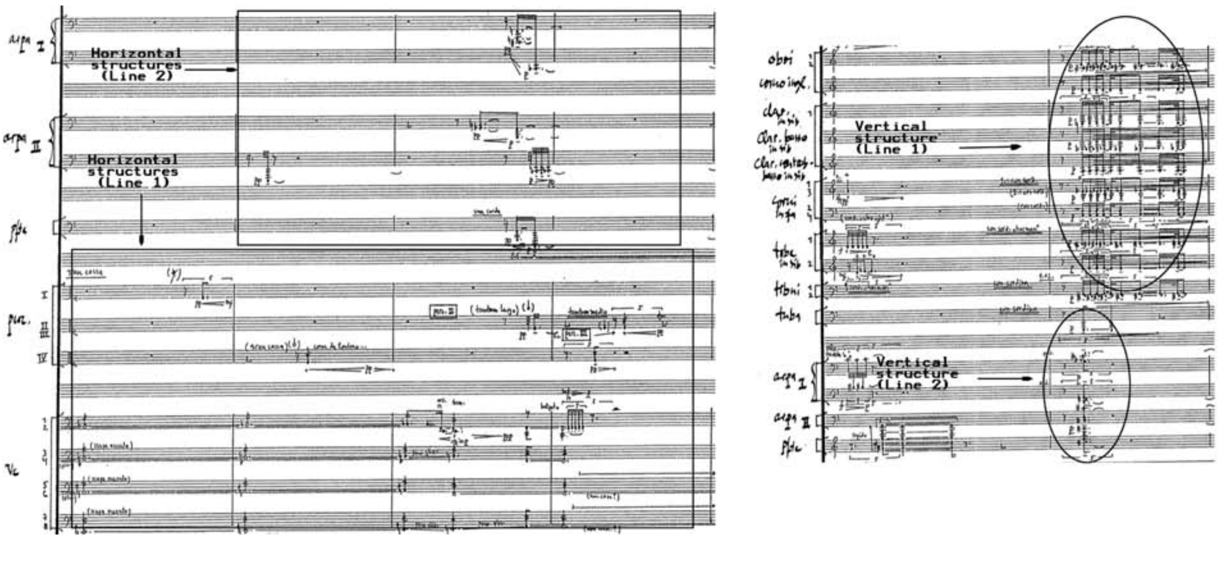

Fig. 28

Horizontal sonoric structures are being perceptually differentiated into two groups due to their distinctive sound qualities (*Gestalt* principle of similarity), textural disposition (proximity) and individual course of processes (common fate). Vertical sonoric structures, on the contrary, sound simultaneously, thus the distinction between two different groups is being weakened. That allows vertical structures to form a single vertical sonoric structure of a composite type. This process is observed in the last section of the piece (bars 82–102, Fig. 29).

Fig. 29

The following scheme (Fig. 30) illustrates a large technical arsenal of the composite principle of structural organization. We can see how textural variety is being constructed and coordinated by manipulating the perception of sonoric structures. The scheme reveals some manifestations of universal principles – prototypes of structural organization which can be found in a number of compositions.

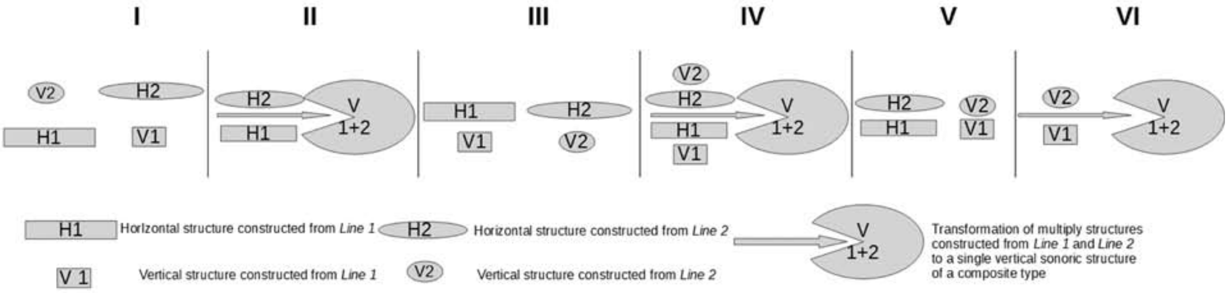

Fig. 30. Scheme of the third movement

We have discussed the parameters of some key parts of sonoristic music. However, this is only a structural point of view and by no means should be considered the only true explanation of the process of composing of sonoristic music. There are a lot of different mental layers that lead to the ways musical form is constructed. This one aims to explain one of those layers that can successfully coexist with a lot of other means of structural organization, which are yet to be explained.

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Vertikaliosios ir horizontaliosios sonorinės struktūros kaip konstrukciniai sonoristinės muzikos elementai

Santrauka

Sonorizmas – tai unikalus muzikos komponavimo ir percepcijos būdas. Pagrindinis kompozitoriaus sonoristo tikslas yra sukurti naujus garsinius potyrius, o to dažniausiai pasiekiama teikiant didesnę svarbą antriniams muzikos parametrams – garsumui, tempui ir ypač tembrui. Tembras neretai tampa pagrindiniu kintamuoju garsinių objektų konstrukcijose, tad dėl tembro, kaip parametro, kompleksiškumo šiuos garsinius objektus sunku diferencijuoti ir kategorizuoti.

Tai, kad vienas pagrindinių sonorinės muzikos (kitaip negu grynai struktūralistinių XX–XXI a. muzikos krypčių) komponavimo uždavinių yra tiesiogiai susijęs su klausytojo percepcija, mums atveria galimybes šios muzikos analizei kartu su muzikologiniais metodais taikyti kitų mokslo sričių – kognityvinės (suvokimo) psichologijos, akustikos, garsinės aplinkos įprasminimo (angl. *auditory scene analysis*) – žinias ir principus.

Straipsnyje nagrinėjama sonorinės muzikos formos analizės problematika. Čia remiamasi I. Deliège ir M. Méleno įžvalgomis apie muzikos formos suvokimo procesus bei vertikalumo ir horizontalumo koncepcijas. Pasitelkiant fundamentalias muzikologines žinias apie sonorinę muziką (J. Chomińskio, Z. Granato, A. Maklygino, P. Boulezo įžvalgos) ir akustikos bei *Gestalt* psichologijos dėsnius, aprašoma sonorinės muzikos formos analizės metodika: segmentavimo procesas, faktūrų tipologizavimo principai, sonorinių dimensijų (vertikalios, horizontalios ir diagonalios) požymiai, faktūrų priskyrimo vienai iš šių dimensijų problematika, loginių ryšių tarp segmentų nustatymas. Pateikiami ir sonorinės muzikos formos organizavimo pavyzdžiai M. Pintscherio kūrinyje „Fünf Orchesterstücken“.

Reikšminiai žodžiai: sonorinė muzika, sonorizmas, kognityvinė psichologija, *Gestalt* principai, vertikalumas, horizontalumas, muzikos forma, Matthias Pintscher.