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THE MUSICAL SPACE: A SKETCH FOR A BROADER MUSICOLOGICAL–SEMIOTICAL DISCUSSION

Abstract: The subject of this paper is an examination of the analytical competences of musical semiotics and prolongation analysis applied to the organisation of the musical space in the music of the 20th century. By means of presenting one of the possible ways of organizing the musical space – the organisation of pitches and registers – one can derive the synthesis of Eero Tarasti's semiotics of the musical space and certain segments of prolongation analysis. Starting from the assumption that the organisation of the musical space is the key determinant of the music of the 20th century (Masnikosa, 2010: 242), I will argue that the musical space has its 'stronghold' in the works of European high modernism. By confronting Tarasti's model of the musical space with some segments of prolongation analysis (more precisely, with the theory of harmony by Olli Väisälä and tonal pitch spaces by Fred Lerdahl, with the addition of the theory of musical forces by Steve Larson), I will try to show how the organisation of the musical space can be implied in the analysis of Iannis Xenakis's (1922–2001) work *Metastaseis* (1953/4).
Key words: the musical space, the organisation of the musical space, Tarasti, prolongation analysis theory, Xenakis.

The notion of space is very broad and very diverse in character. In order to define it (or, better to say, describe it) we must trace the ideas of space in philosophy and science, and confront them with rather different concepts of spatiality which are manifested in the arts and in music as well.[1] And if we do so, it is just

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[1] Cf. Maria Anna Harley (Maja Trochimczyk): *Space and Spatialization in Contemporary Music: History and Analysis, Ideas and Implementations*, Ph.D. Dissertation, Montreal, Quebeck, Canada: McGill University, Faculty of Music, 1994, PDF Reprint, Los Angeles, California: Moonrise Press, 2011, 18–115, http://www.moonrisepress.com/dissertation.html,

a part of what space represents – especially now, we are faced with different spatial paradigms in very distinct and diverse disciplines, such as mathematics, physics, architecture, geography, linguistics, sociology, ethnology etc. Therefore, I choose to explain and to explore *the notion of space in music*, in order to sketch some preliminary thoughts and ideas about the development of the spatio–temporal organisation of musical/sound material in the course of the music of the 20th century. In that sense, I shall (roughly) trace the changes of the musical language from the beginning of the century up to the 1960s. My aim is to emphasize those changes which affected the melodic, rhythmical and harmonic aspect of the piece of music.[2] Therefore, I will select one specific (and, admittedly, rather narrow) line of composers which were, as it may seem, the carriers of such development.

The emergence of the musical space in the music of the 20th century (1900–1960)

One of the main preoccupations since the first decades of the 20th century was to find new ways of musical expression.[3] The results of this search can be represented by the total 'collapse' of tonality as the main paradigm of European (tonal) music and the shift from melody as a primary carrier of the musical idea to the motive and, in later decades, harmony. However, there were some external factors that also had an influence on the music production from this period; for example, the exploration of sound and its acoustical and physical characteristics, and the development of new technologies in recording sounds significantly marked the paths for music composed between the wars.

Although very diverse in character, the music of prominent European composers in the period before World War I – namely, Erik Satie (1866–1925), Arnold Schoenberg (1874–1951), Igor Stravinsky (1882–1971), Anton Webern (1883–1945) and Alban Berg (1885–1935) – shared some similar features, re-

accessed November 2013. The more informative discussion about the development of the ideas and concepts of space in philosophy, science, the arts, and music is also a part of my PhD dissertation *The musical space in the analysis of selected works of European music of the second half of the 20th century*, which I am writing under the mentorship of prof. Marija Masnikosa, Ph.D.

[2] Detailed analysis of the concept of musical space and the analytical model for interpreting the musical space is a part of my Ph.D. research.

[3] This was something anticipated a while ago – if we think of the general history of European music, we can trace those critical points that directed the path of the European music in the 20th century, i.e. the expansion of the tonality, the increasing chromaticism, the loosening of basic harmonic relations, etc.

garding the relation to the musical language. Specifically, the selected composers operated in the domain of two main spheres. The one was the sphere of polytonality, bytonality, octatonality and the whole-scale system (Satie, Stravinsky) and the other was the sphere of atonality, i. e. the lack of any harmonic hierarchy in the course of the musical flow. For those composers who had not abandoned tonality, the answer to the problem of the musical expression was not in the abruption of the tonal system. On the contrary, they operated in the extended tonal sphere, in which harmonic relations were still important, but not definite, rigid and transparent. This enabled them to focus on different musical parameters, such as rhythm, timbre, texture, and on their role in the creation of the piece of music. In other words, they focused – maybe more explicitly than the other group of composers from that period – on the specific spatio–temporal organisation of the piece of music.[4]

The other answer to the "collapse" of the previous system was to develop a new one, which was exactly what Arnold Schoenberg and his students did. They emphasized the role of dissonance in the tonal hierarchy, i.e. they annulled the dominant status of consonance and equalized it with dissonance. In that sense, they managed to free the musical flow of any rules that prevailed throughout the centuries of the dominance of tonality as the major organizing principle in the melodic and harmonic sphere of the piece of music. However, one should not assume that the period of "free atonality" (1908–1912) was anarchistic in character: although the rules established through the use of tonality were no longer valid, the liberation of the piece of music from the constraints of the tonal system introduced some new rules on the scene. In fact, tonality was replaced, in a certain way, by some other organizing principle, which – as we shall later see – relies on the intervalic structure of the piece of music. Since there were not any stable tonal surroundings for the development of a melodic material, the aforementioned changes also affected the melodic aspect of the piece of music. It was challenging to create a melodic phrase without the support of the tonic, dominant and subdominant chords. Therefore, a melody was replaced by a motive, which became the main structural and developmental material in the piece of music.

[4] Of course, this statement raises the question whether the composers *thought rationally* on the problems of spatio–temporal organisation, i.e. was this organisation in their poetical focus while composing the music or not. So far, I haven't found proofs to claim if they were aware of the spatio–temporal organisation, or to claim otherwise; only a few composers actually wrote on the topic of musical time and space, and if they wrote about it, they didn't treat the problem of spatio–temporal organisation as the primary paradigm in their poetics.

However, there were – as mentioned – some external factors which also made a significant impact on the music of this period. In that sense, one composer certainly distinguished himself from the musical 'mainsteam' represented by Schoenberg and his students on the one hand and Stravinsky and Satie on the other: it was Edgard Varèse (1883–1865). His output clearly denotes his preoccupation with the sound itself and different possibilities to 'liberate' that sound from traditional musical instruments and playing, setting the scene ready for electroacoustic music.[5] Varèse focused not on the melodic quality of the sound, but rather on its *duration* and *timbre.* He was not concerned with the questions of musical expression and musical language itself; he was occupied with the acoustical potentiality of the sound as the only means of expressing music.

In the period between the wars (1918–1941), most of the leading composers from before World War I continued with explorations in the domain of musical language and musical style. The result was, on the one hand, the constructivist phase,[6] represented through the use of the twelve-tone technique developed by Schoenberg and his students, and, on the other, the neoclassical phase, which marked the works of Stravinsky and the group of French composers.[7] Despite the diverse stylistic qualities and tendencies, one can notice that parameters such as pitch, rhythm and timbre came into focus in the aforementioned techniques. The use of the twelve-tone technique emphasized the basic tone parameters and give them a prominent role in the shaping and creating of the musical material. The pitch, for example, became an important factor in creating the interval 'fundus' of the piece of music; since there were no harmonic relations, intervals took the role of tonally based harmony. On the other hand, the duration and the rhythm were also important in manipulating the temporal aspects of a piece of music. In the works which were created under the influence of neoclassicism, one can trace the expansion of the registers, i. e. the expansion of the acoustical frame of the piece of music. This expansion is manifested through the differentiation of registers on the instrument, thus creating strong "gaps" between the high and the low registers.

The major changes in musical language – and, indirectly, in the spatio–temporal organisation of the piece of music – occurred after World War II. The

[5] Varèse's most influential and most explicit contribution on the topic is "The Liberation of Sound", reprinted in: Christof Cox and Daniel Warner (Eds.), *Audio Culture: Reading in Modern Music*, New York, The Continuum Books, 2004, 17–21.

[6] Cf. Марија Бергамо, *Елементи експресионистичке оријентације у српској музици до 1945. године*, Београд: САНУ, 1980, 17–18.

[7] Namely, Georges Auric (1899–1983), Louis Durey (1888–1979), Arthur Honegger (1892–1955), Darius Milhaud (1892–1974), Francis Poulenc (1899–1963) and Germaine Tailleferre (1892–1983).

circumstances that influenced the creative output of the leading composers of this period – Pierre Boulez (1925–2016), György Ligeti (1923–2006), Karlheinz Stockhausen (1928–2007) and Iannis Xenakis (1922–2001) – came from two different sides. On the one side, they continued with the explorations of sound and its parameters, exploring the possibility of the *serialisation* of different parameters, such as pitch, duration, intensity of the sound, etc. On the other side, they were strongly influenced by the development of electroacoustic music and electronic studios.[8] In these studios, composers had the opportunity to *directly* explore the sound and its qualities by recording and combining different (real and synthetic) sounds, manipulating with the specific qualities of the sound, i.e. by expanding or shrinking the pitch height, thus creating rather different sound effects, etc. These explorations resulted in works in which the spatial qualities of sound prevailed; therefore, space became *one of the four basic criteria for electronic music*.[9]

Although one cannot claim whether this new genre of music influenced traditional instrumental and vocal music, it is symptomatic to notice that the music composed after World War II definitely found new ways of musical expression. More precisely, the works of Boulez, Ligeti, Stockhausen and Xenakis synthesize the tendencies from the earlier decades of the century, which were directed towards the new spatio–temporal organisation of the piece of music. This new organisation is characterized by the general 'staticity' of the musical flow and is claimed to be the answer to the problems of musical expression.[10] This 'staticity' is often manifested in a piece of music as a lack of development of the musical material, which can be related to the usage of large portions of sound instead of one distinctive motivic or melodic cell, and the collage technique implied to organize these portions of sound in the work. On the other hand, when there is no melody or motive that will grasp the listener's attention, the rhythmical aspect of the works comes to the fore. This situation is reminiscent of one of the concepts of *spatialized time*, which was taken from the philosophical discourse of Henri Bergson (1859–1941). Since time and space are complete opposites of each other, making time measurable, i. e. represented *in space*, we evoke the concept of spatialized time.[11]

If we agree on the notion that the music of the post-war period (up to the 1960s) was static, it means that we admit the possibility that it has no tempo-

[8] Cf. Vesna Mikić, *Muzika u tehnokulturi*, Beograd: Univerzitet umetnosti, 2004.

[9] Cf. Karl Hajnc Štokhauzen: *Četiri kriterijuma elektronske muzike*, prev. Miloš Miladinović i Predrag Cvetičanin, Niš, Studentski kulturni centar, 1989.

[10] Cf. Harley: *op. cit.*, 1994, 3, 13.

[11] *Ibid*., 39.

ral qualities whatsoever, which cannot be true. We can metaphorically speak of staticity, regarding the spatio–temporal organisation of the piece of music, in which certain techniques and the way of organizing the musical material create an impression of staticity in the musical flow. In that case, the staticity characterizes one specified opus (containing the works of different composers) in which we can detect the paradigm of "spatialization", i. e. "the musical utilization of the physical-acoustical-perceptual spatiality of sound."[12] As Maria Anna Harley describes it, "the presence of spatialization can be recognized in every situation in which spatial extensions, positions (directions and distances) of the sound sources as well as the acoustic quality of the performance space are given compositional significance."[13]

Despite the fact that the music of the second half of the 20th century opened up a new sphere of thinking about, composing and listening to music, the questions regarding spatiality and temporality have much deeper roots. One of the ways of defining the spatio–temporal organisation of the piece of music is the musical semiotics of Eero Tarasti.[14] Tarasti's methodological approach to the piece of music relies on three inseparable components: the musical time, the musical space, and the musical actoriality. Through the organisation of these components, one can trace the process of musical semiosis, i.e. the process of the creation of the musical meaning. However, the three components can be separated, in order to establish the organisation of each of the components in Tarasti's semiotical model. In that sense, I will emphasize the musical space, which is one of the subjects of this article.

The musical space in the light of musical semiotics: Tarasti's approach

The essential idea of musical spatiality is that there are different "microspaces", i.e. "registers" modalized in various ways, creating the tension compelling them to move toward, against, and away from each other.[15] In order to explain the structure of the musical space, Tarasti further interprets the phenomenon of space in music as real or as fictive.[16] By the real musical space, the author considers the piece of music itself (i.e. structured and organized sound material),

[12] *Ibid.*, 3–4.

[13] *Ibid.*, 4.

[14] Eero Tarasti, *The Theory of Musical Semiotics*, Bloomington: Indiana University Press, 1994.

[15] *Ibid.*, 85.

[16] *Ibid.*, 78. I presented Tarasti's model of musical space in my MA thesis entitled *Организација музичког простора у камерним делима Јосипа Славенског и Љубице Марић,* Београд, 2012, 34–38.

while the fictive musical space is associated with the possibility to imply the narrative strategies on describing the musical space.[17] However, Tarasti leaves aside the fictive musical space, focussing his attention on the real musical space. The real musical space, according to Tarasti, can be differentiated as the inner and outer musical space. The essential feature of the inner spatiality of music is the concept of centre and periphery, i. e. the centripetal and centrifugal forces within the inner musical space.[18] The centre/periphery pair creates the energetic field in the inner space, and its referring – in the narrower sense of the word – to the pitch organisation of the piece of music. On the other hand, the outer musical space has several possible meanings (and functions) in Tarasti's semiotical model. Firstly, it denotes the acoustic 'frame' of the piece of music, i. e. the disposition of the sound material into different registers, since every acoustically based material can be measured according to the register it occupies.[19] The other possible meanings of the outer musical space call to mind:

1. the position of the performers in the concert hall;
2. the gestures of the conductor;
3. the orchestration (as the specific way of using the instruments in portraying the melodic or harmonic aspect of the piece);
4. the human voice.[20]

However, Tarasti focuses on two primary manifestations of the inner and outer musical space – the pitch organisation and the texture (or register disposition of the musical material).

By selecting and presenting the concrete models of the inner and outer spatiality in music, Tarasti concludes that both inner and outer space can be articulated in the following ways:

1. horizontal (before/after);
2. vertical (up/down);
3. depth (in front of/behind);
4. centre/periphery (foreground/background).[21]

The first three dimensions of the musical space are the same as with physical space, but the fourth dimension is something Tarasti adds to the previous three.

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[17] Tarasti, *op. cit*.

[18] *Ibid.*, 79.

[19] *Ibid*.

[20] *Ibid.* Although Tarasti recognizes many possible meanings of the outer musical space, he doesn't categorize the selected meanings according to one specific criterion. In that sense, the outer musical space may also refer to the actual (physical) space in which the music in performed.

[21] *Ibid*.

This fourth dimension, I would add, is a manifestation of the *energy* within the musical space, since the categories of centre and periphery imply the notion of centripetal and centrifugal forces, i. e. the engagement and disengagement from one chosen point (usually, the centre of the inner musical space) to the other.[22]

Considering the role of the energy in the organisation of the musical space, Tarasti offers the preliminary classification of musical spaces:

1. the point-like spaces;
2. the transitional spaces;
3. the musical fields.

According to Tarasti, the point-like spaces refer to separate tones and pitches. This type of space contains a strong hierarchy between the points, and here we can trace the notion of the centre/periphery in its most transparent manifestation. Every point has its unique modal value, which is "measured" in relation to the other points in space.[23]

Tarasti interprets the transition between one space to the other as transitional space. Tarasti calls the transition lines between the spaces musical vectors.[24] Finally, the musical fields represent the more or less ordered segments of sound; they are homogenous, but functionally undifferentiated segments of the piece of music.[25]

This brief elaboration of Tarasti's model of the musical space requires some further explanations. Firstly, Tarasti defines the musical space in the light of musical semiotics, which means that the principal role in segmenting the space in music goes to the modal values of selected microspaces.[26] However, in his analysis of the organisation of the musical space, one cannot trace the path of these modal values; he is relying on the organisation of pitches and registers, as the primary manifestations of the inner and the outer spatiality in music.

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[22] It may seem strange to isolate and emphasize the energy of a musical space in this context. Having in mind that Tarasti sees the musical time as separate and relatively autonomous phenomenon in his semiotical tripartite model, the isolation of the energy seems justified, because the energy is, also, a part of the space.

[23] The relations between the points, as well as the energy and the type of the movement specific for the point like spaces, are relevant in the analysis of the organisation of such spaces.

[24] *Ibid*., 85.

[25] Cf. *Ibid.*, Марија Масникоса: „Организација музиког простора дела – један од кључних елемената (музичког) модернизма Љубице Марић", у: Дејан Деспић и Мелита Милин (ур.), *Простори модернизма: опус Љубице Марић у контексту музике њеног времена*, Београд: САНУ, 2010, 245.

[26] The modalization is the concept of allocation the extra-musical meaning to the piece of music or its parts. A detailed explanation of the modalization can be found in: Tarasti, *op. cit.*, 38–43.

Where do the musical space and the prolongation analysis theory meet?

As it may be noticed from the previous section, the "focal points"[27] in Tarasti's model of the musical space are pitch, energy and the centre of the musical space. However, these terms need to be re-contextualized, in order to be applied to the analysis of the music of the 20th century. To achieve this, I will use key features of the prolongation analysis theory as a supplement of Tarasti's model of the musical space.[28]

The pitch is "the carrier" of the inner spatiality in music, therefore, the analysis of the inner musical space relies on the analysis of the pitch organisation. In Tarasti's semiotics of the musical space, this pitch organisation refers primarily to *traditional Western tonality*, therefore, this model is bounded exclusively to the repertoire from Haydn to Chopin. However, in the analysis of the music of the 20th century, the pitch organisation relies not on the concept of tonality, but on different pitch structures, such as modes, extended tonality, whole-scales, octatonic scales, twelve-tone scale, etc. In that sense, if we wish to analyze the organisation of the inner musical space in modern music, we must make certain adjustments to Tarasti's model of inner spatiality. Firstly, the pitch structure of the music of the 20th century is very diverse and rich. So the organisation of the inner space must recall all those pitch structures that can be found in the works of composers of the 20th century. In other words, we cannot rely on *one* definite tonal/pitch hierarchy; instead, we must find a specific interval fundus for each analyzed work. Following Fred Lerdahl's theory of tonal pitch spaces, we can find those pitch spaces that correspond to the actual pitch structure of the piece of music.[29]

Lerdahl in detail elaborates the structure and the organisation of *diatonic pitch space*, but he also explores the *chromatic tonal space*, and the *atonal structures* (or flat spaces). In short, he develops a model of the tonal hierarchy, which lies at the base of every piece of music.[30]

The diatonic pitch space contains five structural levels/spaces:[31]

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[27] The term by Ludmila Ulehla, denoting the salient melodic or harmonic tones in the segment of the musical flow. Here, the term is used metaphorically. For the original meaning and its application in the semiotics of musical space, see: Ludmila Ulehla, *Contemporary Harmony: Romanticism through the Twelve-Tone Row*, Rottenburg, Advance Music, 1994, 306 and Масникоса, *op. cit.*, 248.

[28] This type of analytical tool is a preliminary version. The full and detailed elaboration of this tool is a part of my Ph.D. research.

[29] Fred Lerdahl, *Tonal Pitch Space*, Oxford, Oxford University Press, 2001.

[30] *Ibid.*, 41 et pass.

[31] *Ibid.*, 47.

1. the level of octave or root space;
2. the level of fifth space;
3. the level of triadic space;
4. the level of diatonic space, and
5. the level of chromatic space.

This structure represents a "basic space", which can be further elaborated, shifted and discussed. The key feature of this type of space is that at each level of the space it elaborates into (vertically) less stable pitch classes; it represents the diatonic scale and the triad.[32]

Every basic space can be segmented into pitch class, chordal, and regional levels. This segmentation shows the functioning of the deeper space layers in a piece of music. For example, at the pitch class level one traces the distances of the other pitch classes to the tonic (pitch class 0), both vertically and horizontally. These calculations show, firstly, *the depth* of such a level (by counting the number of levels down in the basic space), and, secondly, *the generalized notion of step and skip*.[33] At the chordal level, calculating the proximity of any two chords within a region occurs by the diatonic circle of fifth and common tones.[34] This level of the basic diatonic space makes it possible to comprehend the structure of the deeper layer of the inner musical space, especially in relation to tonally based music. By establishing the types of chordal progression within a chordal space, it is possible to observe the chord proximity across the regions (i.e. the changes in the diatonic collection).[35]

Basically, the structure of the diatonic pitch space can be transformed into the chromatic tonal space. This space is constructed, because of the shift from fifth relations to third relations within the diatonic region. Thus, the chromatic tonal space does not have just *one* possible collection of pitches and space levels; there are triadic/octatonic space, triadic/hexatonic space, nontriadic octatonic spaces, and whole-tone and mystic spaces.[36]

In that sense, the inner musical space of Tarasti's model seems rather simplified in contrast to Lerdahl's pitch spaces. It is not sufficient to refer to a *pitch organisation*; the pitch organisation must be strictly defined and analyzed in order to fully grasp the organisation of the inner musical space. In order to achieve that, one must also rely on *harmony* as one of the primary organisational prin-

[32] *Ibid.*, 48.

[33] *Ibid.*

[34] *Ibid.*, 53

[35] *Ibid.*, 59.

[36] For detailed elaboration on these spatial models, see: *Ibid*., 252–268.

ciples in the piece of music.[37] If we undertake the analysis of pitch relations, intervals, chords or specific melodic/bass progressions in the piece of music, we are on the way not only to establishing the basic pitch structure for the choosen work, but also to firmly defining the *centre* of the inner musical space (which plays an important part for Lerdahl too).[38] One of the possible ways of defining the centre of the inner musical space may be the prolongation analysis theory by Olli Väisälä.[39] According to him, the centre of the inner musical space in post-tonal music (i.e. the music of the 20th century) must be associted with the *harmony*.[40] More precisely, it is necessary to analyze the structure of intervals in one specific piece of music, since – as Väisälä noted – certain interval classes act as a substitute to the traditional harmonic relations.[41] The analysis of the types of interval classes enables the differentiation between harmony (the vertical aspcet) and melody (the horizontal aspect), i.e. the differentiation of background (the structurally deeper layers of the piece of music) and foreground (the manifestation of these deeper layers). In that sense, Tarasti's centre of the inner musical space can be positioned as a *prominent point* in both the background and the foreground, and Väisälä's prolongation analysis theory is a way to demonstrate the role of this point in the piece of music.

To demonstrate the structure of the centre of the inner musical space, one must differentiate between the harmonic and melodic intervals in a chosen piece of music. For example, the interval class 1 (for C=0) usually denotes the melodic interval, because it is manifested as a "step" from one pitch to the other. On the other hand, the "transposition" of ic1 (seventh or ninth) denotes the harmonic interval, since it usually occurs as a leap from one pitch to the other. Thus, the harmonic intervals are perceived vertically, simultaneously, and spatially, while

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[37] By the term harmony, I do not consider the traditional definition, but rather the traces of the classical harmony which are still evident in the modern music. For example, the bass progression, the fifths, fourths and octaves in the melodic or bass line, different manifestations of tonic–dominant relationship, etc. Cf. Ulehla, *op. cit.*

[38] Tarasti does not specify what he means by the term *centre*, nor he gives us any hints on what it could be, there is a perplexity in defining the centre of the inner musical space. However, he briefly suggests that the centre may be any point in the musical space: Tarasti, *op. cit.*, 79.

[39] Oli Väisälä: *Prolongation in Early Post-Tonal Music: Analytic Examples and Theoretical Principles*, Ph.D. thesis, Sibelius Academy, Department of Composition and Music Theory, Studia Musica 23, 2004, http://ethesis.siba.fi/ethesis/files/nbnfife200910222275.pdf, accessed July 2014.

[40] *Ibid.*, 40.

[41] *Ibid.*, 62 et pass.

the melodic intervals are perceived horizontally, as a movement in time.[42] However, this example needs to be additionally supported by the concept of registral distinction, which plays a great part in Väisälä's prolongation analysis theory. He argues the importance of registral distinctions of interval classes, because if we reject this notion and treat the interval classes as they were (in respect of the octave equivalence of the set-theory), we may not obtain a valid analytical insight into the intervallic structure of the piece of music. Therefore, the position of the pitch in the outer musical space is a distinguishing factor in the analysis of the importance of that pitch in the total intervallic/pitch fundus of the piece, and it is empirically based in the psychoacoustical analysis of the significance and function of certain interval classes in the musical flow.[43]

The idea of *energy* in the musical space is another aspect that needs to be recontextualized. Since energy is one of the basic parameters of spatiality (movement is crucial for experiencing space!), this notion can be explained with Steve Larson's theory of musical forces.[44]

According to Larson, the musical forces (i.e. the metaphor of musical motion and musical forces) have a prominent role in the perception of *melody* and *rhythm*, since their meaning evokes the stereotypes of natural forces.[45] Larson identifies five types of musical forces – three melodic and two rhythmical.[46] The melodic forces are: melodic gravitation (the downstep movement), melodic magnetism (the melodically unstable pitch has a tendency towards the nearest stable pitch, while the energetic tension is increasing), and musical inertia (the pitch tends to continue in the previous state of pitch, duration or both).[47] If we apply Larson's musical forces in the structure of Tarasti's inner musical space, we will contribute primarily in the expanding and/or clarifying of Tarasti's classification of point like, transitional spaces and musical fields. For example, the points (pitches, intervals or chords, added M. B.) in point like spaces are positioned according to some modal value they are assigned (based on how much they are wanted, obligated, needed, desired, etc.). However, if we consider these modal values to be musical forces, we can notice completly different relations

[42] *Ibid.*, 62–63.

[43] *Ibid.*, 63. It should be noted that Väisälä's notion on registral distinction resembles Tarasti's notion on how acoustically based material can be measured in respect to the register it occupies.

[44] Steve Larson, *Musical Forces: Motion, Metaphor and Meaning in Music,* Bloomington, Indiana University Press, 2012.

[45] *Ibid.*, 19.

[46] *Ibid.*, 21.

[47] *Ibid*.

between the points. In that sense, if the selected point is melodically unstable (like ic1, minor second), it has a tendency to gravitate towards the nearest stable point in the musical flow. This type of force is called melodic magnetism. On the other hand, if the selected point has no tendency to change its position, or direction, or pitch, remaining the same in a chosen period of time, we are dealing with melodic inertia, etc. Therefore, by exploring the nature of musical forces in a piece of music, we would certainly clarify the organisation of the inner musical space, namely, the relations between the points of the space and the type of forces that prevail.

The analytical competences of the adjusted model of the musical space: the case of Iannis Xenakis's *Metastaseis* (1953/4)

The analytical model of the musical space, presented in the previous section of the article, needs to be verified in the musical analysis of the organisation of the musical space. In that sense, I chose a work from the repertoire of European high modernism – Iannis Xenakis's *Metastaseis* (1953/4). This piece represents the paradigm of musical spatiality and the organisation of the musical space in the music after the World War II.

In order to adequately discuss the organisation of the musical space in Xenakis' work, we must outline the segments of the musical form.

Table 1: The musical form of *Metastaseis*[48]

A (1–103)	**B** (104–149)	**C** (150–308)	**A1** (309–345)
a (1–34)		a (150–166)	a (309–333)
b (35–46)		b (167–173)	b (334–345)
c (47–57)		c (174–208)	
d (58–85)		d (209–221)	
e (86–103)		e (222–235)	
		f (235–263)	
		g (264–282)	
		h (282–295)	

[48] Cf: Iannis Xenakis, *Metastaseis,* London, Bowsey and Hawkes, 1967 [full score].

Table 1 represents the traditional analysis of the musical form. On the other hand, James Harley analyses the work by differentiating the techniques used in each segment of the work:[49]

Table 2: The musical form of *Metastaseis* (according to Harley)

A	B	A′	C	C′	D	A (retro)	B′
Massed glissando from unison	Cluster chord	Glissando	Serial	Quasi-serial (development)	Fragmented glissandi (development)	Massed glissando to unison	Sustained unison to end
34	52	18	23	24–28	115	16	13
104 (30%)			98 (28.25%)		115 (33.25%)	29 (8.5%)	

The first segment of the piece (mm. 1–103, Table 1) is an exposition of the entire piece. The main event in this segment is a cluster chord, which appears in m. 34 for the first time. According to Tarasti's classification of musical spaces, this segment can be described as point like space; there are clearly defined musical "lines" (the glissando), which traces the paths from the beginning of the piece to the cluster chord. The starting point is a tone g, which represents the *ex nihilo* point for Xenakis' composing process. The composer is "drawing lines" from the tone g (with the glissandi in all the instruments), which are headed in different directions, thus intensifying the sound volume. The movement of the musical material in this segment of the inner musical space is mainly directed towards the cluster chord in m. 34. The outer musical space is homogenous in the beginning; but, it soon begins to disintegrate and to expand in two directions: to the upper and to the lowest registers. However, the climax of this segment of the musical space is m. 34 – the outer musical space completly opens in all registers, while the inner musical space becomes centred (the movement of all parts is directed toward m. 34).[50]

[49] James Harley, *Xenakis: His Life in Music*, New York–London, Routledge, 2004, 10.

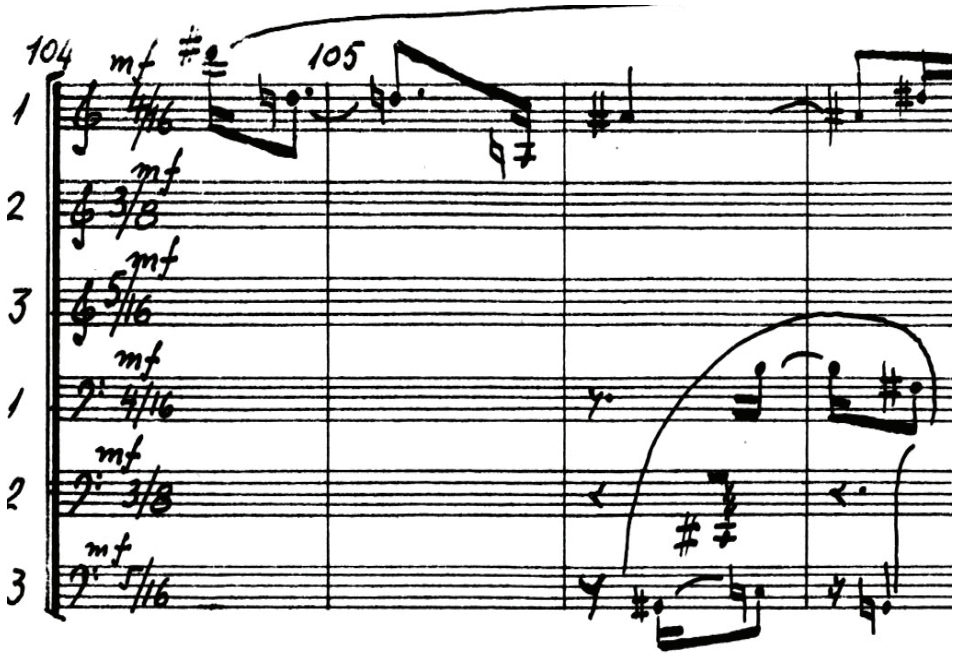
[50] For the explanation of the term "centred", see: Божанић, *Организација музичког простора...*, *op. cit*., 33.

It is interesting to discuss the status of the cluster chord in m. 34, since it is the most salient event in this segment of the musical space. The cluster chord is the result of directed movement of the musical lines (glissandi) in mm. 1–34. In a way, we *expect* the cluster chord to appear, since the musical logic of the piece and the movement within the musical space suggest so. On the other hand, the cluster chord has no structural meaning at all – it is not structured as a chord, there is no intervallic structure in its core, nor is there any logic in the appearance of the tones in the cluster chord. However, we cannot deny its perceptual significance in the context of this segment of the musical space of the piece, since it is expected and, in a way, logicaly prepared. The question is, can we proclaim it as the centre of the inner musical space of this segment of the piece? Considering the fact that the inner musical space contains some sort of pitch organisation, we can hardly claim that the opening segment of the piece possesses any sort of pitch organisation. On the other hand, the movement usually changes to the opposite direction when the music reaches the centre of the inner musical space; but, in this specific case, the movement does not change. The music remains on the cluster chord even when all the parts get to it, thus creating a sort of sound plateau. In that sense, this cluster chord could not be treated as the centre of the inner musical space, but it is surely a most salient and perceptually the strongest point in this segment of the piece.

The greatest intensity of the cluster chord can be felt in mm. 47–55. After that the musical space divides into two layers: a cluster chord forms one layer (it will be repeated in intervals), and the percussions (with the addition of the horn, trumpet and trombone in m. 60) forms the other layer.

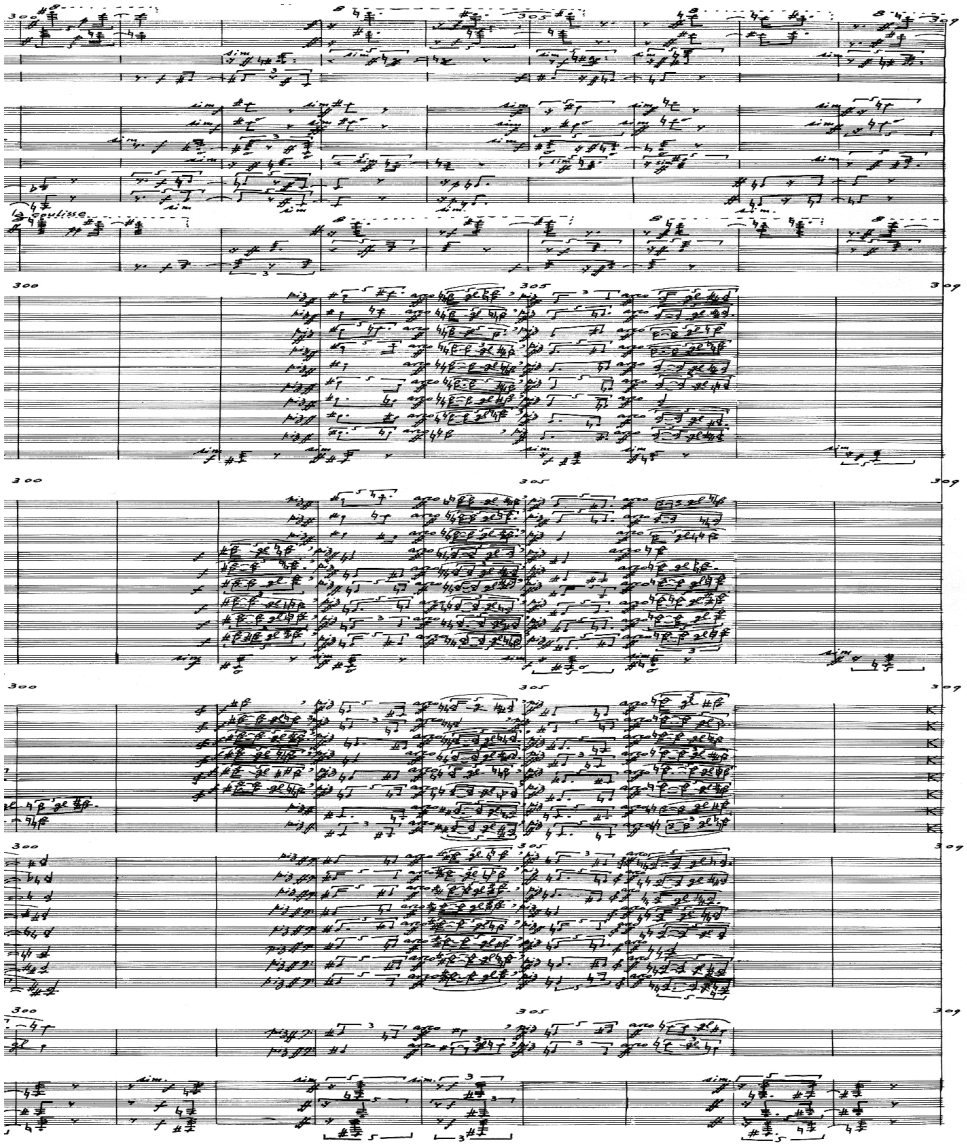
The next segment of the musical space (mm. 104–149, see Ex. 1) could be classified – according to Tarasti – as a transitional musical space. In fact, this segment represents the transition from segment A to segment C. The basic sound material of this segment is a ten-row set, with the d as a starting point. The set is split between the violins (the first four pitches, 0, 1, 7, 8) and the cellos (the rest of the set, 6, 11, 10, 9, 5, 4). The outer musical space is saturated, since every pitch occupies a certain register. However, the inner musical space is centred, because of the ten-row set. Xenakis exposes the twelve transpositions of the original set in succession, leaving out the cellos in the fifth and the last transposition. There is no centre of the inner musical space, since there are not any simultaneous events, or, if there were any, they would be the result of an accidental overlapping of the tones of the set.

Example 1: Iannis Xenakis, *Metastaseis*, mm. 104–109.



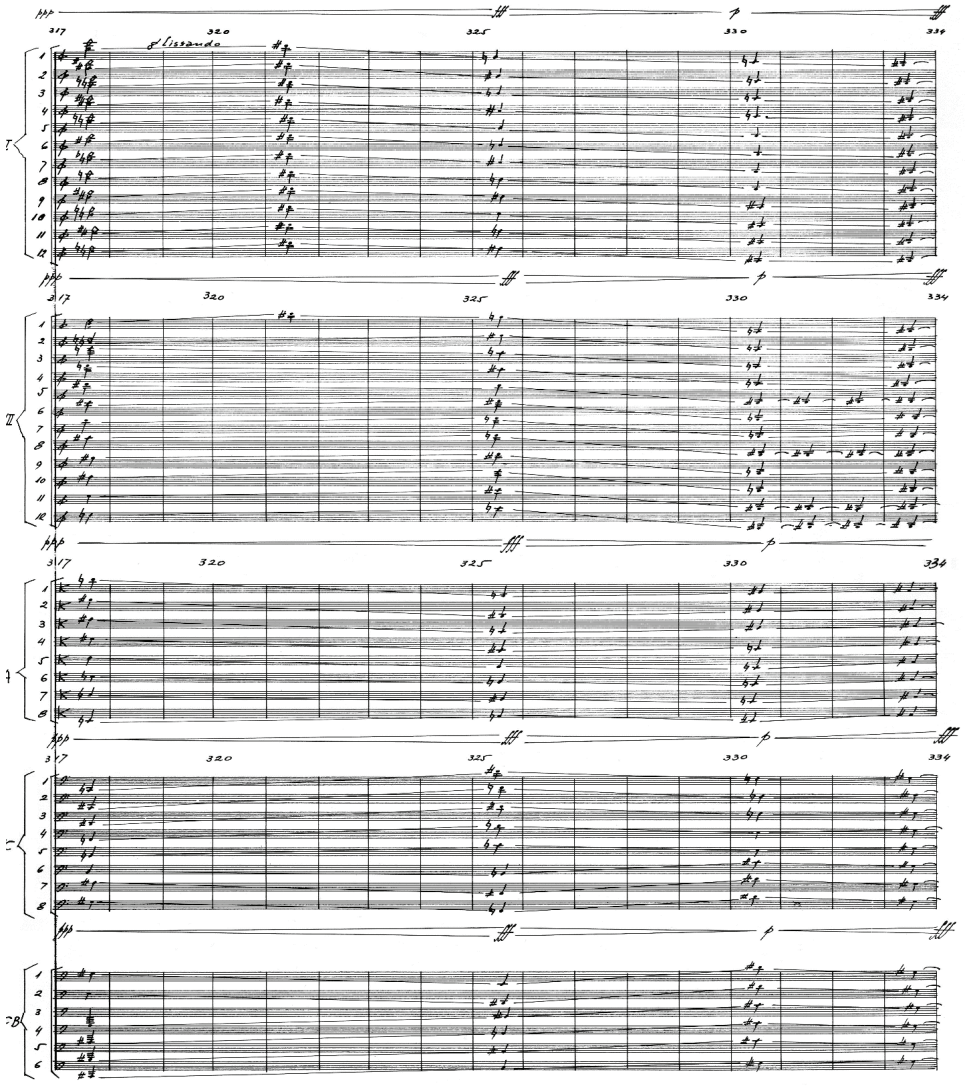
The segment C (mm. 150–308) is developmental in character; it is formed from various microsegments that share a similar motivic nucleus. The inner musical space of this segment is both centred and decentred, while the outer musical space remains wide. Also, there is an intensive linear movement in this segment – all melodic lines move quite independently from each other – and that complicates the identification of the centre/centres of the inner musical space in this segment. There is no one specific nor perceptually salient event (like the cluster chord in the opening segment) which could be structurally important. It can be noticed that the organisation of the musical space in this segment of the piece relies upon some secondary parameters, like dynamics or articulation – we can trace the segmentation of the musical space from m. 202. Xenakis also operates with the density of the musical space, by adding some instrumental groups. The most intense events occur in mm. 264–308 (see Ex. 2). The glissando reappears in this segment of the piece, but with a change in function – it has become the means for the regulation of the dynamics of the musical flow.

Example 2: Iannis Xenakis, *Metastaseis,* mm. 300–308.

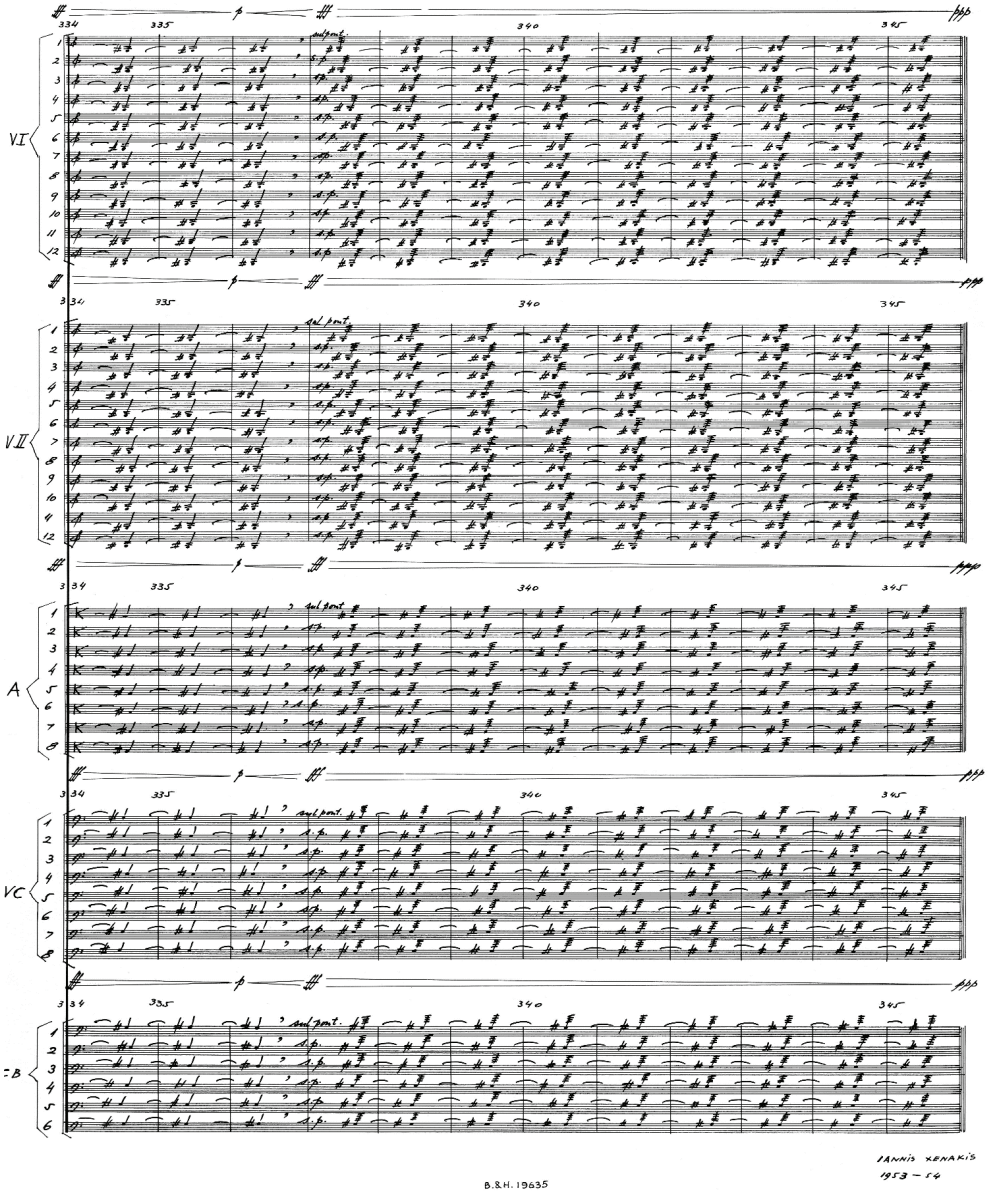


The final segment of the piece, A1 (mm. 309–345, see Ex. 3) represents the inversion of the opening segment: the glissando is directed downwards, until it reaches the tone #g. The other pitches are spread accross the outer musical space, with the tendency of shrinking into the unisono at the end of the piece. There is no centre of the inner musical space, and the musical space can be, overall, classified as point like space.

Example 3: Iannis Xenakis, *Metastaseis*, mm. 317–346.



Example 3, continued.



The conclusion

One of the aims of this article was to discuss the musical space from the musicological and semiotical perspective. As a musicologist, I can say that the musical space represents one of the pillars of the structure of the piece of music itself, which is – I hope – demonstrated by means of the analysis of Iannis Xenakis' *Metastaseis*. However, we can trace the emergence of the musical space accross the 20th century (and even before that time!) – in the outline of the changes and the evolution of the musical language from the beginning of the 20th century up to the 1960s. Through the changes of different musical features and parameters – especially pitch, rhythm, harmony and texture – we could outline the evolution of an awareness of the importance of spatial organisation of sound material and its parameters. More specifically, the composers explored the sound and its organisation with more care and more curiousity than before, which led to the specific organisation of the musical space.

As a (beginner) semiotician, I could argue that the musical space represents one of the basic ways of organising the sound material and creating specific extra-musical values in different segments of the piece of music. In the light of musical semiotics, the musical space is constructed according to the tension that exists between various messages and meanings inscribed in the musical material.

However, the analysis of the musical space does not always seem to be an easy task; especially in the context of the music of the 20th century. Different compositional strategies, and numerous available messages created a complex web of meanings around and in every piece of music. Therefore, the analysis of the musical space needed to be expanded in the domain of the analysis itself; the best way to achieve it was through the prolongation analysis theory. Combining the two seemingly different methodologies – Tarasti's model of the musical space and selected parts of prolongation analysis theory – we could create a unique analytical tool for the analysis of the organisation of the musical space.

The significance of the analysis of the spatial organisation of the sound material is manifold; however, it is yet to be fully explored. In this article, I intended to sketch some basic ideas about one possible way of defining, describing and analyzing the spatial organisation of one specific piece of music.

Translated by the author