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Study of Bartok's Compositions by Focusing on Theories of Lendvai, Karpati and Nettl

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Abstract: *Bela Bartok is one of the most influential composers of the twentieth century whose works have been attended by many theorists. Among the most prominent musical theorists focusing on Bartok's works, Erno Lendvai, Jonas Karpati, Burno Nettl, and Milton Babbitt can be mentioned. These scholars have offered great theories by studying hidden, melodic and harmonic relations, and formal structures in the Bartok's composition. The breadth of Bartok's works, diversity in using pitch organization, and lack of Bartok's personal views on analyzing his works, encouraged theorists to study his work more. The reason for focusing on Bartok in this research can be attributed to his prominent state as a composer in the twentieth century, as well as the way he employs folk melodies as the main component of composing structure. By focusing on tonal aspects, pitch organization, chord relations, and harmonic structures, this study deals with melodic lines and formal principles, and then dissects the theories and indicators in accordance with the mentioned theorists' views.*

Keywords: *Bartok, Axis System, Pole and Counter Pole, Overtone.*

INTRODUCTION

Bartok's musical structure was initially influenced by the folk music of Eastern Europe. However, he has not provided any explanation with regard to his music. John Vinton's paper titled "Bartok in His Own Music" can be considered as the main source of reflection of Bartok's thoughts.

Bartok states that his music is generally made of two main parts:

A. The exact knowledge about using old methods and contemporary Western art (in terms of composition techniques), and
B. The new material discovered from folk music (which he regarded unique in terms of beauty and perfection) (Vinton, 1966, 235).

Motific variations can be found in Bartok's both composing and singing. Using the materials of folk music enables Bartok to expand the range of melodies and to dramatically change the theme character by using any selected mode or scale. When Bartok uses such an expansion, the original form of melody is rarely distinguishable from the modified one. In spite of variety in the melodic structure, Bartok has succeeded to maintain unity toward original root of the theme by making hidden relations in the melodic form. Lack of knowledge on Bartok's personal views on his works has paved the way for their analysis. The most important theories in the study of Bartok's work can be found in the research of Erno Lendvai, Jonas Karpati, Burno Nettl, and Milton Babbitt.

The reason for focusing on Bartok in this research can be attributed to his prominent position as a composer in the twentieth century, as well as the way he employs folk melodies as the main component of composing structure. Persian music is a rich source of folk melodies deserved to be considered as the main essence of compositions. Hence, investigating Bartok's composition techniques with folk melodies can be useful for Iranian composers. The main purpose of this paper is to show the exact order and relations in the interval structure, formal principles, and how Bartok encounters pitch organization through important theorists' view including Erno Lendvai, Jonas Karpati, Burno Nettl. Therefore, Bartok's style, composing method, and the hidden angles in the form and melodic and harmonic relations in his works will be discussed.

The Lendvai's Theory

The Axis System

The axis system is a new substitute for manifesting the functional relationship between notes and chords. By introducing the axis system, Lendvai showed how the chords and tones of the minor third and tritone intervals can act as substitutes for each other tonic alternatives; this function can be seen in many of Bartok's works. The circle of fifths plays an important role in creating the axis system. If each of the three adjacent and sequential notes in the fifth circle, such as F, C, and B notes have tonic, dominant and subdominant roles respectively, and also, if the subdominant, tonic and dominant are applied adjacently and sequentially, the below circle is made:

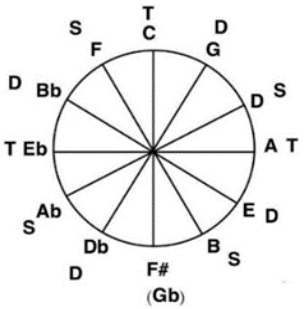


Figure 1. The circle of fifths

When all subdominants, tonics and dominants are connected to each other, the whole circle of fifth is divided into tonic, subdominant and dominant.

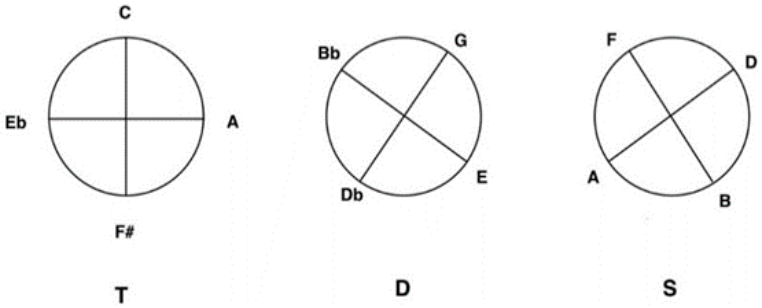


Figure 2. The axis of tonic, subdominant and dominant

Each note in the axis can act as the main tonic of a chord. Lendvai emphasizes that no specific axis should be regarded as the diminished seventh chords, but as a relation of different four-tonality functional, it is so much better to be considered as a major-minor relation in the classic music.

For example, at the end of each axis, the C major, A minor, Eb major, and C minor of opposite notes act as pole and counterpole in contrast to each other. If the tonic axis is based on the C-note, the principle branch contains the axis of the C and F♯ notes, where the C-note is the pole and F♯ is the counterpole. In addition, in the secondary branch, the Eb and A notes have a similar pole and counterpole relation. A pole is always unchangeable and exists along its counterpole without any change in its function (Lendvai, 1971, 4).
Therefore, the keys located with triton interval have close or equal relation, just as they did in the last century's music.
Each axis can be created independently. Lendvai describes this phenomenon with the concept of the keys relationship. The following keys are related to major and minor modes. The keys connected with a line either have the same signature key or are used harmonically.

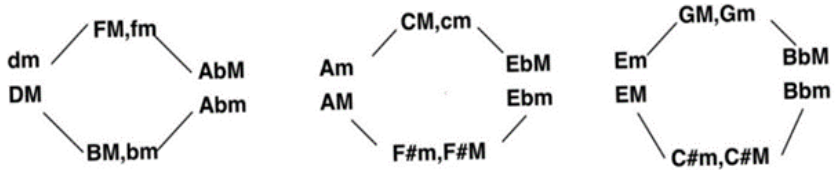


Figure 3. Position of the same-name keys in the Axis system

In Bartok's music, the mode can be a composition of minor and minor chords. Below is a composition of the C major and C minor chords:

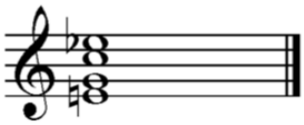


Figure 4. Composition of the C major and C minor chords

Cadence Relations

Lendvai uses overtones to justify his Axis system. All of cadence relations are related to the fundamentals of contrast between the tonics and their overtone. This method easily captures the “functional affinity”" between the produced notes of the E-Bb as well as the G, in the dominant form of C-note, since they are the closest harmonic series.
These overtones constitute a part of the dominate axis. But there is a C♯ note on this axis that can not be easily explained with overtone. In addition, in the traditional notion and approach, there are those who consider the Bb-note as the dominant of C-note (Lendvai, 1971, 11).

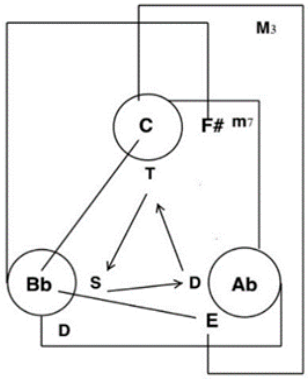


Figure 5. major third and minor seventh as dominants

As already mentioned, the axis system is produced by adding overtones. The role of the leading note in the diatonic scale can determine the pole and counterpole concept. For example, the two leading notes that make the V-to-I cadence, create a duration toward the C, B and F major scales. If the tritone relation of these notes is reversed, the duration will be toward the F♯ note. To make it clearer, the below figure shoe the triton interval in the diatonic scale which can create a duration toward another direction. The first triton is resolved on the (C) pole, while the second one is on the F♯ counterpole. Pole and counterpole are exchangeable. To show the role and function of the F♯ note, still remained as the tonic form, Lendavi states:

"Consider the C-note as the tonic, the fifth movement exactly upward from that note produces the G note. The fifth movement downward from C-note, introduces the F note as the subdominant".

Lendvai believes that the G and F notes show two different functions. But if the movement from the tonic note (C) in another direction, is the movement toward the substitute triton of the perfect fifth, F♯ note will be created in both cases. Lendvai this time claims that there will be no difference in performance, since moving in each of these paths will have the note and, as a result, the function. He pointed out that such a movement is permanent, whether C and F♯ notes are the axial signature keys or considered as the chord tonics. The tritone divides the octave into two parts. Further, the triton interval between the C and F♯ notes will be divided in the minor thirds by the Eb note in the upward direction from the tonic note, as well by the A note in the downward direction from the tonic (C).

Lendvai considers all dual notes in the tonic form. No dual can be made by certain intervals less than the tritone and minor third. The relationship between the first dual of C-F♯ and the second pole relation is the counterpole of the A-Eb which is derived from the second dual.

Given the "twelve-note system" produced by the circle of fifths as well as the three forms of tonic, dominant and subdominant, the axis system is the only system feasible to be made in terms of interval division. Lendvai opined that the axis system has distinguished the twelve-note meaning from the way it was used by Schönberg's.

Schönberg removed tonality and Bartok applied the principles of harmonic thought in a complete composition. However, few individuals agree with Lendvai's description of Schoenberg's techniques. His thinking in terms of Bartok's insistence on his autonomy-based music was alike, even if the twelve-note of the modified scale was used differently in many of his works (Karpati, 1975, 136).

Karpati's theory

Phenomenon of Mistuning

Although this phenomenon means "disturbance" in English, in music it refers to changing the melody or chord structure in term of interval. In other words, phenomenon of mistuning include displacement of a pitch semitone from its initial and standard position in a fixed tonal structure. By using the phenomenon of mistuning, the perfect fourth and fifth intervals can be changed. The chord of the figure. 6, (E, G, C, Eb) is made of the mistuning of the E major triad, since by a downward semitone movement, a downward reverse movement, and a semitone movement, the G♯, B, and E have been turned into the G, C, and Eb notes, respectively.

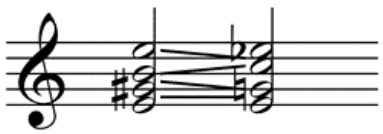


Figure 6. The phenomenon of mistuning in the E major triad

Jonas Karpati points to the importance of tonal principles in Bartok's music and spots it in the poly-tonality base and his personal theory. He knows the tonal principals as a kind of interrelated mistuning.
Before examining these ratios and relations, we need to investigate observations of Karpati's theory. Karpati uses the phrase "Atonality a way to express" to refer to all the meanings based on the equivalent use of the twelve chromatic degrees. He called the Bartok's chromatic system as "the free atonality" (Karpati, 1975, 137). Seemingly, this attitude agrees with Lendvai's theory of how to deal with the twelve chromatic notes within the tonal system, but Karpati believed that there was not only one compositional technique (like application of the Bartok's axis system) compatible with Bartok's music. In fact, he does not agree with Bartok's axis system because it is limited and does not show a valid picture of Bartok's tonal principle.
According to Karpati's theory, the phenomenon of mistuning is a subject imply to Bartok's poly-tonal music (Graves, 1962, 24). When examining Karpati's perspective, the point that matters is that Bartok has rejected the use of poly-tonality. The phenomenon of mistuning occurs when the tone frame of a melody is altered by a different pitch, rhythms, or intervals in the melody. Folklore melodies can be a source of phenomenon of mistuning. A figure provided by Karpati relates to the last "Bartok's First Quartet Movement".

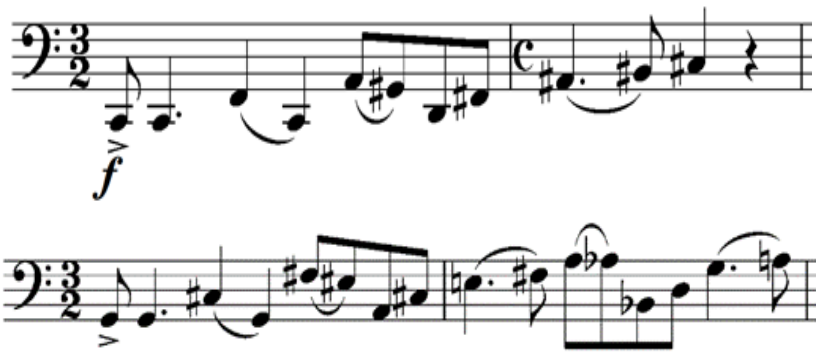


Figure 7. Bartok, opus 7, third movements, 7-8 and 14-15 degrees from Violoncelle part

The second half of the melody goes beyond the framework of the octave and enters the "augmented octave" framework. As shown in the first line of the figure, the second time the melody appears, the second line in the figure, shows the subsequent changes, which include the change of the first intervals from the perfect fourth to the augmented fourth. (Also, the melody is transmitted to one fifth higher and changed the same way).
The five-octave framework is another common method in phenomenon of mistuning which can be found in the main theme in the first movement of the fifth quartet.

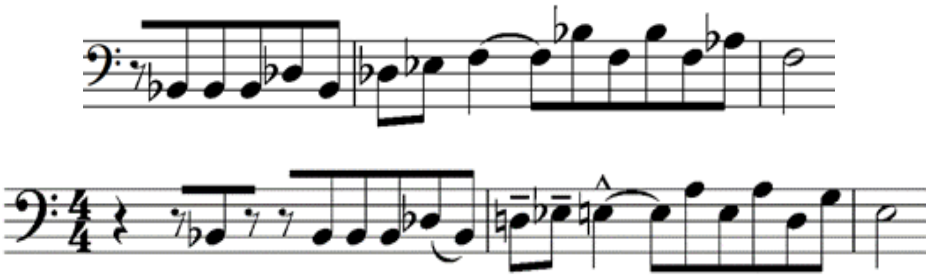


Figure 8. Bela Bartok, opus 102, the first movement, 4-6 degrees from the Violoncelle part

In the second half of the melody, the semitone have been transmitted towards down to reach the theme.
Karpati quotes other figures to support his theory:

"It can be said that in the structure of Bartok's composing, there is clear tendency towards the phenomenon of mistuning in the full octave and the fifth intervals in the melodic framework, which is made by merging or expanding (melodic increase or decrease)" (Karpati, 1975, 147-148)
Applying the phenomenon of mistuning, especially when all parts of the melodic lines have been transmitted, will contribute to the creation of the poly-tonality concept. Nevertheless, if we respect Bartok's view, where the ears still assess a singular tonal center, more accurately we can describe the result of the phenomenon of mistuning as poly-modality. Briefly, poly-tonality includes more than one tonal center while poly-modality uses several medal changes but with one tonal center.

Nettl's Theory

Tonal center

Burno Nettl introduced the ethnomusicologic approach by discussing the tonal center in his book "Theory and Method in Ethnomusicology". Nettl mentions seven criteria related to the tonal center and formation of tonal hierarchy in music material. He says:
"The assessment criterion is the repeated occurrence of a note, and it is the most thing sears understand as the base. Using it as a point of reference gives it a special significance. The length and size of a note duration is often associated with its repetition and sequential onset. To achieve this criterion, the note has to be more prominent in terms of agogic compered to its surrounding notes (Nettl, 1964, 147).
What deserves a note to become a tonic is its position at the beginning and the end of an ascent. A related subject is the creation of a note at the bottom or center of the scale. If the note is used repeatedly, transmitted in more than one octave, or if the fifth lower note is used, it can be converted to the tonal center. Finally, the rhythmic emphasis and placement of irregular patterns per meter may help to establish the tonal center. It may be that all of these criteria do not coincide when specifying a tonal center.
The attitudes of Lendvai, Karpati and Nettle is a typical illustration of dealing with Bartok's tonal principles. On the other hand, as shown in the previous analysis, the best use of the Lendvai's axis system is in selecting the tonal center. The view of Karpati is more about thinking in his nature. No one can definitely claim that Bartok first imagined a melody and then changed it. Bartok could directly use the phenomenon of mistuning technique. One can not expect the ears to compare the final melody produced by the phenomenon of mistuning with something that has never been heard before. In other words, the ear can not immediately detect whether it has heard a tritone or the fourth/fifth phenomenon of mistuning. Of course, it is possible to apply Nettel's attitude toward the tonal center without interfering with those of the other two, and also to adapt it to other existing perspectives.

Formal Principles

Palindromic Form

Palindromic form is a kind of form in which referring to the main structure from both sides will have the same result. For example, the ABCBA form will be ABC on both sides. Bartok has exerted palindromic form extensively. In addition to form, this symmetry is also presented in composition structure of other composers. In the following figure, this kind of symmetry is noted in a part of the "Lulu" opera by Alban Berg.

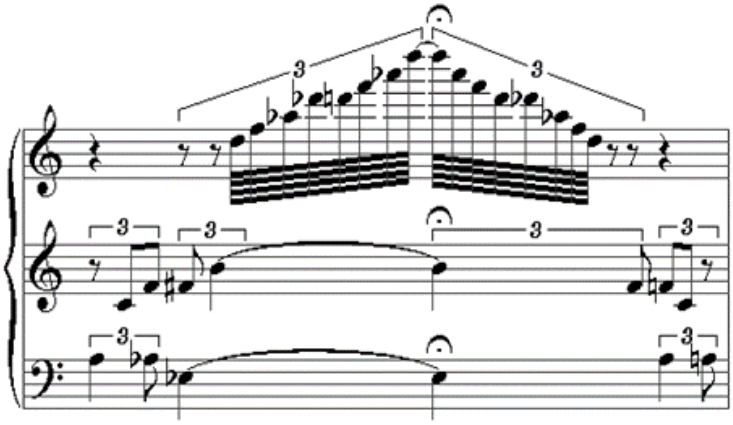


Figure 9. Motific symmetry, Lulu opera, Alban Berg

The formal structure in Bartok's music is often traditional and includes the classical form, although he sometimes insert innovations. He has briefly explained the structure of his music. The general view of Bartok's formal approach can be found in the "Grove Dictionary". After consolidation and continuation of 'ABa'b in the third quartet form, Bartok presents an attractive unexpected structure which is clearly organized. What he found in symmetry determines the classical symmetry of the fourth and fifth quartets. The structure of the symmetric form of 'ABCB'A is where the fourth and fifth sections are not just the second and first variations, but have produced them with the utmost aesthetics. Milton Babbitt calls the palindromic form as the "arch form" and tries to classify one of the two formal techniques in Bartok's music.

From Babbitt's point of view: "The development of Bartok's theme is not limited to one movement region. In all Bartok's quartets, thematic relations occur among the movements" (Babbitt, 1949, 384).

The purpose of the monothematic technique is to create a peak-point structure by gradually evolving the theme at different stages and increasing the degree of significance from one movement to another. The gradual development of the theme has been complemented by extending or compressing its length, or harmonically, through the development of a complex counterpoint structure. Karpati states that monothematicism is a technique that exists in almost all Bartok's music structures. Karpati's comment on this subject is directly in line with Bartok's quotation:

"Note that I greatly emphasize on technical development in my work and I do not like to repeat exactly the same musical thoughts, and I will not go back to the details, as before. This is the results of my tendency toward variation and changing the shape of the themes" (Karpati, 1975, 97).

This statement by Bartok shows the technical essence of his compositions. Bartok's monothematic technique is not a simple variation. His thematic transformation often leads to the creation of an indistinguishable theme that is completely different from the original one (Stevens, 1967, 22). Monothematic or symmetrical techniques of motifs are found throughout the formal structure of a piece. Lendvai's approach to formal principles is much more prominent than that of Karpati and Babbitt, and apparently contrasts with the symmetric monothematic approach. Still, the Lendvai's approach is based on the thematic and natural growth of musical instruments, and it can contain monothematicism which has given rise to a certain symmetry.

Principles of Golden Sections in Form

Lendvai has used the principles of golden sections to express the formal structure of Bartok's works. The Bartok method in the form and harmony structure is closely related to these principles. This figure is a formal element that exist at least as an important part in the works of Bartok 4 + 2, 4 + 2, bras of periods or harmonic series in Vienna's first school. This is how Lendvai explains the golden sections:

"The golden sections mean that interval divisions are made in a way that the full length of the section, in relation to the larger part be related to the larger part in relation to the smaller one" (Lendvai, 1971, 18).

This is shown in the following figure:

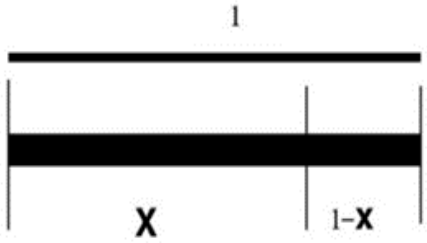


Figure 10. Schematic picture of relations in golden sections

This part is presented by $\frac{1}{x} = \frac{x}{1-x}$. Here, the value of x can easily be obtained by solving this quadratic x=0.618
To calculate the golden section, the total amount of bars is multiplied in 0.618. If we are faced with variable meters, then we should use the total of multiplications instead of bars. It is important to reach the peak point here or another result will obtained.
Golden sections have been emerged approximately, and the themes or bars have a symmetrical structure. One exception is the first movement of music fugue for "chordophones, percussion, and celesta", where meters are variable, but the numbers of bars are calculated by the golden sections in which they harmonize with the peak point. The golden sections can be used symmetrically.
Bartok was interested in using the reversed golden sections which create such a composition: where the negative sections interconnect (conjunction) and the negative sections coincide (junction) "(Lendvai, 1971, 18).

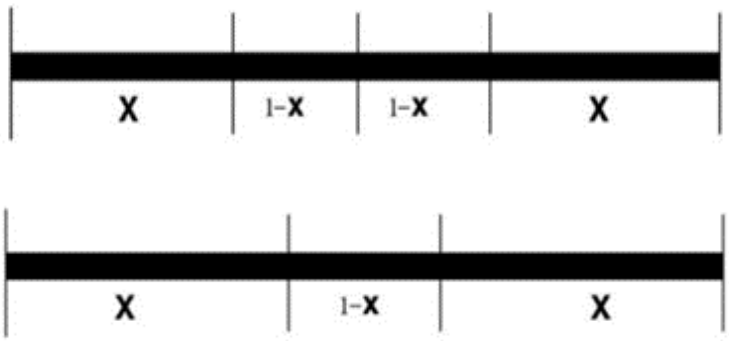


Figure 11. Using symmetric parts

The golden sections have been used symmetrically (conjunction in the first, and junction in the second figure). Even overlying of the golden section on itself can make a new form, as shown below:

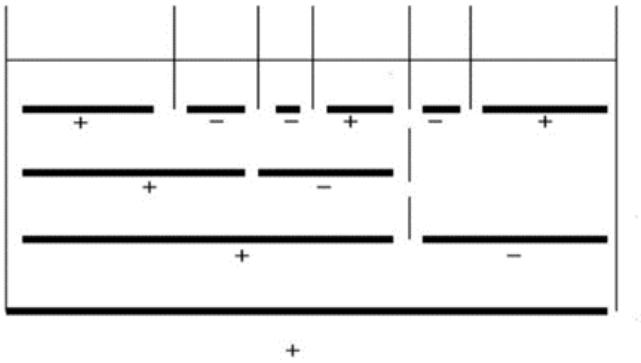


Figure 12. Overlying of the golden sections parts

At each point of the golden sections, some tonal necessities, like tonal center changes, can be seen. Given to Lendvai, this is the case that was precisely occurred in the introduction of 2-17 bars of "sonata for the piano and percussion" in Bartok's first movement. Arrangements of positive and negative sections indicated by the tonal axis in each large section are shown below:

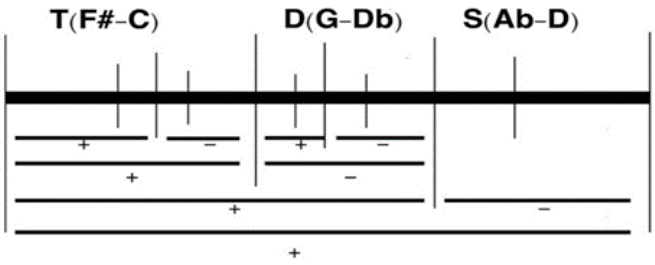


Figure 13. Formal analysis of sonata for the piano and percussion, bars 2- 17, with the tonic axis system

Monothematicism, symmetry and golden sections play a significant role in understanding the principles of formalism in Bartok's works, although Bartok has never mentioned applying of golden sections. Lendvai's theory has greatly contributed to the recognition of various aspects of Bartok's music, both in form and in particularly harmony.

Principles of golden sections in pitch organization

The chromatic based on an octave and 12-semitone species refers to the contrast with the 7-note diatonic scale. The chromatic scale consists of upward and downward lines that move in semitone. The diatonic scale is made of five semitones and five whole tones. Minor and major scales as well as the church modes are diatonic scales separated by two augmented semitones. Another interpretation of the augmented separation is when the diatonic scale is incomplete in the circle of fifths:

Notes of (F, C, G, D, A, E, B), where the F-B note have the most interval in the triton interval. Lendvai applyies the axis system, derived from both chromatic and diatonic harmonies and used in Bartok's music, to interpret this subject. He obtains a range of tonal axes, but for explaining Bartok's chromatic harmony select only those able to be expressed by the Fibonacci series.

In order to define the diatonic harmony, he arranged the intervals based on the overtone. The Fibonacci series is closely related to the golden sections. In fact, the Fibonacci series is a sequence of numbers in which each member equals to the sum of the two previous members. These series also exist in the nature: the arrangement

of sunflower seeds and the repetitive pattern of leaves in many plants all reflect the Fibonacci series. For example, a sunflower has 34 petals, and each of its spiral section contains 21, 34, and ext. petals. The Fibonacci series is related to the golden section (the gold section of 55 equals to 34 which is the minus of 55 out of 89).
Lendvai presented the below table based on the numbers, intervals and their relation. Each number of the Fibonacci series is the representative of the semitones that make up the intervals. Secondary intervals or chords formation take place only by these Fibonacci numbers. For example, 5 can be divided into only 3, 2, and not 4 and 1. In the interval terms, the perfect fourth can be divided into major second and minor third. To make this system, Lendvai has used several features that exist among simple ratios between intervals and the Fibonacci series.

Table 1: The Fibonacci intervals

Intervals	Fibonacci numbers (number of semitone intervals)
minor second	1
major second	2
minor third	3
perfect fourth	5
small sixth	8
augmented octave	13

One of the Bartok's used chords that Lendvai referred to as the minor-major chord in the chromaticism style:

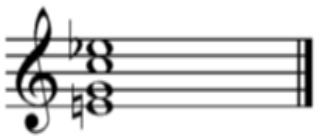


Table 2. The intervals in terms of the Fibonacci numbers

Number of notes	Intervals
E-G	3
G-C	5
C-Eb	3
E-C	8

Chord structure

Major-minor chords resulted in the formation of a chord represented by the letter (E). The structure of these chords does not include the intervals of overtone, fifths, major third and minor seventh.
The chord (E) is made up of two diminished seventh chords, which represent the composition of the tonic and dominant axes. In this case, the tonic and dominant axes as the "C" and "G", respectively. The chord of the perfect C (E) contains these two axes together (Lendvai, 1971, 42).

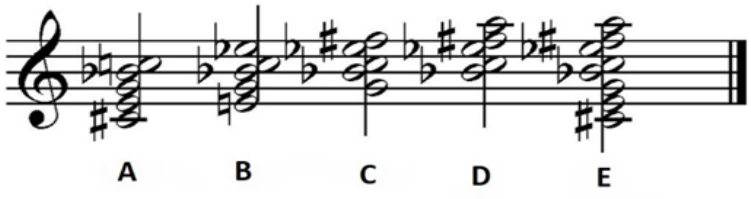


Figure 14. Chords (E) with the tonic note of C

Below are some figures of the Bartok's music in which the chords are based on the golden sections, and Lendvai calls it the Bartok's chromatic style.

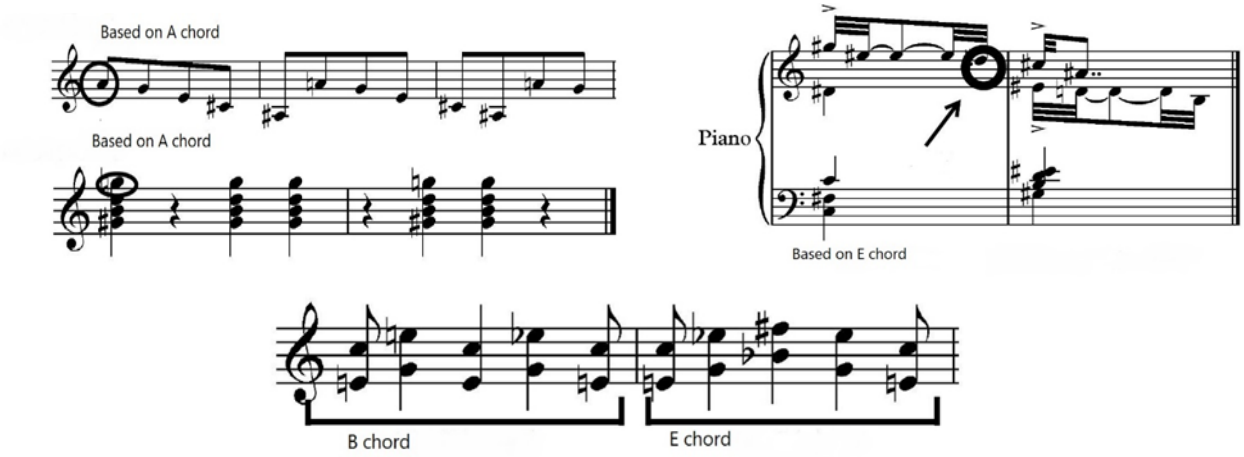


Figure 15. Structure of the chord (E) in Bartok's music

Scales can also be based on the golden sections, including the pentatonic which Bartok frequently combined it with the Hungarian folk music.

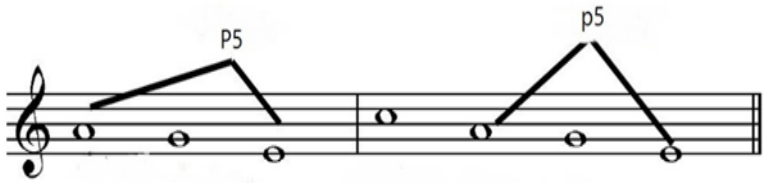


Figure 16. Structure of the pentatonic scale and representation of the golden sections

The pentatonic scale structure, like all interval structures of the golden sections, is not derived from the overtone and Lendvai interprets it in the Bartok's chromatic style. The significance of this structure is apparent when Lendvai analyzes the Bartok's diatonic style. There are other structures that Lendvai introduces them in terms of models, possible to be placed in the chromatic system. He presented three models related to the sections 1: 5, 1: 3, 1: 2. Significantly, the 1: 5 model is made of the minor seconds and perfect fourths, like C, C♯, F♯, G, C, … The 1:3 model, and 1:2 model are made of the minor seconds and thirds, and alternate of the minor and major second, respectively.

Alternate of minor seconds and thirds constitutes the 1:3 model, while the 1:2 model is made of alternate of the minor and major second. Lendvai greatly emphasizes the 1:2 model and calls it "the basic scale" in the Bartok's chromatic system. He also manifests relations among the three aspects of the chromatic system (Lendvai, 1971, 55-56).

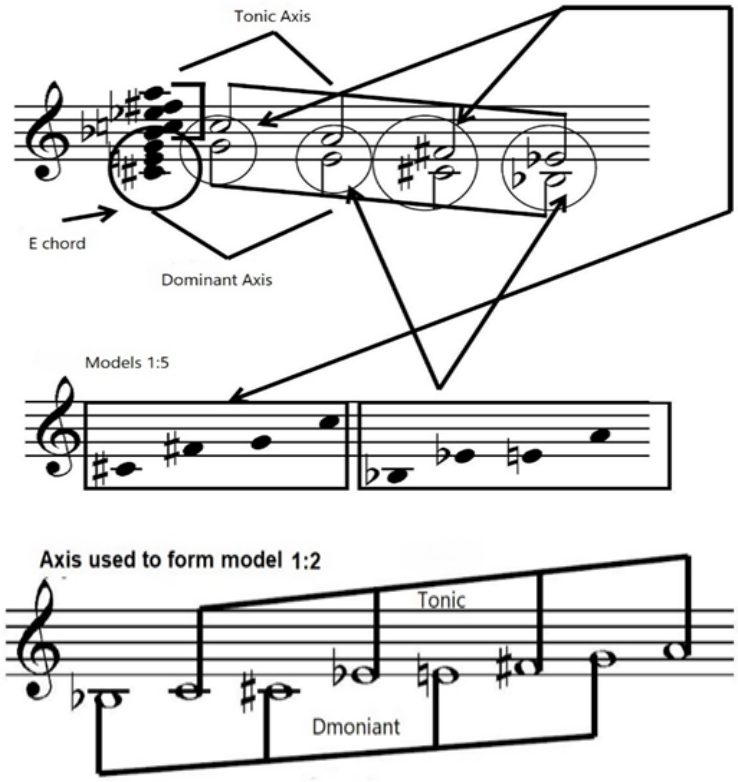


Figure 17. Relations among the axis system, chord (E) and 1:2 and 1:5 models

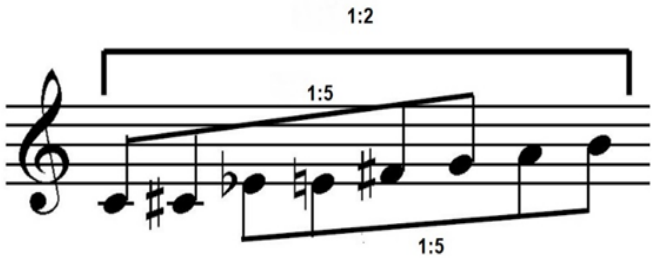


Figure 18. Transitions in the 1:5 model used to form the 1:2 model

If the above layers are the C, A, F♯, Eb, and the below layers are G, C, C♯ and Bb notes, and then overlay the, the chord (v) is formed. If we separate the related pole and counterpole, the 1:5 mole, and if the axis notes are combined, the 1:2 model will be produced.

Chords with equal intervals

The last type of structure that Lendvai placed in the chromatic system was chords with equal intervals. At least those introduced by Lendvai are based on golden sections. The Augmented triad, which is shown in two successive intervals of the minor sixths, (including six semitones) is used to examine the quality of intervals

with the golden sections structures, from the major thirds (including 4 semitones), which is outside the Fibonacci series. Then Bartok discussed about the characteristics of the chromatic technique, and Lendvai used another structure, the overtones, to express the diatonic technique of Bartok (Lendvai, 1971, 62).

Table 3. Structure of chords with equal intervals

Interval organization (semitone)	structure
2+2+2+2+2+2	whole-tone chords
3+3+3+3	diminished seventh chords
5+5+5+5+…	chords with fourth intervals
8+8	augmented triads

Overtone and Diatonic Harmony

Lendvai uses the overtone to express the Bartok's diatonic harmony. The overtone or acoustic scale is a prominent feature of the Bartok's diatonic system. Lendvai states that the acoustic scale is derived from the overtone. Repetitive "diminished pitch class" is the first eleven-note section in the overtone which includes seven unique singular pitch classes.

Figure 19 illustrates the overtone on the C-note, and identifies the relationship and similarity between scale degrees and their position in the series (Searle, 1954, 34).

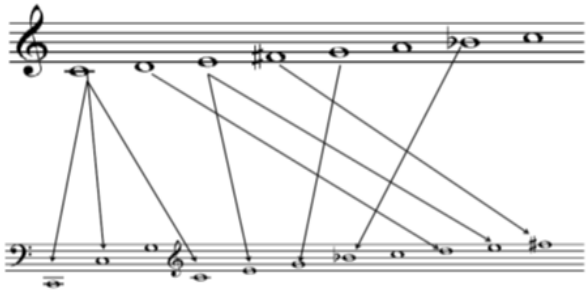
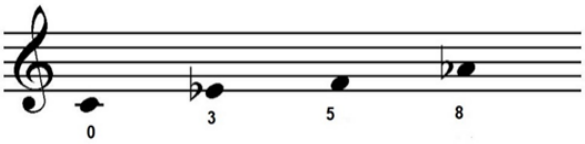


Figure 19. Scale of the overtone and the overtone of C-note

Lendvai has given a new significance to the diatonic word, and it should be remembered that: "quality of the acoustic scale is not like those of the minor and major scales or even the church modes". Bardos, the Hungarian theorist, uses the term "second diatony" to describe the acoustic scale in its form and structure (Hawthorne, 1949, 277). Different transitions and derivatives of scale, as Bardos entitles, is associated with the main characteristics of Hungarian and Arab folk music. Karpati also agrees with him. Additionally, Bartok combined tetrachords extracted from different modes and used them as new melodic patterns and scales. Sometimes such structures do not coincide with the first and second diatony (Bartok. 1931, 16). It is also interesting to compare the typical chromatic scale divided into the golden sections scale and acoustic scale based on the Fibonacci numbers.



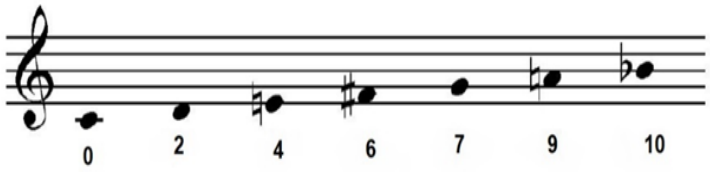


Figure 20: Dividing the chromatic scale into the golden sections and overtone sections

The sequence of Fibonacci numbers allocated to intervals is related to the overtone. When these intervals are removed from the normal chromatic scale, whole notes of the acoustic scale remained. Keep in mind that Lendvai does not include the C♯-note in the golden sections scale, while even the number one is a Fibonacci one. Moreover, he did not express the B-note, maybe due to intending it as a tangible note. Lendvai believed that the both notes (C♯ and B) require a chromatic interpretation, but he does not elaborate more. He also states that "the chromatic and diatonic system are reflections of each other in the opposite way" (Lendvai, 1971, 62). The Fibonacci intervals are inverse in relation to the chromatic harmony (figure 21) and the diatonic intervals include the minor third, perfect fifth, and minor seventh. These diatonic intervals are in fact the distinctive feature of the low sections in the overtone. Lendvai has not categorized the triton interval as chromatic or diatonic. He tried to show how these scales act in a mutual reverse order. If intervals of the acoustic scale are reversed from the beginning note, a new scale is created which Lendvai refers to as the golden sections scale. However, the scale of the golden sections or the Fibonacci intervals present the triton interval as the minor seven-ninth This scale refers to the "octatonic scale", since its unique feature is the diminished fifth.

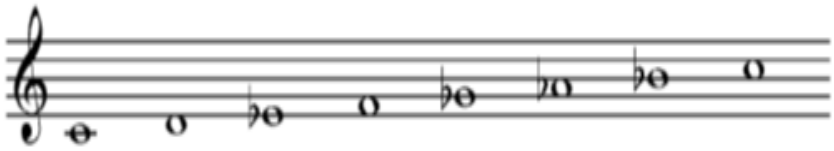


Figure 21. Diminished scale

Lendvai argues that the triads in the tonic position are diatonic since they include the major third and perfect fifth which are related in terms of the tonic relationship. The triads in the first reverse are chromatic because they are made of the Fibonacci intervals (minor third, perfect fourth and minor sixth). Of course, the tonic position of the triad is also the minor third, but in relation to the tonic. A similar composition of intervals from the Fibonacci and diatonic occurs when the chord seventh (C, E, G, Bb) is in the state of the first reverse. Lendvai uses this similarity (E, G, Bb, C) for comparing chromatic and diatonic systems. He consider the diatonic and chromatic harmonies as consonant and dissonant, respectively. The twelve chromatic notes organized in the overtone are naturally unlimited and their diatonic system is free. The diatonic system has a tonic, and the chromatic system has a central note. The harmony of diatonic is statistic while that of the chromatic is dynamic. The chromatic system is closed and like a circle, but the diatonic system is open and like a straight line (Karpati, 1975, 126).

Poly-modal Chromaticism

Bartok has applied the pol-modality method in his works which its simplest figure is the simultaneous use of major and minor mode. Bartok achieved the poly-modal chromaticism in a further step. He describes this method as follows:

"Overlying of the Lydian and Phrygian mode with a common tonic and note (e.g., the Lydian F and Phrygian F) in which the sharp and bemolle will not be a cross sign and are derived from the diatonic factors from the diatonic modal scale. This technique can be made of both of the diatonic modes".

(Vinton, 1996, 239).
Vinton explains the way Bartok uses a harmony:
"Using the minor seventh as the consonant interval, making the chord by the fourths as well as the tritone interval of the minor seventh idea applied as the consonant interval, is derived from the pentatonic scale" (Vinton, 1966, 239).
In folk melodies with this scale (the third, fifth and seventh have the same importance), resolves of the seventh to the sixth is not feasible sine the sixth degree is absent (Chittum, 1970, 135). Sequential fourth jumps in these melodies terminates in making the quartal chords including two or more perfect fourth intervals. Composition of the tritone interval with the perfect fourth makes chords like F♯, C♯ and G. Modality is not limited to the church modes, since the intervals can be placed among the octave differently. Bartok benefited from this wide concept to expand minor-major tonality sources. As a simple diatonic mode, this composer observed composition of intervals of special scales that many of them included augmented seconds, and diminished and augmented fifth(Vauclain, 1981, 52). The acoustic scale is one of these. In Karpati's view, the acoustic scale is a composition of the lowest tetrachord of the Lydian mode and the second tetrachord of Mixolydian. To enforce the tonal frame, Bartok created the heptatonic scale by changing the notes of the perfect fifth which sometimes lacked the octave. These scales with augmented lead notes are similar to twelve-note chromaticism. This modal colorful composition is not always made by augmenting a lead note. In a simple definition, poly-modality have several different modes simultaneously. The exact difference between poly-modal chromaticism and chromticism with change is shown in the figure blow (Karpati, 1975, 126).

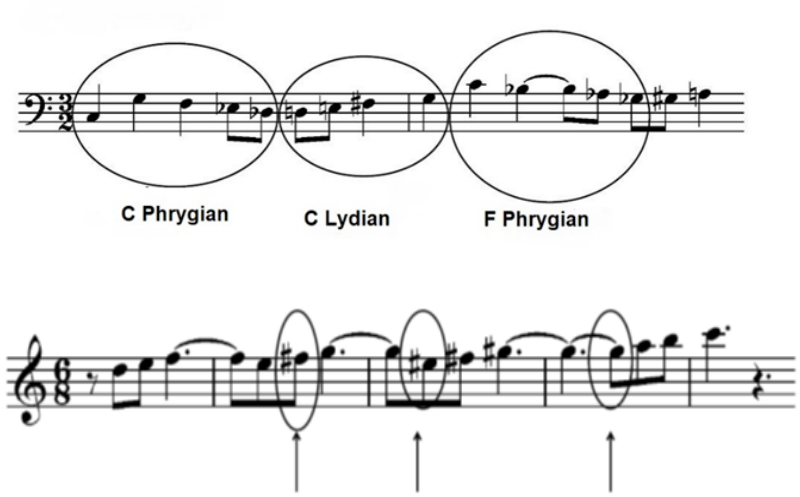


Figure 22. Bartok, Cantata Profana, the second movement, measures 103-104 from Bariton Solo-first movement, measures 5-9 from the 1st flute part

In the Lendvai's chromatic system, there are good figures of using the twelve notes that create chromaticism, especially those that are sometimes present in the melodic structure and pattern. In order to better understand and expand the diatonic sources that tend to chromaticism, the poly-modal chromatic technique used by Bartok represents the composition of chromatic and diatonic thinking. The diatonic interpretation that Bartok offers of poly-modality is in fact the cellular use of various modes. Karpati opined:
"The poly-modality phenomenon is justified when the melodies are interconnected, or at least, the melodic cells individually represent their own modes" (Karpati, 1975, 136).
Karpati discusses about two aspects of poly-modal chromaticism: overlying of the major and minor modes, as well as the bimodality, which is the output of mirror symmetry. Karpati elaborates on his expression based on the "major-minor bimodality" on Lendvai's 1:3 model. The 1:3 model is made of the notes borrowed from the major and minor scales. This model is illustrated in the figure below:

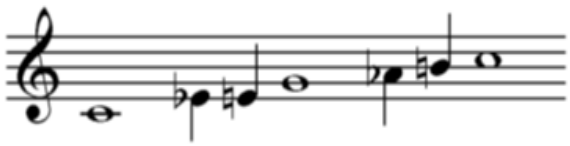


Figure 23. 1:3 Model on the C-note, composition of major-minor modal

Common notes in both major and minor scales have been shown by white notes. The upward and downward arrow represent those derived from the major, and minor mode, respectively. Given to Karpati, the 1:3 model is the most complete composition of minor and major modes. Another form of bimodality has a mirror symmetry and is created when the reverse and symmetrical scales have preserved the joint note. The acoustic scale and its reverses are a joint example of the mirror symmetry. Its reverse creates the down warding diminished scale by the joint signature key. Formation process of mirror symmetry can be found in other forms of poly-modal compositions.

Result

Tonal organization in Bartok's works is the result of his diligence to the creative use of old modes such as pentatonic (rooted in folk melodies), and combining tetrachords to achieve new scales. He gradually developed his musical language richer by combining various modes. Simultaneous use of major and minor modes is a simple example of this trend, while applying mirror symmetrical modes is a more evolved form.

In this study, the poly-modal chromaticism method as an evolved and complex interval forms of organization was studied in Bartok's works. The aforementioned laws and theories of Erno Lendvai, Jonas Karpati and Burno Nettl can shed light on the study of Bartok's works.

The Lendvai's axis system is flexible and can be used to express relations including the tonal center change between the tonal areas in a part of melody or in a whole movement. Also, using the Fibonacci series is useful for describing many scales, harmonic relations and the formal sections in Bartok's works. The phenomenon of mistuning, proposed by Karpati, provides a right solution for examining variation, expansion, and use of folk melodies. The techniques applied in Bartok's works can be a valuable inspiring source for composers to deal with folk melodies.

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