

SYMMETRY: ART AND SCIENCE

POSSIBILITIES OF SYMMETRY IN MUSIC

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Abstract: How to explore symmetry in music? What is the use of uncovering such connections in it? Does it facilitate a better understanding of a piece of music? In order to give answers to such and similar questions, we have to approach the main idea from a bit farther.

How can arts be classified? As it is known, branches of art are defined by the manner of elaboration or representation of their respective subjects, and not by the subjects themselves.

Let me quote at this point an illuminating insight that Lessing contributed to the literature of aesthetics. He chose a topic for his investigations that can be found both in sculpture and poetry. In his study 'Laocoon' he discussed the Hellenistic sculptural group and a passage from Virgil's Aeneis depicting the same scene. He found the rationale for his comparison in 'simultaneity and continuity', thereby suggesting that the ultimate classification by 'time and space' is superficial: it is not true that arts of space represent the abstract spatial reality and temporal arts represent the abstract temporal reality, but both aspire to represent the totality of one and the same reality through their respective means.

Let us see two extreme examples! The prototype of the so called spatial arts is architecture. Its works materialize in space, all the details being perceptible at the same

time. Yet the observer needs time to walk around it and get to know all the sides of the construction thoroughly. The other extreme - to return to our subject - is music which unfolds in time. But it is easy to see that the category of space is severally important in the production of music.

In everyday life sound is synonymous with its source. The convention was inherited by music, e.g. when a faraway sound is to be evoked on the operatic stage, special effects are used suggesting distance and such effects are applied in instrumental music as well. Just think of the so called 'behind the scenes' instruction or 'lontano' which produces a similar effect. The immediate quiet repetition of a loud sound gives the impression of an 'echo'.

Another meaning of musical space is the space where music is actually produced. Think of the various positions that the different groups of strings can take on the concert stage or of special effects marked in the score (e.g. brass instruments placed behind the audience for the expansion of the sound space).

But: pitch itself suggests a sense or image of space. We differentiate 'high' and 'low' registers. It is of etymological interest that in some languages tones of different vibration frequency are distinguished by other than space-related concepts, but whatever their names, the pairs of opposites produce the same effect. The opposite of 'high and low' has a similar meaning to 'rough and tender', 'heavy and light', or 'thick and thin'. They suggest associations with the tactile sense which also implies the concept of space, though less directly. Visual images can also be associated with pairs of contrasting sounds, e.g. 'dark and light'.

Despite the temporal flow of music, its sounding obviously takes place in a virtual space. (In fact, this duality is symbolised by traditional musical notation in that time is measured in the sequence of rhythm values along the horizontal axis of the imaginary system of coordinates, while differences in the vibration of various pitches - their height - are expressed along the vertical axis.)

This 'spatiality' of music encourages the scholar to search for phenomena (e.g. symmetry relations) which typically occur in spatial arts and reveal essential and regular connections for scientific investigations highlighting phenomena of space.

Symmetric formations can be discerned both in classical and contemporary musical compositions in all the components of music. We can thus study symmetry in the construction of form, in harmony and melody.

Being Hungarian, I am proud to mention the epoch-making researches of Ernő Lendvai in international musicology. At the outset of his career he founded in Bartók's music implications already manifest in the written score, which he developed into an ever more complete system over the decades.

His endeavours are known all over the world through his foreign language publications. (Refer to a selection of his typical titles). What confirms that Lendvai's theory constitutes a system is that he always takes the inspiration from the sounding music, from its repetitive-recurrent patterns, which lend objective-practical foundations for his research results. The true significance of his theory, however, lies in the wide scope of its validity: it turned out, that the connections discovered in certain works have been taking part in earlier compositions as well; the conclusions drawn from 20th century works may lend a key to understanding certain phenomena of earlier ages, e.g. that of the Romanticism, which the traditional study of harmony failed to explain objectively.

Let me mention one more thing that supports the singularity of Lendvai's analyses and investigations: he always starts out from the sounding material and the connections he reveals can always be heard; at the same time, he never remains stuck at the formal level of abstraction: the question 'why' is always implicit in his examinations and he can always find the answers. (Why did the composer choose a certain form, why did he use a characteristic harmonic turn, etc.). Answering these questions gives real authenticity to his research: Lendvai never rests content with formal registration but connects it to semantic explanations.

Armed with the knowledge of the connections he has exposed, one can compose formally perfect works that comply with certain laws of proportions, but lacking an adequate charge of meaning, they can hardly carry any artistic value. Likewise, one can analyze a work according to the guidelines he gives, but leaving its meaning, its thought content, out of consideration, one merely 'encodes' the existing connections with new tools. (That is exactly why the analyses of e.g. Elliott Antokoletz, the American Bartók researcher, have little to convey despite their meticulousness. After perusing them one is prompted to conclude that his thorough knowledge of the Bartók works is inspiring and his grasp of the entire oeuvre is impressive, yet a reading of his analyses hardly deepens our knowledge of the works, or to be more exact, one will hardly be more receptive to the Bartók works after reading his analyses.)

Let me get you acquainted with some of Ernő Lendvai's research findings as to the symmetry relations in some Bartók compositions.

Symmetry of the overall form comes into being in 'time': any simple tripartite form with recapitulation is symmetrical, just think of simple dance movements with trios each of whose sections comprises one musical idea (e.g. a minuet of A-B-A construction). The bigger the repeated formal segment and the fewer kinds of material are used for the building of the movement, the easier one can comprehend the form. Extending the A-B-A form we get structures like A-B-C-B-A or A-B-C-D-C-B-A. These are called 'bridge' forms.

In the chapter 'Bartók's Conception of Form' of his book 'The Workshop of Bartók and Kodály', Ernő Lendvai makes the following remark, among other things, about the bridge-form:

"Bartók is, in fact, a dramatic temperament like all creative geniuses in whose character the bents for logic and heroism are united. The form in which this conception, e.g.

- 1 the structural unity,
- 2 the counterposing of characters, and
- 3 the principle of dramatic metamorphosis

materializes is known as the bridge form. This is how Bartók himself named the structure of his mature works on the basis of the symmetrical arrangement of the movements and the themes within them. The five movements of the Fifth Quartet, for example, 'rhyme' with each other as follows: A-B-C-B-A. That is, the outer movements (the first and fifth) on the one hand, and movements II and IV on the other, rest on common thematic material.

But symmetry is merely an external feature of the bridge form. The clue to its content is perhaps best offered by the tale of the *Cantata Profana*. The nine sons pursuing the miraculous stag step onto the bridge, and become stags: they change their form of life. Metamorphosis comes about.

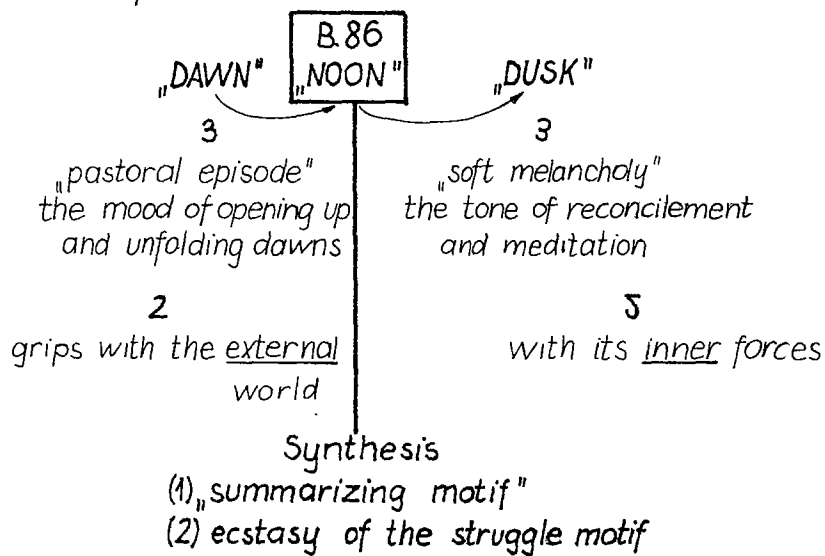
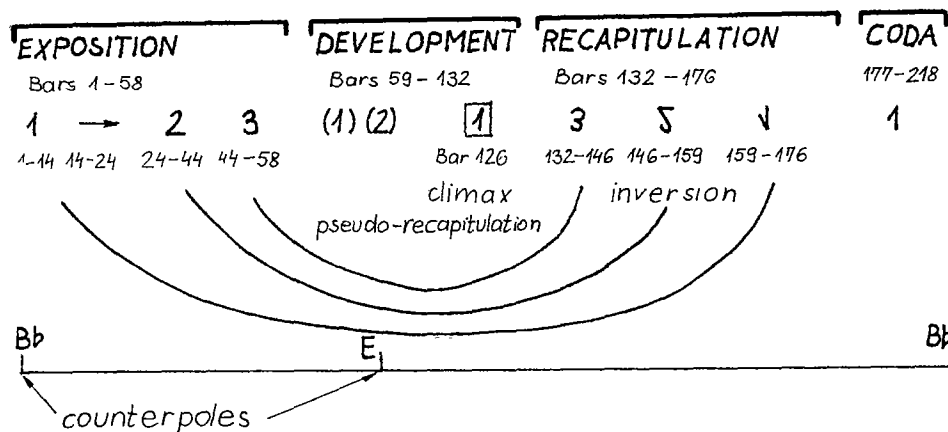
But is this not what happens in the bridge-form? Crossing the centre of the bridge, the musical material gains new meaning: a qualitative transformation is achieved. In the Fifth Quartet, for instance, at the 'pyramid peak' of the composition - the centre of the middle-movement - the 'linear' unisono theme of the first movement turns into a 'vertical' harmony: the melodic element is condensed into a simultaneous colour effect - that is, the dimension of 'time' is replaced by the dimension of 'space'." (Lendvai, 1983, p. 15).

The top of Figure 1 shows the design of a form I drew upon the basis of György Ligeti's (1980) analysis. (See Figure 1, following page).

One can see that the exposition presents three themes (that are related to each other). Bartók constructed the development section from materials of the first and second themes. A 'pseudo-recapitulation' can be heard at this point which makes us believe the third part of the form is to begin. But the way it continues promises something different: the themes return in reverse order, and what is more, in inversion. Arriving at the starting theme, the composer weaves the coda of the movement from its musical stuff.

"Formal Analysis"

First Movement. Sonata Form, Arch-like Construction



Three faces of the same hero

principal idea: heroic passion 1
struggling 2
contemplative man 3

Figure 1

The rest of Figure 1 contains the information about the meaning of the movement suggested by Ernő Lendvai's detailed analysis of the work. He does not merely register the inversion in the recapitulation but also attempts to explain its meaning: as well as in analyzing the three themes of a common root. This is called: 'Three faces of the same hero'. As for the former, he stresses continuity: just as dawn precedes and night follows noon, the order of the two statements of a theme cannot be reversed.

It is interesting to note that in the development section 'Tempo I' is prescribed twice: one is the 'climax' Ligeti found at bar 126, the other is the emphatic 'noon', the synthesis, in Lendvai's content analysis (bar 86).

A glance at the emotional stage of the work - at the 'outward bound' emotions before and the 'inward-turning' reflections after the culminating point - rightly calls Bartók's one-act opera *Bluebeard's Castle* to mind.

The libretto of the opera is based on the mystery play of Béla Balázs, which originally begins with a prologue replaced by an orchestral introduction evoking the atmosphere of an imaginary folksong. The famous poetic question - 'where can the stage be found: inside or outside of us?' - comes from this prologue. This dual stage is created by the composer in the opening movement of his 5th quartet as well.

After the 5th string quartet of 1934, let me quote the opening movement of one of the pacesetting masterpieces of 20th century composition, Bartók's *Music for Strings, Percussion and Celesta*. This is to illustrate another kind of spatial symmetry in music.

The work composed in 1936 upon the commission of the Basel Chamber Orchestra and its conductor Paul Sacher proposes an unbelievably up-to-date problem, so to say ahead of its time. Our most professional guide is again Ernő Lendvai: "The piece engages a double string orchestra, between them the group of piano-celesta-harp and percussion is placed. Thus the arrangement of instruments not only polarizes the tonality (as the title vividly expresses, from the resounding drum to the ethereal celesta), but through the stereophonic effect of the right and left string-bodies polarizes the 'stage' of music as well."

As far as concentration and closeness of form are concerned, none of Bartók's works surpasses the opening movement of the *Music*: the famous 'pyramid-fugue'. Its circle-like closeness is already manifest in the key-structure. The entrances of the fugue-subject are based on the circle of fifths. Starting from the central A and from the 'middle' viola part, the entrances progress in two directions (up and down) round the circumference of the circle of fifths, till they meet - at the centre of the movement - on the opposite side at the counterpole E flat (Figure 2a), then continuing their progress, they find their way back to the starting point: from E flat to A (Figure 2b.)

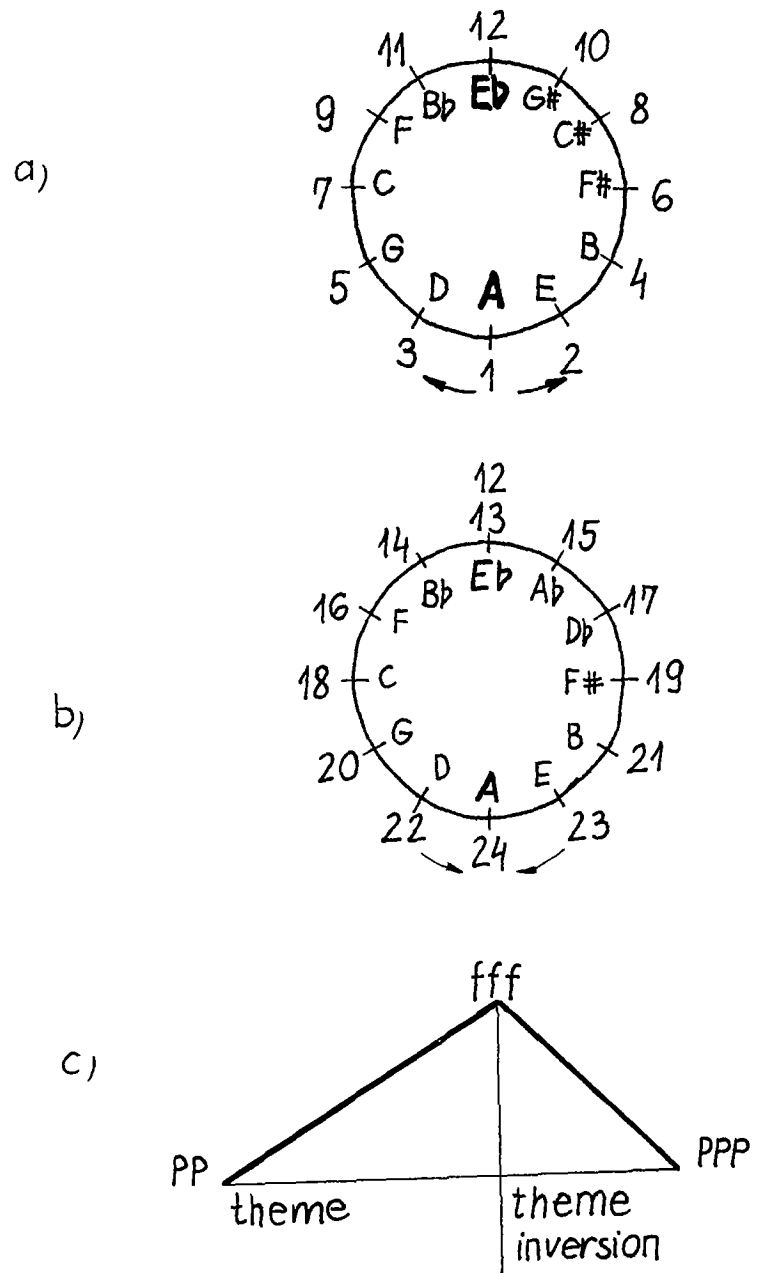
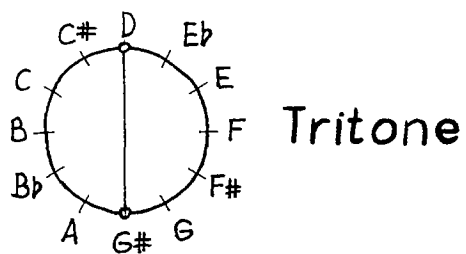
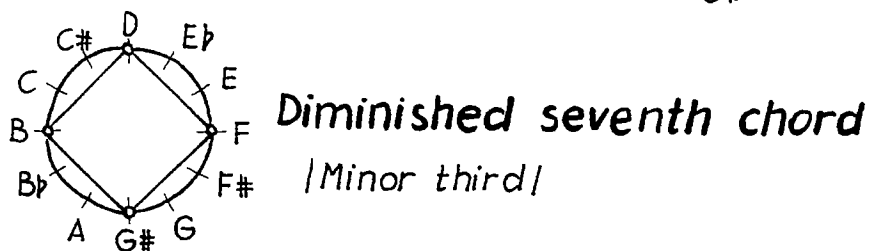
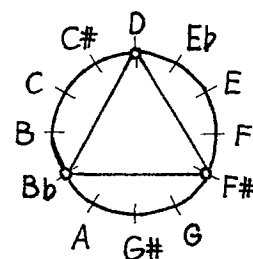


Figure 2



Augmented triad
/Major third/



Whole-tone scale
/Major second/

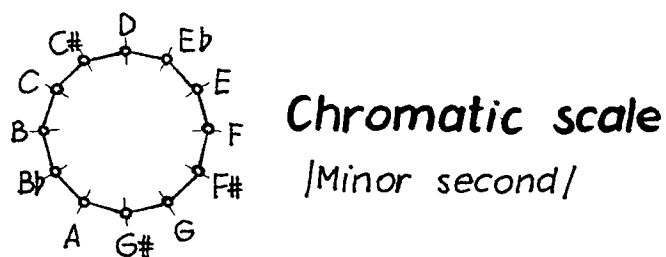
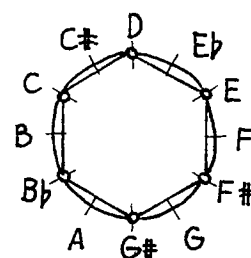


Figure 3

Also the dynamic line follows this arch of form: the movement is built on a single-sweep *crescendo-decrescendo*; starting from *pianissimo*, it rises steadily to attain the climax, the *fortissimo* - and then step by step sinks back to *piano pianissimo* (this is why the movement is also called the 'scissor-fugue' or 'fan-fugue'). In addition, the entrances become more and more frequent up to the culmination, and from there they become rarer and rarer... (Figure 2c.)

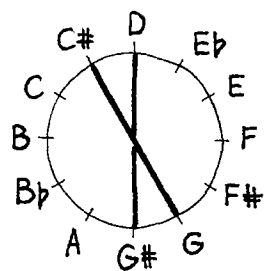
Faced with such a degree of concentration, we can be justified in asking: is this merely a technical stunt, or the opposite: the visible form itself represents the projection of the poetic conception? ...

In the qualitative transformation of the material a significant role is played by the double stage of sound: the double orchestra. The introductory part, the exposition of the fugue takes place in the acoustical area to the right of the centre the movement, however, comes to an end on the opposite, left-hand side of the stage. The concepts of left and right even in ancient philosophy were identified with the 'inner' and 'outer' worlds. On modern stereo stage ('sonic stage') this identification has actually become the rule! The special content of 'right' and 'left' may be brought into connection with the asymmetrical construction of our body - first of all with the fact that our heart is on the left side. (Lendvai, 1983, pp. 71-73).

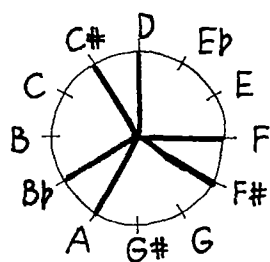
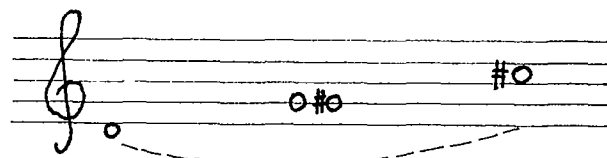
In both the harmonies and the melodies the equal division of the octave produces symmetric formations. These are listed in Figure 3. Representing the 12 different tones available in our tonal systems similarly to the face of a clock, I get the following five possibilities:

Starting out from the same division, so-called 'model scales' can be formed in which the alternation of a greater interval and a semitone produces an octave. (Figure 4) You can find a lot of examples for these type of symmetries in Bartók's oeuvre.

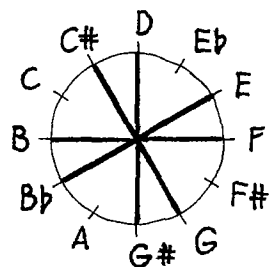
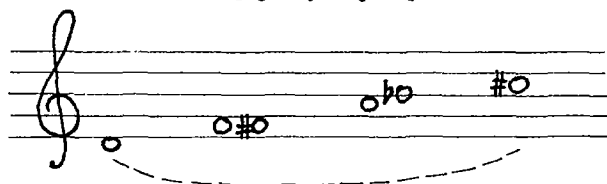
After the works of Bartók let us turn to the late piano pieces of another Hungarian composer, Ferenc Liszt. Posterity treated - and is still treating - these compositions rather badly. They put forth incredibly modern ideas, yet they can heart very rarely in concerts. True, their interpretation does not entail spectacular success. The Liszt works that are best known are mostly virtuosic, bravura pieces, so the almost skeletal simplicity of these works and their concentration on the ultimate essence may cause disappointment at first listening for the audience. Misinterpretation was in part to blame for this because these late masterpieces of few notes and much silence were thought to be sketches, fragments, experiments for a long time. Their true discovery waited for a performer - a practising instrumentalist - who not only played the notes from the score but also took pains to discover their hidden connection, that is, who could make a profound analysis.



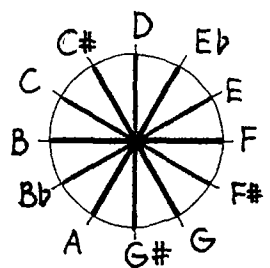
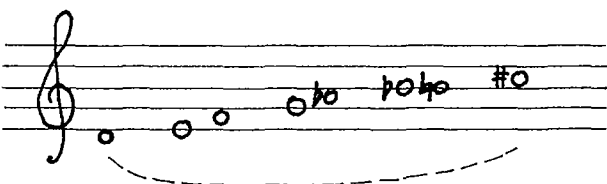
model 1:5



model 1:3



model 1:2



chromatic scale

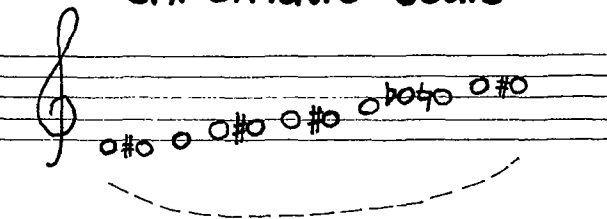


Figure 4

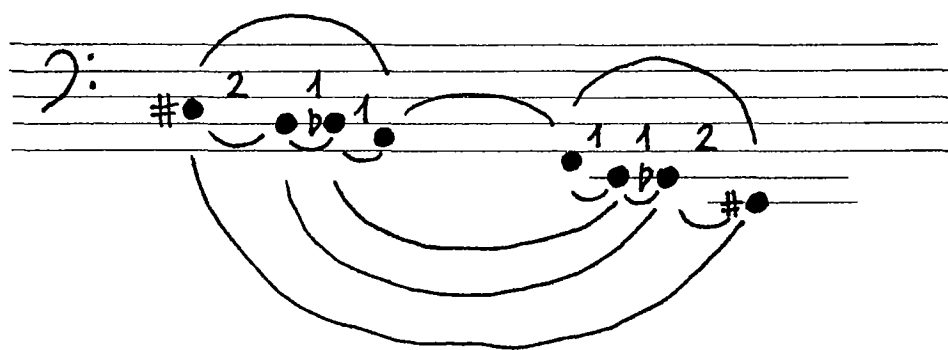


Figure 5

This mission was fulfilled by Erzsébet Tusa, a pianist and teacher well known in Japan too. She has been the professor of Musashino Music Academy in Tokyo for many years. Allow me to quote two passages from her confessions about musical performance first published in periodicals and later in book form.

Listening to 'Preludio funebre' everyone can spot the typical descending melody in the lower register. (Figure 5.)

What can a receptive performer make out of the score I just showed you? I am quoting Erzsébet Tusa's remarks. "This single idea is actually a boldly original scale whose downward-pulling course in the bass - perhaps reminiscent of the descending character of ancient Greek modes - is wrought with tragic greatness. Its pull into the depths is coupled with a perfectly symmetrical structure. ... The skeleton constituted by the C[#]-A-F-C[#] augmented triad stands out saliently, with the space between the two outer intervals (C[#]-A and F-C[#]) being filled symmetrically ... and the central core interval (A-F) seemingly remaining 'empty', yet in fact carrying the largest charge of tension. It produces a similar effect to the meeting of the two hands in Michelangelo's *Creation of Adam*: the hands just miss touching, there is an 'empty' space between them, but the viewer senses high tension in this space, the flow of powerful forces there and back; which represents a living, working dynamism. [...] At the same time, it reminds one of the structure of the atom where the most densely compressed energy is in the nucleus and the concentric bands recall the paths of electrons." (Tusa, 1990, p. 27).

It is justified to mention the piece 'Unlucky star' whose Hungarian title 'Balcsillagzat' is of poetic beauty. Its translations (etymology again!) are thought-provoking: in Italian it is simply called 'Sinistra' or left. The German title 'Unstern' sounds menacing, "as if we said 'anti-star'", Erzsébet Tusa remarks. 'Disastro' - disastrous, ominous. The work begins with a concise 'stellar motif' in which the symmetric relations can be heard easily.

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NOTE

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