Abstract: The verticality process in music realm started in the 10th century is materialized in the 14th century by the bring into use of the chords. Since that time, the music world has been continuously operating with this notion, even though it required a research study designed to elucidate this phenomenon. The chords formation was achieved within the framework of the principles similar to those designated to the generation of all music phenomena: the consonantal, symmetric and sectio-aurea principles.

Key-words: verticality, organum, chord, consonance, symmetry, sectio-aurea, polyphony.

1 Introduction

One of the greatest enigma of the Western-European countries music of the 2nd millennium AC is the genesis of the chords. The matter is about the four chords of three sounds (two overlapped thirds) usually designated as triads: major, minor, descending, ascending, and of their inversions (the sixth chord and the fourth-sixth chord).

In fact, during the music utilization process they become four sounds by repeating one of the three sounds, thus achieving the framing into an octave.

It is not known why the musicology did not approach the matter of elucidating this “secret”, even though the impression that it is known does persist yet. Some explanations of physical nature (e.g. the upper harmonics) seem to be sufficient, and will be resumed in this study.

Accordingly, the matter is about the musical birth of these chords during the music evolutionary process, from monody to harmony (polyphony).

2 Consonance accumulation

The first musical culture that deliberately used these triads was the Renaissance (the 14th-16th centuries). Noticeably, within the 14th century there were composers (Guillaume de Machaut, Philippe de Vitry, etc.), who created music using chords with such a structure by a permanent vertical reference of sounds to melodies overlapped polyphonically; thus, it was legiferated their way of succession by the consonance-dissonance ratio.

The subject to come into question is when and who made this “discovery”, or more precisely how these chords were formed?

This puzzle should be elucidated by an insight into the earlier stage of the Western-European ecclesiastic music.

But how earlier?

Well, previously to the production of the first verticality “rebounding”, i.e. when singers and choristers exasperated by the monotony of the monodic Gregorian singing have spontaneously discovered during the singing process the possibility of the solemn voices “to slip” towards a lower fifth, or fourth, and to sing concomitantly the same melody. Perhaps, at the beginning it seemed strange to them (there were probably some bans on this matter), but in the end this phenomenon was settled (as a counterbalance to the sobriety of the Gregorian melody singing submitted for centuries to a continuous pressure to simplicity).

The occurrence of this „incident” approximates to the beginning of the 10th century and extends until the 13th century; it is designated as Ars Antiqua. Presumably, this initiative was taken by certain religious schools (e.g. St Martial and St Victor monasteries, continued by Nôtre Damme), and subsequently disseminated; however, there is the possibility of a polygenesis phenomenon (in several Western-European countries).

Nowadays, this „product” is designated as organum.
Consequently, the intervallic ratio of the melodic parallelism is the fifth and its inversion, the fourth. Certainly, the two intervals are not equivalent, but anyhow they are complementary within the octave. From here result their quasi-equality (as halves of an octave) and interchangeability as steadiness.

Why the fifth and the fourth?

The explanation for the occurrence (and presence) of these verticality intervals consists in the consonantal principle, an ancestor of the ancient oligochordic and pentatonic modes.

Where from did the human kind take over this principle?

It is known from the physical principle of resonance, where the fifth and the fourth follow the consonantal intervals next to the octave, adopted by the first tuning up of the antique string instruments (lyre, guitar, etc.), or by the wind instruments.

It must be emphasized that these first intervals—the fifth and its complement the fourth—were the first verticalities.

Besides, the onset of the verticality process determined its dissemination throughout the Western Europe (the Catholic cult).

In contrast to the findings concerning the introduction of the fifth and the fourth verticality the way of the thirds and the sixths consonance’s setting up was somewhat more difficult. It would be tempting to believe that this phenomenon took place by the gymel structure integration, a polyphonic form appeared in England during the 12th century. But an insight into the European continental music (France, Italy, Germany), especially the Léonin’s and Pérotin’s creation—considered to be prodigious musicians of the Ars Antiqua—reveals that the gymel was not assimilated. The basic form remained the organum characterized by a remarkable blooming. However, this flourishing state has developed only at the linear polyphonic level by voice’s melodic garnishing, especially of the leading tenor’s melody. Within this period, no concern for verticality did exist, the fundamental sound being totally neglected (Chailley, 1960).

In this polyphonic context, the third and the sixth consonance was quasi-conscientiously “insinuated”, especially when the cadence was required. Here is a cadence example from the 13th century:

But the G-B third is not conceived as a G-B ratio; it comes from the melodic flow of each voice.

Certainly, a consistent contribution to this phenomenon was brought by the discantus technique; its combination with the organum generated an enriched slanting and contrary movement.

These movements were greatly favorable to the expression of the thirds and the sixths. This phenomenon will be consistently revealed within the motetus technique, which will be the final stage of the 13th century organum evolution.

Consequently, the Ars Antiqua music is the receptacle for chords conceiving that will be building stones for more than 600 years. Nevertheless, the leap towards the awareness of these vertical formations will be achieved in the 14th century by the contribution of composers endowed with genius, who synthesized the four triad forms.

3 Principles of triads formation

As the musical genesis of these triads can be detected this way, the second question is awaiting: why exactly these overlapping forms have been imposed (with fifth, fourth, and thirds), and no other intervals including the second (mainly the augmented second present in the ancient oligochordic and pentatonic formations) remains to be elucidated by musicologists.

The answer to this question is not offered by the Ars Antiqua praxis process; it should be found
among other coordinates of the human musical spirit. The first answer is given by the Renaissance theoreticians (Zarlino, 1558) followed by the Baroque one (Rameau, 1722), who “enjoyed” finding a “scientific” explanation to this matter after having discovered the hidden presence of the major triad inside the upper harmonics.

Fig. 8

It was considered that this finding was explainable for the complete genesis of harmony.

Nevertheless, even though for the major chord the sound resonance logic is accepted (the consonantal principle), for the other three chords the upper harmonic offer explanations only by a lot of numeric “speculations”. One can conclude that the consonantal principle has consumed its explanatory resources.

According to our previous viewpoint, the explanation for triads steadiness should be searched inside the nature of the genetically structured human mind, where are reflected fundamental principles of the geometrical ratios from the macro and microcosmic universe.

The matter is about the principle of symmetry and, of the sectio aurea proportion (the golden section).

Similarly to the vivid manifestation of these principles inside the melodic genesis of the ancient oligochordic and pentatonic systems (Szalay, 1968), they will be also present in the harmonic verticality at thousand years distance (about 40,000 years).

Thus, according to the principle of symmetry we discover the converse symmetry between the major and minor chords (augmented-diminished third/diminished-augmented third), with augmented third as axis.

Fig. 9

Regarding the diminished chord the principle of symmetry operates in a simply way; it is a symmetry of two conjunct diminished thirds (with axis sound).

Fig. 10

The augmented chord is formed on the basis of the same rationale, i.e. two conjunct augmented thirds (with axis sound).

Fig. 11

A certain surprise is offered by the chords inversion: the sixth chords and the fourth sixth chords.

Alongside the major sixth chord the third principle comes on stage: the golden section (sectio aurea). By analyzing the sixth chord structure, it can be seen that it is made up a diminished third having 3 semitones and a perfect fourth with five semitones.

Fig. 12

This ratio leads us to the sectio aurea proportion, according to Fibonacci’s numbers. Not dependent on chance, among the most spectacular forms of harmony appears the faux-bourdon in the 14th century that from the sound viewpoint means a succession of sixth chords.

Surprisingly, by a (symmetric) inversion of this sixth chord can be obtained the minor fourth sixth chord (with diminished fourth and third – 5,3 ratio).

Fig. 13

Hence, a sectio aurea ratio. This converse pair will offer (to B. Bartók ) in the 20th century the idea of the bitertiary chord (major-minor) by the vertical overlapping of the two symmetrical structures,

Fig. 14

legitimating the synthesis of the two modes of the major-minor tonalities, and establishing the chord (and the principle) non-octaviant by the E – E flat diminished octave. (Rîpă, 2001). The other pair, the minor sixth chord and the major fourth sixth chord, maintains the geometry of symmetry but their structure augmented third and perfect fourth- are no more fitted to the golden section ratio.

Fig. 15

By the two structures overlapping results again a new complex non-octaviant bitertiary complex , but with augmented octave (C – C#):

Fig. 16

The diminished sixth chord comprises the same symmetry in direct stage but as a double ratio of 3/6

Fig. 17

This sixth chord seems to derive directly from the ancient anihematomic pentatonic formation 2 (Rîpă, 2001)
The diminished fourth sixth chord is the converse symmetry of the sixth chord with axis on D note.

By overleaping we can obtain a symmetry with augmented fourth axis enclosed in the octave, because the augmented fourth is the quantitative half of an octave (six semitones), whilst the two thirds (3+3) constitute the other half; thus, they amount to twelve semitones.

In a somewhat similar way is presented the augmented chord on the basis of the same symmetry of the formation in direct state; without warning, it keeps the equality ratio (symmetry) of the augmented thirds both within the sixth chord and fourth sixth chord, through the augmented third enarmony with the diminished fourth.

The sixth chord and fourth sixth chord overleaping will fill the octave frame by the total of twelve semitones of the three major thirds (4+4+4), with major thirds axis or diminished fourth.

The analysis of the third - fourth chord formations (the sixth chords and the fourth sixth chords), revealed that they are not mere inversion of the chord in direct state (according to all treaties of the theory of music) but structures with autonomous “personality” through which they enhance the harmony musical expression.

Consequently, during the process of the harmonic concept formation (vertical) did operate the same structural principles, similarly to the melodic process (linear): the consonantal, symmetry and sectio aurea principles.

4 Conclusions

The musicology of all times went about in search of scientific explanations of acoustic and mathematical nature for the musical phenomena.

Nevertheless, it was the inorganic, mainly the organic chemistry that over the latest centuries dealt with the matter microstructure organization, rendering evident the specific ways of molecular “arrangement” of the leaving and non-living nature reflected within the human artistic and scientific mind.

Accordingly, in the case of harmony the construction “stones” derived from the inner structure of the human conscience, as well.

At the beginning of the 14th century, Guillaume de Machaut, Philippe de Vitry, Marchetto di Padua, Pietro Casella, Giovanni da Cacicia, Jacopo da Bologna, Francesco Landino, synthesized the chord types existing under budding form in their mind owing to their musical education in the spirit of Ars Antiqua polyphony from the polyphonic linearity of Léonin’s and Pérotin’s creations.

The introduction of a brand new vertical composition technique exceeding the simple polyphonisation of melodies by using the imitation as developing procedure required a new vertical order that stabilized the chords; their succession ensured the functioning of the basic principle of the future polyphony (Renaissance polyphony), i.e. the consonance-dissonance ratio. Thus, the consonance pillars become the two chords with perfect fifth, major and minor, whilst the diminished and augmented chord together with the melodic notes (transgression, compensation, anticipation, delay) were the dissonant notes.

The improvement of this technique style will take three centuries reaching its apogee in Palestrina’s creation, developing later towards Monteverdi’s and Gesualdo’s chromatic notes.

The Renaissance ending and the evolution towards the Baroque era determined the tri-sound “interdependence” by the so-called functionalism, creating a new language for another 300 years (the 17th and the 19th centuries), until the 20th century when Schönberg declares their ineffectiveness.

In conclusion, after a century of the chords „exit” from the history of music stage we succeed to near the understanding of their reason of formation.

Acknowledgement

This work was supported by CNCSIS-UEFISCU, project number PNII-IDEI Code 718/2008 named Exploring the adaptation of on-line learning means to music education.

References:
[1]. Chailley, Jacques, La musique post-gregoriennne, in Encyclopédie de la pléiade, Histoire

