TONALITY / ATONALITY: ORDER / DISORDER OR ORDER / NEW ORDER

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Part 1: ORDER

During their history, the European musical theory and aesthetics constituted by an empirical-rational method the system of musical rules: the laws for the construction of musical works, based on seven-tone tonality. The Major-Minor tonal system with a tonic as the tonal center dominated in the whole European musical tradition for the centuries. From the basic statement that the laws of mathematics and proportions (arithmetical, geometrical and harmonical) could describe the nature, Pitagoreans derived the theory of musical harmonies, identifying it with the harmony of the well-organized Universe. Starting from the *tetrakis* – 1, 2, 3, 4 – the ordered sequence of small natural numbers, and forming their proportions 1/2, 2/3, 3/4, the four basic tones $c^1=1$, $c^2=1/2$, $g^1=2/3$, $f^1=3/4$, and the unit measure - the interval f^1 - g^1 are derived. After tempering this system, it is obtained the half-tone sequence, that could be simply denoted as 0,1,...,11 (*mod* 12), where the enharmonic tones are treated as the same. In fact, the tempering was the symmetrization of this system: its division in equal half-tone intervals. During the history, from all Greek *moduses* two seven-tone tonalities are distinguished: the Major and Minor. In the sense of their meaning and emotional-symbolical role they are a well-known example of antisymmetry (or bivalent symmetry).

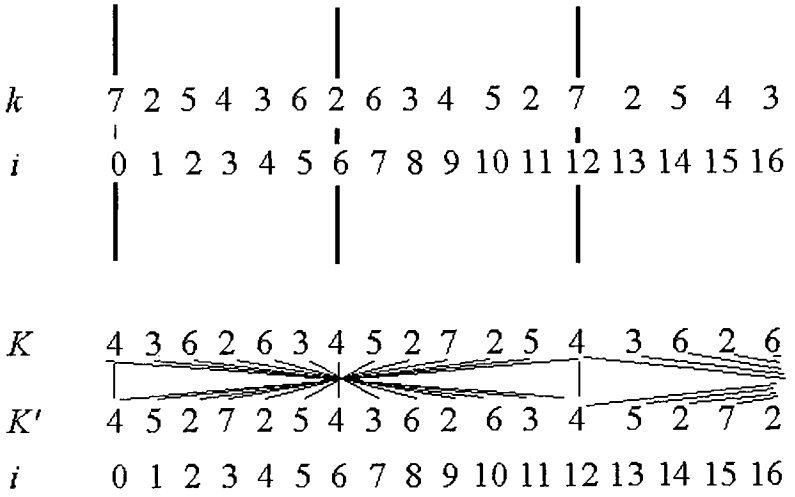

Figure 1.

Except this (global) antisymmetry, in every tonality we could discover the basic (local) antisymmetry: the relationship between the complementary intervals (e.g. third – sixth, forth - fifth...). The only interval, equal to its complement is the *triton*, the ambiguous interval having a double sense (unperfect forth or fifth), the main dissonance, center of instability for every tonality. If we identify the complementary intervals (i.e. if we reduce them to the minimal interval between two tones *mod* 12), for every two tonalities we could find the number of joint tones, called the coefficient of similarity. This way, we could notice the first (anti)symmetry property: the coefficients of similarity for the tonalities bearing the same name (Major-Major or Minor-Minor) are mirror symmetrical, and the coefficients of similarity of opposite tonalities (Major-Minor) are point-symmetrical. In the both cases, the symmetry element (the mirror axis or the center of symmetry) coincides with the point 6, this means, with the triton interval (i=6) (Fig. 1).

Continuing with this approach we, could prove the remarkable fact: the tonal system Major-Minor is completely invariant with regard to the complementarity of intervals. First, we could explain, by using only the symmetry arguments the reasons of the priority of Major-Minor tonalities in the complete system of Greek *moduses*, and to show why exactly those two *moduses* are distinguished (by the empirical "natural selection", during the history of European music). The basis of all tonalities is the periodical tonal sequence ...0,2,4,5,7,9,11... with the period 12. Particular tonalities (or *moduses*) are derived from it by a different choice of the beginning point. For example, if we start from 0 and reduce all the intervals to their minimal intervals (i.e. if we identify the complementary intervals with their minimum), the following table of the interval structure for all possible *moduses* is obtained:

0 2 5 5 5 3 1	that could be, according	0 2 4 5 5 3 1
2 0 2 3 5 5 3	its symmetry, reduced to	0 2 3 5 5 3
4 2 0 1 3 5 5	the diagonal table:	0 1 3 5 5
5 3 1 0 2 4 6		0 2 4 6
5 5 3 2 0 2 4		0 2 4
3 5 5 4 2 0 2		0 2
1 3 5 6 4 2 0		0

If we denote the intervals 6,5,4,3,2,1 by the corresponding lines, as the result we obtain the following circle diagram (Fig. 2).

In it, at a first glance it is possible to notice two properties: the singularity of the interval 6 (tritonic interval) and the mirror symmetry of the diagram, where the mirror line contains the point 2 and the mid-point between 7 and 9. Let us notice that the tritonic chord (0,3,6) or (3,3) is the only symmetrical chord and the only chord appearing just once in every Major or Minor tonality (the chord singularity).

Because of the instability of triton, the points 2,5,11 are not suitable to be taken for the first tone of a tonality. Among the remaining candidates, the points 0,4 and 9,7 are two mirror-symmetrical (equivalent) pairs. This means that as only nonequivalent beginning points remain 0 and 9. Depending from the choice, the result is the (natural) Major or Minor.

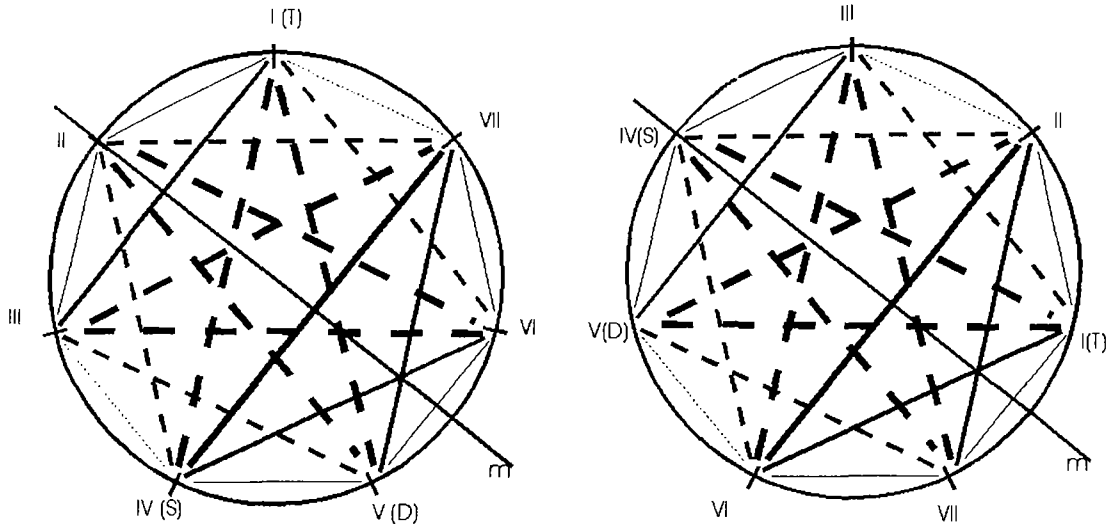

Figure 2.

The already noticed mirror-symmetry remains preserved at all the harmony levels: the chord structure – antisymmetrical distribution of Major and Minor chords, the main and other harmony functions (**T,S,D,s,d**), the coefficients of stability, etc., are all mirror-(anti)symmetrical.

The different symmetries, resulting from this basic symmetrical organization of tonalities occur in the case of all three-tone and four-tone chords, and represent the standardized patterns of tonal music (Fig. 3).

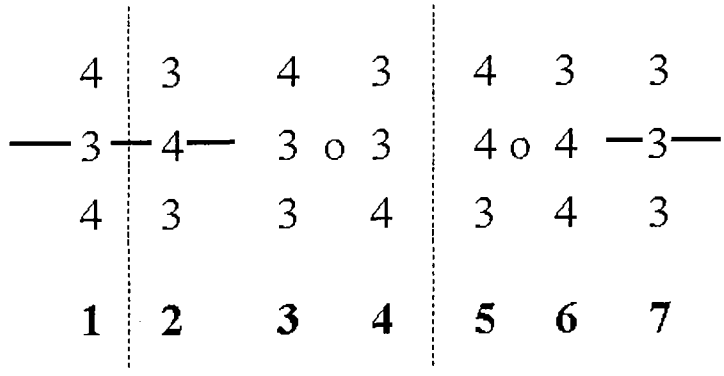

Figure 3.

This way, after the mutual identification of complementary intervals (e.g. fifth = fourth, sixth = third...), i.e. if we reduce all the intervals between two tones to the minimal ones, we could discover the basic symmetries of this system: its invariance with regard to the complemantarity of intervals. As the result, all the important parameters of the tonal system (e.g. number of joint tones for two tonalities, the chord structure of every tonal system, etc.) are symmetrical with regard to the tritonic interval. From this basic symmetries resulted a large number of symmetries at the complete harmony level of the tonal music. So, at the beginning it was the ***ORDER***.

Part 2: DISORDER

The break of the tonality: appearance of atonality, by leaving of mono-central classical tonality, historically coincide with the similar process in painting – the appearance of cubism, where the Renaissance mono-centric perspective is replaced by cubist polycentrism - a chance to see simultaneously an object from several viewpoints in space. There, every space point has an equal chance. The same holds for the tones in dodecaphony: all the tones have the equal role. Together with the break of tonality, appeared the question: are we perceptively able to accept the music without tonal center and without the standardized patterns - the chords and their isometric transformations.

Part 3: NEW ORDER

The retreat from tonality has not resulted in completely disordered structures, but in the new order: dodecaphony with the tonal series, where the classical patterns – the chords are replaced by the new patterns: permutational twelve-tone series. Isometric transformations of tonal music are replaced by permutational symmetries, where the invariant remains the twelve-tone material (*mod* 12). This way, the static symmetry of classical tonal system is replaced by dynamic permutational symmetry of a serial system: a classical symmetry is replaced by its generalization - colored (permutational) symmetry.

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