

The Tonal Structure of Chopin's Mazurkas

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Summary

My presentation concerns the application of an analytical method called “The Irrelative System in Tonal Harmony” for the purpose of study of the tonal structure of F. Chopin's Mazurkas.

Original method (Majchrzak 2005, 2007) consists in assignation of chords appearing in a piece of music to individual key ranges being keys in their respective natural variety. Using the analytical method in question, a diagram of tonal structure of a piece can be produced, such tonal structure being understood as quantitative relation of key ranges for which specific chords have been classified.

Let us mark the keys with the consecutive integers: the sharp keys with positive numbers, the flat keys – with negative numbers. The absolute value of the integer designates the number of accidentals in the key. The number (4) marks the keys of E major and C# minor; the number (-1) – the keys of F major and D minor.

For any tone, we can determine the keys it appears in. For instance, the tone D appears in these keys: -3 (E flat major and C minor), -2 (B flat major and G minor), -1 (F major and D minor), 0 (C major and A minor), 1 (G major and E minor), 2 (D major and B minor), 3 (A major and F sharp minor), whereas the tone D does not appear in e.g. -8 or 4 keys. The successive columns in the table 1 represent: A - tones; B - the keys in which those tones appear.

Table 1

A	B	A	B
...	...	C	(1, 0, -1, -2, -3, -4, -5)
C sharp	(8, 7, 6, 5, 4, 3, 2)	B flat	(-1, -2, -3, -4, -5, -6, -7)
E	(5, 4, 3, 2, 1, 0, -1)	D flat	(-4, -5, -6, -7, -8, -9, -10)
A	(4, 3, 2, 1, 0, -1, -2)	G flat	(-5, -6, -7, -8, -9, -10, -11)
G	(2, 1, 0, -1, -2, -3, -4)

The substratum for our chord classification is the arithmetic average of keys wherein the tones of a given diatonic chord appear:

$$\text{arithmetic average} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{n}$$

where:

$X_1, X_2, X_3, \dots, X_n$ – keys wherein the tones of a given diatonic chord appear

n – number of all keys.

Examples:

1) E-G sharp:

$$\text{arithmetic average (AA)} = \frac{(5+4+3+2+1+0-1)+(9+8+7+6+5+4+3)}{7+7} = 4$$

2) G-B-D-F:

$$\text{AA} = \frac{(2+1+0-1-2-3-4)+(6+5+4+3+2+1+0)+(3+2+1+0-1-2-3)+(0-1-2-3-4-5-6)}{7+7+7+7} = -0,25$$

In this method:

Arithmetic average space - all numeric values derivable from the above arithmetic-average formula. The arithmetic average space is divided into key ranges (KRs), each of which is a key range with a given number of clef signs. E.g., the key range of one-flat keys (F major and D minor) encompasses the arithmetic average space's open-ended range, spanning between -0,5 and -1,5. The key range of two-sharp keys (D major and B# minor) encompasses the arithmetic average spanning between 1,5 and 2,5. The key range of four-sharp keys (E major and C# minor) encompasses the arithmetic average spanning between 4,5 and 5,5.

Chords and Key Range. Examples: the chord GBDF (AA = -0,25) belongs to KR 0 (C major and A minor). The chord EG#BC# (AA = -4) belongs to KR 4 (E major and C# minor). The chord BDGA (AA = 0,75) belongs to KR 1.

N-D – non-diatonic chords

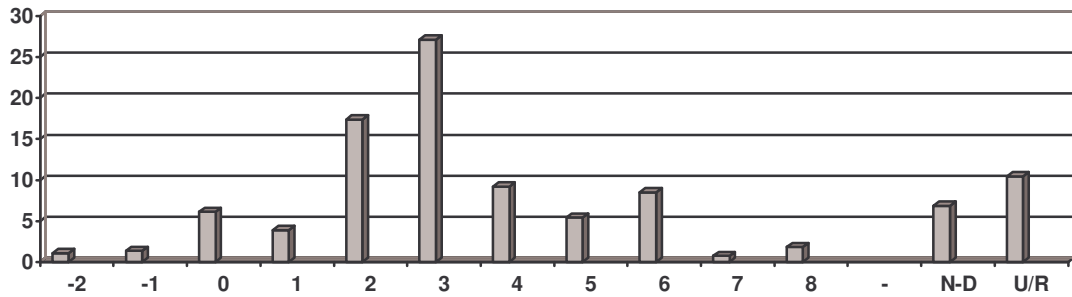
U/R – unison/rests

Bibliography:

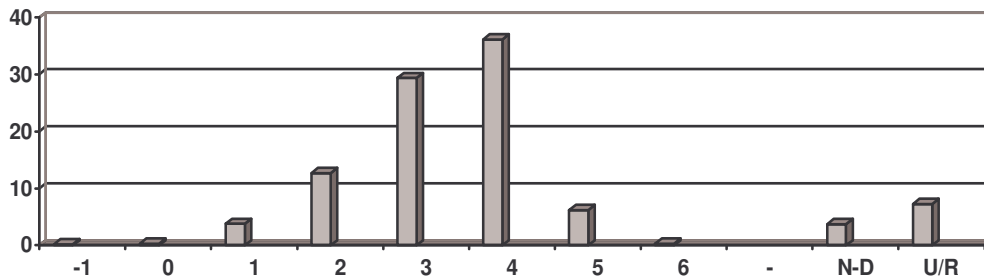
- Mirosław Majchrzak (2005), *Dywergencje i konwergencje szeregów rozdzielczych tonacji durowych i molowych w utworach okresu supremacji harmonii tonalnej* [Divergences and convergences of major and minor key distribution series in musical pieces of the tonal harmony supremacy period], Master Thesis, Wrocław Academy of Music 2005.
- Mirosław Majchrzak (2007), *Irrelative System in Tonal Harmony*, First International Conference of Society for Mathematics and Computation in Music, Berlin, May 18-20, 2007.

Examples of tonal structure of selected Mazurkas

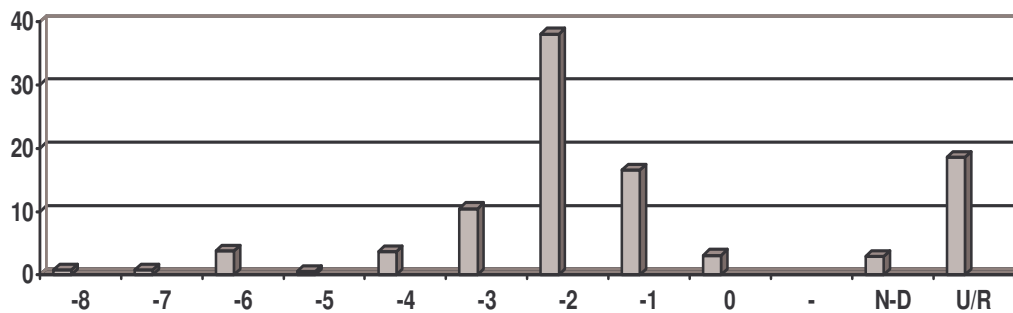
Mazurka in F sharp Minor (KR 3), Op. 6, No. 1



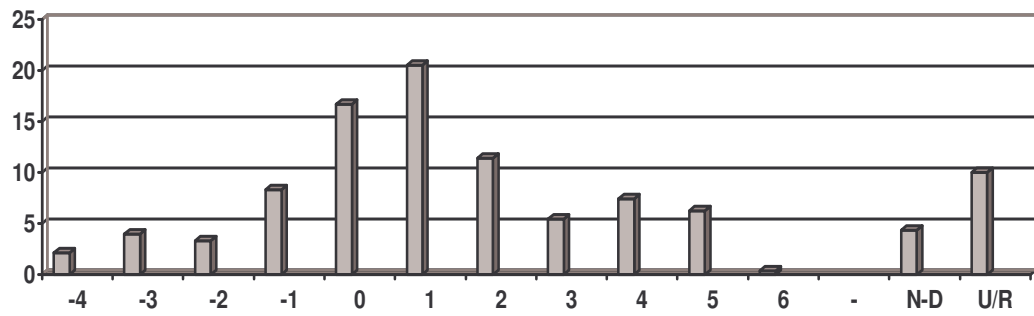
Mazurka in E Major (KR 4), Op. 6, No. 3



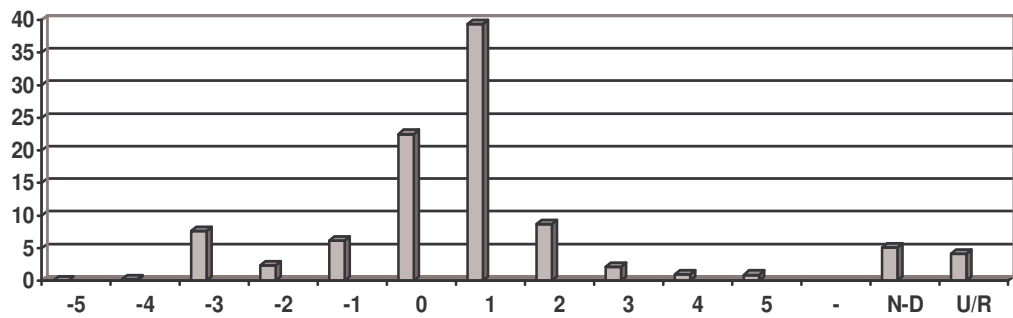
Mazurka in B flat Major (KR -2), Op. 7, No. 1



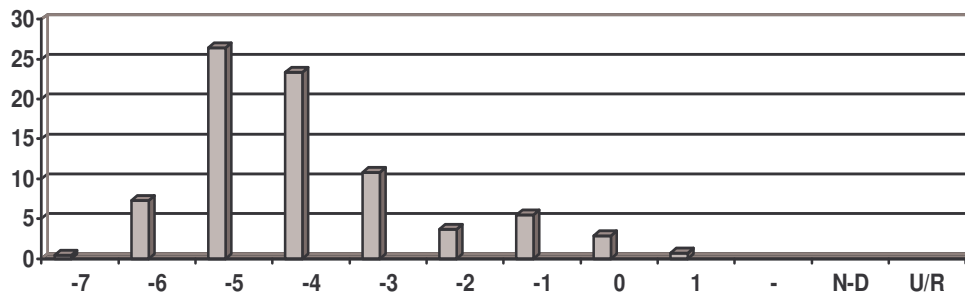
Mazurka in E Minor (KR 1), Op. 17, No. 2



Mazurka in G Major (KR 1), Op. 50, No. 1



Mazurka in A flat Major (KR -4), Op. 50, No. 2



Mazurka in F Major (KR -1), Op. 68, No. 3

