The impact of language on cadential structure: Evaluating penultimate stress in Polish instrumental music using the Common-Practice Cadence Corpus (CPCC)

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Introduction

- The Polish language features a system of fixed accent in which the default primary stress of a word is located on the penultimate syllable.[1]
- It has been suggested that the characteristic mazurka rhythm (**Fig. 1**) crystalized alongside the standardization of the penultimate stress system in the Polish language.[2],[3]
- When Polish text is set to music, this often results in penultimately-accented melodic cadences (**Fig. 2**), what we call *paroxytonic cadences*.

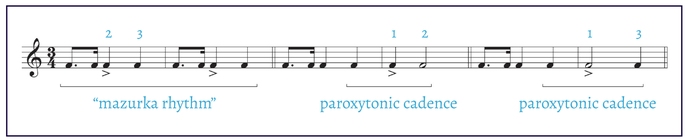

Fig. 1. Mazurka rhythms and paroxytonic cadences

- **Aim**: Investigate the role of paroxytonic cadences in non-texted Polish music with corpus methodologies.
- **Null-hypothesis**: There is no significant difference in paroxytonic usage between genres.

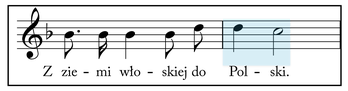

Fig. 2. Paroxytonic cadence in Dąbrowski's Mazurka

Method (CPCC Organization)

Corpus Collection

- We identified and manually encoded cadences using vertical slices—called "stages"—of music.[4],[5] Each cadence includes its last two harmonies with a maximum span of two measures. Each cadence included the counterpoint and metric position for each stage (**Fig. 3**).
- Cadences were filed into a spreadsheet and included additional information such as **paroxytonic status**, harmony, formal position, composer, name of piece, key, and other musical and meta parameters.
- These encoded cadences make the **Common-Practice Cadence Corpus** (**CPCC**) which currently contains over 1,000 cadences from 9 composers (**Fig. 4**).

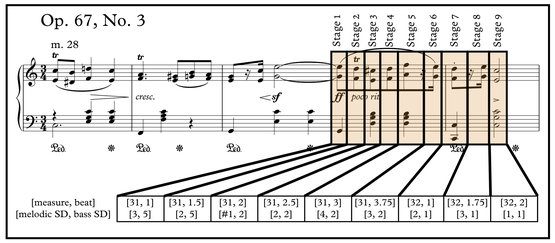

Fig. 3. Mazurka rhythms and paroxytonic cadences

Composer	Mazurkas	Waltzes	Minuets
Beethoven, Ludwig van			80
Chopin, Fryderyk Franciszek	420	141	
Dobrzyński, Ignacy Feliks	44		
Krogulski, Józef Władysław	26		
Kurpiński, Karol Kazimierz	16		
Nowakowski, Józef	77		
Schubert, Franz Peter		42	110
Strauss, Johann (II)		49	
Szymanowska, Maria Agata	19		31
Total: 1055	**602**	**232**	**221**

Fig. 4. Common-Practice Cadence Corpus (CPCC)

Results

Experiment 1: Paroxytonic prevalence between genres

To evaluate the prevalence of paroxytonic cadences in polish instrumental music, we tallied paroxytonic cadences in mazurkas, waltzes, and minuets in the CPCC. The data revealed that out of 602 mazurka cadences, 72% were paroxytonic; of 232 waltz cadences, 28% were paroxytonic; and of 221 minuet cadences 26% were paroxytonic. Multiple chi-square tests showed that there was no significant difference between the paroxytonic cadence usage in minuets and waltzes, but mazurkas were significantly different from both (**Fig. 5a–5b**).

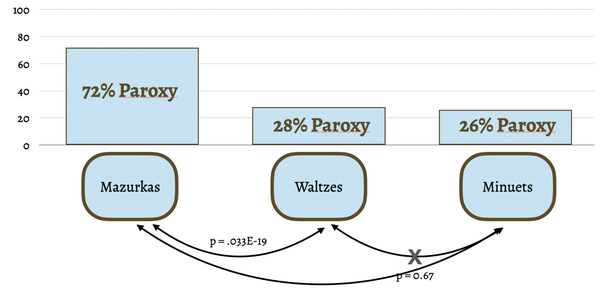

Fig. 5a. Chi-Square tests and percent paroxytonic cadences between difference genres.

	Mazurka	Waltz	Minuet
Mazurka		0.40	0.41
Waltz			0.16
Minuet			

Fig. 5b. Craver's V for Chi-Square tests

Experiment 2: Paroxytonic prevalence between composers

As Chopin occupied around 70% of mazurkas, we wanted to evaluate whether Chopin had an influence on our tests; perhaps the paroxytonic cadence is a distinctly Chopin-like signifier. The corpus revealed that Chopin used paroxytonic cadences 75% for mazurkas and 30% for waltzes. Further, non-Chopin mazurkas use paroxytonic cadences 62% of the time and non-Chopin waltzes 21% (**Fig. 6a**). Chi-square tests found all differences significant ($p < .001$) *except* between Chopin and non-Chopin waltzes ($p = .06$) (Craver's V in **Fig. 6b**).

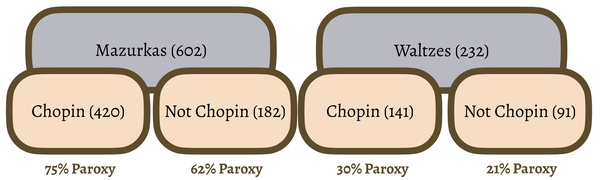

Fig. 6a. Chi-Square tests and percent paroxytonic cadences between difference genres.

	Chopin Mazurkas	Non-Chopin Mazurkas	Chopin Waltzes	Non-Chopin Waltzes
Chopin Mazurkas		0.16	0.41	0.45
Non-Chopin Mazurkas			0.35	0.43
Chopin Waltzes				0.15
Non-Chopin Waltzes				

Fig. 6b. Craver's V for Chi-Square tests

Summary and Conclusion

Experiment 1

With our results, we reject the null hypothesis that there is no difference in paroxytonic use between genres. End-accented cadences appear to be a signifier of the mazurka—a distinctly Polish style—and, connected to linguistic influence, this suggests a connection between the Polish language and end-accented languages.

Experiment 2

The second experiment compared mazurkas and waltzes composed by Chopin to those *not* by Chopin. Results showed that there was always a difference between genres regardless of composer, and there was not a significant difference in paroxytonic use in waltzes regardless of composer. Though the effect size (Fig. 5b) is small, there is still a difference between mazurkas by Chopin and those not by Chopin. This suggests that, even if paroxytonic cadences signify the mazurka, Chopin made particular use of the compositional technique in his mazurkas.

Future Research

Next steps in the project will continue to explore the mazurka style and its connection to the Polish language.

1) Subject studies and perception of genre
2) Study of melodic cadential schemata
3) Further research musical accent, entrainment, and metric placement

References

1. Domahs, U., Knaus, J., Orzechowska, P., and Wiese, R. (2012). Stress "deafness" in a language with fixed word stress: an ERP study on Polish. *Frontiers in Psychology,* 3, 439.

2. Paczkowski, S. (2017). Polish Style in the Music of Johann Sebastian Bach. Translated by Piotr Szymczak. *Lanham, MD: Rowman & Littlefield.*

3. Zaborowski, M. (2013). Gestural patterns in Kujaw folk performing traditions: implications for the performer of Chopin's mazurkas. *MA thesis, University of Victoria*.

4. Cuthbert, M.S., and Ariza, C. (2010). music21: a toolkit for computer-aided musicology and symbolic music data. *11th International Society for Music Information Retrieval Conference*.

5. White, C.Wm., and Quinn, I. (2016). The yale-classical archives corpus. *ICMPC 2014: Seoul, South Korea*.