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Studying Rhythm Morphology
Ritmo morfologijos tyrimai

Abstract

The article presents a computer-aided method of studying the morphology of the rhythm developed in order to analyse the so-called "Polish rhythms", that is, triple-time rhythmic structures of decreasing rhythm condensation within a measure. Such rhythms, typical of Polish music since the 16th–17th century, became symbols of Polishness in music, particularly in the 19th century when the mazurka and the polonaise created the canon of Polish national dances. Despite their crucial importance for Polish culture, they have not been studied by music historians in the way allowing the precise reconstruction of their evolution in time. The proposed method of analysis helps reveal changes in their morphology throughout the centuries.

Keywords: morphology of rhythm, computer-aided method, "Polish rhythms", triple-time rhythmic structures, Polish music, mazurka, polonaise.

Anotacija

Straipsnyje aprašomas ritmo morfologijos tyrinėjimo kompiuterinis metodas, sukurtas analizuoti vadinamiesiems „lenkiškiesiems ritmams", t. y. tridalėms ritminėms struktūroms su silpnėjančia ritmine kondensacija takte. XVI–XVII a. lenkų muzikai būdingi ritmai tapo lenkiškumo muzikoje simboliu, ypač mazurkai ir polonezui XIX a. suformavus lenkų tautinių šokių kanoną. Nors šios ritminės struktūros labai svarbios lenkų kultūrai, jos nebuvo išsamiai nagrinėtos muzikos istorikų, nebuvo stengtasi tiksliai atkurti šių struktūrų raidos laike. Siūlomas analizės metodas padeda atskleisti minėtų ritminių formulių morfologijos kaitą.

Reikšminiai žodžiai: ritmo morfologija, kompiuterinis metodas, „lenkiškieji ritmai", tridalės ritminės struktūros, lenkiškoji muzika, mazurka, polonezas.

Introduction

According to one of definitions, rhythm is a "subdivision of a span of time into sections perceivable by the senses; the grouping of musical sounds principally by means of duration and stress" (Dürr & Gerstenberg, 1980, p. 804). Similarly, Cooper and Meyer state that rhythm is being experienced as grouping of individual sounds into structured patterns, the grouping resulting from such different elements of music as pitch, intensity, harmony, duration and other (Cooper & Meyer, 1960, p. V). However, while Cooper and Meyer consider grouping independent from periodicity, Sven Ahlbäck points at theories using periodicity as the base for rhythm theory (Ahlbäck, 2004, p. 73).

Włodzimierz Rudziński defines musical rhythm as "humanly organized order of musical sounds in time" (Rudziński, 1987, p. 145) and stresses its synthetic nature. His approach is closer to the perspective of music anthropology, where rhythm is studied rather in the context of human life than as a separate phenomenon, to point at the case of the Northern Ewe society where "potentially infinite set of rhythms includes everything from the cosmic periodicity of seasonal change to the localized rhythms of drum music" (Agawu, 1995, p. 8). What Kofi Agawu calls rhythms of society, rhythms of language, rhythms of drumming and dancing, rhythms of musical performance and rhythms of folktale performance are all rhythms realized at different temporal levels, as in the theory by Ludwik Bielawski, probably the most complex and fully systematized approach toward musical phenomena ever. Bielawski's theory enables the ordering of all music phenomena (although its universal character goes far beyond the scope of musicology) at temporal levels which "evolved in the evolution of the universe and well-settled in human brain, allow distinguishing basic levels of knowledge, also of music, not excluding rhythm (Bielawski, 1999, p. 63). In this theory "traditional" rhythm, as in the above definitions, is only a narrow sector.

Even if morphological studies of music repertoire do not belong today to the mainstream of ethnomusicology, the use of morphological analysis can be highly recommended and successful in the case of research problems referring to historical music sources which do not contain information other than written musical text. This was the case of the author's studies of the so-called "Polish rhythms", the term denoting descendent triple-time rhythmic structures, that is, with decreasing condensation of rhythmic impulses within a measure. Such rhythm can be as simple as *iambus* ♩ ♩ and *ionicus a minore* ♫ ♩ ♩ (considered the "mazurka formula"), and as complex as polonaise measures (♫♫ ♫ ♫♩).

Such rhythms, which in the 18th and 19th centuries became part of canonical symbols of Polish national culture, are present in both folk music and art music, with the mazurka and the polonaise as most visible genres. Therefore it is not surprising that Polish musicologists have been paying much attention to this phenomenon. The long list of researchers who studied "Polish rhythms" includes ethnomusicologists focused on Polish folk songs and dances, but also music historians concentrated on 16th and 17th century "Polnische Tänze".

Material

"Polish rhythms" can be traced in the music sources from the 16th century onwards. The objective of the author's research was to reconstruct their development from that time to the mazurkas and polonaises by Frédéric Chopin. The analytical material comprised 791 compositions, primarily instrumental, from the mid-16th century (mostly the so-called "Polish dances" from the 16th and 17th century keyboard and lute tablatures) to the 19th century, with a few exceptions spanning to the 20th century. The present article is focused on the method developed by the author for the study of "Polish rhythms". Full results of the research can be found in the published study (Dahlig-Turek, 2006).

The chosen musical examples represent different epochs and different performance conventions, which are often impossible to decipher and interpret today, like the tempo of performance, dance gesture accompanying the music, articulation etc. They were written for different settings and purposes. However, despite all the doubts and questions regarding the homogeneity and credibility of the material, the use of all the various scores seems to be the only way to study the phenomenon of "Polish rhythms". When all the information about the given piece of music is "hidden" in the musical text itself, the profound analysis of the latter allows drawing conclusions going far beyond pure description.

The repertoire is published in its entirety, transcribed and prepared for print by historians of music. In the case of analysis conducted by an ethnomusicologist, possibility to benefit from the extensive accomplishments and specialist knowledge of competent authors appeared to be an optimal solution. Consequently, the research could start with the next stage, i. e. the preparation of material for a computer-aided analysis of the rhythm.

Method

Different approaches toward rhythm analysis have been practiced today: from anthropological methods (Kofi Agawu, Ludwik Bielawski) and Schenkerian analysis (David Loeb, Jonathan Stock) to linguistic distributional analysis (Nicolas Ruwet, Simha Arom). For the sake of the present study, priority must be given to a quantitative method which operates on large data sets and which is focused on examining music language by looking for formulae and variants. Distributional analysis, which may be considered an introduction to information theory, is particularly well tailored to such studies as it helps recognize rules of music grammar.

According to this method, applied for the first time by Nicolas Ruwet in 1964, music is a chain of elements ruled by distribution principles, that is, the rules describing how these elements join, complement or exclude each other. The key question is that of isolating basic unit, i. e., elements that either are indivisible or do not need to be divided because their components never appear alone. The labeled units make a "dictionary" of which the music text is built. The text is then interpreted as a sequence of the units.

For the presented study on "Polish rhythms" a simple code was developed, representing different rhythmic groups in frame of the metric unit. In other words, rhythmic organisation of metric unit was a basic portion of information. As a rule, encoded was the rhythm of the main melodic line, and in the case of notation with elements of polyphony – to that rhythm which was most characteristic, e. g. descendent and not evenly fragmented.

The main body of the alphabet contained nine items (from 00 to 08),

with additional variants, if necessary, e. g.:

Rhythmic groups exceeding the length of one metric unit were substituted by a combination of smaller units, e. g.:

Sequences of numbers replaced the original rhythm notation. The encoded material looks like text and can be processed like text.

I. Diagrams of the descendability and condensation of rhythm

In his *Deep and Surface Structure in Venda Music* John Blacking wrote that the sequence of intervals going up and down is more significant than the exact pitch (Blacking, 1971, p. 99). *Per analogiam*, we may accept that increasing or decreasing rhythm condensation is more important than rhythmic values as such, and that in the case of "Polish rhythms" the research must concern general tendencies in shaping the rhythm and not performance details.

Having in mind that the most characteristic feature of "Polish rhythms" is their decreasing rhythm condensation, two basic parameters of rhythm should be considered crucial:

• Condensation, i. e. an average number of impulses corresponding to a metric unit in the given piece of music;

• Descendability, i. e. difference between average rhythm density in the first and last parts of measures in the entire work.

Apparently, already those two parameters differentiate the examined material and co-harmonise with its chronology. These quantities have been calculated for each music example separately, and, for comparative purposes, also for exemplary formulas considered indicators of historical phases (iamb, mazurka and typical polonaise rhythms; for details see Dahlig-Turek, 2006), and then transferred to a coordinates' diagram. Thus, each examined piece of music is represented in the diagram by one point. The exact placement of the point in the diagram shows the stage of development of "Polish rhythms" – the lower the parameters of condensation and descendability, the older the phase. The higher the values of both parameters, the closer to a polonaise given example is.

The way how different repertoires "move" around the diagram shows historical evolution of "Polish rhythms". This can be observed in a series of diagrams representing selected repertoires of the 16th–17th century. The chosen examples are:

• Thirty-five dances from Jan of Lublin Tablature (Tabulatura Jana z Lublina) (1537–48); PL-Kp Ms. 1716;

• Fifty-nine dances from the *Vietoris Codex* (1660–80); H-Bami Ms. K. 88–89;

• "Polish dances" from the Lute Book of Virginia Renata von Gehema (1640); D-Bds Mus. ms. 40264 olim 20052;

• "Polish dances" from the Szirmay-Keczer collection *Nápévy starých slovenských zpjevanek od urozenè panj Anny Szirmay rozené Keczer roku 1625–1630* (c. 1700?); SK-Mms B II 37.

Collated in one diagram (**Diagram 1**, see the Appendix), the examples representing all the above sources only partly overlap, thus showing that their rhythm parameters (descendability and condensation) differ. This can be followed in detail in diagrams 2–4.

Diagram 2 illustrates how the (still ascendant) rhythms of the dances from the Jan of Lublin tablature, i. e. Jan of Lublin organ book, *Alia [chorea] Poznanie*

change into descendent rhythms of the *Vietoris Codex*:

Vietoris Codex, [Chorea] Poloni:[ca], Prop:[ortio]

while the two collections represent the same rhythm condensation.

Diagram 3 compares dances from the *Vietoris Codex* to those from the Virginia Renata von Gehema lute book. As can be seen, not only descendability, but also condensation of rhythm of the latter is higher, therefore the assumption that despite the supposed chronological order of the two sources, the *Vietoris Codex* represents an earlier stage of development of "Polish rhythms".

In **Diagram 4** further increase in both parameters between the Virginia Renata von Gehema lute book and the Szirmay-Keczer collection can be observed. While the first shows the fully developed mazurka rhythm,

Taniec polsky, Virginia Renata von Gehema lute book (c. 1640?)

the latter actually represents the stage of an early polonaise:

Szirmay-Keczer collection (c. 1700), Dance F3

Generally, the shifting of the music repertoire of the 16th–17th century in terms of descendability and condensation of rhythms can be seen in **Diagram 5**.

This part of the method is very useful to observe general tendencies in historical development of "Polish rhythms". However, to trace particular structures, another representation is more practical.

II. Matrices

Already in the 17th century "Polish dances" and all the more so in mature polonaises we encountered a great variety of rhythms far beyond the boundaries of the typical mazurka or polonaise bars. Analysis reveals hundreds of different types of measures in which subdivision of rhythm on particular beats blurs the distinctness of the "models". To solve the problem, it was necessary to replace particular basic rhythms (the "alphabet") by symbols representing the reduced information.

Thus, the second stage of the analysis consisted of preparing rhythmic matrices according to a specially designed classification of triple-time rhythms. The point of departure of the proposed classification consists of the obvious premise that a rhythmic formula may possess in a given part of the measure: no impulse (0), a single impulse (1),

two impulses (2), or numerous impulses (R). Additionally introduced auxiliary symbols define the syncope (S) and the dotted (punctuated) rhythm within two metric units (Pp). Combinations of those symbols make it possible to present all the fundamental types of formulas. After substituting musical signs, this ostensibly complicated record becomes very simple. The "R" symbols signify the possibility of a further fragmentation of the rhythm in those parts of the measure in which they had been placed.

The classification itself was inspired by the Ludwik Bielawski's classification of triple-rhythms (Fig. 1).

In the next step, the Bielawski's table was turned upside down, with notes substituted by number of impulses and with additional variants representing more fragmented rhythms (in Bielawski's proposal the maximum number of impulses per unit was two). The letter "R" stands for possible fragmentation of rhythm (that is, three impulses or more). I added also secondary symbols denoting syncopation (S) and a dotted rhythm within the compass of two metric units (Pp). Grey fields represent Bielawski's bar-types (Fig. 2).

Fig. 1. Classification of triple-metre rhythms (Bielawski, 1970, p. 114)

Fig. 2. Modified classification of triple-metre rhythms

With combinations of these symbols, all the basic types of bars can be displayed. This seemingly complex notation is in fact very simple.

The proposed method allows precise distinguishing of model-bars and their variants. To identify the model, the most important is the position of non-subdivided values (1) and the values subdivided into two.

The above classification served as a foundation for matrices demonstrating the occurrence of all types of rhythmic structures in the whole analysed repertoire. Matrix is a large table in which columns display all the revealed bar-types (taken from the above classification), while rows contain percentage of particular bars in each composition. Calculations were made automatically in MSExcel macro. To make the matrix visually more informative, it is convenient to substitute numbers with graphic symbols. The size of a symbol is directly proportional to the frequency of given rhythm in the composition. The bigger the symbol, the more frequent the formula, while the lack of any symbol signifies the absence of that type of measure:

Example of rhythmic matrix presenting rhythms of Chopin's Mazurkas

If the repertoire is put in chronological order, the matrix makes it possible to follow the changes in rhythmic structures piece by piece. It is therefore possible to ascertain when a given type of rhythm appears for the first time, in what sort of a repertoire does it attain its apogee, when its role becomes marginal, and when it disappears. Thus, rhythmic matrices allowed precise description of rhythmic properties of compositions of each period.

Conclusions

Thanks to the applied method, it was possible to back up the discussion on "Polish rhythms" using solid ("objective") arguments rather than emotional ("subjective") statements, typical of many previous studies.

The conducted analysis helped reveal five main periods in the development of "Polish rhythms" (Dahlig-Turek, 2006):

From the middle of the 16th century to the early 17th century:
• growing descendental quality + the ♩♩ formula;

The last decades of the first half of the 17th century:
• growing rhythm density + the ♫♩♩ (♪♫♩♩) mazurka formula;

The second half of the 17th century:
• growing rhythm density + the ♫♫ ♫ ♫ polonaise formula;

The 18th century:
• a lowered descendental quality + the crystallisation of the proper mazurka and polonaise;

The 19th century:
• development of so-called "national" dances.

Calculations of rhythm condensation and descendability made it possible to verify some of the heretofore hypotheses relating to the periodisation of "Polish dances", polonaise and mazurka, as shown on the example of the *Vietoris Codex* and the lute book of Virginia Renata von Gehema.

Instead of doing research into Polish art music compositions and Polish folk dances separately, it became possible to compare both repertoires using one unified method, as well as to compare Polish examples to Scandinavian "Polish dances" (especially the so-called *polska* dances in Sweden).

The survey of the sources analysed with the presented method, albeit unquestionably representative, especially in reference to the sparsely preserved oldest stratum, encompasses only a fraction of the repertoire which in the course of centuries grew around "Polish rhythms". On the other hand, the proposed manner of analysing this phenomenon offers opportunities that considerably transcend the above presented application.

We cannot exclude the eventuality that in the future more detailed research into particular fragments of the history of "Polish rhythms" will produce new findings, verifying the conclusions obtained with the presented method. It seems, however, that a cross section presentation of this phenomenon makes it possible to perceive its evolution in a way which may be slightly simplified, but which remains lucid and does not give rise to doubts.

The above-presented method may be also applied to a repertoire not considered in the presented investigations, e. g. in order to compare seventeenth-century "Polish dances" with German dances originating from the same sources, or the rhythmics of Chopin's late mazurkas with that of his waltzes, and in this way to seek eventual similarities and influences. The proposed analysis may also constitute a foundation for a more profound and all-sided interpretation of the repertoire not restricted to "Polish rhythms" because the presented approach, although developed for the study of "Polish rhythms", can be successfully used to study any rhythmic structures within regular metre.

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Santrauka

Kalbant apie muzikinius reiškinius, būdingiausius lenkiškajai muzikai, pirmiausia neabejotinai reikia atkreipti dėmesį į trijų dalių metro šokio ritmiką. Nors ji neišsiskiria unikaliais bruožais, kai kurie tridalių ritminių struktūrų elementai iš tiesų pasirodė besą gana svarbūs ir charakteringi, todėl priskirtini Lenkijos nacionalinės kultūros (kartu ir Europos muzikinio paveldo) kanoniniams simboliams.

Šiame straipsnyje aprašomas ritmo morfologijos kompiuterinio tyrinėjimo metodas, sukurtas lenkų šokių tridaliams ritmams (vadinamiesiems „lenkiškiesiems ritmams") nagrinėti. Atsižvelgiant į tai, kad literatūroje šia tema aiškiai dominuoja istorinio pobūdžio refleksijos ir visiškai ignoruojamos analitinės interpretacijos, šią spragą būtų tikslinga užpildyti ypač dabar, kai šiame procese gali labai padėti šiuolaikinės kompiuterinės priemonės. Todėl šiuo tyrimu buvo siekiama pamėginti atkurti „lenkiškųjų ritmų" formavimąsi.

Nagrinėjami rinktinių kūrinių garso įrašai (visų pirma XVI a. vid.–XIX a. ir kelios XX a. kompozicijos), instrumentinės muzikos notacijos bei liaudies šokių melodijos. Iš viso tyrimo metu išnagrinėtas 791 kūrinys.

Ritmai buvo užrašomi skaitmeninio kodo forma. Atlikti skaičiavimai leido nustatyti du pagrindinius ritmo parametrus: 1) vidutinį ritminį tankį, t. y. impulsų skaičių, vidutiniškai atitinkantį takto vienetą, ir 2) mažėjančią kokybę, t. y. skirtumą tarp ritminio tankio pirmoje ir paskutinėje takto dalyje.

Antrajame analizės etape buvo sukurtos ritminės matricos, kuriomis remiantis galima nagrinėti tirtos medžiagos ritminių formulių atsiradimo chronologiją. Tai reiškia, kad galima nustatyti, kada ritminė figūra pasirodo pirmą kartą, kokios rūšies repertuare ji pasiekia apogėjų, kada jos vaidmuo tampa ribinis ir kada ji išnyksta.

Siūlomas analizės metodas padėjo nustatyti penkis „lenkiškųjų ritmų" raidos etapus ir patvirtinti kai kurias repertuaro periodizacijos hipotezes. Šis metodas tinka ne vien „lenkiškiesiems ritmams", bet ir kitokioms ritminėms struktūroms tirti.
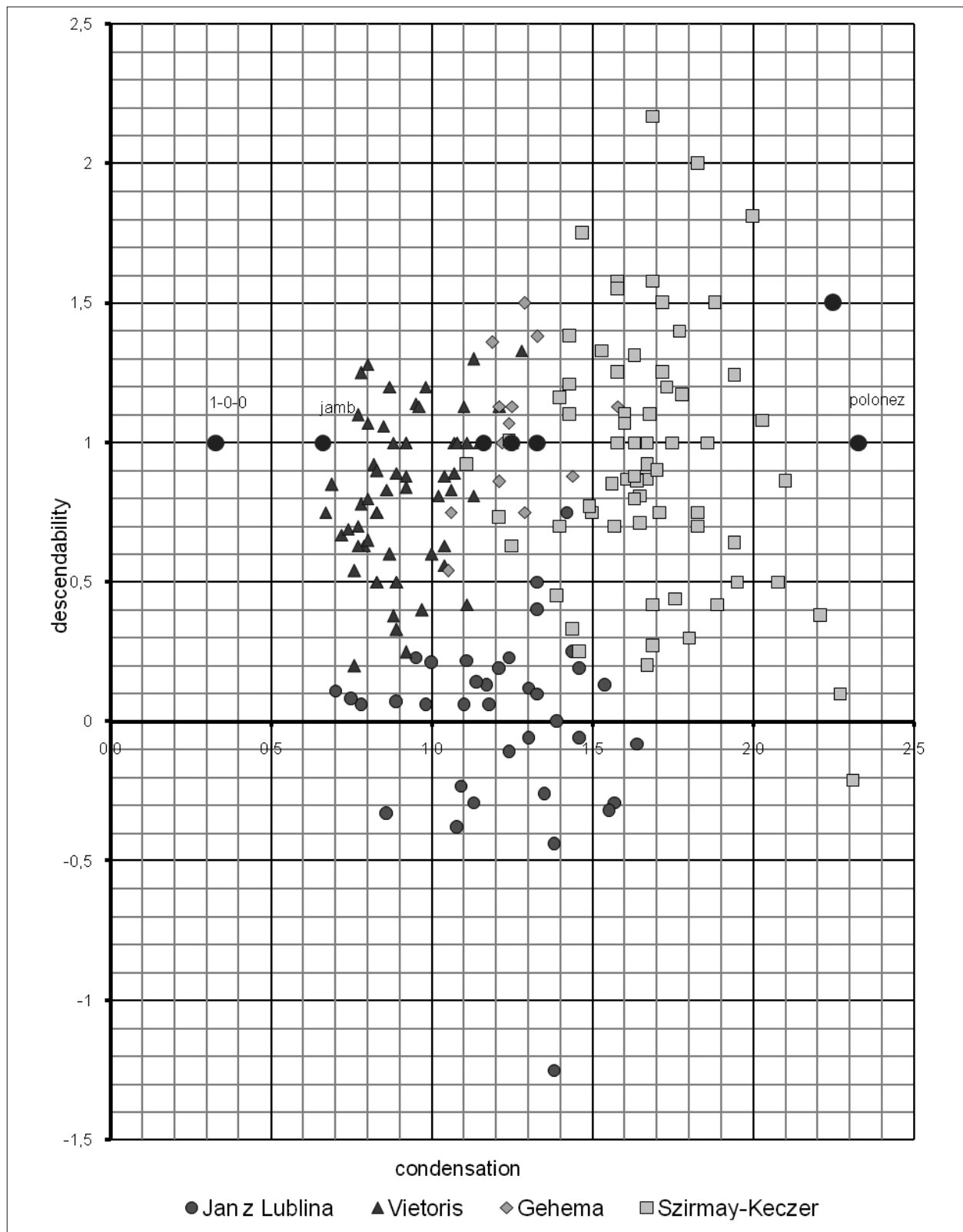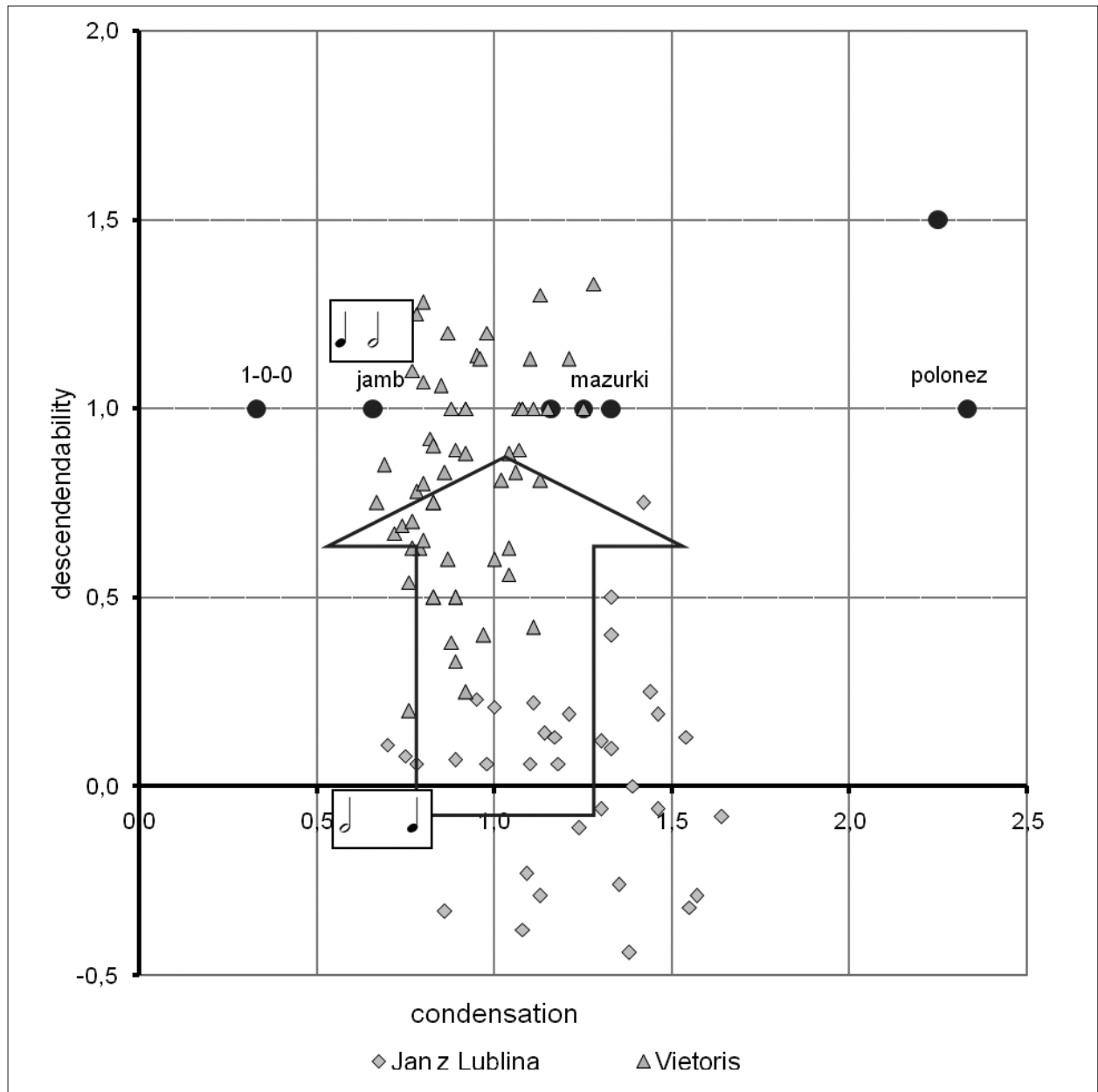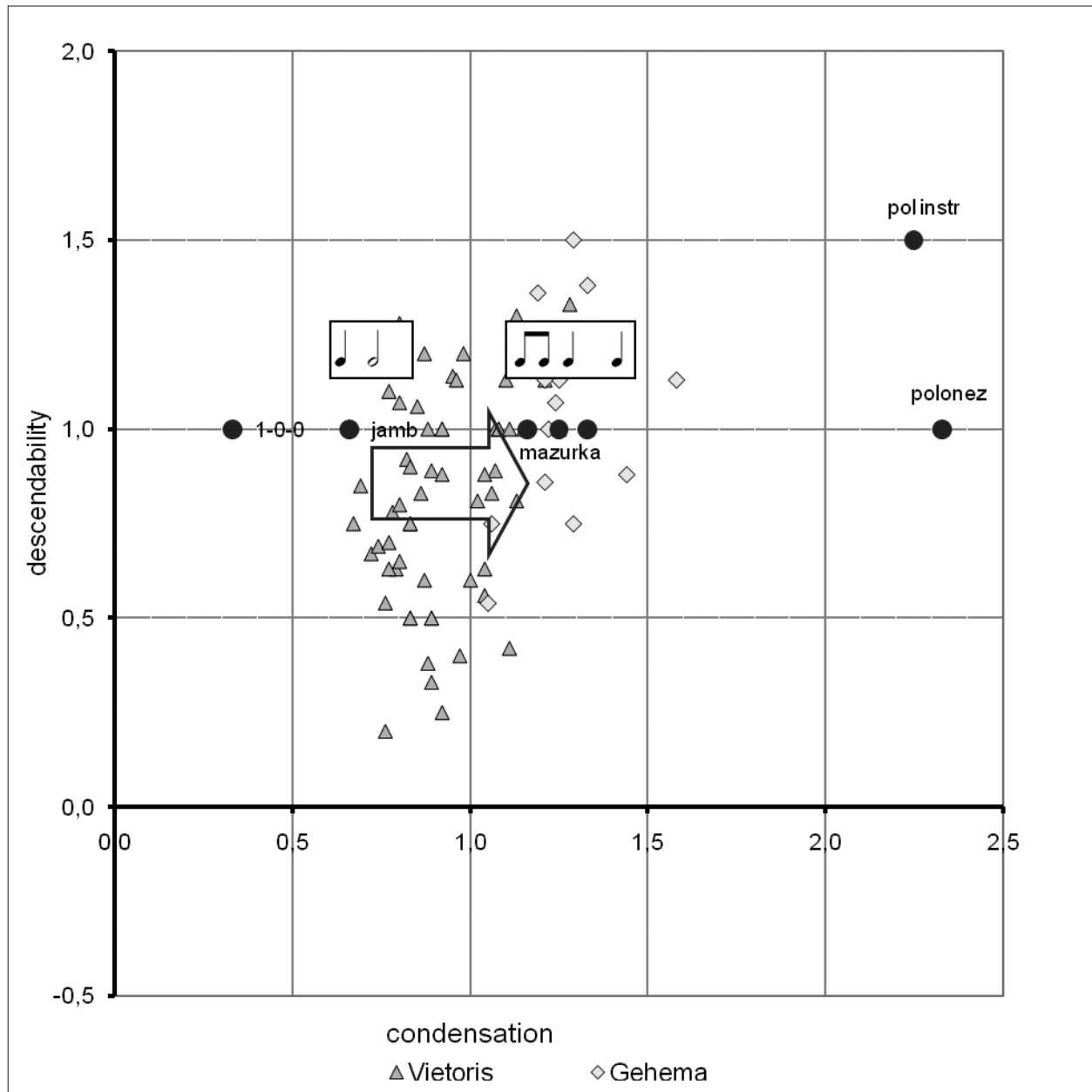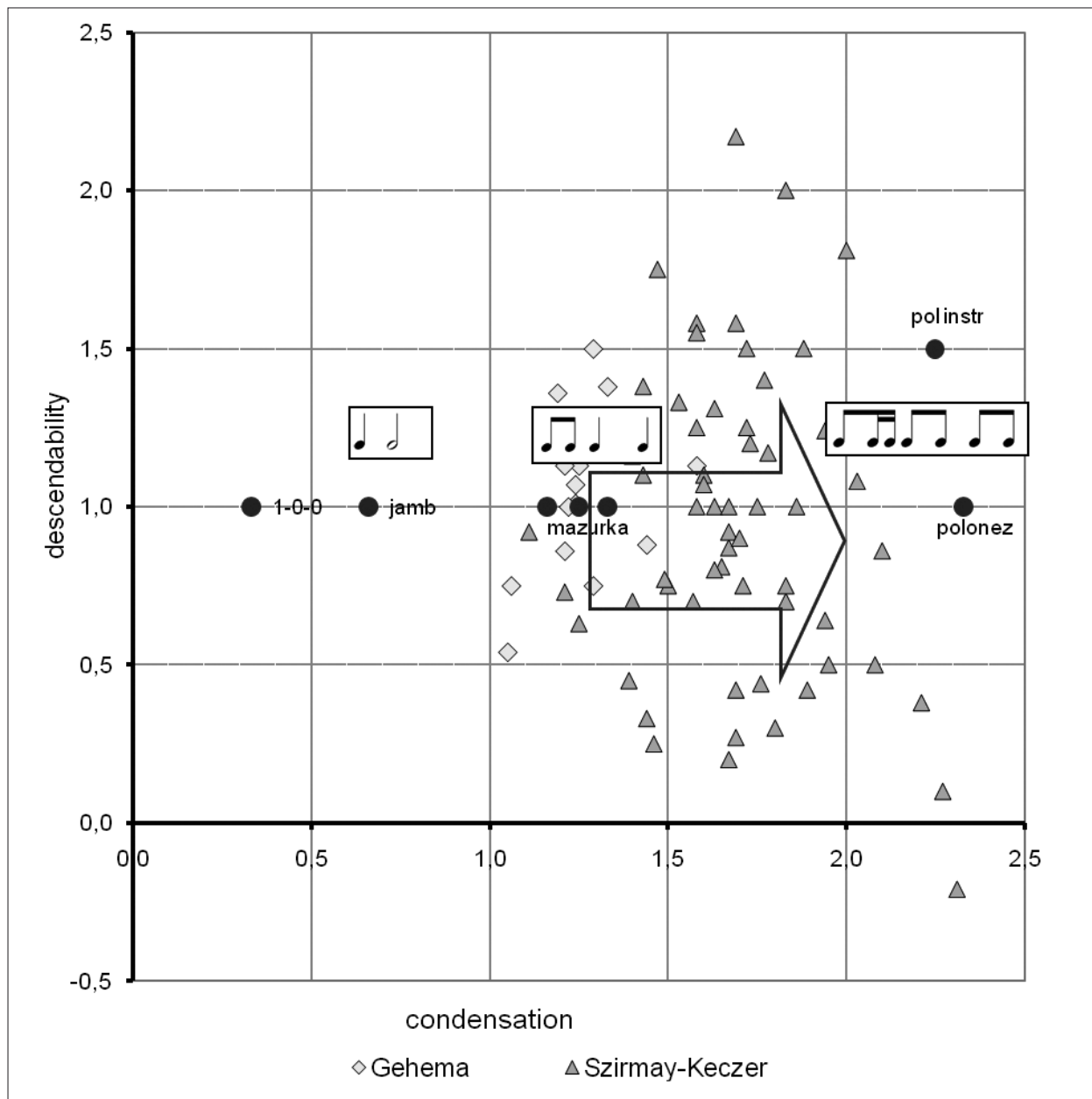
Appendix

Diagram 1

Diagram 2

Diagram 3

Diagram 4

Diagram 5