journal of interdisciplinary music studies
fall 2010, volume 4, issue 2, art. #10040207 pp. 121-142

Drawing a Parallel between the Gaida (bagpipe) and the Zonarádikos Line Dance through Statistics

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Background in Ethnomusicology: The *gaida* bagpipe is a musical instrument highly characteristic of the agricultural societies of Western Thrace. Its special playing technique influences its repertoire (Sarris 2007). One of the main characteristics observed in most genres of the instrument's repertoire is the technique of *parataxis*. A music piece is constructed by a sequence of music segments, which are the structural units of the repertoire (Sarris, Kolydas, & Tzevelekos, 2010). This technique is dominant in *Zonarádikos* line dance, which is considered the 'backbone' of the instrumental dancing repertoire of Thrace.
Background in Statistics: Statistics, as a scientific tool, has been broadly used in sciences as well as in humanities. Regarding music studies, statistics has been applied in compositional techniques, as well as in historical musicology. Regarding Greek traditional music, limited use of statistical methods has been made. Spyridis (1997) has applied the methods of descriptive statistics (distributions, graphic charts, histograms etc.) and stochastic processes for the multilateral charting of a corpus of *Zonarádikos* line dance songs from Western Thrace.
Aims: In this study, we aim to chart instrumental *Zonarádikos* dance played by the *gaida* bagpipe in the Evros region of Western Thrace, in terms of melody, rhythm, and structure, using descriptive statistics. Data from statistic analysis are evaluated under the prism of the instrument's capabilities, hence demonstrating the instrument-repertoire relationship.
Main Contribution: In order to shed light on the instrument-repertoire relationship we use statistical methods. We acquire frequency distributions of absolute pitches, frequently used melodic intervals, rhythmical patterns and other musicological elements of *Zonarádikos*. In a second level of analysis, we attempt to evaluate statistical data under the prism of the *gaida*'s playing techniques and capabilities. We are based on the population of instrumental *Zonarádika* from the *Research Programme "Thrace"* archive (http://epth.sfm.gr). We conclude that instrumental *Zonarádikos* is characterized by 'bipolarity'(song melodies and instrumental phrases, which both have distinctive musical characteristics, are 'interwoven') hence creating the form.
Implications: Our research will help us to draw parallels between the *gaida*, a characteristic instrument of the agricultural societies of Thrace, and *Zonarádikos*, the 'backbone' of instrumental dance repertoire of those societies. Further, our data may have a tutorial application for a prospective *gaida* player wishing to shed light on this genre of repertoire, given that the bearers of this oral tradition cease to exist.

Keywords: gaida, bagpipe, instrumental improvisation, Thrace, music statistics, Evros

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• *Received:* 24 March 2010; *Revised*: 25 September 2010; *Accepted:* 3 November 2010
• *Available online:* 30 November 2010
• doi: 10.4407/jims.2010.11.007

Introduction

Recent research on the *gaida* bagpipe in Greek Thrace revealed a relationship between the instrument's peculiarities and its repertoire. Understanding the instrument's limited capabilities (narrow range, limits in the articulation of melodies, etc.), as well as the way its music is interconnected with them, is of great importance. This knowledge can be used as an analytical tool in order to investigate the relevance of the instrument with the genres of its repertoire. Hence, light can be shed on issues such as the origin of the instrument's music; i.e. whether a dance belongs to the nucleus of the *gaida*'s repertoire, or rather whether it was introduced from the repertoire of another instrument. In order to find answers to such questions we have to codify firmly the instrument's capabilities and the way its melodies unfold. Statistics can offer us the methodology for such a codification.

In this article, we investigate one genre of the *gaida*'s repertoire, the *Zonarádikos* line dance, in terms of statistics. The *Zonarádikos* is considered the most representative dance of Western Thrace, and the most frequently played. It was played mainly by the *gaida* in the past, since the latter was one of the few instruments used. As we will see, it incorporates melodies from the local vocal repertoire together with instrumental phrases. All of these melodies seem to have been 'made' in order to fit to the *gaida*'s peculiarities and 'technical drawbacks'. Hence, focussing on such a considerable genre of the repertoire could offer a stable basis for the continuation of research to other genres. After discussing the *gaida* and the *Zonarádikos*, we present our statistical methodology. Subsequently, we use statistics to draw conclusions regarding the modes used, the displacement of the tonic, the use of the motivic technique and the technique of melodic unfolding, as well as the notes, the melodic intervals and the rhythmic patters used more frequently. Finally, we attempt a cross-parameter consideration of the results of our analysis, under the prism of the instrument's capabilities.

The gaida

The *gaida* bagpipe (Fig. 1) is a popular instrument in the Balkan Peninsula, appearing with minor organological differentiations from place to place. In Greece, it is used in the northern provinces of Thrace and Macedonia. It consists of two cylindrical bored pipes of unequal length, each of which has a single reed. The short one is the chanter (Fig. 1, left), and the long one is the drone (Fig. 1, right). The drone sounds the tonic two octaves lower than the chanter. The musician blows through a tube, while the pipes fit into special stocks, tied on the bag. The instrument's code, on the Hornbostel-Sachs system, is 422.221.262.

The *gaida* has a range of an octave (noted from E4-E5 in Fig. 2, with the A4 as the tonic), divided into two registers: the high register above the tonic, which is more

sonorous, and the low register below the tonic, which is less sonorous. Like all bagpipes, the *gaida* produces a continuous sound due to the constant flow of air through the reeds. The musician cannot articulate the melody by tonguing because he does not have physical contact with the reeds, nor can he play pauses or rests, staccato, or even the same note twice in succession. Furthermore, bagpipes do not have a range of dynamics. Therefore, *gaida* players have developed special techniques to overcome what might be considered the limitations of the instrument, using special articulation techniques, which have a great impact on the distinctive melodic aesthetics of the *gaida*'s music (Sarris & Tzevelekos, 2008).

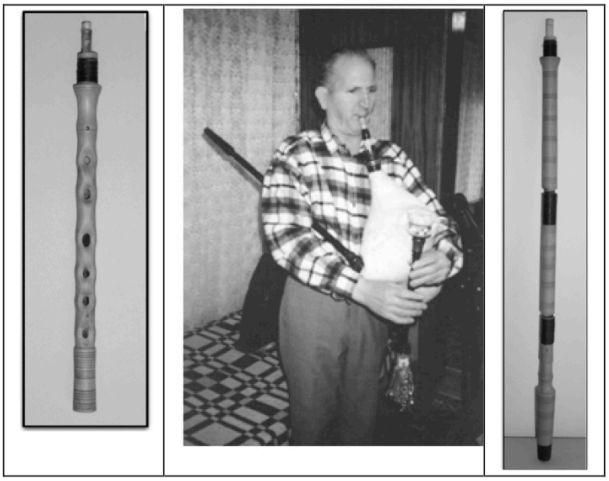


Figure 1. Left: *Gaida* chanter. Middle: Vangelis Kekes (*gaida*), from the village of *Kyani*, *Evros*. Right: *Gaida* drone.

Recent organological research about the *gaida* in the Evros region of Greek Thrace (Sarris, 2007) has indicated a strong correlation between the instrument's capabilities and some genres of its repertoire. Systematic analysis of the recorded corpus of the *Research Programme "Thrace"*[1] revealed the existence of four 'families of genres' for the repertoire of the *gaida*. In the first one, the pieces seem to have been 'tailor made' for the *gaida* since they take full advantage of its capabilities and reflect the instrument's peculiarities. At the same time, these pieces seem to go back in time because some of them are interconnected with carnival and wedding rituals. Based on these facts, this family of genres was named 'The native stream of the *gaida*'. The second family seems to be more related to the makam-system's logic than merely to the *gaida*. These genres seem to have been influenced by the playing technique and the repertoire of instruments such as the *zournás* shawm or the clarinet, which are the agents of an urban repertoire in Thrace. As such, this family was named 'The eastern stream'. The third family was named 'The northern stream' because it is mainly associated with the *Baidúska* (5/8 line dance) and some phrases of the *Zonarádikos* (6/8 line dance) that were introduced from Bulgaria through the clarinet and the 'pan-Thracian'[2] repertoire. This stream is characterized principally by western-type

melodies and is relatively widespread in Bulgarian popular music from the Socialist era on. Finally, the fourth family was named 'The pan-Hellenic stream', since it consists of dancing songs widespread throughout Greece thanks to radio and discography, which fits the *gaida*'s capabilities as well.

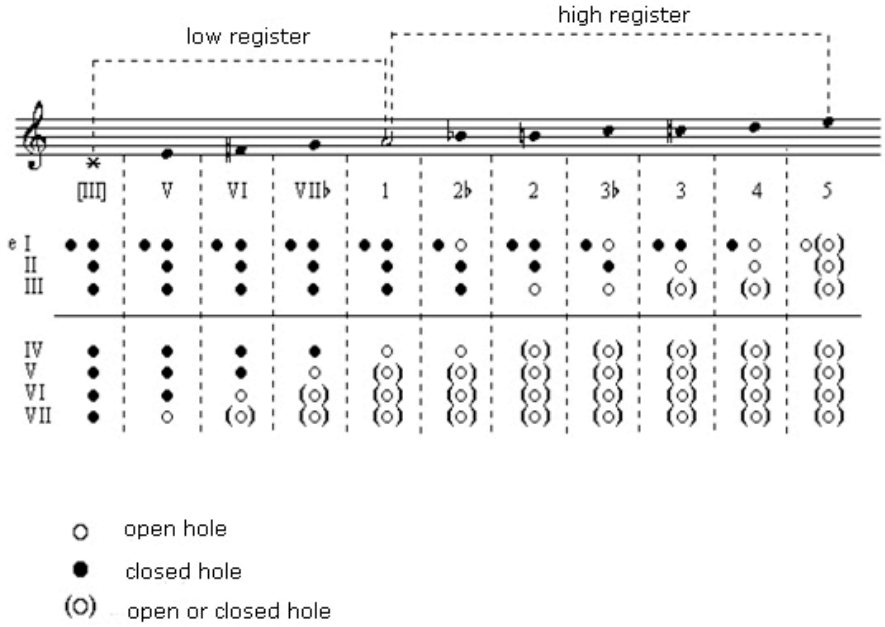


Figure 2. Range and fingering chart of the *gaida*.

Regarding structure, folk music played by the *gaida* can be divided into two categories: the music pieces that follow a periodic logic, and those that follow what we may call 'the technique of *parataxis*'[3]. In the former, a given melody is repeated, with slight variations, throughout a music piece. Such is the case of songs, where the instrument accompanies the singing verse[4]. In the latter, a music piece is constructed by a sequence of *music segments*. As we have written elsewhere (Sarris, Kolydas, & Tzevelekos, 2010):

> We prefer to use the term 'music segment' after Schoenberg's definition (1972, p. 57), instead of the commonly used term 'phrase' because it is rather 'neutral' and can be valid for every self-efficient melodic unit, regardless of its internal structure. Hence, a music segment can either be a song's melody or an instrumental phrase, which in turn may be characterized either by motivic logic[5] or by melodic unfolding[6]. In other words, music segments are the 'structural units' of the repertoire following the technique of *parataxis*: They are complete, but not autonomous; they make sense as the units of a sequence, which in turn creates a form. A form can be composed of segments, repeated and played one after the other according to a traditionally established series as well as according to the musician's fancy. A sequence is neither strictly determined nor absolutely free. Each time the music is played, it is recreated in a new form (p. 73).

The *Zonarádikos* line dance

The *Zonarádikos*[7] is a line dance in 6/8 beat following the technique of *parataxis* (sound example 1)[8]. It is played by the *gaida*, as well as by other instruments, and it is considered the most characteristic dance of Thrace. The music segments used in *Zonarádikos* are three-fold: melodies of dancing songs played instrumentally (I) (sound examples 2, 3, and 4), instrumental music segments (II) (sound examples 5, 6, and 7), and 'burst' instrumental segments (III) (sound examples 8, 9, and 10), which are characterized by short motifs of high ornamentation. As we will see, in the 'burst' instrumental segments the instrument's capabilities are skillfully used in order to give an 'intense' character to the melodies. Anyone who has observed a *Zonarádikos* dance, or has listened to recorded material, would realize that this repertoire is a bipolar of musical and dancing situations: With respect to dancing, on the one hand we have what natives call 'even' and 'smooth' movements (*strotó*, *isio zonarádiko*). On the other hand, we have loftiness of movements, highly ornamented dancing, coiling of the dancers, etc. (usually named *klóssimo,* 'spinning', and *kouloúriasma*, 'coilling'). Dancers can discriminate the music segments suitable for the 'spinning' of the dance, and they dance appropriately. Accordingly, music, being linked with dancing, has two commensurate phases: the music segments used for the 'smooth' dancing (which are melodies of dancing songs played instrumentally, as well as instrumental segments) and the ones used in *klóssimo* (the 'burst' instrumental segments). Each *gaida* player is improvising based on a large sum of music segments from the three abovementioned categories. He forms his music taking into consideration for who he performs, what song he/she may like to hear and dance to, or whether the dancers want to dance more vividly, etc.

Methodology

Our starting hypothesis, based upon the experience we gained through the transcription and analysis of the field recordings gathered for the *Research Programme "Thrace"* archive, is that each one of the three groups of the *Zonarádikos*' music segments played by the *gaida* has distinctive musicological characteristics. Hence, by studying each group through statistics, and, at the same time, knowing about the instrument's capabilities, we should be able to shed light on the interconnections between the *gaida* and the *Zonarádikos*. The first step in our study was to constitute pool of recordings for the three groups of music segments. We carried out the following procedure:

a. We had a group of 437 *gaida*'s recordings coming from the *Evros* region of Greek Thrace. We chose to focus on the Evros region since there is still a concrete living tradition of native *gaida* players, as well as a few second generations' refugees[9] from Eastern Thrace (now in Turkey). Twenty out of thirty musicians found in Thrace were from the *Evros* region, most of them living in a group of villages round the *Erythropotamos* river. The music traditions of the abovementioned villages had much

in common; the *gaida* players were able to play for the dances of each-others' villages. On the other hand, the gaida players living in Rhodopi and Xanthi regions were dispersed with each other. They were second-generation refugees, settled in villages with mixed populations which affected the faster homogenization of people over the last decades, and the fading of the *gaida*'s tradition due to urbanization. Hence, we believe that studying the recordings coming from *Evros* offers a stable basis for our investigation.

b. One hundred seventeen out of 437 recordings were *Zonarádikos*.

c. The next step was to create a group of *Zonarádika* that follows the technique of *Parataxis*. The *Zonarádika* recordings are of two types: the ones were the *gaida* accompanies singing, where the singing verses co-exist with instrumental segments which act as interludes, and the instrumental *Zonarádikos,* which is considered to be 'the original *Zonarádikos*' by the natives, where the player has the opportunity to unfold his skill in improvisation. We chose to focus on the latter exclusively because there the whole 'palette' of the music material used by *gaida* players was present in this group. Hence, the number of recordings of instrumental *Zonarádika* we were going to study was 43.

d. Our corpus consists of a total of 405 music segments, found in the 43 *Zonarádika* of our population. The next step was to categorize them into the three abovementioned groups of music segments (I, II, III). This categorization was done by the authors of this paper. *Gaida* players, as well as dancers, can easily set apart the music segments suitable for the 'spinning' of the dance (group III), while the others are suitable for 'even' dancing (groups I, II). Thus, we relied on our fieldwork experience in order to sort out the segments of group III. Next, we could easily set apart the singing melodies because they were well known. Ninety-two segments for group I were found, 204 segments for group II, and 109 segments for group III.

For the purposes of our study, we investigated the segments of each group in terms of a) mode, b) tonics, c) notes used more frequently, d) appearance of ascending and descending melodic intervals, and e) frequently used rhythmical patterns. For a) and b), since it is a rather simple procedure, we investigated the relative frequency of appearance over for the total of the music segments. For c), d), and e) we used a sample selected by random numbers tables. The results of our analysis will be presented in tables and commented on under the prism of the *gaida*'s potentials.

Statistical Analysis

For our research we focused mainly on general theoretical titles (Croxton, 1953; Mood, Graybil, & Boes 1974; Spiegel, 1975), which offer a comprehensive review of statistics.

Modes

Given that the *gaida* is an instrument with specific capabilities, knowing which music modes are used more frequently and which of them are used less is of great importance. At the same time, if we compare the usage of each mode in music segments of different origin (vocal or instrumental), we may have interesting conclusions. Regarding the music modes, we follow Spyros Peristeris' system (1968) (see Appendix), which is dominant in Greek bibliography of traditional music. The system is based on Peristeris' vast knowledge of Byzantine, as well as Western theoretical systems. Each mode is named after its tonic (C mode, D mode, E mode, etc) and consists of tetrachords and pentachords. The modes are characterized as diatonic (e.g. C diatonic), chromatic (e.g. D chromatic), anhemitonic (e.g. C anhemitonic) and oligotonic, for cases where just a few notes that do not form a tetrachord are used (e.g. E oligotonic). It is a rather 'neutral' system compared to other ones appropriate for modal music, such as the makam system, which focuses on delicate subdivisions based on oral tradition. On the contrary, Peristeris' system offers an abstractive and descriptive charting of the melody (range, notes used, tonic). Appendix 1 shows the tonic and typical range of music modes.

Table 1 shows the appearance of the music modes used in each of the three groups of our corpus' music segments. In the first column, we give the modes. In the second, the tonic of each music segment is given because we may have the same mode with a different tonic. The next three columns correspond to the . The number of appearance of each mode is encoded as well as the relative frequency of its occurrence. The latter, written in parentheses, comes by dividing the number of appearance of each mode by the total number of modes. The closer to the unit, the more frequent the appearance of a mode.

From Table 1, one can see the following results:

- Half of the music segments (50.37%) belong to group II (instrumental segments), whereas 22.72% of the music segments can be classified as group I and 26.91% as group III.
- D diatonic (with A as tonic) appears to be the most frequently used mode (see also Spyridis 1997, p. 300). It dominates in song's melodies (I) (60.87%), and it is used in half of the instrumental segments (50.49%). It is worth of note that in group III, its presence reduces to almost half (30.28%).
- The analogy of the use of C diatonic (A) in the three groups offers us an antithetic icon, compared to D diatonic: its use almost doubles in group III (27.52%), (17.39% in group I, 14.71% in group II).
- D chromatic (A) is used more frequently in group II (9.8%) and less frequently in group I (6.52%) and group III (4.59%). Hence, we can assume that D chromatic is more frequently used in instrumental segments (II) and less frequently used in instrumental segments of the 'spinning' *Zonarádikos* (III).

- The use of G diatonic (A) is almost twice as frequent in group I (8.69%) than in group II (4.9%) and group III (4.59%). Hence, we may assume that G diatonic is rather related to segments of singing origin than to instrumental music segments.
- Regarding D diatonic-chroa A', we observe its double use in group II (5.39%) compared to group I (2.17%) and group III (2.75%).
- At this point, we could possibly draw a parallel between the increased presence of G diatonic in singing segments (I) and the increased (almost double) use of D chromatic, and D diatonic-chroa A' in instrumental segments (II).
- Finally, it is worth mentioning that the use of E diatonic (B), as well as E diatonic (C#), is only present in group III (5.5% and 4.59%, respectively).

Table 1. The appearance of modes in absolute numbers and relative frequencies. I: melodies of songs. II: instrumental music segments III: instrumental segments of high intensity.

MODE	TONIC	I	II	III
D diatonic	A	56 (0.6087)	103 (0.5049)	33 (0.3028)
D diatonic	G	1	1	
D elliptic	A		1	
D chromatic	A	6 (0.0652)	20 (0.0980)	5 (0.0459)
D chroa A'	A	2 (0.0217)	11 (0.0539)	3 (0.0275)
D/C diatonic	A	1	4	3
D oligotonic	A		3	1
D anhemitonic	A		3	1
D/C oligotonic	A			1
D chroa A'	G		2	
D diatonic	B			3
D elliptic	E		1	
D diatonic	D			2
C diatonic	A	16 (0.1739)	30 (0.1471)	30 (0.2752)
C oligotonic	C			1
C elliptic	A		1	
C diatonic	G	1	6	
C oligotonic	D		1	
G diatonic	A	8 (0.0869)	10 (0.0490)	5 (0.0459)
G chromatic	A		1	
B diatonic	C#			1
E diatonic	A		2	3
E diatonic	B		2	6 (0.0550)
E diatonic	C#		2	5 (0.0459)
E oligotonic	A	1		3
E elliptic	B			2
E oligotonic	B			1
TOTAL		92 (0.2272)	204 (0.5037)	109 (0.2691)

Tonic

Investigating which note is used as tonic and where it is used is of great importance for the understanding of *gaida*'s music. The instrument's tonic is A. This note is also played constantly two octaves below the chanter by the drone. As we will see in the next table (Table 2), the A dominates as a tonic for all the groups of music segments. Hence, it is worth exploring where and why the tonic of music segments is not A.

In Table 2, we investigate the notes used as tonics. In the first column, we indicate the respective tonics. The next three columns correspond to the three groups of music segments. The number of appearance of each tonic is encoded, as well as the relative frequency of its occurrence. For the latter, we follow the same procedure as in Table 1.

- The tonic A is used in the majority of music segments: 97.83% in song's melodies (I), 92.65% in instrumental segments (II), and 80.73% in 'spinning' instrumental segments (III). The relative low use of A as tonic in group III is worth to be mentioned.
- In the context of A's monocracy, B and C# have a remarkable presence, but only in group III (11% and 5.5%, respectively).
- G is sometimes used (4.4%) as a tonic in group II.

Table 2. The appearance of tonics in absolute numbers and relative frequencies.

TONIC	I	II	III
E		1	
D		1	2
C#		2	6 (0.0550)
C			1
B		2	12 (0.1101)
A	90 (0.9783)	189 (0.9265)	88 (0.8073)
G	2	9	
TOTAL	92	204	109

From Table 2, we see the predominance of A as the tonic of the music segments. What deserves further research is the relatively high percentage of B, as well as the use of C#. Regarding the former, B evokes a rather harsh dissonance when sounding in an environment where A dominates (i.e. through the drone, or even by the acoustic memory of other music segments that have A as their tonic). As for the latter, C# (which is the fifth harmonic of the drone as well) gives a rather delightful effect when played together with the tonic of the instrument.

Motivic segments and segments of melodic unfolding

Understanding whether a music segment is motivic or follows melodic unfolding may be of great interest. They are antithetic techniques; melodic unfolding is used in the songs sung in *Evros*, ergo in their instrumental version. On the other hand, the

motivic technique is a characteristic of instrumental music. Hence, it would be worth investigating where each one is used, and where these two techniques blend. In the next table, we describe the use of the abovementioned techniques in the three groups of our corpus.

Table 3. The appearance of motivic segments and segments of melodic unfolding in absolute numbers and relative frequencies.

	I	II	III
Motivic		38 (0.1863)	103 (0.9450)
Melodic unfolding	92 (1.000)	166 (0.8137)	6 (0.0550)

We see that the *Zonarádikos* has two antithetical poles; the songs' melodies (I), bearing melodic unfolding, on the one hand, and on the other hand, the 'spinning' instrumental segments (III), which are mainly motivic (94.5%), that seems to constitute a hard core of instrumental segments. Instrumental segments (II) mainly follow melodic unfolding (81.37%).

Pitches

Given that the *gaida* has specific capabilities, knowing which notes are used more frequently and which of them less can provide valuable clues about the instrument's repertoire. Therefore, in this section we try to extract conclusions regarding the relative occurrence of pitches. We chose a sample[10] of music segments from each group based on tables of random numbers; hence, each was just as likely to be chosen. Our samples consisted of about 20% of a genre's population; that is 19 segments from group I, 41 from group II, and 22 from group III.

We applied the following procedure:

- We defined the eighth note (♪) as the metric unit.
- We calculated the number of metric units of each music segment.
- We calculated the duration of each note's appearance in a music segment in terms of metric units. We did not take into consideration the grace notes, which are widely used in the *gaida*'s technique (Sarris & Tzevelekos, 2008). Although the focus on grace notes is crucial for the study of aesthetic and stylistic issues, we preferred to concentrate on the 'main' melody here because the grace notes are under represented in terms of duration. Figure 3 shows an example of a music segment's processing following the abovementioned steps.
- We divided the metric units found in a music segment for each note by the total number of its metric units.

All these values created a distribution for each note and led to the calculation of the mean[11], the standard deviation[12], and the coefficient of variation[13].

In the following tables, we offer information about the mean, standard deviation, and

coefficient of variation for the relative frequency of occurrence of each note for the three groups based on the samples chosen. In cases where some notes are under represented it is impossible to make clues about their relative frequency. In cases where their relative frequency is negligible compared to the remaining notes, the corresponding cells were left blank.

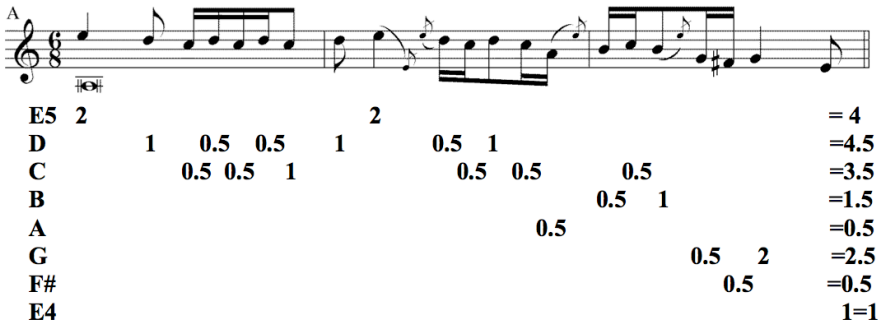


Figure 3. Model of metric unit calculation for each note within a music segment.

Table 4. The appearance of pitches in group I (melodies of dancing songs played instrumentally).

I	Mean (μ)	Standard deviation (σ)	Coefficient of variation (CV)
E	0.0842	0.0817	0.9703
D	0.1517	0.0678	0.4469
C#			
C	0.1969	0.0772	0.3921
B	0.1688	0.0501	0.2968
B♭			
A	0.3121	0.0854	0.2736
G	0.0793	0.0427	0.5385
F#			
E			

Note: Metric unit = the eighth note (♪).

Table 4 indicates that notes A, B, C and D have the largest expected mean frequency, and that they belong to comparatively more homogeneous samples: In other words, their deviations from the mean are not as large as those for the remaining notes.

Table 5. The appearance of pitches in group II (instrumental music segments).

II	Mean (μ)	Standard deviation (σ)	Coefficient of variation (CV)
E	0.1116	0.0490	0.4391
D	0.1381	0.0839	0.6075
C#	0.2110	0.1117	0.5294
C	0.1630	0.1199	0.7356
B	0.1885	0.0536	0.2844
B♭	0.1183	0.0333	0.2815
A	0.3421	0.1640	0.4794
G	0.1070	0.0823	0.7692
F#			
E			

Note: Metric unit = the eighth note (♪).

Table 5 points out that all the notes of the high register of the *gaida* (A-E) have a significant representation. However, apart from B and B♭, their samples are less homogeneous, so we cannot make considerable conclusions.

Table 6. The appearance of pitches in group III (instrumental segments of high intensity).

III	Mean (μ)	Standard deviation (σ)	Coefficient of variation (CV)
E	0.1921	0.1117	0.5815
D	0.2149	0.1272	0.5919
C#	0.2004	0.1573	0.7849
C	0.2812	0.2091	0.7436
B	0.3602	0.2217	0.6155
B♭			
A	0.1317	0.0753	0.5718
G	0.1158	0.0961	0.8299
F#			
E			

Note: Metric unit = the eighth note (♪).

Table 6 can only give indefinable conclusions, due to large values of Coefficient of variation. While Table 4 offers relatively concrete clues, with a range of notes, which could make a diatonic tetrachord, things become more complicated in Table 5. On the one hand, the representation of the notes increases, hence transcending the diatonic logic of Table 4. On the other hand, our knowledge about the mean decreases. A possible explanation could be that the melodies of group II do not remain stuck on a small sum of notes, but, being instrumental, use a wider array of notes found within the *gaida*'s capabilities. It seems that B and B♭ offer us a comparatively reliable value for the mean. The results are rather hard to interpret in Table 6 because the sample is highly inhomogeneous.

Melodic intervals

In the context of the *gaida*'s specific capabilities, knowing which melodic intervals are used more frequently and which of them less, is of great importance as well. Hence, in this section we try to extract conclusions regarding the relative frequency of melodic intervals[14].

In the table presented below, the first column contains all the melodic intervals found in our samples. The next three columns have the number of ascending (+) and descending (-) melodic intervals;,the relative frequency of occurence is given in parentheses for the most frequently used intervals

Table 7 shows this analysis for group I:

- The most frequently used second's intervals are G-A, A-B, B-C, C-D and D-E, both in ascending and descending versions, hence indicating a diatonic logic.
- The most frequently used thirds are the descending B-G, the ascending A-C, and B-D intervals. A diatonic logic is met here as well.
- The fourth's interval A-D, as well as the fifth's interval A-E, both as ascending and descending versions, (also common in groups II and III) are frequently used in all the groups.

Regarding group II we can report the following results:

- The most frequently used second's intervals are F#-G, G-A, A-B ♭, B ♭-C, and C-D. The appearance of the intervals is related to the logic of songs' group, where a diatonic logic predominates.
- The most frequently used thirds are the descending B-G, and the A-C, both as ascending and descending intervals.

Analysis of group III revealed the following results:

- The most frequently used second's intervals are A-B, B-C, C-D, and B-C#, which are found in both ascending and descending versions. The interval G-A mainly occurs in its ascending version, and the C#-D interval mainly in its descending version.

Table 7. Relative frequencies of melodic intervals found in the samples of the three groups.

MELODIC	**I**		**II**		**III**	
INTERVAL	**+**	**-**	**+**	**-**	**+**	**-**
D-E5	28 (0.0397)	25 (0.0354)	12	10	7	10
C-D	75 (0.1062)	62 (0.0878)	50 (0.0604)	47 (0.0567)	23 (0.0454)	18 (0.0355)
C#-D	6	9	8	9	13 (0.0256)	30 (0.0592)
B-C#	4	5	8	6	34 (0.0671)	35 (0.0690)
B♭-C#	3	4	4	4	1	2
B-C	56 (0.0793)	67 (0.0949)	46 (0.0555)	71 (0.0857)	36 (0.0710)	24 (0.0473)
B♭-C						
A-B	49 (0.0694)	70 (0.0992)	63 (0.0761)	50 (0.0604)	51 (0.1006)	22 (0.0134)
A-B♭	6	7	11 (0.0133)	15 (0.0181)	1	3
G-A	42 (0.0594)	36 (0.0510)	83 (0.1002)	39 (0.0471)	24 (0.0473)	9
F#-G	3	7	15 (0.0181)	22 (0.0266)	3	2
E4-F#	1	5	5	4		
C#-E5	2	1	8	5	3	
C-E5	1	5	3	4	2	1
B-D	5	12 (0.0170)	6	4	2	4
B♭-D			3	7		
A-C#	4	7	9	8	22 (0.0434)	31 (0.0611)
A-C	21 (0.0297)	4	38 (0.0459)	15 (0.0181)	5	10
G-B♭	1	1	1	5		
G-B		14 (0.0198)	3	45 (0.0543)	11	32 (0.0631)
F#-A			2	1		
E4-G	2		1		1	2
E4-A	3	4	6	4		
F#-B		1	1			
F#-B♭						
G-C	6		5		3	2
G-C#						
A-D	14 (0.0198)	12 (0.0170)	17 (0.0205)	9	13 (0.0256)	4
B♭-E5				4		
B-E	1			2	1	2
E-B	1	1				
F#-C			1			
F#-C#	1					
G-D			5	2		
A-E	5	7	3	16 (0.0193)	6	2
E4-C			1	2		
Partial Sum	340	366	418	410	262	245
SUM	706		828		507	

Rhythmic patterns

Understanding which rhythmic patterns are more frequently used in each of the three groups of *Zonarádikos* may shed light on the technical differentiations between them, as well as on matters of virtuosity.

The observation of dancing led us to establish a beat of three eighths as the pulse[15]; therefore, we decided to investigate the rhythmic patterns which frequently take place

within a pulse in order to compare their use in the three groups of music segments. Among all the rhythmic patterns found in our sample, we present the most frequently used within each group, which add up to give a relative frequency of 95% or more.

In Table 8, the relative frequency of the main rhythmic patterns found in each group is presented. These patterns are divided into two sets using technical criteria, depending on the presence of sixteenth notes.

Table 8. The appearance of absolute numbers and relative frequencies of the rhythmic patterns found in the samples of the three groups.

	I	II	III
TOTAL BEATS	459	248	312
Set 1			
	146 (0.3180)	66 (0.2661)	50 (0.1602)
	85 (0.1851)	38 (0.1532)	106 (0.3397)
	90 (0.1960)	25 (0.1008)	38 (0.1218)
	34 (0.0741)	46 (0.1855)	26 (0.0833)
SUB TOTAL	355 (0.7734)	175 (0.7056)	220 (0.7051)
Set 2			
	43 (0.0937)	30 (0.1209)	54 (0.1731)
	40 (0.0871)	24 (0.0968)	36 (0.1154)
		10 (0.0403)	
SUB TOTAL	83 (0.1808)	64 (0.2581)	90 (0.2885)
GRAND TOTAL	438 (0.9542)	239 (0.9637)	310 (0.9936)

From the table above, concerning Set 1, we observe that:

- The rhythmic pattern of the dotted quarter is most frequently used in groups I and II, while in group III its presence is reduced almost significantly.
- The quarter-eighth pattern dominates in group III, whereas in the two other groups it is reduced.
- The three-eighth pattern characterizes group II, while its use in the other two is comparatively limited.

Regarding the patterns of Set 2, they are characterized by the intensity of melodic rhythm, due to the use of sixteenth notes. It is worth mentioning that the percentage of use of these rhythmic patterns increases from group I to II, and then from II to III. A possible explanation for this phenomenon is that these rhythmical patterns require more virtuosity; consequently, they are used more frequently in instrumental segments. Within this context, we can interpret the almost exclusive use of the pattern four sixteenths-eighth in group II.

Conclusions

The descriptive statistical analysis supports our starting hypothesis that each genre of music segments has distinctive musical characteristics. Results from the study of the most frequently used modes, frequently used notes, as well as the most frequently used melodic intervals, indicated the predominance of a diatonic logic, especially in the song's melodies (group I). Equivalent results are obtained by Spyridis (1997, p. 300). These results lead us to the conclusion that the mobility of the melody within the context of a musical mode is reinforced by the technique of melodic unfolding. Fieldwork experience has indicated that this logic prevails in Evros' vocal repertoire as well.

At the same time, analysis data point to the division of the *gaida*'s range in two registers: the one above the tonic, where most of the melodic activity takes place, and the low register below the tonic, which is scarcely used. Wherever chromatic, oligotonic, or anhemitonic modes appear, they are mainly connected with instrumental music segments, which take advantage of a wider range of capabilities. On the contrary, it is rather difficult to have secure conclusions regarding the relative use of notes and melodic intervals in instrumental music segments, as well as in the 'spinning' segments of group III. In the latter, things seem much more unspecified because we observe a 'detachment' from the logic of modality, an increased number of tonic centers, and the melodic activity is spread all over the upper register of the *gaida*; melodies have a minimalistic character, bearing a motivic logic, which means that they are reduced into rudimentary motifs, which are merely produced by mechanistic finger movements of the *gaida* player, rather than being inspired by a melody line.

From the deductions above, we corroborate the finding of our previous research that the *Zonarádikos* is above all characterized by a bi-polarity between groups I and II on one hand, and group III on the other. While in the former a song-like character is brought out, in the latter the effect of tension predominates. Given that the instrument is characterized by the monocracy of its tonic (A), which also sounds constantly by the drone, each time a different note is used as tonic an intense effect comes out. This effect is supported by the more frequent use of rhythmic patterns including sixteenth notes, which affects the increase of the melodic rhythm.

Epilogue

The aim of our paper is to investigate the musical characteristics of one of the most significant genres of the Thracian *gaida*'s repertoire, which is the 'backbone' of its music. Unfortunately, our analysis can reveal only a few things about such a multilateral musical and cultural phenomenon as the *Zonarádikos*. Anyone who has observed or danced this dance, anyone who has felt all the energy coming out of the dancers who hold each other tightly in the cycle of the dance, and anyone who has

'filtered' the sound of the *gaida* through his/her soul will understand what we are addressing here.

In the context of the rapid urbanization of Thrace, the *gaida* was almost displaced by the clarinet, especially from the 1950s till early 1990s. The clarinet was considered the bearer of music modernity, while the humble *gaida* was a 'trademark' of the old, poor world that everyone wanted to surpass. In our field research during the late 1990s, we witnessed a gap of almost two generations; the younger *gaida* player in Thrace was in his early sixties, while no one seemed to be interested in learning this 'strange' instrument. During the last few years many young musicians from Thrace, as well as from big cities such as Athens, are interested in learning this instrumental tradition. We believe that this article may be helpful for all those people. It offers the opportunity to perceive music under the prism of the *gaida*. Contrary to the capabilities more sophisticated instruments may offer, one has to take into consideration that for a vast geographic area inhabited mainly by agricultural societies until recently (approximately until the WWII) the limit of instrumental music was the limit of the *gaida*! Hence, anyone interested in this charming instrument and its repertoire has, first of all, to take this into consideration. Descriptive statistics may offer a suitable tool for such a task.

While working for this paper, we realized that the *gaida* was revealing the extent to which an instrument may be interconnected with its music: We firmly believe that this work may be the first step in a wider study for the 'charting' and, consequently, the understanding of the instrument's total repertoire. Hence, unexpected correlations may be unveiled. The elderly *gaida* players of *Evros* are bearers of this amazing living tradition; they manipulate their music material skillfully in their improvisations, and they can still unfold their *Zonarádika*, mixing song melodies and instrumental phrases, hence provoking their dancers to dance vividly. Unfortunately, scholars have much more work to do to fully understand this musical phenomenon someday.

Acknowledgments.

We would like to thank Diana Omigie and Manuela Marin, Department of Psychology, Goldsmiths, University of London, for their significant help in the English editing of our article. We would also like to thank all the *gaida* players of Thrace for the precious gift of their music that they shared with us. The *Friends of Music Association* of Athens for the recording of Paschalis Christidis, the members of the *Research Programme "Thrace"* and, finally, Nicolas and Hypatia for their patience.

References

Croxton, F. (1953). *Elementary statistics*. New York: Dover Publication.

Hippel, P., & Huron, D. (2000). Why do skips precede reversals? The effect of tessitura on melodic structure. *Music Perception*, *18*(1), 59-85.

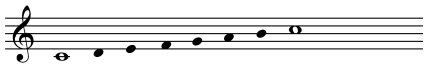
Mood Al., Graybill F., & Boes, D. (1974). *Introduction to the theory of statistics* [3rd edn]. New

York: MacGraw-Hill.
Peristeris, S. (1968). *Ellinika dimotika tragoudia, vol. 3* [Greek Folk Songs, vol. 3]. Athens: The Academy of Athens, Hellenic Folklore Research Centre.
Rombou-Levidi, M. (1999). Pieces of a dance puzzle in the Evros region. The past, the present, local practice, and supra-local ideology. In: L. Drulia, & L. Liavas (Eds.). *Music of Thrace: An interdisciplinary approach, Evros* (pp. 155-59). Athens: The Friends of Music Society, Research Programme "Thrace".
Sarris, H. (2007). *I gaida ston Evro: Mia organologiki ethnographia* [The gaida bagpipe in the Evros region of Greek Thrace: An organological ethnography]. Ph.D. diss., University of Athens.
Sarris, H., Kolydas, T., & Tzevelekos, P. (2010). Parataxis: A framework of structure analysis for instrumental folk music. *Journal of Interdisciplinary Music Studies*, *4*(1), 71-90.
Sarris, H., & Tzevelekos, P. (2008). "Singing like the gaida (bagpipe)": Investigating relations between singing and instrumental playing techniques in Greek Thrace. *Journal of Interdisciplinary Music Studies*, *2*(1-2), 33-57.
Schoenberg, A. (1972). *Models for beginners in composition. Syllabus, music examples, and glossary* (revised edition with corrections by Leonard Stein). Los Angeles: Belmont Music Publishers.
Spiegel, M. (1975). *Probability and statistics*. New York: McGraw-Hill.
Spyridis, C. (1997). *Informatics in ethnomusicology*. Thessaloniki: Gartaganis.
Vos, P. G., & Troost, J. M. (1989). Ascending and descending melodic intervals: Statistical findings and their perceptual relevance. *Music Perception*, *6*(4), 383-396.

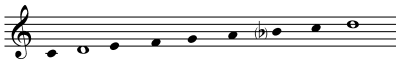
Appendix 1.

Brief depiction of modes after Peristeris system (1968). Holigotonic modes are not included in this table; they are abstract forms of the modes presented here, and they usually consist of two or three notes.

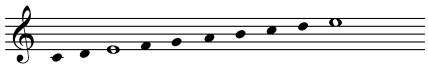
Diatonic modes



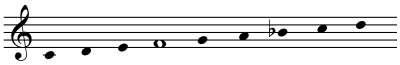
C diatonic



D diatonic

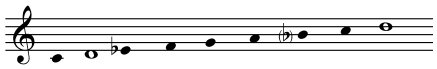


E diatonic

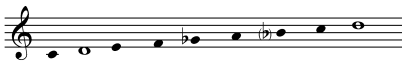


F diatonic

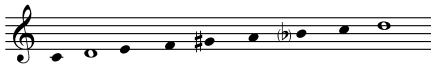
***Chroas* of the D diatonic mode**



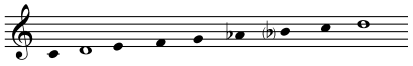
D chroa A’



D chroa B’

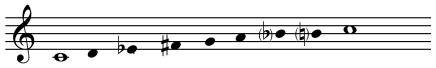


D chroa C’

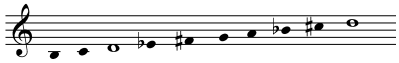


D chroa D’

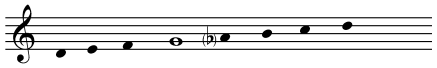
Chromatic modes



C chromatic

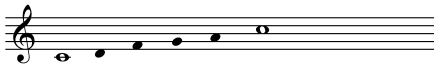


D chromatic

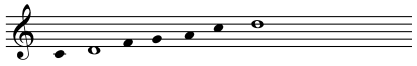


G chromatic

Anhemitonic modes



C anhemitonic



D anhemitonic

[1] *Research Programme "Thrace"* (1995-2004) was an interdisciplinary project of the Lilian Voudouri Music Library of Greece, dedicated to the research of the music tradition of Thrace and Eastern Macedonia provinces of Northern Greece. A large multimedia database was developed, where music recordings, interviews, photos and videos were stored. Access to the database is free after subscription, follow URL: http://epth.sfm.gr

[2] The 'Pan-Thracian' repertoire is a simplified and homogenized version of the repertoire of Thrace, which was introduced in the big cities of Greece (mainly in Athens) through the radio, the discography, as well as through folkloric dance groups. The music pieces were orchestrated and played by mixed orchestras of Greek folk instruments, which were not in use in Thrace. The musicians were professional soloists from various areas of Greece, hence they 'grafted' the music they played with exogenous music elements. The power of the radio broadcasting brought about the vast diffusion of this new music aesthetics.

[3] Parataxis: from Greek verb *paratásso*, which means 'the act of placing side by side' (*pará*, beside + *tássein*, to arrange). It is a literary technique in writing or speaking that favors short, simple sentences, often without the use of conjunctions.

[4] Singing verse: a complete structural unit, where an entire circle of a song's melody is unfolded.

[5] Motive: The smallest self-efficient, but not autonomous melodic unit, through which a melodic idea is emerging. Motivic logic: When motivs are standing out through the unfolding of a music segment; these motifs are placed side by side, they are modified, developed, or interchanged.

[6] Melodic unfolding: When one cannot make out motifs in a music segment, but rather a unique unfolding melodic line. In melodic unfolding, a 'melodic liquidation' of the original motivic material is taking place; that is a melodic development, through which one cannot make out any characteristic motifs.

[7] *Zonarádikos* is named after the *zonári* (= belt), because of the common practice of male dancers to hold each other by their belts. This term was one among all used for the instrumental 6/8 line dance, which is danced with some differentiations in almost all the vast area of Thrace. The term *Zonarádikos* was broadly diffused since the 1960s through the 'pan-Thracian' repertoire, as well as due to the influence of folkloric dance groups and dance researchers, who wanted to categorize the dance repertoire of Thrace, using *etic* criteria. It was used both for instrumental music, as well as for dancing songs sung vocally. Many of the locally used names, which had a rather descriptive than 'tagging' character, have been unearthed through recent research (Sarris 2007, 290-93, for the names used in instrumental music, Rombou-Levidi 1999, 169-74 for the names used in vocal songs). Here, we use the term *Zonarádikos* for the instrumental 6/8 line dance.

[8] The recording of Example 1, as well as the sound excerpts of it heard in Examples 2 – 10 is a *Zonarádikos* performed by Paschalis Christidis in Didimoticho, on July 1st 1998, and was recorded by Haris Sarris. *Research Programme "Thrace"* Archive, code: Md084_11. The music examples can be found in *JIMS* webpage (http://www.musicstudies.org/).

[9] In 1923, as a consequence of the creating of nation states with homogenous populations, a compulsory exchange of populations between Greece and Turkey (Treaty of Lausanne, July 24, 1923) and between Greece and Bulgaria (Treaty of Neuilty, November 27, 1919) took place. Moslems from Greek Thrace were exempted from the exchange, along with the Greeks of Istanbul.

[10] Since the processing of a single music segment in terms of the parameters under investigation in the paragraphs 3.4, 3.5 and 3.6 is rather time consuming, we chose to select a sample from each group, using random number tables.

[11] The mean is the arithmetic average of a set of values, or distribution.

[12] The standard deviation is a measure of the variability of a data set. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.

[13] The coefficient of variation is a relative measure of dispersion that helps us to compare the variation of two or more sets of values, taking into account their means and standard deviations. Values of 0.1 or lower reveal a satisfactorily homogeneous sample.

[14] The issue of ascending and descending intervals is discoursed by Vos and Troost (1989). They focus on the intervals mainly used in classical music. They are based on the study of a selected sample consisting of the beginnings of a number of classical compositions. They also include in their sample songs by the Beatles, as well as material from eight ethnic cultures. Doing so, they attempt to compare the classical samples with the popular/ethno samples in terms of ascending and discending intervals. At the same time, they perform acoustical tests in order to support their statistical analysis. Hippel and Huron (2000) analyze a sample of vocal music coming from four continents using statistics. They focus on the sequence of ascending and descending intervals in relation to the vocal tessitura.
On the other hand, our statistical analysis is rather descriptive. Contrary to the abovementioned works, which are based on a multi-fragmental sample, we rely on recordings of a particular dance genre (the *Zonarádikos*) played by a specific instrument (the *gaida* bagpipe) originating from a specific geographical area (the *Evros* region of Greek Thrace). The recordings took place in late 1990s and they have been transcribed following the same methodology. Hence, we believe that this material is suitable for an in-depth analysis, which can lead to concrete conclusions regarding the style of music in this repertoire.

[15] Spyridis (1997, 361-65) focuses on the rhythmical patterns used in vocal songs of the *Zonarádikos* within a 6/8 music meter, hence producing valuable data for a wide array of rhythmical possibilities. We chose to use the pulse of three eighths as our unit not only because of its connection with dancing movements, but due to the fact that all the rhythmical motifs take place within this unit, and that the 6/8 meter is, in fact, the combination of two three-eighth patterns.

Biographies

Haris Sarris is a research associate at the Department of Traditional Music of the Technological Institution of Epirus, Greece, as well as in the Department of Music Studies in the Universtity of Athens. He teaches Ethnomusicology, Organology, and Music Cultures courses. He received his PhD degree in Ethnomusicology (2007) from the Department of Music Studies of the University of Athens. His PhD is an organological ethnography of the *gaida* (bagpipe) in the Evros region of Greek Thrace. He has also studied the accordion, harmony and counterpoint in various music schools. He plays the Cretan, Dodecanesian, and Thracian *lira*, as well as the *gaida*. He was a member of the *Research Program "Thrace"* (1995-2004), where he undertook a special research project about the *lira* fiddle and the *gaida* in Thrace and Macedonia. He also undertook the transcription of about 3000 songs and tunes of the Programme's archive. From 2001 to 2004 he taught Music cultures and Greek traditional music in the University of Thessaly. His research interests include musical instruments, instrumental music analysis, and ethnographic film. He has written reviews for the Hitech magazine since 1998. Contact: hsarris@otenet.gr

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