# “Ethnic” Music in the Balkans: Identity, Similarity and Classification Norms

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***Abstract*—In extended regions, where several “ethnic” groups have been living together for many centuries, apart from systematic instruction, given at schools or universities, not always fixed boundaries develop for ideas, customs and social behavior. This is also true for music, and generally speaking for arts, whose intellectual achievements transcend human societies and cultures. In networked communities, the information superhighway brings together musical activity reflecting spheres of influence in the synchrony or diachrony of their ongoing social development. This research examines the features involved in setting up Metrics and Norms for Identity and Similarity, along with Classification methods for South-Eastern European and Eastern Mediterranean tunes as they have been traced in a survey in the Balkans.**

***Keywords*—Comparative Study of Musical Features, Modes, Genres, Scales, Organizing Principles.**

## I. Introduction

In recent times, music distribution has reached a highest point of influence, as cost-effective business models overwhelmingly supply virtualization platforms, i.e. Software-as-a-Service networks, providing endless streams of melodious hearings. Some of these function as on-demand payable amenities, while others base their revenues on public media-like promotional campaigns [1].

Even further, unauthorized reproduction of artistic works, usually developed on parallel with software piracy, has made it possible for developing countries to be provided with amenities, like music streams, that otherwise would be unaffordable, and thus, limited in circulation for them [2].

This form of communication reaches large numbers of people, and is vigorously added to the existing triad for music distribution: radio, television and digital discs sales.

However, while some methods for transmitting music, like RF broadcasts, are subject to geographical restrictions due to physical or imposed controls by regulating authorities, others have a clearly transnational range, operating across state boundaries and nationalities. Not withstanding the commercial model for music distribution, contemporary music thrives via various alternative channels of communication, albeit sometimes piracy is promoted as an essential factor. Therefore, somehow, an extensive beyond border-lines continuum is shaped for musical exteroception.

In the region of the Balkans, it is not unfamiliar to have in concerts concurrently traditional Slavonic music patterns accompanied by 19th century Western European polyphonic choral renditions, Byzantine scales interfering with maqams, microtonal scales from antiquity revived by contemporary composers of electronic music, to mention a few styles of popular art [3].

Musical depth in its diachrony mingles with apparent chartbuster trademarks, like Spotify, Amazon, e-Bay, YouTube or iTunes, which contribute to the excessive increase in the supply chain for goods and services over the Internet. For practical reasons, all these providers need to classify, often in an arbitrary or controversial way, their commodities available on demand.

Music can be categorized into different genres in a multitude of ways. There are commercial and academic approaches for such a classification. Genres (from French, meaning “kind” or “sort”, originating from Latin GENUS and Greek ΓΕΝΟΣ) were consistently used for many centuries to classify in ordered sets of similar works literature pieces along with other forms of art and entertainment [4]. As new forms of music are invented, genres may be altered, discontinued or mixed together to produce new forms [5]. It is also possible for opuses of music to fit into two or more categories.

As a result, the way that music is classified may be different when encountered as a commercial activity, strongly biased by the production tactics of the prolific music industry, and when academic criteria are applied

In academic terms, for instance, Beethoven's Op. 61 and Mendelssohn's Op. 64 violin concertos are considered part meronyms of the same genre, but somehow different in form [6]. Therefore, apart from the genre classification, we may have hyponyms for style and form classifiers. Not all scholars agree on how classification should be administered, or how different is style from genre, but more or less it is accepted that they rely on common “basic musical language” characteristics.

Even further, technological vendors and some scholars, having experience in music which has proliferated in the Western world [7], have developed criteria in response to demand by audiences and producers that live in such countries, and consequently characterize all other forms of music outside their paradigm as “ethnic” (Figure 1).

(a) 

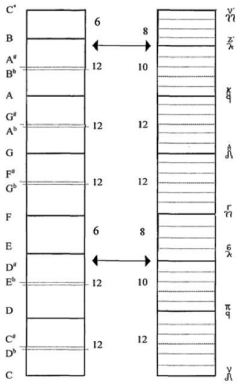
(b) 


Figure 1. (a) A well-appreciated commercial scheme for classifying music; image cropped from social media (b) an Academic approach in discriminating Genuses and Modes by comparing Scales. The intervals per octave are denoted in echomoria.

There seems not to be a dynamic tool to segregate what is common between the music of Balkan countries, Middle East countries or countries around the Mediterranean basin [7]. When Far East traditions are encountered, matters become more complicated. For example, researchers are systematically investigating what common exists between a song accompanied by a bass in one case and tambour in another. They also try to encode what is the bias exercised by the musical "language" used, along of course with the phraseological attributes of the natural language used and the idiolect features it may mold in singing [8].

Therefore, apart from the overwhelmingly obvious characteristics, that have to do with the CMN-based classification schemes, there other criteria that aid the distributors and the public to make sense out of "unpredictable art" and not pack it in the loose, shapeless category of "ethnic" [9].

It is true that up to now most contemporary music produced originated from the "Western" world, not to say the English speaking part of it. It is also obvious that styles like "Hip-hop" or "Rap" are highly influential among young audiences and thus have been adopted by the community of "ethnic" music as well. However, it is not the same to have the Hispanic version of it or the Middle East variants of it.

Even further, as modern technology facilitates the production and distribution of music, it seems that most arrangements will be sooner or later produced by the "other" world, whose tradition was styled as "ethnic".

This paper presents examples of Balkan Music, along with the scheme of melodies used in the greater region of South-Eastern Europe and East Mediterranean, that provide intuitive incentives for more accurate classifiers, based on Identity and Similarity characteristics.

## II. Problem Formulation

Music, in its generalization and in a global level, comprises a complex phenomenon, which cannot be uniquely described, due to its inherent acoustical variegation. This diversity in the characteristics of the auditory effect is due to the geographical dispersion, the musical culture of the peoples, the historical periods of music, the languages used and other issues, which are studied extensively in ethnomusicology.

One of the greatest differences spotted between the so-called "Western" and "Eastern" Music is related to the musical scales and modes that are used in both cases. Eastern modes (e.g. Oriental Music, Byzantine Music, etc.) have a very wide range of microtonal intervals and therefore strong use of music chromaticism, both in notation and during performance [7].

This is pictorially explained in Figure 1(b): the chromatic scale of Western Music, in its most decorative form, as far as semitones are concerned, is parallelized, in terms of similarity, with the most diatonic of the Byzantine Music scales, that of the 8th Mode [10]. The strong lines denote the fixed notes and the intervals formed between them, in echomoria, rather than in cents. The full octave thus extends to 72 echomoria, having as equivalent 1200 cents.

The double-edged arrows denote pitched toned incompatibilities for specific notes (E with Βου and B with Ζω) [10].

The dotted lines denote the alterations of natural pitches that may appear as accidentals of various forms. This comparison is not derogatory to Western Music; it rather reflects the fact that in "West" instrumental symphonic music has prevailed, demonstrating the zenith of its influence with polyphony and contrapuntal masterpieces, while in "East" the epicenter remains the interminably evolving singing voice. For example, this microtonal nature is evident as everyday practice in Middle East, when the muezzin's voice is coming atop the minarets fives times announcing the call to prayer in a melodic way. Furthermore, the wide range of "exotic" microtonal fluctuations seems quite logical to contemporary researchers, since the mathematic modeling of music allows the extensive use of sound frequencies and intervals, from both electronic musical instruments (except for those tuned and restricted according to the equal temperament system, like the piano) and the en masse singing voice recordings, dynamically variable due to human physiology deviations from typical norms [11].

On the other hand, this microtonal autonomy has been significantly reduced in Western music as, apart from the tonic notes involved, in conventional harmony, only two "modes" have been established as dominant (major / minor) yielding the apposite scales. In East, however, there is an astounding variety of scales and modes, as seen in Figure 2 for Byzantine Music [9][10][12].

This particular simplification is usually only adopted in notation (Common Music Notation – CMN), since in

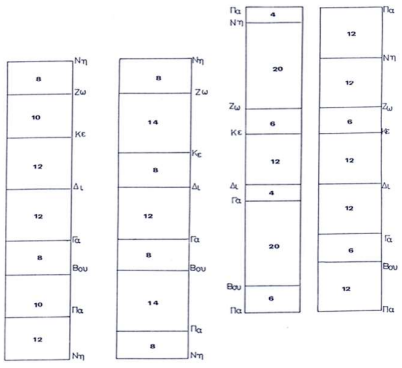



Figure 2. The diatonic scale of Byzantine Music compared to chromatic and enharmonic scales. Intervals denoted in echomoria.

actual performances, the deviations from notation are obvious and in many cases overshadow the writings on the sheet. This can become obvious from the comparison of two audio performances of the same song from different artists. Although both versions are based on exactly the same western music notation (they can even be in the same tonality as well), the auditory and aesthetic result can be very different for many reasons: different chromaticism [7], different musical instruments, etc.

However, although in our era music circulates predominantly recorded, in the majority of cases, for centuries, music was received in written form. Therefore, the acoustic content related with the conceptual semantics of music (i.e. its semasiology) was inferred out of its semiology [13].

## III. Information Theory: The Theoretical Background

When different sets of symbols are used for music notation, then a mathematical quantity expressing the "a priori" probability of occurrence for a particular symbol or a sequence of symbols may be used, as contrasted with that of alternative sequences of basic elements.

If $M$ different symbols are encountered, representing the multitude of notes for a certain musical system in fixed order $1, 2, \dots, M$, and having correspondingly possibilities of appearance $p_1, p_2, \dots, p_M$ within a melody, in Information Theory terms no other constraint may be set for the use of these symbols, at least denoting knowledge that proceeds from theoretical deduction [14]. Shannon's equation denotes that if $M$ different symbols are encountered in a sequence of $G$ musical events, then the "entropy", i.e. the informational content of this series of semeiotic events is

$$H = GI = G_k \sum_{j=1}^{M} p_j \ln p_j \quad (1)$$

where $I$ is the mean piece of information delivered by each symbol encountered in a melodic sequence, and $G_k$ a constant dependent on the analysis of $k$-length tuples of notes; it is also true for these symbols that

$$\sum_{j=1}^{M} p_j = 1 \quad (2)$$

How this concept works out may be demonstrated with the use of a very simple "alphabet", comprising of two "letters", namely *0* and *1*. If $G$ cells are encountered in a sequence, $N_0$ may be assigned to *0* and $N_1$ assigned to *1*, so that $N_0 + N_1 = G$. The probability that a certain cell may contain *0* is $P_0 = N_0/G$ and the probability that it may contain *1* is then $P_1 = N_1/G$.

The number of possible ways to arrange these $G$ consecutive cells is $P = G\,! \,/\, (N_0\,!\, N_1\,!)$ (3)

Out of these numerous "messages" that may be formed by arranging the letters of the "alphabet" along these $G$ cells, entropy is related to the uncertainty the observer senses out of a series of notes, describing a melodic line.

In music, it is obvious that notational symbols are not arbitrarily put together, but rather they are ingredients and constituents with artistic arrangement, i.e. they are successive applications of "functions" that contribute to the formation of harmonized sequences.

Conditional entropy $H_{cond}$ is a measure of how "bounded" is the melodic message, that is what is the probability of a musical symbol $a_j$ to appear, if a sequence of $k$ symbols has preceded, arranged within the $G$ melodic cells. This set $\{p_i\}$ of $k$ symbols $\{a_{i1}, a_{i2}, \dots, a_{ik}\}$ imposes some kind of restriction on what the $k+1$ symbol of the sequence may be.

If $p(a_j/a_{i1}, a_{i2}, \dots, a_{ik})$ is the probability that symbol $a_j$ may appear if the tuple of $k$ symbols $\{a_{i1}, a_{i2}, \dots, a_{ik}\}$ has prevailed, then

$$H_{cond} = -\sum_{s^{k+1}} p(a_{i1}, a_{i2}, \dots, a_{ik}, a_j) \cdot log_2 p(a_j / a_{i1}, a_{i2}, \dots, a_{ikj}) \quad (4)$$

in bits/symbol [14].

During the transmission of these symbols, the melodic source may be found in different states. Compound entropy is a measure of the ability of a melody to shift into various $r$ sequences of symbols, i.e. to form various characteristic compositions, different one from each other.

$$H_{comp} = -\sum_{i=1}^{r} p(k_i) log_2 p(k_i) = -\sum_{i=1}^{r} p(a_{i1}, \dots, a_{ik}) log_2 p(a_{i1}, \dots, a_{ik}) \quad (5)$$

in bits/k symbols [14]

where $p(k_i)$ is the appearance-probability of the $k_i$ state.

This approach yielded notable analyses till the turn of the millennium, where music was more circulating in written form than as an audiovisual event. Indeed, in our times music is disseminated without any delay or difficulty in multiple forms (lyrics, scores, videos, audio files, karaoke, MIDI, audio tracks, etc.). Therefore, analyses where then more "alphabet" oriented.

To explain this situation, one may use the parallelism of the Slavic languages. It is evident that this linguistic family is distinct from the others surrounding it geographically, and that there are clearly many common elements between its members when the verbal communication is encountered. However, when written communication is taken into account, the family of West-Slavic languages (Polish, Czech, Croat, Slovak, Slovene and Sorbian), which is using variants of the Latin alphabet, is quite different from the East-South subgroup (Russian, Ukrainian, Byelorussian, Bulgarian, Macedonian) in its semeiotics. Many times no one-to-one correspondence may be found, not only to morpheme level, but sometimes even between characters representing sounds used in speech. Serbian, even though not any more directly linked to Serbo-Croat, is a special case of one language, more or less with its variants and dialects in neighboring countries, written in both the Cyrillic and Latin alphabets.

Consequently, there is an obvious shortage of symbols representing sounds between members of this linguistic family group, and some kind of symbolic augmentation is employed, leading to disambiguation for the exact pronunciation. This happens to many other languages as well; however, it is characteristically obvious in the enclave of Slavic languages acoustics.

## IV. Experimental Results

As hitherto explained, there is a considerable multitude of scales used in modal music in the Balkans and Eastern Mediterranean, apart from the usual major and minor ones. Not all musicians are trained to reproduce this versatile music literature adequately; as a mater of fact, few can shift from one musical paradigm to another.

For testing the acoustic properties and qualities of the singing voice, as information received out of semantics, a liturgical tune performed widely in the Balkans and Eastern Mediterranean was used: the 9th ode of Mode 5, "Isaiah Dance", in "Heirmologic" style. In its contemporary written form it has been excerpted from memorable editions of the "Heirmologion" in 1825 and 1901, and it is attributed to Petros the Peloponnesian (1730-1778). Scholars reasonably induce that it has been performed more or less the same melodic-semiotic way in sermons like matins, weddings and ordinations since the early 17th century [15].

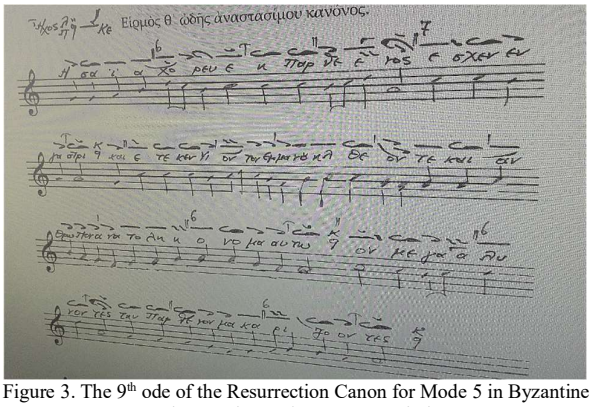


Figure 3. The 9th ode of the Resurrection Canon for Mode 5 in Byzantine Music Notation and CMN transcription.

The melody was critically edited by Prof. N. Paris, and was also transcribed to CMN semeiotics [16]. Experts in music were used to perform it.

In terms of Information theory, the performers decipher a series of *G* notes to describe the combining vocal or instrumental sounds that produce the melodic form. Not all (musical) "alphabets" have one-to-one correspondence in reflecting particular quantities, like pitches, or qualities, like expressions of stress. As it happens with spoken languages, there is a multilevel set of forms, especially in vowels, where in some languages certain combinatory sounds, phenomenally alike, may be perceived as monophtongs, diphthongs or even triphthongs. Also, as for writing purposes languages may employ syllabic or logographic signs, in the same sense music semeiotics may be pitch oriented, as is the case with CMN, or to form a Delta system, as is Byzantine Music [11].

Many times the score itself, leaves room to the singer for more added value in his performance by patterns of intonation, prosody and "qualitative" patterns of stress, that have no exact equivalents in CMN and Western European "diatonic" mentality.

This research involves three levels of expertise involved.

### *A. The* "*scholars*"

They are the ones that may compose melodies. They attempt to express as better as they can, in writing, the melismatic nature of an artistic arrangement, like a song. Their accomplishments are not particularly probed in this survey - rather they are taken axiomatically. (Figure 3.)

Figure 4. Musicians performing the ode "Isaiah Dance" in various modes. Left, Group I performers, right, a Group II one.

### *B. The* "*performers*"

They are skillful in interpreting, vocally or instrumentally, a piece of music. They are experts in "translating" the semeiotics of melodies to accomplished performances. Their skills are easily recognizable. They are capable of quickly comprehending the score; in some cases they were able to give a rendition of it as soon as they had seen it in the computer screen (Figure 4).

They acted modally in three clusters.

The first cluster, aka Group I, performed the melody following the Byzantine Music semeiotics, in their original form, for the vocal part. For the instrumental rendition, the CMN score was adapted to the maqam style closest to the vocal performance and was adequately performed by an accordingly tuned tambour (Figure 4).

The second cluster, Group II, performed the melody instrumentally, using a bass and CMN (Figure 4). However, before playing the tune, they had listened many times the "original" performance, as Group I recorded it. In the places where they sensed a discord, they rather played the music by ear than by the exact CMN dictation so to pertain the pervading mood. When using a keyboard, they exerted pitch bendings to "correct" the discorded tones.

The third cluster, aka Group III, to avoid this obvious dissonance of the written forms, as far as this specific ode is concerned, employed computer technology to reproduce instrumentally the tune. Instruments like harp or piano where used. Then, the singers hearing with headphones the CMN tune, they performed accordingly the vocal part, following the notation rather than the original hearing, as recorded by Group I.

Obviously, the renditions of Groups I and III are the ones semeiotically correct. For this purpose, *F0* was calculated, with an autocorrelation method, using MATLAB. The exact comparison of the fundamental frequency curves between them reveals the difference in styles of execution (Figure 5).

Indeed, the melodic curves reveal many characteristics of voicing that are inherent to the way of each musical system used. Of course, some phenomena are not related with *F0* per se; for instance, the "chirp" like deviation seen between 450 and 550 *ms* in Group III's performance, is due to the emphatic way that the singer performed the otherwise unvoiced alveolar fricative /s/.

It also becomes evident, that Group I's singing is producing continuous sounds, and the alteration from one vowel to the other is performed in a combinatory way that keeps track of the "qualitative", vocalization expressive

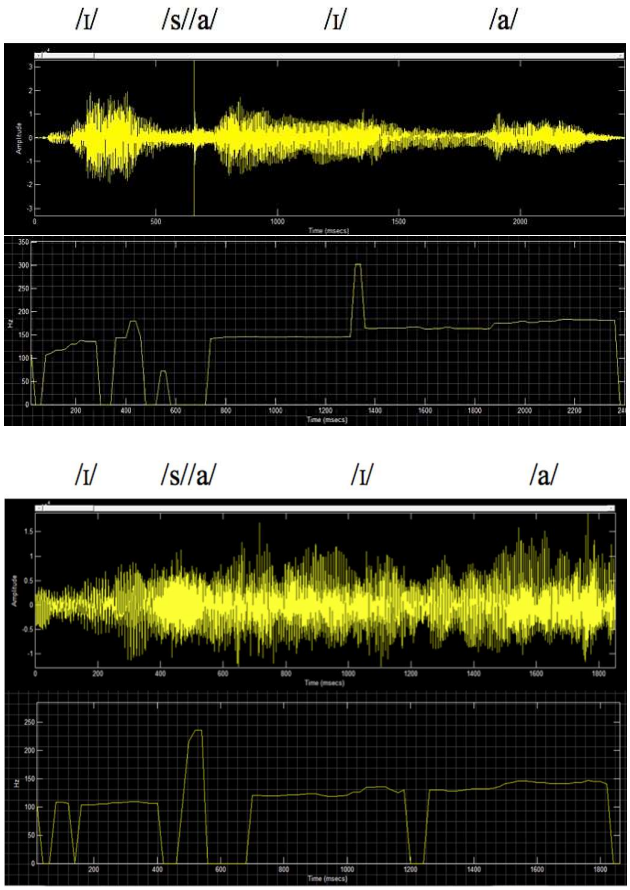



Figure 5. The first word of the ode, as performed by Group I (upper part) and by Group III (lower part). The time series and the calculated *F0* curve of each recording are presented.

nature of Byzantine Music semeiotics [11]. On the contrary, when CMN style performance is given eminence, vowels rather stick to the pitch levels of the note executed than following the oscillating characteristics of the singing voice; as a result there are no obvious "passing" paths from one pitch to the other.

Apart from the partial discord in pitch levels, for B (Figure 1b), it seems that notes are perceived in CMN performance style as clearly sustainable voicing quantities at a specific pitch level [12], while in Byzantine Music they are expressive voicing curves anchored around some basic tonal levels. Alterations are more detailed, and they are more oriented to forming specific accentuated intervals (Figure 1b, Figure 2), some times smaller than a semitone, than hitting a specific note by any means.

In Figure 6, this specific difference in performing mentality is demonstrated. The transient suffix /a/ of the word /ɪsaɪa/ is demonstrated; it is not the ending of a melodic phrase, but merely a word ending.

Apart from the differentiating characteristics spotted thus far, it is obvious the disparity in the sustainability of the phonation, in *ms*, albeit the fact that both groups pronounce /a/ quite energetically, characteristic to Greek style articulation [17].

Furthermore, it is obvious that note B is somewhat lowered, when performed the Byzantine Music style, while for Group III performers it seems that it cannot deviate from the CMN dedicated key signature, and form a smaller interval A-B.

It is an obvious point of discord.

### *C. The "wide public"*

The "performers", being experts in the field, where able to specifically detect the difference between the various renditions. More or less they spotted the points emphatically presented in Figures 5 and 6.

In order to detect if the "wide public" responds in a similar manner to the rendition of the song, a survey was conducted aiming to decipher the sensitivity and the specificity of the final recipients of music, the so called "wide public" [18].

It is apparent that audiophiles do not have the same subtlety in musicological matters as performers do. However, the degree of sensitivity demonstrated by listeners is critical for the way that music is accomplished as an artistic product.

For this purpose, a group of some 40 audiophile Computer Science students, aged 21 to 25, was used to diagnose the reaction of the general public to the differentiating versions of a song. From this audience, 14 members were female and 26 were male.

They were quite proficient, as they were actively engaged in computer music production and distribution practices. Nevertheless, not all of them had profound musical skills, and therefore they were quite a representative pool for the reactions of the section of the contemporary community that is actively engaged in listening to music.

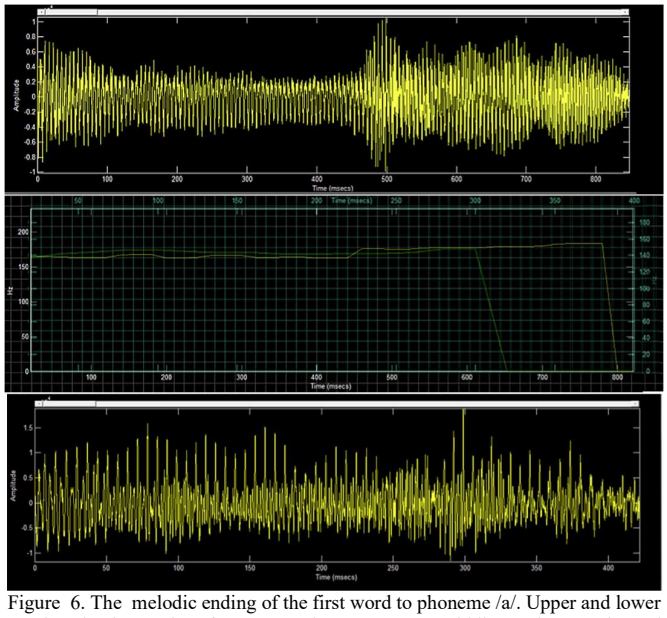


Figure 6. The melodic ending of the first word to phoneme /a/. Upper and lower graphs: the time series of Group I and III utterances. Middle graph, *F0* estimated with an autocorrelation method for Group I (yellow curve) and Group III (green curve).

TABLE I.
EVALUATION OF SONG DIFFERENCES FROM THE "WIDE PUBLIC"

| No | Perception of Differentiation | Quantity |
|---|---|---|
| 1 | Cannot comprehend the issue / No answer | 10 |
| 2 | No notable difference detected | 1 |
| 3 | Overall difference detected | 18 |
| 4 | Considerable difference detected | 3 |
| 5 | Can identify which quantities exactly differ | 5 |
| 6 | Mainly perceived differences in timbre | 2 |
| 7 | Mainly perceived rhythmic variability | 1 |

The evaluation of the performances delivered by Groups I, II and III is analytically presented in Table I.

The evaluators were not given a set of predefined phrases to choose from; rather they were guided to express themselves freely in what they sensed as "different" or "alienating" in the renditions involved.

However, if they spotted a deviation, they were hinted to describe it in an exact manner.

A considerable percentage could not even trace a significant difference. The majority, nevertheless, could sense, at least, that there was some kind of a different tuning involved. Few, furthermore, could even exactly spot it. These qualitative evaluation results may be graphically observed in Figure 7.

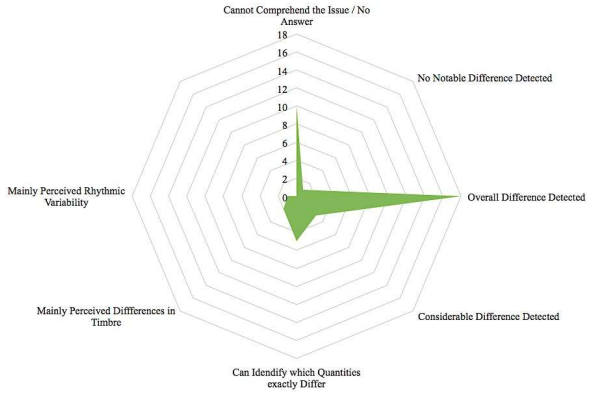



Figure 7. The evaluators' perception of the differences between the melody interpreted with Byzantine Music scales and CMN scales.

## V. CONCLUSION

Musical "alphabets" attempt to decipher a continuum, the musical one, whose adjacent elements are in many occasions perceptibly different one from each other, in their attempt to describe phenomena of the singing voice like stress - intonation, prosody, and sequences of melodic pitches. Since these features are also language dependent, it becomes obvious that semeiotics are reprimanded amidst their mission to accurately describe, in scientific terms, with sets of limited representative characters, the complex perceptual characteristics of musical sounds.

The musical continuum of the Internet connected societies and economies, within which hearings from a wide gamut, in terms of synchrony and diachrony abundantly circulate to its most remote nodes, may provide the incentive for augmentation and merging of a variety of signs and symbols, along with their use or interpretation.

Genuses, Modes and Genres may not be sufficiently decoded, if not previously recorded and, the most important, encoded so to include most, if not all, of their relevant characteristics, qualities and events associated with them.

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