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The theory of music intervals during the era of the Byzantine Maistores

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One of the basic factors that established the New Method of teaching was the defining of the echoi scales and the numbering of the intervals. After centuries of silence on behalf of the theoretical literature, Chrysanthos reintroduced the Aristoxenean method for the measurement of the intervals, breaking the major tone into twelve *moria*, as Aristoxenos and Kleonides had suggested. The seduction of the non-tempered scale with intervals different from those of the European tempered instruments triggered for decades dozens of studies which shed more and more light on a theory that traces its origins back to Ancient Greek music and is historically considered to be the most appropriate to describe a modal music system such as psaltiki.

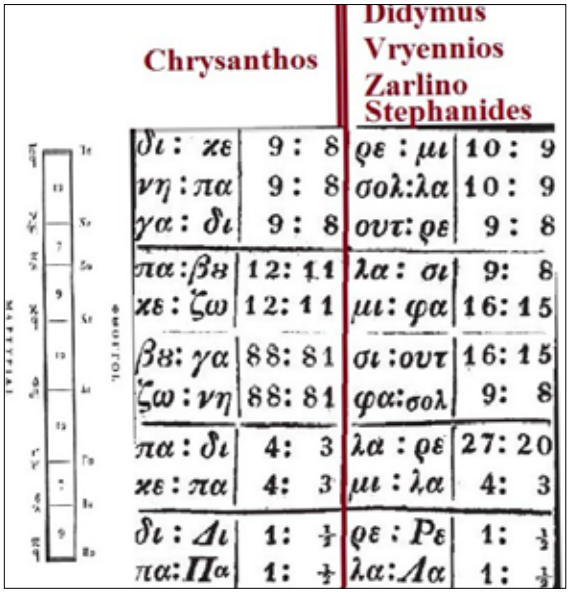
Before Chrysanthos, only a few musicians would have possessed the knowledge and the material required to construct an interval theory. The *Musici Scriptores Graeci* had just come to light via various editions in Western Europe. The bad conditions education has to face under the Ottoman yoke are reflected in the deficiencies or even the absence of important theoretical works on music. The issue of the variety the intervals demonstrate as well as the existence of the so-called ***thin intervals*** proves to be crucial, especially when it comes to the contrast with the rising European tempered system. Beginning with the most recent, this presentation will attempt in ten steps to detect the relevant references.

1. The first outstanding case is that of Chrysanthos's contemporary Vasilios Stefanidis, who suggests a non-tempered scale of didymus, which is measured with analogies of the strings, as Zarlino had adopted it and as Chrysanthos cites it in the *Mega Theoretikon*.[1] However, he provides for special intervals such as *mild minor (elassones) tones* at the geometrical centre of the pentachord or enharmonic *very small nenano* (Fig. 1).[2]

1 Χρύσανθος εκ Μαδύτων, *Θεωρητικόν Μέγα της Μουσικής, ήτοι βιβλίον διδακτικόν και πολύτιμον της Μουσικής Επιστήμης και σύγγραμμα περί της Βυζαντινής Εκκλησιαστικής Μουσικής*, Michele Weis, Τεργέστη 1832, 99.

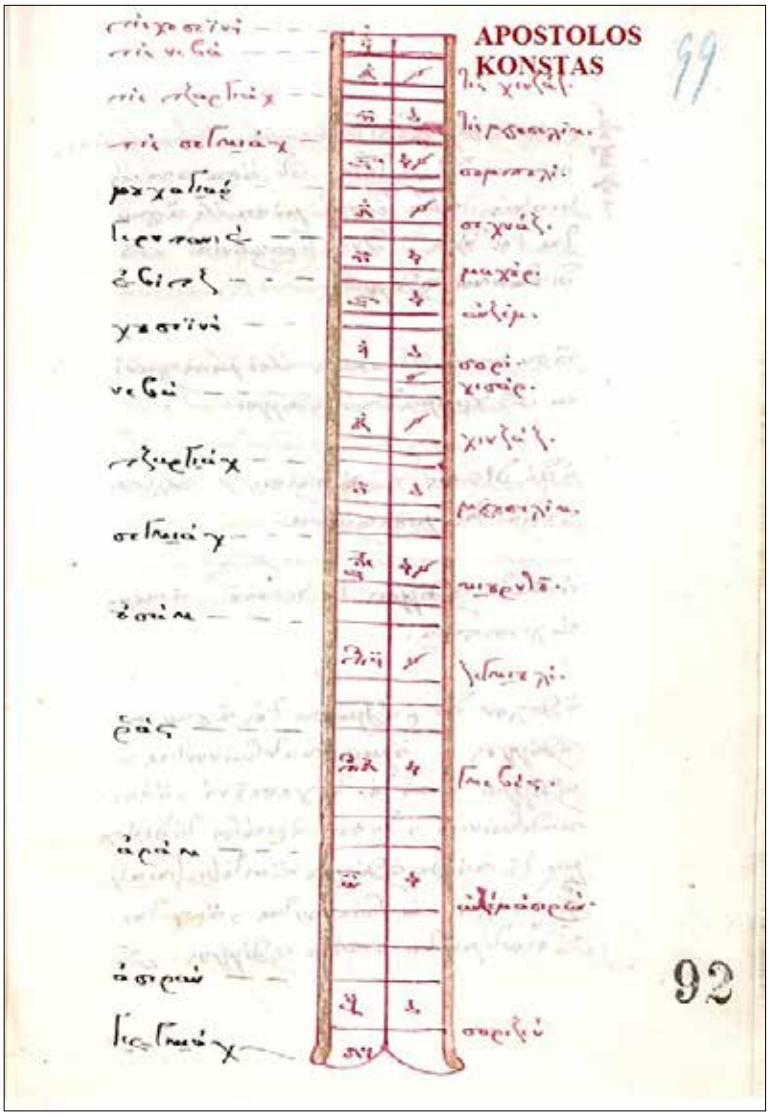
2 Στεφανίδης, Βασ., "Σχεδίασμα περί μουσικής, ιδιαίτερον εκκλησιαστικής" στο *Παράρτημα Εκκλησιαστικής Αληθείας (Π. Ε. Α.), τ. Ε'*, σ. 207-279 Κωνσταντινούπολη 1902/1819, 228, 230, 258.

Fig.1. Chrysanthos, Stefanidis – Zarlino.



2. Apostolos Konstas was unable to construct a complete theory and to number intervals. Nonetheless, he considered the variety to be self-evident and he distinguished the "gherofonies" (entire tones), the "misifonies" (half tones), the "yfeseis" – "dieseis" (flats and sharps) and the "small nenano."[3] He is the main representative of a simple practice launched in the time of Kantemiris, according to which the main instrument for the teaching of the intervals was the Persian *tambur* with the frets of the main *maqams* and the intermediates of the *nymia*, an instrument widely used as a *phthongometron* (measure of the intervals) by cantors since the end of 17th century (NLG 1867, f 92r, Fig. 2)[4].

Fig. 2. The ftrets in Konstas NLG1867.



3. Third, we examine some anonymous theoretical works of the 17th and 18th centuries which refer to *τα λεπτά φωνών (thin tones)* and *λεπτότερο (thinner) "εθνικόν νενανώ"* in ZO flat (cod. Mont Athos - Xeropotamou 317, f 6r, NLG 968, f 182v, 17th c., Fig. 3).

3 Αποστολόπουλος, Θωμάς, *Ο Απόστολος Κώνστας Χίος και η συμβολή του στην θεωρία της μουσικής τέχνης - Μουσικολογική θεώρηση από έποψη ιστορική, κωδικογραφική, μελοποιητική και θεωρητική,* Ίδρυμα Βυζαντινής Μουσικολογίας της Ιεράς Συνόδου της Εκκλησίας της Ελλάδος, Μελέται 4, Αθήνα 2002, 209.

4 Αποστολόπουλος, Θωμάς, "Αναλύσεις στην περί τροπικότητας διδασκαλία του Αποστόλου Κώστα του Χίου", Ανακοίνωση στο Γ' Συνέδριο ΙΒΜ (*Πρακτικά* Συνεδρίου), Αθήνα 2006/2010, 319.

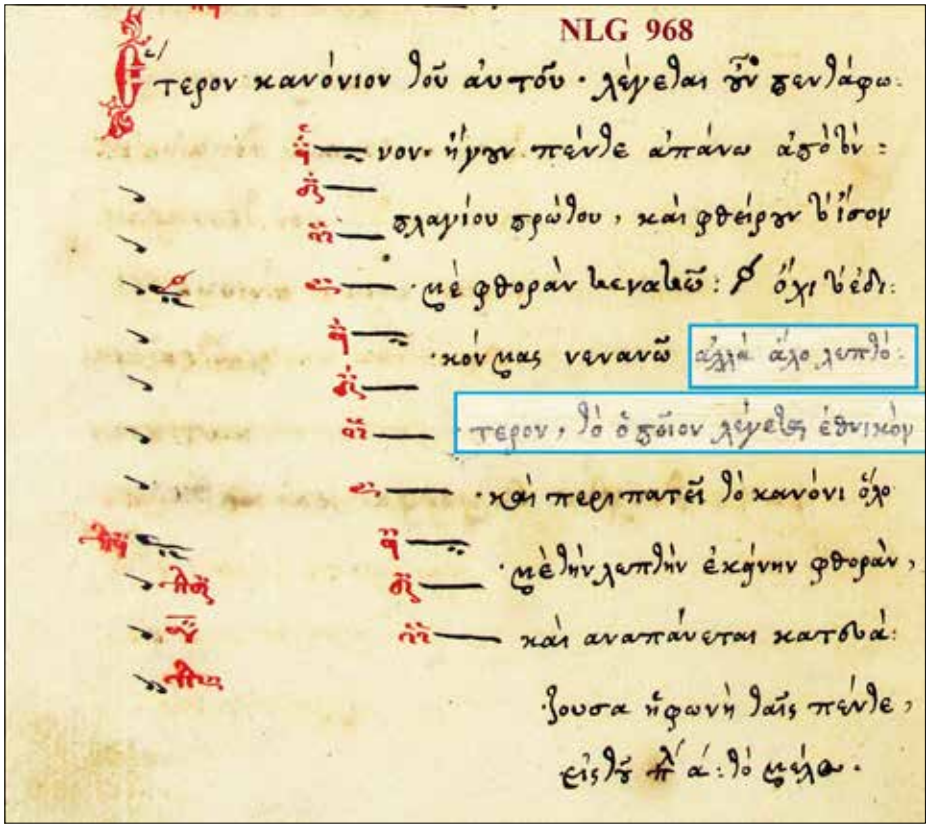
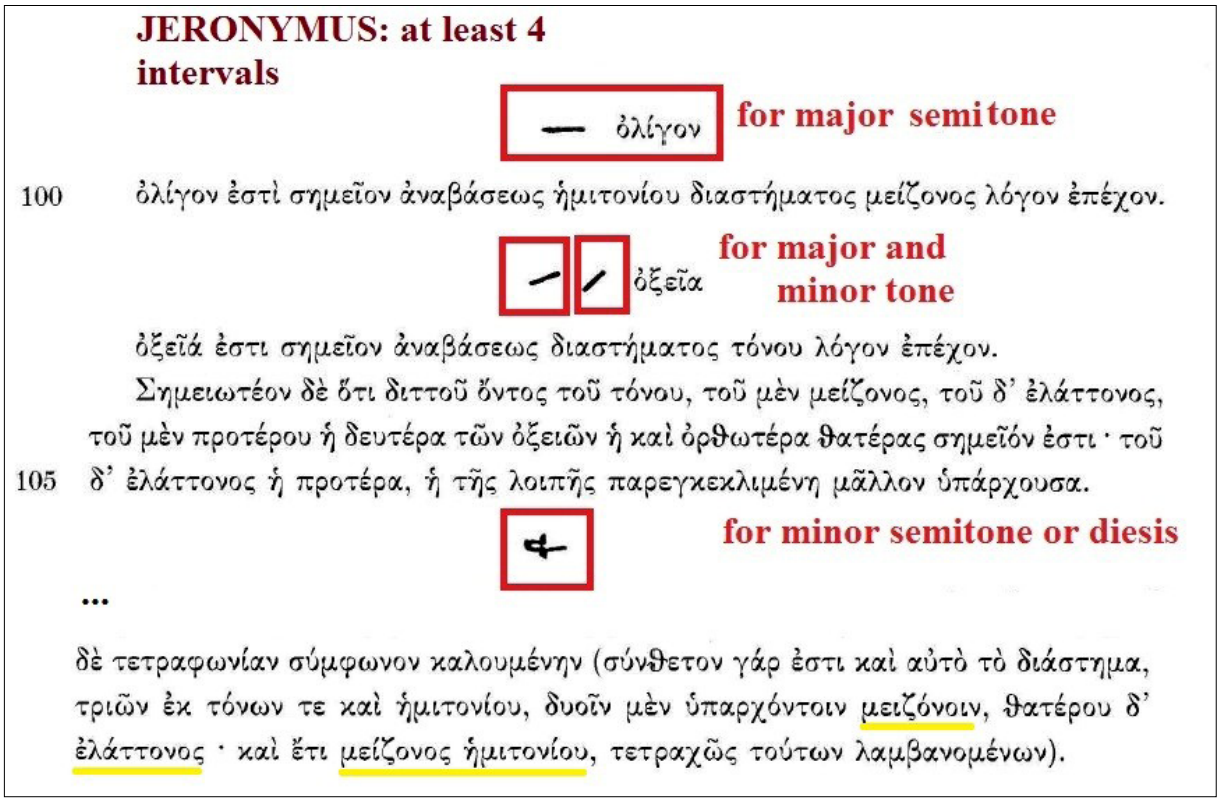


Fig. 3. The *thinner nenano*, NLG 968.

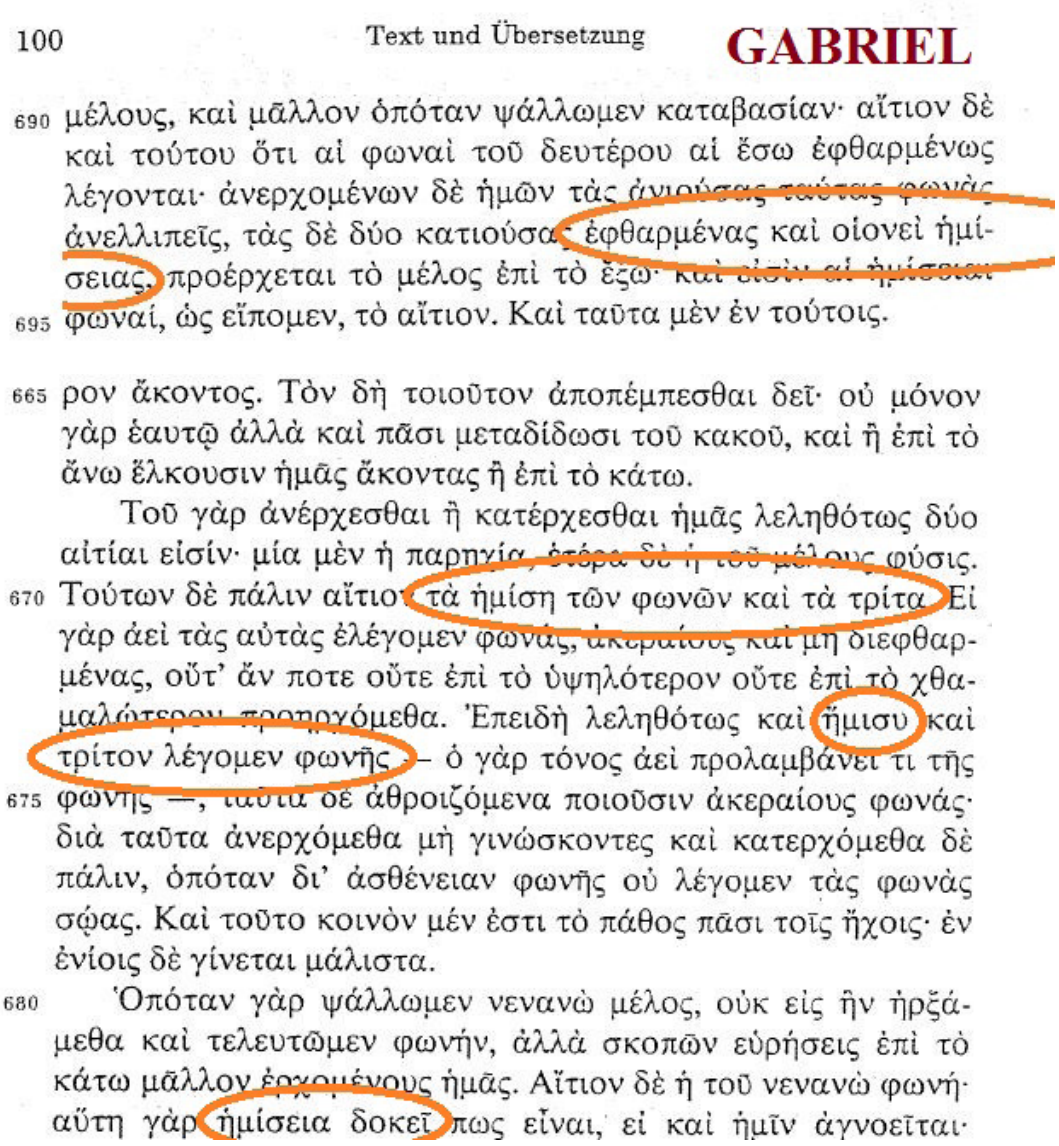
4. An important case in the first post-Byzantine years is Hieronymus Tragodistis (mid 16th century). It should be pointed out that he refers to major and minor *δίεσις* as well as to "the common, the major and the minor semitones" and "major and minor tone". For the word "interval" he uses the word "*diastasis*". The influence of the Aristoxenean division of the intervals and the numbering of the Zarlino – didymus scale is obvious. Of particular importance is the reference to the three ancient genera: diatonic, chromatic and enharmonic – especially the latter, which seems to be a rare exception in psaltiki from the Byzantine era already (Fig. 4).[5]

Fig. 4. Hieronymus.



5 Schartau, Biarne, "Hieronymus Tragodistes (Ιερωνύμου του Τραγωδιστού, κώδικας Σινά 1764), *MMB, Corpus Scriptorum de Re Musicae, III*, Wien 1990, 48.

5. And now we come to the purely Byzantine texts of the 14th and 15th centuries. The most fundamental reference to small intervals is found in Gabriel, who talks about "*τα λεπτά των φωνών, τα ημίση, τα τρίτα και τας εφθαρμένας και οιονεί ημίσεις φωνάς*" ("The thinnesses of the tones, the halves, the thirds and the worn quasi-half tones") Gabriel refers to the intervals that are slightly being modified due to the upward or the downward movement "…*ελκόμεθα άνω ή κάτω*…" ("we are attracted up or down"), having as a result the occasional loss of the *ison* (Fig. 5,6).[6]



100 Text und Übersetzung **GABRIEL**

690 μέλους, καὶ μᾶλλον ὁπόταν ψάλλωμεν καταβασίαν· αἴτιον δὲ
καὶ τούτου ὅτι αἱ φωναὶ τοῦ δευτέρου αἱ ἔσω ἐφθαρμένως
λέγονται· ἀνερχομένων δὲ ἡμῶν τὰς ἀνιούσας ταύτας φωνὰς
ἀνελλιπεῖς, τὰς δὲ δύο κατιούσας ἐφθαρμένας καὶ οἱονεὶ ἡμί-
σειας, προέρχεται τὸ μέλος ἐπὶ τὸ ἔξω· καὶ εἰσὶν αἱ ἡμίσειαι
695 φωναί, ὡς εἴπομεν, τὸ αἴτιον. Καὶ ταῦτα μὲν ἐν τούτοις.

665 ρον ἄκοντος. Τὸν δὴ τοιοῦτον ἀποπέμπεσθαι δεῖ· οὐ μόνον
γὰρ ἑαυτῷ ἀλλὰ καὶ πᾶσι μεταδίδωσι τοῦ κακοῦ, καὶ ἢ ἐπὶ τὸ
ἄνω ἕλκουσιν ἡμᾶς ἄκοντας ἢ ἐπὶ τὸ κάτω.

Τοῦ γὰρ ἀνέρχεσθαι ἢ κατέρχεσθαι ἡμᾶς λεληθότως δύο
αἰτίαι εἰσίν· μία μὲν ἡ παρηχία, ἑτέρα δὲ ἡ τοῦ μέλους φύσις.
670 Τούτων δὲ πάλιν αἴτιον τὰ ἡμίση τῶν φωνῶν καὶ τὰ τρίτα. Εἰ
γὰρ ἀεὶ τὰς αὐτὰς ἐλέγομεν φωνάς, ἀκεραίους καὶ μὴ διεφθαρ-
μένας, οὔτ' ἄν ποτε οὔτε ἐπὶ τὸ ὑψηλότερον οὔτε ἐπὶ τὸ χθα-
μαλώτερον προερχόμεθα. Ἐπειδὴ λεληθότως καὶ ἥμισυ καὶ
τρίτον λέγομεν φωνῆς — ὁ γὰρ τόνος ἀεὶ προλαμβάνει τι τῆς
675 φωνῆς —, ταῦτα δὲ ἀθροιζόμενα ποιοῦσιν ἀκεραίους φωνάς·
διὰ ταῦτα ἀνερχόμεθα μὴ γινώσκοντες καὶ κατερχόμεθα δὲ
πάλιν, ὁπόταν δι' ἀσθένειαν φωνῆς οὐ λέγομεν τὰς φωνὰς
σῴας. Καὶ τοῦτο κοινὸν μέν ἐστι τὸ πάθος πᾶσι τοῖς ἤχοις· ἐν
ἐνίοις δὲ γίνεται μάλιστα.

680 Ὁπόταν γὰρ ψάλλωμεν νενανὼ μέλος, οὐκ εἰς ἣν ἠρξά-
μεθα καὶ τελευτῶμεν φωνήν, ἀλλὰ σκοπῶν εὑρήσεις ἐπὶ τὸ
κάτω μᾶλλον ἐρχομένους ἡμᾶς. Αἴτιον δὲ ἡ τοῦ νενανὼ φωνή·
αὕτη γὰρ ἡμίσεια δοκεῖ πως εἶναι, εἰ καὶ ἡμῖν ἀγνοεῖται·

Fig. 5,6. Gabriel, the attractions and the thin voices.

This observation is a distant ancestor of the melodic attraction theory of the 19th century. Furthermore, in another anonymous text of the 15th century we read, "όπου ου ψάλλεται φωνής το ήμισυ, ή το τρίτον ή το τέταρτον ουκ ενι φθορά, αλλ' εναλλαγή απλή τελείας φωνής" ("where the half, the third or the fourth of the tone is not sung, there is no phthora but a simple change of a full tone") (NLG 899, f 6v, Fig. 7).

6 Hannick, Christian & Wolfram, Gerda, "Gabriel Hieromonachos, Abdhandlung uber den Kirchengesang" στη σειρά *Monumenta Musicae Byzantinae, Corpus Scriptorum de Re Musicae, I*, Wien 1985, 98, 100.

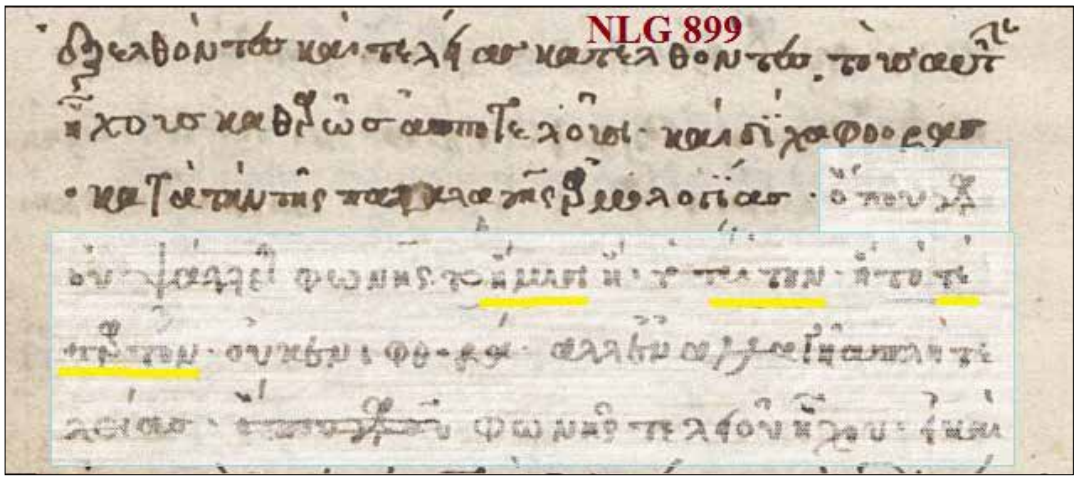


Fig. 7. NLG 899, the half or third of the tone.

This Aristoxenean citing of the subdivisions of the tone is not accompanied by a mathematical analogy, despite the comment "τα γαρ λεπτά των φωνών έχουσιν αριθμόν όν οι πολλοί αγνοούσιν" ("the thin tones have a number that most people ignore"). Just one enigmatic ratio appears, *ημιτριτόνης*, which, however, probably means half a tritonon, namely a trisemitone – one more argument for the use of chromatic scales in Byzantium (NLG 899, f 7r). In general, in the psaltic theoretical texts we do not have numbered scale intervals apart from the terms "voices" and "worn voices" ("φωνές και φθειρόμενες φωνές").[7]

6. Byzantine psaltic texts, viewed from the most recent to the older ones, are complemented by references in *Hagiopolites*, from approximately the 12th century. The text is a combination of Ancient Greek theory with the psaltic theory. The main model is the so-called *Bellermann's Anonymous.* He also makes a clear reference to the 9/8 ratio (*επόγδοος λόγος*) and the major consonant intervals (octave, fifth, fourth) and interval subdivisions (cod. NLF 360, f 235v, Fig. 8).[8]

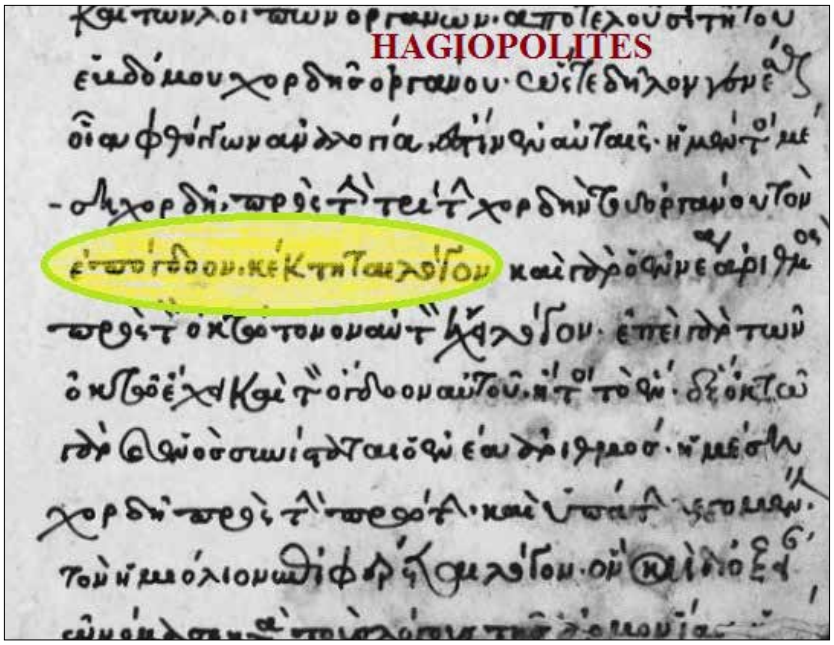


Fig. 8. Hagiopolites, *the 9/8 ratio.*

7 Apostolopoulos, Thomas, *Volume I: History 2.1.2: The musical system: Elaboration and development –The Byzantine period,* and 2.2.4: *Local mutations Post – Byzantine Theory*, Medi muses project – Musical traditions of the Mediterranean, En Chordais, Thessalonici 2005, 199.

8 Raasted, J.,"The Hagiopolites, a Byzantine Treatise on Musical Theory", ("Αγιοπολίτης"), *Cahiers de l' Institute du Moyen – Age Grec et Latin: "CIMAGL" 45*, Copenhague 1983, 67, 93.

7. In another, instantly related to the notation, an early text, the famous table of *melodimata* of the 10th century there are references to *phonae* (*voices* – tones), to *phthorae* and to the sign *hemiphthora* (Mount Athos – Lauras Γ67, Fig. 9).

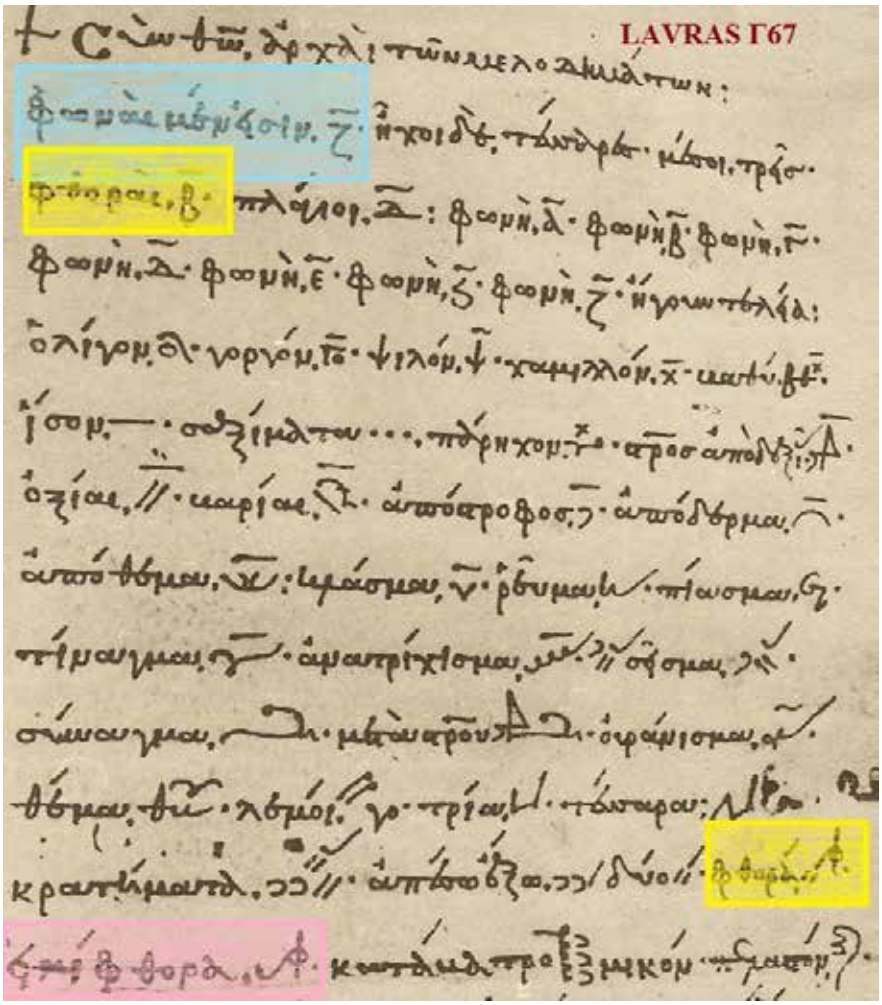


Fig. 9. The *Melodimata*, Lauras Γ67.

Gradually a sign "*hemiphonon*" is added. The meaning of these terms were obscure for centuries, as it varies: on a case by case basis, the signs may represent intervals or *phthorae* or belong to the so-called *great hypostaseis*, so they represent *theseis or grammae* (formulas). Other signs of *parasemantiki* are called *tones*, others *semitones*.[9] During the Byzantine and post-Byzantine period, this terminology emerges repeatedly in many forms. In *Hagiopolitis* and the anonymous *"Damaskinos's Questions-and-Answers"*, the 15 tones are related to the 15 semitonal degrees – the *kavalia* of the neo-Aristoxenean tones.[10] Simon Karas published a relevant diagram with the matching of those very terms to intervals. Probably his interpretation does not reflect the accurate size of the intervals as it is represented by the terms, yet the etymology makes it explicit that there are at least four different interval sizes: the *phonae* and the *hemifona*, the *phthorae* and the *hemiphthora* respectively (Fig. 10).[11]

9 Raasted 1983, 29, 30.

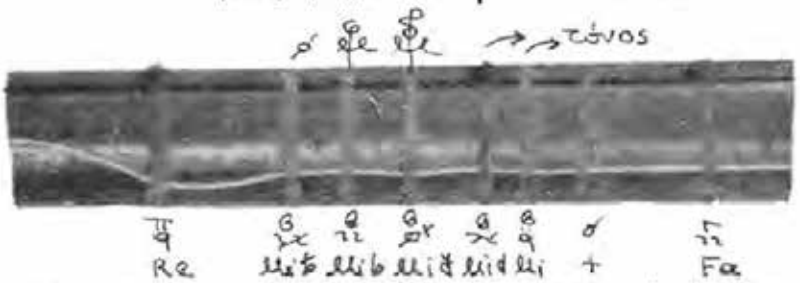
10 Raasted 1983, 19, 20; Wolfram, Gerda & Hannick, Christian, "Die Erotapokriseis des Pseudo-Johannes Damaskenos zum Kirchengesang", ("Ερωταποκρίσεις της παπαδικής τέχνης, περί σημαδίων καί φωνών καί τόνων καί πνευμάτων καί παραλλαγών καί όσα εν τη παπαδική τέχνη διαλαμβάνουσι"), *Monumenta Musicae Byzantinae, Corpus Scriptorum de Re Musicae, V*, Wien 1997, 40-44.

11 Καράς, Σίμων, *Αρμονικά*, Αθήνα 1987, 25.

ἔργῳ του «Ameli ve Nazari Turq musikisi», μόνον περὶ ὑφέσεως καὶ διέσεως —ἤ καὶ διλείμματος 59049/65596— ἀναφέρουσι καὶ οὐδὲν πλέον. Καὶ μόνον ὁ Rodolfe d' Erlanger εἰς τὸ σύγγραμμά του «La Musique Arabe» ἀναφέρει τοὺς λόγους τῶν μαλακῶν χρωματικῶν διαστημάτων 6/7·14/15 καὶ 15/16.

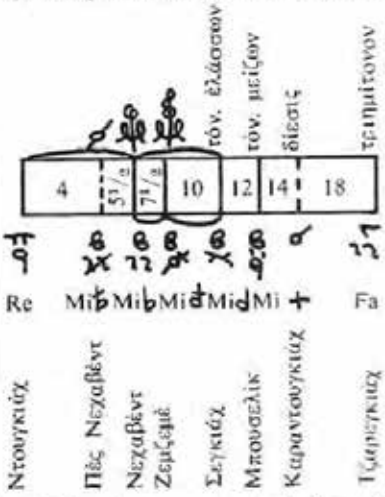
Ἀκολουθεῖ διάγραμμα ἀπὸ πήχυν θαμπούρας ποὺ ὑπάρχει εἰς τὸν Μουσικὸν Σύλλογον καὶ ἔχει δημοσιευθῆ ἐν φωτοτύπῳ εἰς τεῦχος ὑπὸ τὸν τίτλον «Γένη καὶ διαστήματα εἰς τὴν βυζαντινὴν μουσικήν», σ. 19 — (Διάλεξις εἰς Συνέδριον τοῦ 1968 εἰς τὴν Μονὴν τῆς Κρυπτοφέρρης ἐν Ἰταλίᾳ).

Διαίρεσις τριημιτόνου = Re - Fa



Ἰδοὺ καὶ σημάδια τῆς παλαιᾶς βυζαντινῆς μουσικῆς ποὺ δείχνουν τοῦ μείζονος τόνου τὰς ὑποδιαιρέσεις, μὲ βάσιν τὴν θαμπούραν τὴν βυζαντινὴν καὶ ἀρχαιοελληνικήν. Προστίθενται ἀκόμη καὶ οἱ κατὰ δεσμοὺς ὅροι τῶν Ἀνατολικῶν, μαρτυρία τοῦ ὅτι καὶ οὗτοι τὴν αὐτὴν ἀκολουθοῦντες παράδοσιν, διαφέρουσιν ἡμῶν μόνον κατὰ τὴν ὀνοματοθεσίαν τῶν δεσμῶν.

λεπτόν	1/3 τόνου	τμ.	4
ἡμίφωνον	1/2 »	»	$5^1/_2$
ἡμίφθορον	2/3 »	»	$7^1/_2$
τόνος ἐλάσσων	4/5 »	»	10
τόνος μείζων	5/5 »	»	12



Ὁρολογία ἀνατολικῶν, εἰς ἔκτασιν τριημιτόνου ἤ Re - Fa

Διακρίνεται σαφῶς τόσον διὰ τοῦ ἐπὶ τοῦ ὀργάνου σχετικοῦ δεσμοῦ ὅσον καὶ διὰ τοῦ σημείου τοῦ ἡμιφθόρου τὸ χαρακτηριστικὸν τοῦ μαλακοῦ χρώματος διάστημα τοῦ ἐλαχίστου τόνου (Re - Mi♮) τμ. $7^1/_2$ ἤ ἄλλως (Sol - La♮) διὰ τοὺς ἤχους καὶ (Μπεϊατὶ Ἀραμπὰν καὶ Σὲτ Ἀραμπὰν μακ.).

25

Fig. 10. Karas

8. We arrive at the three final steps of our course. The core question is: Is it possible that an art so advanced as the *Kalophonia* of the 14th century, namely the *Era of Maistores*, is based on so simple a theoretical background as the principles stated in the Byzantine theoretical works of

psaltiki? To what extent has a *Maistor*, that is a university (*pandidaktirion*) professor, theoretical knowledge? The answer is simple and self-evident. When the Byzantines say that they study music or "*harmonike"* as a part of the ancient *Tetraktys* of the mathematical sciences, they imply that they study Ancient Greek "harmonic" writers, who deal with the teaching of the intervals. The Ancient theory is preserved until the last Byzantine centuries in copies. The Bellermann's *Anonymous* and ten more texts are Byzantine texts. Dionysios, Gregoras, Pediasimos, Gemistos and many other anonymous authors constantly reproduce the ancient texts from the 10th to the 16th centuries (Hunger-Hannick 1994). For instance, in a manuscript of the 13th century from the Library of the Laura, or in a manuscript of the 16th century from the Library of Munich, the construction of the *canon*, namely a monochord with the ancient scale broken into 12 Aristoxenean semitones, is taught (cod. Munich library104, f 289v, Fig. 11).[12]

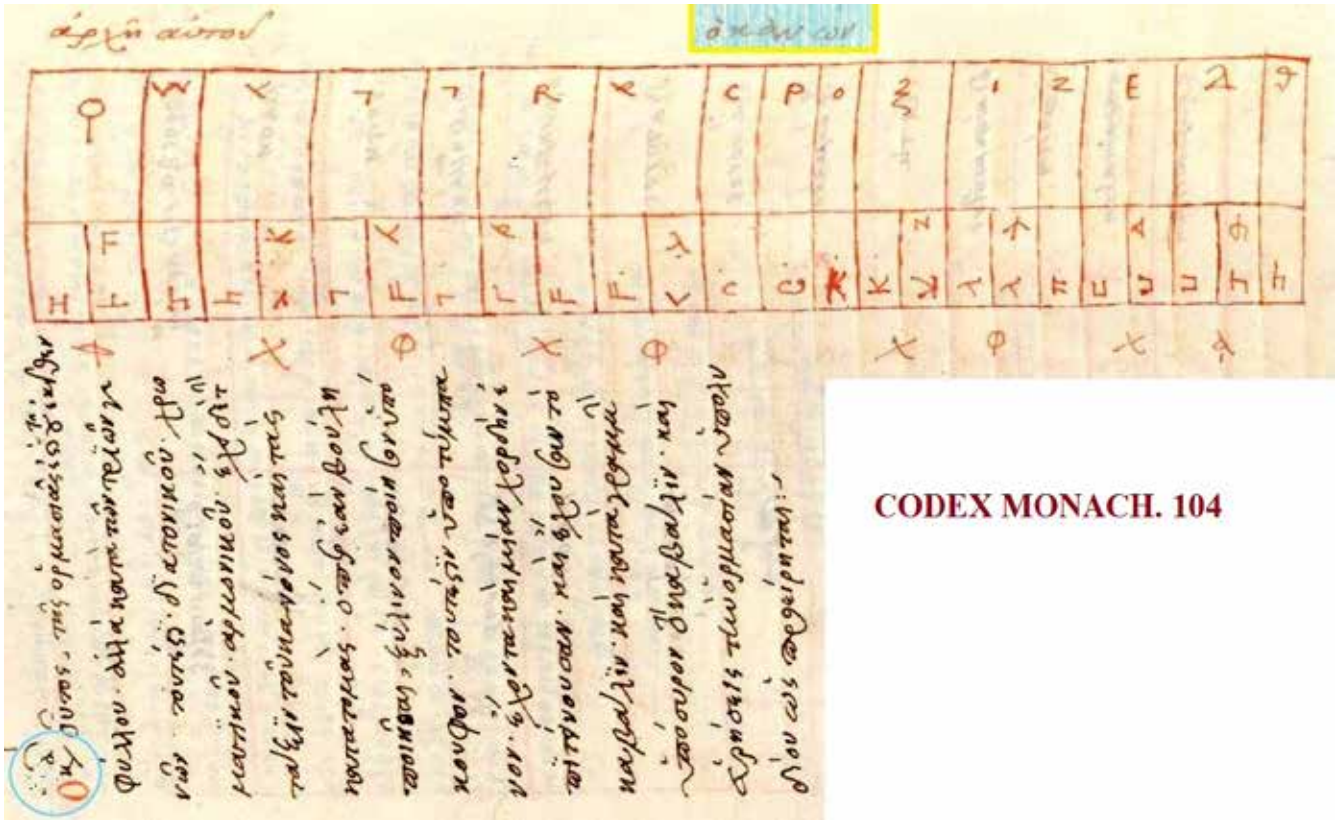


Fig. 11. 11. Cod. Monach 104, *Kanon of Lydios tropos.*

This fact along with the fact that the most usual scale for the ancient theory is a "tense diatonic" with *tones* and *leimmata* led many to the false conclusion that those were the only Byzantine intervals, and that micro-intervals or the chromatic scales were absent in Byzantium and were initiated later by the Persians and the Turks.[13] Nevertheless, as is made clear in Vryennios, this description was just an introduction, as the many positions of the moving notes ("*κινουμένων φθόγγων*") were taught afterwards (cod. Magdalene College MS. Gr. 13, f 60r, Fig. 12).[14]

12 Hunger & Hannick, Ch., "Βυζαντινή μουσική" στον Γ' τόμο της *Ιστορίας της βυζαντινής λογοτεχνίας*, εκδ. MIET, Αθήνα 1994, 400; Vincent, M., *Notices et extraits de la bibliotheque du roi*, Imprimerie royal, Paris 1847, 255.

13 Amargianakis, G., "The Chromatic Modes", *Jahrbuch der Osterreichichen Byzantinistik* 32/7 Wien 1982, 7-17; Στάθης, Γρηγόριος, "Η εξήγηση της Ψαλτικής Τέχνης", *Θεολογία* ΝΗ', τ. 2, Αθήνα 1987, 340-356; Αλυγιζάκης, Αντώνιος, *Η Οκταηχία στην Ελληνική Λειτουργική Υμνογραφία*, Πουρνάρας, Θεσσαλονίκη 1985, 204; Apostolopoulos 2005, 186.

14 Jonker G. H., *The Harmonics of Manuel Bryennius*, Groningen 1970, 186.

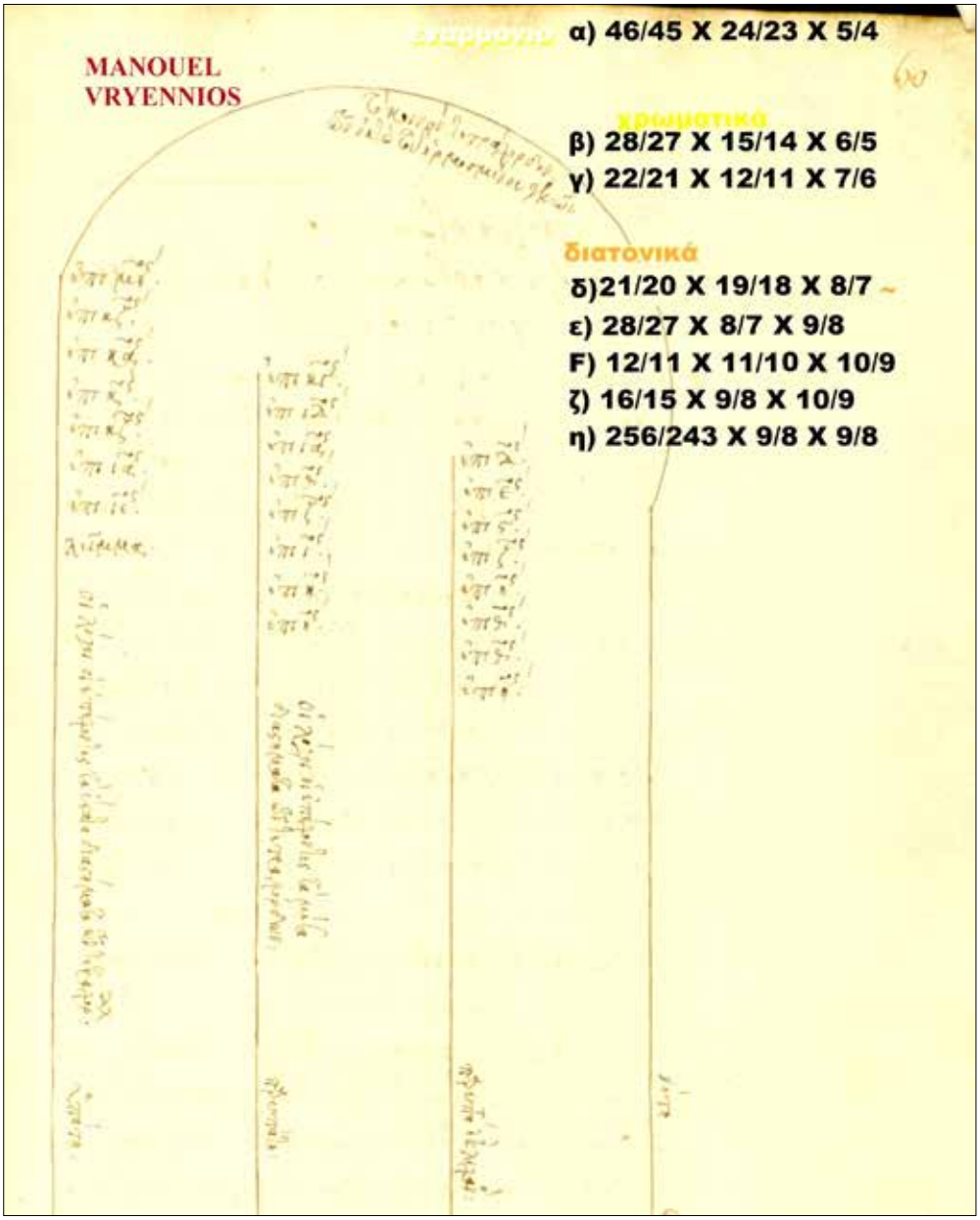


Fig.12. Tetrachords in Vryennius.

9. The two last prominent Byzantine music writers, Pachymeris (13th century[15]) and the mentioned Manuel Vryennios (14th century[16]) deliver a pure ancient theory with a leaning towards the Ptolemaic and the Pythagorean teaching. A look at a summary table by Vryennios communicates perfectly the meaning of the above-quoted anonymous line "*τα λεπτά των φωνών έχουσιν αριθμόν όν οι πολλοί αγνοούσιν*…" ("the thin tones have *α* number that most people ignore"). Vryennios was also familiar wirh psaltiki and its echoi, which he relates to the ancient modes, while Chrysanthos dedicates to him a whole chapter of the *Mega Theoretikon*.[17] The mixture of the Ancient Theory with the needs of the echoi system is obvious in many examples. The scale, the degrees of which are the bases of the echoi, is structured using the Hellenistic *stochoi* as a model.[18] The well-known *trochos* is in all probability a mild diatonic scale of five degrees of Ptolemaeus or Didymus, since all the intervals are tones – *phonae*. The echoi A', D', A' plagal, varys "other" (according to the *Mega Ison* by Koukouzelis) and D' plagal

15 Tannery, Paul & P. E. Stephanou, *George Pachymeres*, Bibliotheca Vaticana /Tipo-1994 Litografia Dini 1940.
16 Jonker 1970.
17 Chrysanthos 1832, 127.
18 Αλυγιζάκης 1985, 84.

are diatonic, unless they have *phthorae*. It is common that the *phthora* of *nenano* is applied to B' and B' plagal, so, in spite of their being diatonic initially, they turn obligatorily to chromatic (*ειπέ τον β΄ δίχα της εν τω β΄ αποστρόφω φθοράς και ερείς απαραλλάκτως τον Α΄…*) (*sing the B' echos without the phthora at the second apostrophos and you will sing without change the A' echos* NLG 899, f 9v). Echos C΄ *nana* and varys *aanes* demonstrate the other ancient *phthora* of *nana*, therefore with the system of *triphonia* there emerge principally "tense" – hard diatonic intervals, without excluding the triphonic transpositions of the mild diatonic D' plagal, as it is shown in its *Anastasimon apolytikion* or the *mathimata* of papadiki. Generally, the presence of diatonicity in the era of the formation of the system is strong. Even nowadays the "tense" – hard chroma is not represented in the eight *Anastasima apolytikia* that established the *Octoechos*, and the mild chroma is not entirely different from the mild diatonon, especially if we adopt a geometrical division of the pentachord into two identical trichords (*diphonies*). The term "*γνωριστική ιδέα*" (idea of its knowledge) in Gabriel combined with fragments in which it is stated that the echoi, with the exception of A' echos, "*δίχα Φθοράς την ιδίαν φύσιν ου δύνανται δείξαι*" ("..without a phthora they cannot show their nature") must be interpreted as concerning the specific intervals of the Echoi, particularly the B's and C's, which are related to the ancient *phthorae, nenano and nana*. The two ancient *phthorae* obey a very simple model, since they secure the small interval above and below the echos A' degree (KE) (Fig. 13).[19]

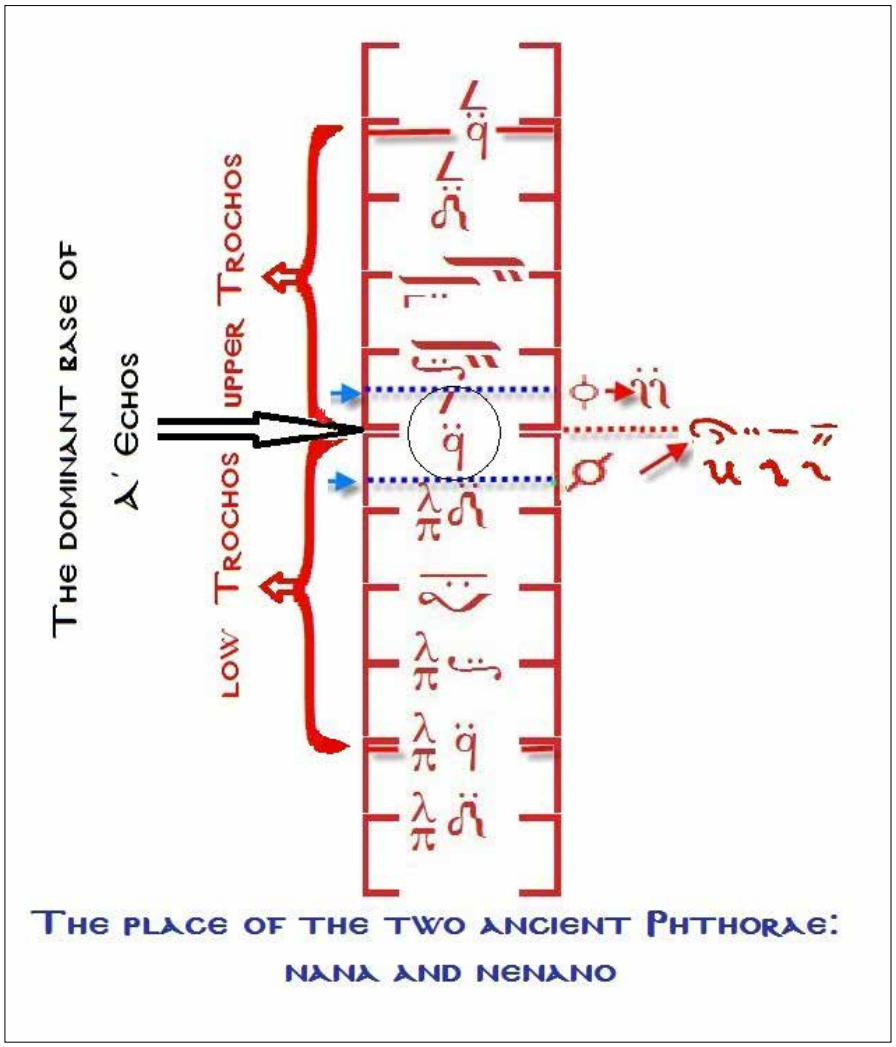
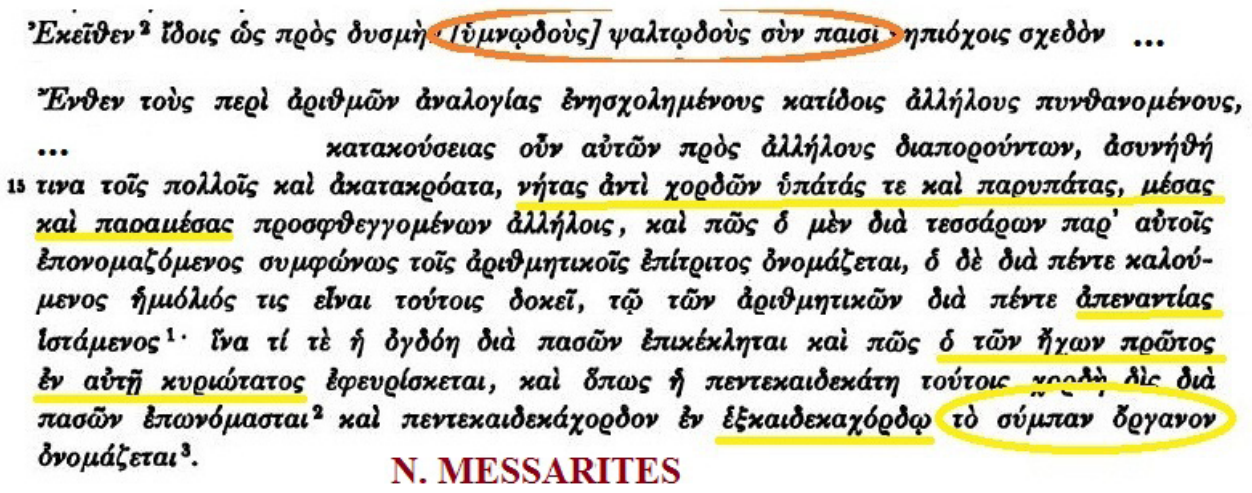


Fig.13. The two ancient Phthorae, *Nana and Nenano*.

19 Αποστολόπουλος 2006/2010, 331.

With those two *Phthorae* placed on the initial diatonic scale, and with the melodic attractions, we can produce all the known scales of the 8 Echoi. Later on, the *phthora* technique seems to be used for every degree of the scale – and this is the reason why their number increased. In B' Echoi, the name of the *nenano phthora* is the name of the *Parallagi* tone, and the form of *Martyria*, namely the letter Φ, is the same every two Tones: *Νεανές, Νενανώ, Νεανές, Νενανώ* etc. This provides us with further evidence in support of the interval changes in the initial scale.[20]

10. Among the references available, the most pivotal to our discussion are those in Nikolaos Messarites, 12th century. In a non-music theoretical work of his that describes the temple of Apostles we read: *"…Εκείθεν ίδοις προς δυσμήν ψαλτωδούς συν παισί νηπιόχοις….μικρόν παριών μειρακίοις εντύχοις εύρυθμον μέλος και σύμφωνον αρμονίαν προπέμπουσι… προελθών δ' ουκ επί πολύ τους περί αριθμών αναλογίας ενησχολουμένους… εγγύς που τούτων τους περί φθόγγων και αρμονίας… Κατακούσειας ουν αυτών προς αλλήλους διαπορούντων, ασυνήθη τινα τοις πολλοίς και ακρότατα, νήτας αντί χορδών υπάτας τε και παρυπάτας, μέσας και παραμέσας προσφθεγγομένων αλλήλοις, και πώς ο μεν δια τεσσάρων παρ' αυτοίς επονομαζόμενος συμφώνως τοις αριθμητικοίς επίτριτος ονομάζεται, ο δε δια πέντε καλούμενος ημιόλιός τις είναι τούτοις δοκεί τω των αριθμητικών δια πέντε απεναντίας ιστάμενος. Ίνα τι τε η ογδόη διαπασών επικέκληται και πώς ο των ήχων πρώτος εν αυτή κυριώτατος εφευρίσκεται, και όπως η πεντεκαιδεκάτη χορδή δις διαπασών επωνόμασται και πεντεκαιδεκάχορδον εν εξκαιδεκαχόρδω το σύμπαν όργανον ονομάζεται"* (Fig. 14).[21]


Ἐκεῖθεν[2] ἴδοις ὡς πρὸς δυσμὴ[ν ὑμνῳδοὺς] ψαλτῳδοὺς σὺν παισὶ νηπιόχοις σχεδὸν …

Ἔνθεν τοὺς περὶ ἀριθμῶν ἀναλογίας ἐνησχολημένους κατίδοις ἀλλήλους πυνθανομένους, … κατακούσειας οὖν αὐτῶν πρὸς ἀλλήλους διαπορούντων, ἀσυνήθη τινα τοῖς πολλοῖς καὶ ἀκατακρόατα, νήτας ἀντὶ χορδῶν ὑπάτάς τε καὶ παρυπάτας, μέσας καὶ παραμέσας προσφθεγγομένων ἀλλήλοις, καὶ πῶς ὁ μὲν διὰ τεσσάρων παρ' αὐτοῖς ἐπονομαζόμενος συμφώνως τοῖς ἀριθμητικοῖς ἐπίτριτος ὀνομάζεται, ὁ δὲ διὰ πέντε καλούμενος ἡμιόλιός τις εἶναι τούτοις δοκεῖ, τῷ τῶν ἀριθμητικῶν διὰ πέντε ἀπεναντίας ἱστάμενος[1]· ἵνα τί τὲ ἡ ὀγδόη διὰ πασῶν ἐπικέκληται καὶ πῶς ὁ τῶν ἤχων πρῶτος ἐν αὐτῇ κυριώτατος ἐφευρίσκεται, καὶ ὅπως ἡ πεντεκαιδεκάτη τούτοις [illegible] διὰ πασῶν ἐπωνόμασται[2] καὶ πεντεκαιδεκάχορδον ἐν ἑξκαιδεκαχόρδῳ τὸ σύμπαν ὄργανον ὀνομάζεται[3].

N. MESSARITES

Fig. 14. Messarites.

Translation: *"…And from there you will see at the West Cantors and young children… and a little later you will meet adolescents singing a melody of nice rhythm and harmonic symphony…and a little farther those who occupy themselves with the ratios of the numbers, and next to them others, with the tones and the harmony theory. And you will hear them talking about things unusual and inaccessible to the many, saying "netes and hypates and parhypates and meses" instead of strings, and that the perfect fourth, according to the arithmetic order, is called epitritos and the fifth appears to be some hemiolios (one and a half) and to stand opposite to the arithmetic fifth. And why the octave is called diapason and the first echos in it proves to be the most powerful and that the fifteenth string was named "twice dia pason" and that the universe is called fifteen-chord instrument inside a sixteen-chord".*

The conclusions are particularly interesting:

The cantors-to-be, even in an unofficial church school responsible for the preparation of the *Apostolites* – analogous to the *Agiosofites* or to the Ψάλται του Βασιλικού Κλήρου (the cantors

20 Amargianakis 1997, 100; Amargianakis 1982, 7-17.

21 Heisenberg / Mesarites – Μεσαρίτης, έκδοση υπό August Heisenberg, *Zwelter tell Die Apostolkirche in Konstantinopel*, Leipzig 1908, 20-21.

by the royal clergy) – are taught, according to their age, melos, rythmics and obedience to the *cheironomoi – chorarches*. The music students in the same school are taught ancient terminology with the degrees, mathematical analogies and the mathematical ratios of the intervals. They deal with advanced theoretical issues like the placement of the Echoi system into the ancient greek framework, and, specifically, the placement of A' Echos (an absolutely psaltic term) on the *Paramesi* of the ancient scales (today's KE) as the most crucial tone of the system. The characterization *απεναντίας ιστάμενος* of the hemiolios ratio 3/2 (divide by five) most probably makes reference to the *pythagorean ypenantios analogia* 3 – 4 – 6 or 6 – 8 – 12. In around 11th century, Psellos, who is also a hymnographer, brings back the theory of the 10 analogies by Nikomachos, a fundamental theory of the harmonic ratios that are instantly related to the intervals and the genera.[22]

We will analyse just one more obscure reference to the universe as a sixteen-chord musical instrument following the famous *harmony of the spheres*, with a range of two diapason plus one Major Tone! This range is connected to a very old tradition, which returns in the greek practice re-borrowed from the arabopersian music, as it is shown by the range of the fretboard of the tambur (2 Diapason plus 1 Major Tone) and it is applied as well on the neohellenic bouzouki. Ptolemaeus, already in the 2nd century, describes the range of the universal *harmony of the spheres*, in which the whole universe is viewed as a musical instrument, with strings numbered from 8 to 36: *"Ἀρχὴ τῶν μουσικῶν λόγων ἐστὶν ὁ η΄ ἀριθμὸς καί εἰσιν ὅροι τοῦ κοσμικοῦ συστήματος οὗτοι… Καὶ ἔστιν ὁ μὲν θ΄ ἐπόγδοος τοῦ η΄ σελήνης ὁ ιβ΄ ἡμιόλιος τοῦ η΄, ἑρμοῦ, ὁ ιστ΄ διπλάσιος τοῦ η΄, ἀφροδίτης, ὁ ιη΄ διπλάσιος τοῦ θ΄ ἐπόγδοος τοῦ ιστ΄ ἡλίου, ὁ κα΄ διπλασιεπίτριτος τοῦ θ΄ ἄρεος, ὁ κδ΄ διπλάσιος τοῦ ιβ΄ Διός, ὁ λβ΄ τετραπλάσιος τοῦ η΄ κρόνου, ὁ λστ΄, τετραπλάσιος τοῦ θ΄ ἀπλανῶν"* (*The start of the music ratios is the number 8 and the terms of the cosmic system are the follow … Earth 8, Moon 9, Mercury 12, Venus 16, Sun 18, Mars 21, Jupiter 24, Saturn 32 and Stars 36)* (TLG, Ptolemaeus, Excepta napolitana, Musica T1.1 - 2.8). The analysis of this range gives an octave from the Stars 36 – low ΔΙ to the Sun 18 – ΔΙ, that was considered to be the ancient *Mesi* string of the instrument (the shortening of the strings gives higher frequencies) and another octave to the Moon 9 – high ΔΙ', while the top is occupied by the Earth – high ΚΕ', to complete the "cosmic system". (8-9-12-16-18-21-24-32-36, 8/9X3/4X3/4X8/9X6/7X7/8X3/4X8/9, Fig. 15).

If one looks carefully at the musical intervals that come of, one will see mainly Tetrachords and Major Tones. Two difficult "natural" intervals, though, the Minor Enharmonic Third 18/21 or 6/7 and the Supermajor Tone 21/24 or 7/8, should be correlated to anything but a simple musical intervals theory.

What eventually becomes more and more clear and apparent is the splendid tradition of the Ancient Greek musical Theory. The Byzantine Music is being constantly and "naturally" reinforced by the Ancient Greek Music, since, to put it simply, it is a "natural child" of its.

22 Ψελλός, Μιχαήλ Κωνσταντίνος, *Του σοφωτάτου Ψελλού, Σύνταγμα ευσύνοπτον εις τας τέσσαρας μαθηματικάς επιστήμας, Αριθμητικήν, Μουσικήν, Γεωμετρίαν και Αστρονομίαν,…της Μουσικής σύνοψις ηκριβωμένη…* Βενετία 1532, 17.

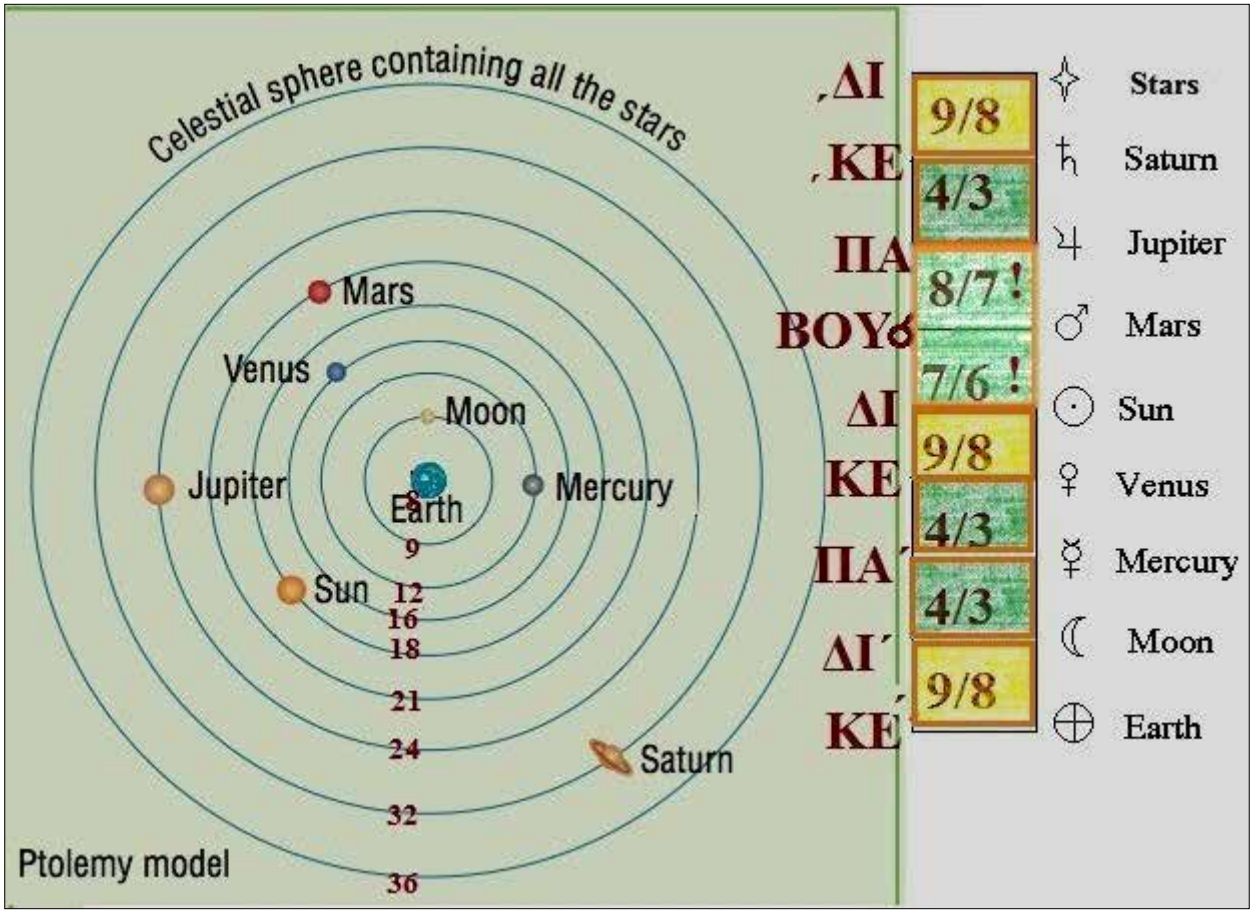


Fig.15.Universe of Ptolemaeus and intervals.

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