Unicode Technical Note: Byzantine Musical Notation

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This note documents the practice of Byzantine Musical Notation in its various forms, as an aid for implementors using its Unicode encoding. The note contains a good deal of background information on Byzantine musical theory, some of which is not readily available in English; this helps to make sense of why the notation is the way it is.[1]

1. Preliminaries

1.1. Kinds of Notation.

Byzantine music is a cover term for the liturgical music used in the Orthodox Church within the Byzantine Empire and the Churches regarded as continuing that tradition. This music is monophonic (with drone notes),[2] exclusively vocal, and almost entirely sacred: very little secular music of this kind has been preserved, although we know that court ceremonial music in Byzantium was similar to the sacred. Byzantine music is accepted to have originated in the liturgical music of the Levant, and in particular Syriac and Jewish music. The extent of continuity between ancient Greek and Byzantine music is unclear, and an issue subject to emotive responses. The same holds for the extent of continuity between Byzantine music proper and the liturgical music in contemporary use—i.e. to what extent Ottoman influences have displaced the earlier Byzantine foundation of the music.

There are two kinds of Byzantine musical notation. The earlier *ecphonetic* (recitative) style was used to notate the recitation of lessons (readings from the Bible). It probably was introduced in the late 4th century, is attested from the 8th, and was increasingly confused until the 15th century, when it passed out of use. Lessons are no longer musically notated, though they are still chanted. The notation consisted of marking the overall musical rendering of phrases in the reading (prosodic signs), rather than individual notes.

The second kind of notation is *neumatic*, i.e. it uses neumes (musical notes). Various subdivisions of the notation have been proposed; the standard subdivisions, put forward by

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[1] I am currently preparing a proposal for the Unicode Technical Committee on rationalising and expanding the current Unicode encoding of Byzantine musical notation within the constraints of stability. (The immutability of the spelling error in `U+1D0C5 Byzantine Musical Symbol Fhtora Skliron Chroma Vasis` is only the most visible instance of such constraint.) Should any of the proposal be accepted, the contents of this note shall be revised accordingly.

My thanks to Rick McGowan, Christian Troelsgård and Fr Constantine Terzopoulos for their comments.

[2] Earlier in the 20th century, Russian and Western inspired use of harmony began to appear in the Greek church; this was widely condemned, and appears to have died out in Greece under the same resurgence of traditionalism which is also seeing icons painted in Byzantine rather than Western style. Harmony is used in some Greek churches in America; and many parishes in Greece have cantors accompany the head cantor in thirds, although this is not sanctioned practice.

Tillyard and Wellesz, are:

1. *Early Byzantine* (palaeobyzantine), 9th–12th century; its final phase is termed 'Coislin' notation. (The short-lived Kontakarian notation presumably belongs here as well.)
2. *Middle Byzantine* (hagiopolite, round), 12th–14th century.
3. *Late Byzantine* (Koukouzelean, hagiopolite–psaltic), 14th–19th century (associated with the 14th century musician St John Koukouzeles).
4. *Modern* (neobyzantine), 19th century onwards, following the reform of the notation in 1814,[3] with revisions by the Patriarchal Musical Commission in 1881.

Middle, Late, and Modern notation use the same basic signs, with similar if not the same meanings, and so may be unified as the one notation system (which I refer to here as post-Early). There is no clear break between Middle and Late Byzantine notation; and some Late signs still have occasional contemporary use, even though they are not officially part of the Modern system. Middle Byzantine notation was deciphered in the 1910s, although the repertoire of neumes in the system is not completely exhausted, and the Tillyard–Wellesz interpretation is not accepted by all specialists in its totality. There are still signs in Middle and Late Byzantine sources which have no counterpart in either Byzantine musical treatises or the modern notation, and should be considered undeciphered (and not necessarily suitable for encoding); this is particularly problematic for the possibly open-ended collection of Late Byzantine Great Hypostases (ornaments). The Early Byzantine system, which is transitional from the Ecphonetic, is poorly attested, and not fully understood.

Post-Early Neumatic notation indicates the intervals of the melody, using *interval signs* (*phonetika*), rather than the absolute pitches of the notes, as does Western notation. (Early Byzantine notations still does not appear to have indicated precise interval sizes.) Certain signs were initially used to indicate accentuation rather than an interval. Though these signs came to have a default interval associated with them (rising second), they combine with other interval signs, so that the accentuation of the one neume is associated with the interval value of the other. Other signs, corresponding to ornamentation, tempo markings, accidentals and so forth in the Western system, also combine with interval signs, being placed above them or below them.

There is a notion of modifier and modified signs, with the main signs lining up horizontally. In the manuscripts the vertical lining up of signs is not strict—scribes placed the neumes somewhat freely in absolute terms (though their position relative to each other

[3]The reform is usually attributed to Chrysanthus of Madytos, Archbishop of Dyrrachium (Durrës/Durazzo) and Metropolitan of Prousa (Bursa), and is dated 1821, when Chrysanthus published his first treatise, *Εἰσαγωγὴ εἰς τὸ θεωρητικὸν καὶ πρακτικὸν τῆς Ἐκκλησιαστικῆς μουσικῆς*. The reform was a collaboration with two other cantors, Gregory Levitis (Gregory the Protopsaltis [Head Cantor; in 1814 still a Lampadarios, Second Cantor]), and Hourmouzios Georgiou/Giamalis (Hourmouzios the Chartophylax [Archivist]). Chrysanthus was responsible for the theoretical side of the proposal, and the other two contributors with the practical side—the transcriptions. The fact that Chrysanthus was the one who got published helped him get the primary credit. Chrysanthus' 1832 publication, *Θεωρητικὸν μέγα τῆς μουσικῆς*, contains minor revisions to the 1821 scheme, and is the main reference for modern notation. For more on the reformers, see Morgan (1971).

remained semantically significant), and the stronger sense of lining up in modern notation is an artefact of printing. This freedom in vertical positioning was especially pronounced for pre-Modern notation, where the interaction of hypostases and interval signs was complex: an entire phrase of interval signs could modify a single large hypostasis, meaning that all the pitches in the phrase were to be chanted with the same accentuation. (Figures 10, 11)

That said, the same sign can be used both as a modifier and a modified; signs can be place to the top left or top right as well as just above another sign; signs can tie underneath or above multiple other signs; modifier signs can appear either above or below their modified, in some instances with no semantic distinction; and so on. In other words, the challenges of correctly positioning neumes are beyond the scope of what Unicode is intended to cope with, and should be relegated to a higher level protocol.

The modern Byzantine notation system remains in liturgical use throughout the immediate sphere of influence of the Patriarchate of Constantinople, the Orthodox churches formerly under Byzantine and then Ottoman dominion: namely, the Orthodox churches of Constantinople, Alexandria, Antioch, Jerusalem, Greece, Cyprus, Bulgaria, Serbia, FYR Macedonia, Albania, and Rumania, as well as the Orthodox churches in the rest of the world under the jurisdiction of these churches (e.g. the Greek Orthodox Church in the Americas). The notation is applied to the liturgical languages used in these churches: Greek, Rumanian, Old Church Slavonic, but also English and Spanish. There is also frequent use of the notation to transcribe folk music (at least in Greece), particularly since both the collectors and the audience of such collections were formerly likely to be more familiar with Byzantine notation, through the church, than with Western notation. Although this is no longer the case, folk song collections are still being published in Greece in both notation systems—the collector often having to translate from their Byzantine original to Western to reach a broader audience.

The earliest instance of printing Byzantine neumes is in parodic form, in the 16th century edition of the satirical *Mass of the Beardless Man*. The increasingly ornate Late Byzantine system was not well-suited to printing, and indeed one of Chrysanthus' stated aims was to simplify the notation in order to make it easier to print (Tillyard 1970:16). Editions of liturgical music are often printed, although reproductions of hand-written notation also circulate widely; editions intended for wide use (standard hymnals) tend to be printed. Editions of folk-song transcriptions have not been printed to my knowledge, presumably as the collectors lack access to the appropriate infrastructure.

The description of Modern Byzantine notation is based on Greek sources, which are the most readily available to me, and reflect the provenance of the current encoding. I am currently unfamiliar with the details of the notation as applied, previously or recently, outside the Greek-speaking domain; but it is clearly important that the Unicode encoding encompass such variation. I welcome any supplementary information, and will be updating this document as I receive it.

According to Palikarova Verdeil (1953), Bulgaria initially adopted Early Byzantine notation; after the First Bulgarian Empire was conquered by Byzantium the liturgy was chanted in Greek instead of Bulgarian, and even after the Second Bulgarian Empire was reestablished, Bulgaria remained beholden to the Byzantine musical tradition, adopting all

the innovations in notation current in Byzantium.

The East Slavonic tradition of musical notation (Russia, Byelorus, Ukraine, Galicia, Carpatho-Ruthenia) is distinct from that considered here. The main notation system used up until the 17th century in Russia (and still used by the Old Believers sect) was the Stolp (Hook, Znamenny) notation. Other notation systems also emerged in Russia through its history—Ecphonetic (in early manuscripts, but sporadically used until the 16th century), Kontakarian (in a few manuscripts), Put', Demestvenny, not to mention local innovations such as Kazan notation. Since the 17th century, the mainstream Russian Church has used Western staff notation, initially with square note-heads.

Of these Russian notations, the *ecphonetic* is the same as that used in Byzantium. *Kontakarian* notation appears linked to a shortlived melismatic innovation in Byzantine notation, current during the transition from ecphonetic to neumatic, but quickly abandoned in Byzantium. The *Stolp* notation is a continuation of Early Byzantine Neumatic notation; like that notation it did not indicate precise interval sizes, but was used more as an aide-de-memoire than an explicit notation. Some signs were added to the notation, particularly from the 15th century on, and some combinations of signs were unknown in Byzantium; but it appears that Stolp and Early Byzantine notation can be unified. (I do not feel competent to essay such a unification myself.) The Unicode Consortium currently has no plans as to the encoding of the East Slavonic musical notations, and has not included them in its roadmap.

1.2. Existing infrastructure

The NEUMES project for the digitisation of Western Mediaeval musical notation (`http://www.scribeserver.com/NEUMES/`) includes within its scope Byzantine and Slavonic musical notation (and is committed to using Unicode to encode neumes); NEUMES has formulated an XML grammar to encode Western and Eastern chant.

All existing infrastructure that I know of deals only with the modern notation. Velisarios Gezerlis in Athens has available for sale a set of Microsoft Word macros (`ByzWriter`) for the authoring of Byzantine notation (`http://cgi.di.uoa.gr/~gbelis/`). This is presumably the major electronic infrastructure already in use for Byzantine Musical notation. Fr Constantine Terzopoulos in Aegina (`http://users.forthnet.gr/ath/frc/home.html`) has developed the Ephesios font set for Byzantine notation, and is in discussion with typographers Tom Gewecke, James Kass and John Hudson to develop a Unicode version of the font based on the Unicode encoding.

I have only found two font suites online for Modern Byzantine. Both are distributed by the Association of Constantinopolitan Friends of Music in Athens (`http://www.cmkon.org/fonts.htm`), although their public domain status is not clear. The provenance of the Bem13 font is unknown. The more compehensive ED suite (Psaltica, Fthora, Isson) were designed by Elie Daoun in Beirut (192 Nassif Rayes St., tel. +961 3 278 344); the original ZIP package is available at `http://www.procopiou.net/download/byzantine.zip` . I use the ED suite in this document, and appeal to it and Ephesios for hints on frequent combinations of neumes. The ED fonts, as one would expect, use single codepoints to render frequent combinations of neumes, particularly interval signs. The Ephesios user manual (`http://users.forthnet.gr/ath/frc/Manual.html`)

provides the full list of keystrokes for the fonts in the font set, including the frequent combinations in the font, and should be consulted by font designers. In this document, I give codepoints in Daoun's and Terzopulos' 8-bit fonts, as well as Unicode codepoints; "ED Psaltica: 0", for instance, means that an ison is obtained in the ED Psaltica font by typing *0*.

1.3. Text

In ecphonetic notation, the individual words in the text retain their traditional Greek accentuation, despite the fact that the ecphonetic signs themselves substantially overlap with the traditional accents, and have the same origin as them. In neumatic notation, Greek text appears without diacritics, presumably because of the difficulty of having textual diacritics clash with the neumes above them. This has remained the case with Byzantine notation.

Contemporary usage with Greek text makes uses of the conventional modern Greek script, as one would expect; so 'Byzantine' signs such as the lunate sigma and epsilon are not used in the text. However the two ligatures to have survived into 19th century typography, stigma (στ = ϛ; EphesosIson: s) and ou (ου = ȣ; EphesosIson: o), are occasionally retained (Figure 13). As far as I can tell, `U+1D0E6 Byzantine Musical Symbol Digramma GG` ('Digraph GG') is another such ligature.

It is conventional to repeat vowels over which several neumes appear. The Rumanians Lungu et al. (1984) consider this practice antiquated, and prefer the Western practice of dashes for multiple notes over the same syllable; but repeating vowels remains the practice for Greek.

1.4. Colour

It is conventional to write and print certain classes of sign in red rather than black—notably phthorae (modulants, accidentals), martyriae (signatures), and the Great Hypostases (ornaments). (I have also seen green used for this purpose.) The choice of colour is not semantically significant in modern notation, which in published book form usually sidesteps this requirement. In earlier stages of the notation, colour was significant, indicating amongst other things corrections.

2. Ecphonetic notation

Whereas Greek accentuation applies to a vowel, the ecphonetic signs apply to an entire phrase, with the appropriate sign placed above or below both the beginning and the end of the phrase (Figure 21). The Lesbos table (Figure 1), which was the first instance of ecphonetic notation described, names and illustrates the use of most of the signs.

Wellesz's (1961:252–253) account of the ecphonetic signs is as follows, supplemented by Höeg (1935); my elaborations are in square brackets:[4]

`U+1D003 Byzantine Musical Symbol Oxeia Ekfonitikon`

[4]Wellesz uses Classical transliterations of the Greek names of the neumes; Unicode uses a transliteration based on Modern Greek, which, as with the transliterations in the Greek and Coptic and Extended Greek blocks, originates in ELOT, the Greek Standards Organisation.

The *Oxeia* [Acute] indicates that the voice should rise and remain on a higher pitch until the end of the phrase, marked by a second Oxeia.

U+1D004 Byzantine Musical Symbol Oxeia Dipli
[Double Acute: As with the Oxeia, but more emphatic, typically at the end of a lesson, where it may have been sung rather than chanted.]

U+1D005 Byzantine Musical Symbol Vareia Ekfonitikon
The *Bareia* [Grave] stands for lowering the pitch of the voice and giving emphasis to the words encompassed by the two signs.

U+1D006 Byzantine Musical Symbol Varia Dipli
[Double Grave: As with the Bareia, but more emphatic, typically at the end of a lesson, where it may have been sung rather than chanted.]

U+1D007 Byzantine Musical Symbol Kathisti
The *Kathiste* [Sitting] marks the narrative style without emphasis, and is always found at the beginning of a lesson from the Gospel, introduced by [the standard formula] Τῷ καιρῷ ἐκείνῳ ('at that time').

U+1D008 Byzantine Musical Symbol Syrmatiki
The *Syrmatikē* [Drawn Out] demands an undulating movement like the shape of the sign [a tilde].

U+1D009 Byzantine Musical Symbol Paraklitiki
Parakletike [Supplicating] indicates a phrase executed in an entreating, praying manner.

U+1D00A Byzantine Musical Symbol Ypokrisis
The *Hypokrisis* has the opposite meaning to the *Synemba* [U+1D013]; it is a sign of separation. Since it may consist of two or three hooks, it can indicate a shorter or longer pause. [Höeg, however, believes that the single hypokrisis indicated a gradual ascent in pitch at mezzo-forte, leading up to an oxia, with the double hypokrisis forte.]

U+1D00B Byzantine Musical Symbol Ypokrisis Dipli
[Double Hypokrisis: This is the form of the Hypokrisis with three hooks, indicating a longer pause between notes or an ascent in pitch.]

U+1D00C Byzantine Musical Symbol Kremasti
The *Kremaste* [Hanging] marks a rise of the voice with slight accentuation.

U+1D00D Byzantine Musical Symbol Apeso Ekfonitikon

U+1D00E Byzantine Musical Symbol Exo Ekfonitikon
The combination [Apostrophos] ... [Oxeia] is called *apeso exo* [from inside to outside] and indicates a beginning on a low pitch and rising to the Oxeia at the end of the phrase. [Presumably there are instances in the manuscripts where the Apeso + Exo was distinguished visually from the Apostrophos and Oxeia.]

U+1D00F Byzantine Musical Symbol Teleia
The *Teleia* [Full] means a full stop. [For example, a phrase could open with an Oxeia and end with a Teleia.]

U+1D010 Byzantine Musical Symbol Kentemata

[Stitches: Mentioned but not decoded by Wellesz; Höeg suspects that whereas the hypokrises led up to an oxia, the kentemata descended away from it.]

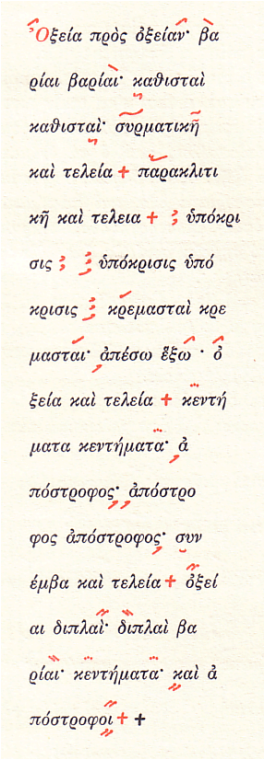


Figure 1. The Lesbos table in transcription (Höeg 1935:19).

U+1D011 Byzantine Musical Symbol Apostrofos
The *Apostrophos* [Apostrophe] seems to indicate a somewhat low pitch of the voice without giving emphasis to the words which the two Apostrophoi enclose, but it seems also to have retained the original meaning which the grammarians had given it as one of the *Pathē* or declamatory signs where it means to take breath and to begin to read. [By Early neumatic notation, the Apostrophos had become an interval sign.]

U+1D012 Byzantine Musical Symbol Apostrofos Dipli
[Double Apostrophe: As with the Apostrophos, but more emphatic, typically at the end of a lesson, where it may have been sung rather than chanted.]

U+1D013 Byzantine Musical Symbol Synemva
The *Synemba* [Entering Together] is a kind of slur, combining two words in one breath.

U+1D014 Byzantine Musical Symbol Theta
[Not mentioned by Wellesz or Höeg; I do not currently know its meaning.]

Of the signs, the Oxeia, Vareia, Syrmatiki, Paraklitiki, Kremasti, and Kentimata appeared above the text; the Kathistai, Apostrophos, and Synemva below it. The Teleia and Ypokriseis appeared on the line and between texts.

The prosodic signs U+1D000 Byzantine Musical Symbol Psili, U+1D001 Byzantine Musical Symbol Daseia, U+1D002 Byzantine Musical Symbol Perispomeni are of course the smooth and rough breathing and circumflex of normal Greek textual accentuation. I am unaware of specifically ecphonetic use of these signs, and the rubric 'Prosodic' ties them in with the earlier Alexandrian accentuation system.

3. Post-Early Neumatic notation

Since the three last phases of neumatic notation are identifiably the same system, notwithstanding differences of detail, I discuss them together. Though the Early system is not quite the same semantically, many signs are shared between the Early and later systems.

The Unicode table usually includes distinct codepoints for Early and Middle or Middle and Modern signs. If the Middle term is understood to be the same as the Modern, both semantically and in name, it would have made sense to conflate them even if they did not look identical, and rather leave the glyph differences to fonts or glyph variants; this appears to have been the case for several neumes. The inclusion of the separate repertoires is irrevocable because of Unicode's stability commitments.

There are restrictions in Byzantine musical tradition on how signs combine: which interval signs can follow which; which interval signs can begin or continue a syllable; and which temporal or consonant signs can modify which. These are beyond the scope of this document.

Figure 2 gives the Middle forms of the glyphs, as conventionally used in the *Monumenta Musicae Byzantinae* series.

3.1. Interval signs

3.1.1. Interval signs alone

Interval signs indicate the interval by which the current note differs from the preceding. Several of them also indicate a particular kind of accentuation. Their Unicode rubric is *Fonitika (Vocals)* (since *phonetika* in Byzantine musical theory could mean both 'vocal' and 'interval').

The following signs appear in all Post-Early notation, though the glyphs used vary slightly from period to period.

U+1D046 Byzantine Musical Symbol Ison Neo [Modern Equal]
ED Psaltica: 0
EphesiosMain: i

Ison: Repeat preceding note.

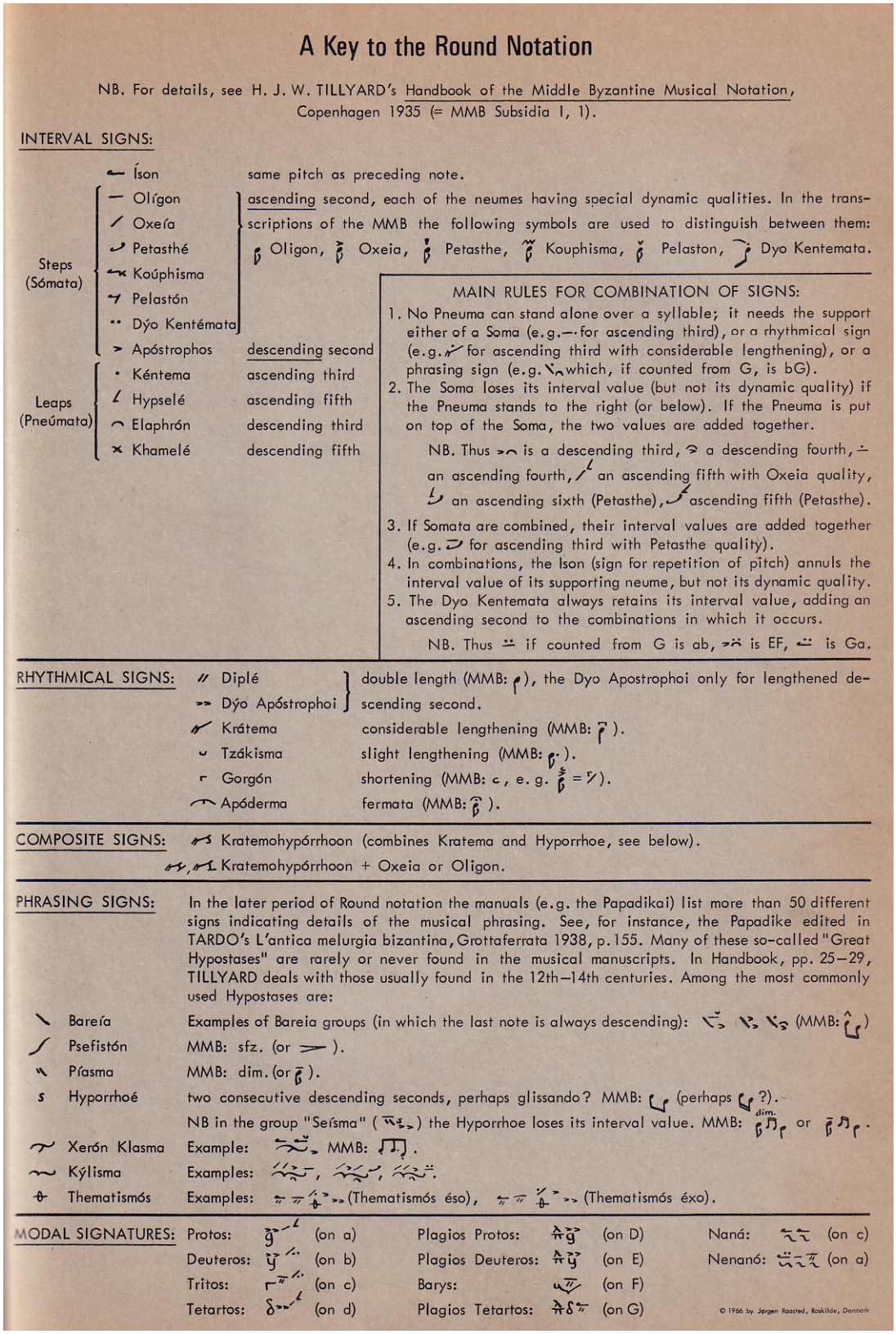


Figure 2. *Monumenta Musicae Byzantinae* glyphs for Middle notation.

U+1D047 Byzantine Musical Symbol Oligon Neo [Modern Slight]
ED Psaltica: 1
EphesiosMain: o

Oligon: Ascend by a second; no accent.

U+1D049 Byzantine Musical Symbol Petasti [Flung]
ED Psaltica: q; ED Fthora: a
EphesiosMain: p

Petasti: Ascend by a second, with accent.

U+1D04E Byzantine Musical Symbol Kentimata Neo Ano [Modern Upper Stitches] ED Psaltica: `
EphesiosMain: n, N, Option-Shift-n

Kentimata: Ascend by a second, softer, no accent (legato, tied with previous note)

U+1D04F Byzantine Musical Symbol Kentima Neo Ano [Modern Upper Stitch] ED Psaltica: ~
EphesiosMain: x, X, Option-x

Kentima: Ascend by a third.

U+1D050 Byzantine Musical Symbol Ypsili [High]
ED Fthora: s
EphesiosMain: Option-Shift-e, Option-Shift-f

Ypsili: Ascend by a fifth.

U+1D051 Byzantine Musical Symbol Apostrofos Neo [Modern Apostrophe]
ED Psaltica: !
EphesiosMain: a

Apostrophos: Descend by a second.

U+1D053 Byzantine Musical Symbol Yporroi [Underflow]
ED Psaltica:)
EphesiosMain: s

Hyporroi: Descend by two consecutive seconds. Tied to preceding note. Formerly known as *katavasma* [Descending].

U+1D055 Byzantine Musical Symbol Elafron [Light]
ED Psaltica: @
EphesiosMain: e

Elaphron: Descend by a third.

U+1D056 Byzantine Musical Symbol Chamili [Low]
ED Psaltica: $
EphesiosMain: h

Hamili: Descend by a fifth.

The following additional (or variant) interval signs occur in pre-Modern systems.

U+1D048 Byzantine Musical Symbol Oxeia Neo [Modern Acute]

U+1D04A Byzantine Musical Symbol Koufisma [Hollowing]

U+1D04D Byzantine Musical Symbol Pelaston Neo [Modern Approached]

All three are ascending seconds, alongside the Oligon and the Petasti. Of these, the Oxeia appears to have been associated more with accented syllables, and is described as an abrupt raising tone followed by a decrescendo. The Petasti in Middle notation is described by Wellesz as “sung quickly and with élan”. The Koufisma may have been a minor second, or a weak and hesitant major second according to Wellesz; Tillyard deems it to have been a tremolo. The Pelaston was more intense than the Petasti.

Despite their Unicode name, the Oxeia and Pelaston have not made into the Modern system, and are named *Neo* to differentiate their Middle–Late forms from their Early or Ecphonetic equivalents. (This occurs frequently in the table, and all instances of *Archaion/Neo* in the table are potentially Early/Post-Early glyph variants.) The Oxeia nonetheless has some usage among contemporary scribes, and was included in early modern notation publications; in EphesiosMain, it appears as Y.

U+1D052 Byzantine Musical Symbol Apostrofoi Syndesmos Neo [Modern Conjunction of Apostrophes]

Long descending second; properly either *Syndesmos* or *Apostrofoi*.

U+1D054 Byzantine Musical Symbol Kratimoyporroon [Held Underflow]

A sign, like hyporroe, for two descending seconds in a row; the note preceding the combination is lengthened. Also known as *Kratimo-katavasma*.

U+1D018 Byzantine Musical Symbol Chamilon [Low]

This is properly a symbol of the Early system, but the glyph appears as a variant of U+01D056 in Middle notation; it is the 'missing link' between the acronym χ for χαμηλή and the modern sign.

The two remaining interval signs, *Petastokoufisma* (U+1D04B) and *Kratimokoufisma* (U+1D04C), are clearly Middle Byzantine compounds, which happen not to have been included in Wellesz' or Tillyard's survey; presumably the petastokoufisma combines the accentuation of the petasti and the koufisma, while the kratimokoufisma is a koufisma with either the note itself or the preceding note lengthened.

3.1.2. Interval signs in cumulative combination.

The interval notes often occur in combination with other interval notes. In Pre-Modern notation, a leap (*pnevma*, 'spirit': a third or fifth) can never appear on its own, but only modifying a step (*soma*, 'body': a second). In the Modern system, the elaphron and hamili can appear on their own, but the kentima and ypsili must still be used only as modifiers, not as modifieds.

In the pre-Modern system, notes combined cumulatively (adding their interval values together) if a leap sign was written above a step sign; but if the leap sign was written below or to the right, they combined through subordination, substituting the step's accentuation but leaving the leap interval unaffected. So an ypsili could be written to the right of an oligon or below it, meaning in both cases an unaccented interval of an ascending fifth (interval size: ypsili; accentuation: oligon). Or, an ypsili could be written above an oligon, meaning an interval of an ascending sixth (interval size: ypsili + oligon). An ison above any neume except kentimata appears to have indicated an ornament centered at the same pitch as its precedent.

The modern system restricts the positions of combination: e.g. the ypsili may only appear at the top right, not below or to the right of the step. On the other hand, the restriction on appearing alone does not hold at all for descending intervals. Throughout post-Early notation, the choice of modified neume determines the accentuation of the note even in cumulative combinations—the oligon indicating that the note is unaccented, the petasti indicating an accent. The following are the more frequent cumulative combinations in the modern system (see also EphesiosCombination and ED Psaltica for leaps greater than a ninth):

Ascending third: Oligon over petasti (ED Psaltica: w; EphesiosMain: Option-Shift-p,

)

Ascending fourth unaccented: Kentima over oligon (ED Psaltica: 3; EphesiosMain: K,

)

Ascending fourth accented: Kentima over petasti (ED Psaltica: e; EphesiosMain: Option-k, )

Ascending fifth unaccented: Ypsili at right end or middle of oligon (ED Psaltica: 4; EphesiosMain: u, )

Ascending sixth accented: Ypsili at left end of petasti (ED Psaltica: t, )

Ascending octave unaccented: Ypsili over kentima over oligon (ED Psaltica: 7; EphesiosMain: J, )

Ascending octave accented: Ypsili over kentima over petasti (ED Psaltica: u; EphesiosMain: Option-Shift-j, l, )

Descending fourth: Elaphron over apostrophos (ED Psaltica: #; EphesiosMain: Option-h, )

Descending sixth: Hamili over apostrophos (ED Psaltica: %; EphesiosMain: H, )

Descending seventh: Hamili over elaphron (ED Psaltica: ^, )

Descending octave: Hamili over elaphron over apostrophos (ED Psaltica: &, )

Descending ninth: Hamili over hamili (ED Psaltica: *, )

In the case of subordination (*hypotaxis* in Byzantine musical theory), where the modifier interval is combined with the modified's accentuation, the modifier is placed above the oligon/petasti—except for the kentima, which is placed to the right or below an oligon. (When the kentima is placed above, the effect is cumulative instead.) The following are the combinations included in Daoun's and Terzopoulos' fonts as single codepoints:

Unison accented: Ison over petasti (ED Psaltica; EphesiosMain: I: p, )

Ascending third unaccented: Kentima under oligon (ED Psaltica: 2; EphesiosMain:

Option-Shift-x, ) or Kentima to the right of oligon (EphesiosMain: k,)

Ascending fifth accented: Ypsili at right end or middle of petasti (ED Psaltica: r, )
Ascending sixth unaccented: Ypsili at left end of oligon (ED Psaltica: 5; EphesiosMain: U, )
Ascending seventh unaccented: Ypsili next to kentima over oligon (ED Psaltica: 6; EphesiosMain: j, )
Ascending seventh accented: Ypsili next to kentima over petasti (ED Psaltica: y; EphesiosMain: Option-j, )

Ascending ninth unaccented: Two ipsiles over oligon (ED Psaltica: 8, )

Ascending ninth accented: Two ipsiles over petasti (ED Psaltica: i, )

Descending second slightly accented: Apostrophos over oligon (ED Psaltica: I, )
Descending second accented: Apostrophos over petasti (ED Psaltica: Q; EphesiosMain: Option-Shift-h, )
Descending third accented: Elaphron over petasti (ED Psaltica: W, EphesiosMain: E, )
Descending fourth accented: Elaphron over apostrophos over petasti (ED Psaltica: E, )

The cumulative combinations may also combine with an accentuation neume through subordination: hamili over elaphron over apostrophos over oligon is a slightly accented descending octave. (Interval: Hamili + Elaphron + Apostrophos = −4 + −3 + −2; Accentuation: Oligon.) In all such cases, the interval of the modified ascending second does not count, and is only used for accentuation.

The combination of neumes is potentially open-ended, and existing fonts do not exhaust all such possibilities.

The *Specials* rubric includes positional variants of the Kentimata and Kentima; this would be used, for example, to differentiate glyphically kentima over oligon and kentima under oligon.

`U+1D0F0` `Byzantine Musical Symbol Kentimata Neo Meso` [Modern Middle Stitches].

`U+1D0F1` `Byzantine Musical Symbol Kentima Neo Meso` [Modern Middle Stitch].

`U+1D0F2` `Byzantine Musical Symbol Kentimata Neo Kato` [Modern Low Stitches].

`U+1D0F3` `Byzantine Musical Symbol Kentima Neo Kato` [Modern Low Stitch].

3.1.3. Note sequence combinations

The kentimata specifically refer to an ascending second tied to a preceding note; so when it combines with an oligon it results in two ascending seconds. Its position when it combines determines whether the first or the second note of the group is tied to its preceding note.

Kentimata above oligon (ED Psaltica: O; EphesiosMain: W,) two ascending seconds, second note legato.

Oligon above kentimata (ED Psaltica: o; EphesiosMain: w,): two ascending seconds, first note legato.

Oligon before kentimata ( ): same as oligon above kentimata. The distinction is syntactic (as a hint to the performer): the kentimata are written separately if a run of ascending notes are to be followed by a run of descending notes.

An apostrophos under an ison (ED Isson: q; EphesiosMain: q,) is performed as an ison followed by an apostrophos.

Two apostrophoi in a row over the same syllable may be stacked (ED Isson: w; EphesiosMain: V,).

3.1.4. Note letters

In the modern system, the letters of the alphabet were used to coin equivalents to the Western Do–Re–Mi: starting from d, πA, Βου, Γα, Δι, κΕ, Ζω, νΗ (*pa, vu, ga, di, ke, zo, ni*). In imitation of Do–Re–Mi, a hymn was devised to justify the choice of initial syllables. The

acronyms of these letters are used to form modern signatures (see below); the Unicode table has accordingly included them under the rubric of *Grammata (Letters)*, although these are merely stylised Greek letters.

U+1D0E9 Byzantine Musical Symbol Arktiko Pa [Initial Pa]
ED Psaltica: v; ED Fthora: V, v

EphesiosPhthora: a, (raised) A

The note d.

U+1D0EA Byzantine Musical Symbol Arktiko Vou [Initial Vou]
ED Psaltica: b; ED Fthora: B, b

EphesiosPhthora: b, (raised) B

The note e.

U+1D0EB Byzantine Musical Symbol Arktiko Ga [Initial Ga]
ED Psaltica: n; ED Fthora: N, n

EphesiosPhthora: g, (raised) G

The note f.

U+1D0EC Byzantine Musical Symbol Arktiko Di [Initial Di]
ED Psaltica: m; ED Fthora: M, m

EphesiosPhthora: d, (raised) D

The note g.

U+1D0ED Byzantine Musical Symbol Arktiko Ke [Initial Ke]
ED Psaltica: , ; ED Fthora: , , <

EphesiosPhthora: k, (raised) K

𝛘

The note a.

U+1D0EE Byzantine Musical Symbol Arktiko Zo [Initial Zo]
ED Psaltica: . ; ED Fthora: ., >

EphesiosPhthora: z, (raised) Z

𝛇

The note b.

U+1D0EF Byzantine Musical Symbol Arktiko Ni [Initial Ni]
ED Psaltica: c; ED Fthora: C, c

EphesiosPhthora: n, (raised) N

𝛎

The note c.

Byzantine chant features a few soloists singing against pedal notes (ison)[5] sung by the remainder of the choir. The ison is not indicated in Chrysanthine notation; no standard has been set, but the usual modern practise is to indicate the ison using the pitch letter in parentheses—capital for the Mese[6] octave (ED Isson: P B G D K Z N (Π) (Β) (Γ) (Δ) (Κ) (Ζ) (Ν)), and lowercase for the Nete octave (rare).

Other practices are attested: Panagiotopoulos uses the full syllables, while Efthymiadis avoids the parentheses. Terzopoulos notes the alternate practise of placing a tie under the note initial (EphesiosIson: Option-9; somewhat broader than U+0323); some scribes also

[5]Properly, the ison is the bass note of the current tetrachord of the melody. On the tetrachord, see §3.4.1.

[6]Byzantine music, which is only vocal, admits the following ranges: Hypate: G-A. Mese: B–a. Nete: b–g′. See Figure 8.

put the ison note in a circle.

In the EphesiosIson font, Nete notes are in uppercase and have a prime next to them, while Hypate notes have a down-arrow (U+2193 Downwards Arrow) next to them. Where the choir is meant to temporarily stop singing ison and join the soloists, this is indicated by alpha (ἀκολούθει, "follow") or mu (μαζί, "together") (ED Isson: M, (Μ)

; cf. Figure 14). The choir can be split into octaves, with the high ison dropping out where it would clash with the melody; this is indicated by writing the two ison notes next to each other, e.g. Δ.δ (G, g); Δ.α (G, silent); Δ.δ (G, g). (Figure 19)

Note letters are also written on occasion over a large leap, as a reminder to the chanter of what note is reached; this is normally the function of the pitch signature (see §3.4.3), but the signature can only be used on a cadence.

3.2. Temporal signs

By default, each note has the duration of one beat (cf. the Western quarter note).[7] Temporal signs modify the duration of notes, and may be placed above or below a neume. In the Unicode table, they appear under the rubrics *Argies (Retards)* and *Synagmata or Gorgotites (Synagmas or Quickeners)*.

3.2.1. Klasma

U+1D07F Byzantine Musical Symbol Klasma Ano [Upper Breaking]
ED Psaltica: A, Z, a
EphesiosMain: c, C, ç, Ç

U+1D0F4 Byzantine Musical Symbol Klasma Kato [Lower Breaking]
ED Psaltica: z

In the modern system, the klasma lengthens a note by a beat: where normal notes are transcribed as quarter notes, notes with klasma are transcribed as half notes. There is no semantic difference between klasma above or below, except in combination with the petasti. A klasma below a petasti has the effect of modulating the note: half beat on note, half beat ascending second with crescendo, then full beat descending second, decrescendo. With the oligon, the klasma is written above, except if the oligon already has a kentima or ypsili above, in which case it is written below. If an oligon has a psifiston below it as

[7] Pieces which in Western notation would be written mostly in eighth notes will have one neume written per eighth note; this results in tempi very fast by Western standards.

well, though, the klasma is written to the right of the kentima. These distinctions are all syntactic, rather than semantic, so the two klasmata are equivalent semantically.

In the pre-Modern system, the Klasma (or *Tzakisma*, 'Breaking') was a consonant sign, used to mark detached notes; in some usage its precise meaning was determined by the colour of ink used.

3.2.2. Gorgon

U+1D08F Byzantine Musical Symbol Gorgon Neo Ano [Modern Upper Swift]ED Psaltica: S, s

EphesiosMain: g, 1, Option-Shift-6

U+1D0F5 Byzantine Musical Symbol Gorgon Neo Kato [Modern Lower Swift]ED Psaltica: X, x

EphesiosMain: G, !

The gorgon and argon (§3.2.5) served in pre-Modern notation as accelerandos and ralletandos. In the Modern system, both signs modify note durations instead. The gorgon has scope over the note it modifies and the note before it, halving both their durations. It has the effect of a duplet: 1:2. The gorgon is normally placed above the neume; it appears below the neume when an oligon begins a musical phrase, and when it modifies kentimata following an oligon. (The gorgon above and below are different codepoints in 8-bit fonts.)

When the gorgon is located on an oligon–kentimata combination, it applies to the kentimata. So in the combination Gorgon over kentimata over oligon (ED Psaltica: l, ), the first note is an eighth note rising by a second, the second note is an eighth note rising by another second, and the two notes are tied. (The kentimata is the second note of the combination, so both it and the oligon are halved.) In the combination Gorgon over oligon over kentimata, the note before the first note is an eighth note, the first note is an eighth note rising by a second and tied to the note before it, and the second note is a quarter note rising by another second. (The kentimata is the first note of the combination, so it and its preceding note are halved; the oligon retains its normal length.)

When the gorgon modifies a hyporoe (ED Psaltica: -, ), the first note of the hyporoe

and its predecessor are both halved; if the hyporoe also has an apli, &c., the apli applies to its second note. When any other note has both a gorgon and an apli, its duration becomes 1 + 1/2. When a note with a gorgon follows a note with a klasma, the result is that the first note has a duration of 1 + 1/2 rather than 2, and the second note a duration of 1/2: ♩.♪ .[8]

The precise placement of the gorgon (and signs like it) depends on the sign it is modifying; this is often only one sign within a combination of signs, and as seen the width of neumes is also variable. For that reason, the font EphesiosHronos contains a range of locations for the various modifiers (middle, upper, lower, middle right, upper right, lower right, upper left).

The gorgon in the modern system indicates that the current note and its predecessor are to be sung in the time of a single note, as a duplet. The notation stacks gorga to obtain the same effect with other subdivisions of the beat: if *n* gorga appear over a note, then that note, the note preceding it, and the *n*−2 notes following it, are each sung with the duration of 1/(*n*+1) beats. Thus the digorgon (n=2) makes a triplet (3:1) out of three notes—the note modified, and the two notes on either side of it:

`U+1D095 Byzantine Musical Symbol Digorgon` [Two-Swift]
ED Psaltica: D, d

EphesiosMain: Option-g, 2, Option-Shift-7

The trigorgon makes a quadruplet (4:1) out of four notes—the note modified, the note before it, and the two notes following it. Each note becomes a sixteenth note:

`U+1D096 Byzantine Musical Symbol Trigorgon` [Three-Swift]
ED Psaltica: F, f

EphesiosMain: Option-Shift-g, 3, Option-Shift-8

[8]Idiomatically, when an apostrophos is followed by an elaphron, in what is called a continuous elaphron (ED

Psaltica: _,), the apostrophos note and the note before it are halved (as if the apostrophos has a gorgon over it), and the elaphron note descends by a second instead of a third. The sequence has its normal interpretation if space or a comma is inserted between the two neumes.

When applied to Greek folk music, the system is extended to tetragorgon for quintuplets and pentagorgon for sextuplets. V. Gezerlis informs me that his notation system includes such high-end quickeners; EphesiosHronos also includes the tetragorgon (codepoints: 8, 9, 0, -, =, [,]). The current encoding makes no provision for such quickeners. (Figure 15)

In folk music usage, the multiply stacked gorga are often felt to be insufficiently distinctive, and the requirement of placing them on the second note confusing; so a clarifying arabic numeral, giving the number of notes involved, is placed over the first neume in the group (e.g. a *5* before the tetragorgon: Figure 15).

3.2.3. Apli

`U+1D085 Byzantine Musical Symbol Apli` [Simple]
ED Psaltica: :, ;, é

EphesiosMain: d

𝅥

`U+1D086 Byzantine Musical Symbol Dipli` [Double]

ED Psaltica: Å, Ä[9]

EphesiosMain: D

𝅥𝅥

`U+1D087 Byzantine Musical Symbol Tripli` [Triple]
EphesiosMain: Option-d

`U+1D088 Byzantine Musical Symbol Tetrapli` [Quadruple]
EphesiosMain: Option-Shift-d

The apli &c. are dots that appear under a neume, and increase its duration by one, two, three, or four beats. So a tripli appearing under an oligon converts it from a quarter note into a whole note. Theoretically the system is open-ended, although I have not seen any usage past the tripli: longer durations use the tie (`U+1D07C Byzantine Musical Symbol Yfen Kato`) instead.

3.2.4. Punctuated gorgon

The apli, dipli &c. dots combine with the gorgon and digorgon to produce the equivalent of dotted rhythms in the modern system, imitating Western notation. There is confusion in the precise value of the times indicated (which Tillyard was dismissive of); while there is a straightforward logic to the value of dotted gorga, it is not followed by all authorities.

The logical scheme, which appears to be what Chrysanthus put forward in 1821, is that

[9]That is to say, the dipli codepoint in ED Psaltica corresponds to the codepoints for Å and Ä in Latin-1.

an *m*-gorgon with *n* dots divides a single duration into 1/(*m*+*n*+1). So a gorgon with a single dot divides the duration into thirds; a trigorgon with two dots divides the duration into sixths (3+2+1). The dots act as retards; the number of dots indicates by how many subdivisions the note is lengthened, and the relative location of the dots indicate which note in the group is lengthened. So two dots to the left of a digorgon indicate that we are dealing with quintuplets; that one of the notes is three fifths long, while the other two notes remain a fifth long; and that the lengthened note is the leftmost: 𝅘𝅥𝅮.𝅘𝅥𝅯𝅘𝅥𝅯. A single dot over the third gamma of a tetragorgon indicates that the fourth note of a sextuplet is doubled in length: 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅮𝅘𝅥𝅯 .

Following this scheme, the punctuated gorgons already in the Unicode encoding have the following values.

U+1D090 Byzantine Musical Symbol Gorgon Parestigmenon Aristera
[Swift, Side-Dotted to the Left]
ED Psaltica: H, h

EphesiosMain: Option-1, Option-Shift-1, @, Option-8, Option-=

𝅘𝅥𝅯.⌐

Apli before gorgon: quarter plus eighth triplet, 𝅗𝅥3𝅘𝅥𝅮 . Also known as hemigorgon (semi-swift).

U+1D091 Byzantine Musical Symbol Gorgon Parestigmenon Dexia
[Swift, Side-Dotted to the Right]
ED Psaltica: ì

EphesiosMain: Option-2, Option-Shift-2, #, Option-9

⌐.

Apli after gorgon: eighth plus quarter triplet, 𝅘𝅥𝅮3𝅗𝅥 . Also known as trihemigorgon (three–semi-swift).

U+1D093 Byzantine Musical Symbol Digorgon Parestigmenon Aristera Kato [Two-Swift, Side-Dotted to the Left Below]
ED Psaltica: J, j

EphesiosMain: Option-3, Option-Shift-3

𝅘𝅥𝅯.⌐

Apli before digorgon: eighth note, two sixteenth notes, 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯

U+1D095 Byzantine Musical Symbol Digorgon Parestigmenon Dexia [Two-Swift, Side-Dotted to the Right]
EphesiosMain: Option-5, Option-Shift-5, Option--

Apli after digorgon : two sixteenth notes, eighth note, 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅮

U+1D094 Byzantine Musical Symbol Digorgon Parestigmenon Aristera Ano [Two-Swift, Side-Dotted to the Left Above]
EphesiosMain: Option-4, Option-Shift-4, Option-0

Apli above digorgon: sixteenth note, eighth note accented, sixteenth note, 𝅘𝅥𝅯𝅘𝅥𝅮𝅘𝅥𝅯

Dipli before gorgon : dotted eighth note, sixteenth note, 𝅘𝅥𝅮.𝅘𝅥𝅯

Dipli after gorgon : sixteenth note, dotted eighth note, 𝅘𝅥𝅯𝅘𝅥𝅮.

Apli above trigorgon (EphesiosMain: Option-Shift-9): quintuplet with third note tied to fourth.

Apli to right of trigorgon (EphesiosMain: Option-Shift-0): quintuplet with fourth note tied to fifth.

Apli below and gorgon above note A, followed by gorgon on note B: note before A is eighth note, A is accented quarter note, B is eighth note: 𝅘𝅥𝅯𝅘𝅥𝅘𝅥𝅮 .[10]

Straightforward combinations such as dipli after gorgon are not available as precomposed codepoints in Unicode. Combinations with more than a single dot, however, are rare in practice (particularly given the confusion with the value of punctuated gorgons).

[10]This is the system as described in Lungu et al, Theofilopoulos and Margaziotis. Chrysanthus in 1832, Panagiotiopoulos and Efthymiadis consider the singly punctuated gorgon to be 3/4 + 1/4 rather than 2/3 + 1/3, and this is presumably the reason the right dotted version is termed a trihemigorgon. (Panagiotopoulos allows the triplet interpretation through clarifying arabic numerals under the notes, indicating the beat durations. Both Panagiotiopoulos and Efthymiadis keep the punctuated digorgon as quadruplets.) At least according to Margaziotis, the 'logical' system I have described is that recommended by the 1881 Commission, and that originally adopted by Chrystanthus in 1821.

Chrysanthus in 1832 also considered the digorgon by default to be 2/4 + 1/4 + 1/4, and notated the triplet digorgon using an arabic numeral 3 to its right.

3.2.5. Argon

U+1D097 Byzantine Musical Symbol Argon [Slow]
ED Psaltica: g

EphesiosMain: r

In pre-Modern notation the argon was widely used as a tempo marker (ralletando). In the Modern system, the Argon appears only in the combination

Argon over oligon over kentimata,  . Instead of two ascending seconds (three crotches in a row), the first ascending second and its predecessor become (tied) eighth notes, while the second ascending note becomes a half note: 𝅘𝅥𝅘𝅥𝅘𝅥 > 𝅘𝅥𝅘𝅥𝅗𝅥 . An argon can also be dotted on either side; this affects the relative durations of the first two notes, so that an argon dotted on the left corresponds to 𝅘𝅥3𝅘𝅥𝅘𝅥𝅗𝅥 , and one dotted on the right to 𝅘𝅥𝅘𝅥3𝅘𝅥𝅘𝅥𝅗𝅥.[11]

U+1D098 Byzantine Musical Symbol Imidiargon [Semi–Two-Slow]
ED Psaltica: G

EphesiosMain: R

As with the argon—  ; but the second ascending note is lengthened by two beats (dotted half note): 𝅘𝅥𝅘𝅥𝅗𝅥. . Called hemiolion or trihemiargon in Margaziotis; epiargon in Theofilopoulos; diargon in Efthymiadis and Panagiotopoulos; hemiargon in Terzopoulos. The imidiargon can also be dotted, again with the dot affecting the two initial notes of the group.

U+1D099 Byzantine Musical Symbol Diargon [Two-Slow]
EphesiosMain: Option-r, Option-Shift-r

As with the argon; but the second ascending note is lengthened by three beats

[11]Panagiotopoulos gives the dotted gorgon the value 𝅘𝅥.𝅘𝅥𝅘𝅥, and accordingly gives the dotted argon the value 𝅘𝅥.𝅘𝅥𝅘𝅥𝅗𝅥.

(dotted half note): 𝅘𝅥𝅘𝅥𝅗𝅥. Called diargon in Margaziotis and Theofilopoulos; triargon in Efthymiadis and Panagiotopoulos. The diargon can also be dotted, again with the dot affecting the two initial notes of the group.

3.2.6. Rests

U+1D07E Byzantine Musical Symbol Stavros [Cross]
ED Psaltica: +

EphesiosMain: Shift-Option-]

+

In the Modern system, a breath mark. In the pre-Modern system, a ralletando. The Western breath mark (U+1D112 Musical Symbol Breath Mark; EphesiosMain: Option-Shift-,) is also used by some scribes to distinguish between breath marks applying to the whole choir or only to the soloists.

U+1D089 Byzantine Musical Symbol Koronis [Coronis]
ED Psaltica: Æ. æ

EphesiosMain: Option-.; EphesiosPhthora: u, (inverted) U

This is a borrowing into the modern system of the Western fermata, with the same meaning.

Rests proper in Byzantine notation are created by combinations of the varia (see below) with retards. These have been treated as precomposed units for the most frequent combinations in the Unicode table; not all possible combinations have been or could have been accounted for. Rests have been placed under the rubric *Leimmata or Siopes (Leimmas or Silencers).*

U+1D08A Byzantine Musical Symbol Leimma Enos Chronou [Taking of One Beat] ED Psaltica: |

EphesiosMain: B; EphesiosPhthora: v

Varia modified by apli: quarter rest.

U+1D08B Byzantine Musical Symbol Leimma Dyo Chronon [Taking of Two Beats] EphesiosMain: Option-B; EphesiosPhthora: V


Varia modified by dipli: half rest.

U+1D08C Byzantine Musical Symbol Leimma Trion Chronon [Taking of Three Beats]
EphesiosMain: Shift-Option-B; EphesiosPhthora: Option-v


Varia modified by tripli: dotted half rest.

U+1D08D Byzantine Musical Symbol Leimma Tessaron Chronon [Taking of Four Beats]
EphesiosMain: Option-z; EphesiosPhthora: Option-Shift-v


Varia modified by tetrapli: whole rest.

U+1D08E Byzantine Musical Symbol Leimma Imiseos Chronou [Taking of Half a Beat] EphesiosMain: Option-t


Varia modified by apli under gorgon: eighth rest . The gorgon has its normal effect of halving the duration of both the rest and the neume preceding it.

Varia modified by apli under gorgon-after-apli: sixteenth rest.

3.2.7. Tempo markings

Tempo markings also involve modifying a sign with a temporal sign, and have also been taken as precomposed in the Unicode table. The rubric under which they appear in Unicode is *Agogika (Conduits)*. The conduit appears in the initial signature of the work, though it is usually left implied by the genre of the piece; it may also appear in the middle of a piece, as a temporary tempo change.

The modified in the tempo marking is the letter chi (for χρόνος, 'time'). In Rumanian practice, it is T for *timp*; e.g. T. The ranges of the tempo markings were fixed by the 1881 Commission.

U+1D09A Byzantine Musical Symbol Agogi Poli Argi [Very Slow Tempo]
EphesiosArchtika: ö

Chi modified by diargon. 56–80 beats per minute (Largo or Adagio to Efthymiadis, Grave or Largo to Panagiotopoulos).

U+1D09B Byzantine Musical Symbol Agogi Argoteri [Slower Tempo]
EphesiosArchtika: õ

Chi modified by imidiargon. 80–100 bpm (Andante to Efthymiadis, Lento or Adagio to Panagiotopoulos).

U+1D09C Byzantine Musical Symbol Agogi Argi [Slow Tempo]
ED Fthora: x

EphesiosArchtika: ú

Chi modified by argon. 100–168 bpm (Moderato or Allegro to Efthymiadis, Moderato to Panagiotopoulos).

`U+1D09D Byzantine Musical Symbol Agogi Metria` [Moderate Tempo]
ED Fthora: Z

EphesiosArchtika: ù

Chi modified by gorgon next to argon. This value was not mentioned by the 1881 Commission, but is used for the higher end of slow tempo, around 130 bpm. (Andante to Panagiotopoulos, not mentioned by Efthymiadis.)

`U+1D09E Byzantine Musical Symbol Agogi Mesi` [Medium Tempo]
EphesiosArchtika: û

Chi modified by mu (for μέση, 'medium'). Not mentioned in any of my sources, presumably a synonym of `U+1D09D Byzantine Musical Symbol Agogi Metria`.

`U+1D09F Byzantine Musical Symbol Agogi Gorgi` [Swift Tempo]
ED Fthora: X

EphesiosArchtika: ü

Chi modified by gorgon. 168–208 bpm (Presto to Efthymiadis, Allegro to Panagiotopoulos).

`U+1D0A0 Byzantine Musical Symbol Agogi Gorgoteri` [Swifter Tempo]
ED Fthora: z

EphesiosArchtika: †

Chi modified by digorgon. Over 208 bpm (Prestissimo to Efthymiadis, Presto or Prestissimo to Panagiotopoulos). Tempo known as χύμα, "flowing", and used in

recitatives.

U+1D0A1 Byzantine Musical Symbol Agogi Poli Gorgi [Very Swift Tempo] EphesiosArchtika: Shift-Option-8

Chi modified by trigorgon. Unattested in my sources.

3.2.8. Pre-Modern Temporal Signs

U+1D080 Byzantine Musical Symbol Dipli Archaion [Ancient Double]

This is the Middle form of U+1D086, and doubles the length of the note, rather than adding two beats to it. So there is a graphemic and semantic difference between the Middle and Modern signs; it is not clear from this that they should have been disunified.

U+1D081 Byzantine Musical Symbol Kratima Archaion [Ancient Hold]

U+1D082 Byzantine Musical Symbol Kratima Allo [Other Hold]

U+1D083 Byzantine Musical Symbol Kratima Neo [Modern Hold]

All these signs likewise double the length of the note. The Kratima was also produced with emphasis. It is not clear whether the three kratimata should not simply have been counted as glyph variants.

U+1D069 Byzantine Musical Symbol Seisma [Shaking]

Lengthening by half. The Seisma also involved a tremolo. (See also Klasma, above.)

U+1D084 Byzantine Musical Symbol Apoderma Neo [Modern Giving]

According to Tillyard this was a lengthener like the kratima (and he transcribes it as a fermata), but according to Wellesz this indicated the end of a musical phrase, and a slight ralletando.

3.3. Consonant signs

The consonant signs involve various kinds of ornament or phrasing. They appear under the rubric *Afona or Ypostaseis (Mutes or Hypostases)*. There was a profusion of hypostases particularly in the Late system, introduced in the 12th and 13th century (termed Great Hypostases). The meaning of many hypostases is obscure, and Wellesz doubts that the names of others, not included here, are even meaningful.

As a result of the Chrysanthine reforms to the notation—which aimed to simplify it and expand out the abbreviations endemic to the system—only six consonant signs have survived into the Modern system: varia, omalon, antikenoma, psifiston, eteron, and endofonon. (Chrysanthus also considered the stavros to be a consonant sign.)[12]

U+1D058 Byzantine Musical Symbol Varia Neo [Modern Grave]
ED Psaltica: \

EphesiosMain: b, .

[12]The values of the consonants are inconsistently and sketchily described in the references, which appear to rely on practical instruction on this point instead.

Accent note.[13] The varia is conventionally used before certains kinds of runs and ties of notes; we have already seen it is also used as a rest, in combination with retards. In the pre-Modern system, the Varia was used to mark the start of a run of ascending and descending notes just before a strong accent; but by the Late system it had become a mere sign of separation—whence its modern use in rests.

U+1D05B `Byzantine Musical Symbol Omalon` [Smooth]
ED Psaltica: [, {

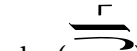
EphesiosMain: /, Option-Shift-/

In the Modern system, light undulation of the voice between two notes.[14] In the pre-Modern system, the Omalon indicates “the rhythmical equality of the tones of the melisma”.

U+1D05C `Byzantine Musical Symbol Antikenoma` [Instead of Void]
ED Psaltica: "

EphesiosMain: f

In the Modern system, note is sung “with an ascent more lively than the tempo”

(and a grace note). If placed under an oligon (EphesiosMain: M, ): eighth note on pitch, then sixteenth note up another second and sixteenth note back down (). If placed under oligon with gorgon: small crescendo (). If

[13]According to Lungu et al., before a note of a full beat, equivalent to a Western mordent (rapidly raising voice to note immediately above and back again). Before note with half a beat (i.e. next note modified by gorgon), or before note with full beat in lively tempo: accent.

[14]According to Lungu et al., crescendo–decrescendo affecting two or three tied notes. The group of notes involved conventionally starts with a varia, which has its mordent effect on the first note.

placed under note, with antikenoma modified by apli (): dotted eighth note on note, then sixteenth note up a second, and quarter note back down (𝅘𝅥𝅮.𝅘𝅥𝅯𝅘𝅥).

In the Middle system, a tie connecting ascending and descending notes; when used between two apostrophoi, Tillyard believes it was a glissando.

U+1D05A Byzantine Musical Symbol Psifiston Neo [Modern Reckoned]
ED Psaltica: ', }, ü

EphesiosMain: ,

In the Modern system, indicates an accent followed by a diminuendo, which ranges over the next few syllables unless the next syllable is accented.[15] In the pre-Modern system, the Psifiston indicated that each note of a phrase was articulated separately according to Wellesz; according to Tillyard it was a sforzando.

U+1D060 Byzantine Musical Symbol Eteron Parakalesma [Other Beseeching]
ED Psaltica:]

EphesiosMain: t

In the Modern system termed simply Eteron. Slur two notes. If more than two notes need to be slurred together, the notes involved are often lined up on top of an oligon. The oligon is cancelled out through subordination, but the combination still counts as a single note, which can be tied to another; e.g.

 (-3 tied with [-2 +1]). (The practice is common enough that Daoun's fonts contain several such combinations as single codepoints:

[15]According to Lungu et al., inserts preceding grace note a second above. If the neume is also modified by a klasma (), eighth note a second above, followed by dotted quarter note at the initial pitch (𝅘𝅥𝅮𝅘𝅥.).

, ED Psaltica P R T U Y à â ä å ç . Such combinations are also present in the EphesiosMain font.)

If the second note tied is an ison, sing it with slight undulation upwards. (This means that the eteron is not a tie, used merely to elongate the duration of a note.) If the eteron appears under a single note with dipli or tripli and preceded by varia (), the retard lengthens the note, and the eteron has the same effect on the penultimate beat as an antikenoma with apli. (So eteron with dipli—three beats: quarter note + dotted eighth note tied, then sixteenth note up a second, then quarter note down a second: ♩..𝅘𝅥𝅯♩)

U+1D07B Byzantine Musical Symbol Endofonon [Inner Sound]
EphesiosMain: z; EphesiosPhthora: w

Sing nasally. This sign is restricted to melismata, and has fallen into disuse since Chrysanthus' time.

There are also conventional grace notes associated with normal neumes in certain contexts; these are performance issues beyond the scope of this document.

The modern sign repertoire also includes ties borrowed from Western notation:

U+1D07C Byzantine Musical Symbol Yfen Kato [Lower Hyphen]
EphesiosPhthora: y

U+1D07D Byzantine Musical Symbol Yfen Ano [Upper Hyphen]
EphesiosPhthora: Y

These signs are always used to connect a note to an ison (since their point is to lengthen the note); unlike the eteron, there is no grace note inserted between the notes. Their Hellenic name appeals to the original shape and function of the hyphen in Hellenistic Greek punctuation, which was similar.

On occasion, other Western devices are borrowed, such as dynamics (*piano*, *forte*) (cf. Figure 14).

The Pre-Modern repertoire of consonant signs was rather more extensive.

U+1D059 Byzantine Musical Symbol Piasma Neo [Modern Catch]

"Probably a slight accent with groups of descending notes."

U+1D05E Byzantine Musical Symbol Paraklitiki Neo [Modern Supplicating]

U+1D05F Byzantine Musical Symbol Parakalesma Neo [Modern Beseeching]

U+1D060 Byzantine Musical Symbol Eteron Parakalesma [Other Beseeching]

According to Tillyard, expressives of beseeching, and slurs. According to Wellesz, lengthening by half.

U+1D05D Byzantine Musical Symbol Lygisma [Bending]

U+1D061 Byzantine Musical Symbol Kylisma [Rolling]

The Lygisma and Kylisma are counted, along with the Omalon and Antikenoma, as types of slurs. However the Kylisma (and apparently the Lygisma) was also a trill, and corresponds to the Western neumatic quilisma. According to Tillyard the Kylisma was a flourish at a medial cadence, usually with the neumes of the flourish written out around the kylisma sign.

U+1D062 Byzantine Musical Symbol Antikenokylisma [Instead of Empty Rolling]

The Antikenokylisma was an inverted trill.

U+1D063 Byzantine Musical Symbol Tromikon [Trembling]

The Tromikon was a "turn" of the voice.

U+1D064 Byzantine Musical Symbol Ekstrepton [Turning Out]

An inverted Tromikon; also *Strepton*.

U+1D065 Byzantine Musical Symbol Synagma Neo [Modern Gathering]

The Synagma was a legato marking.

U+1D066 Byzantine Musical Symbol Syrma [Dragging]

Indicates a turn, same as Ecphonetic Syrmatiki (U+1D008).

U+1D067 Byzantine Musical Symbol Chorevma Neo [Modern Dancing]

A kind of mordent, distinct from the Ouranisma (U+1D075).

U+1D068 Byzantine Musical Symbol Epegerma [Awakening]

Like the Middle Antikenoma, a tie uniting ascending with descending notes.

U+1D06A Byzantine Musical Symbol Xiron Klasma [Dry Breaking]

Voice rising abruptly and harshly; mezzo-staccato.

U+1D06E Byzantine Musical Symbol Tromikoparakalesma [Trembling Beseeching]

The Tromikoparakalesma was an intensified tremolo.

U+1D06F Byzantine Musical Symbol Psifistoparakalesma [Reckoned Beseeching]

The Psifistoparakalesma was a mordent.

U+1D070 Byzantine Musical Symbol Tromikosynagma [Trembling Gathering]

The Tromikosynagma was a soft tremolo.

U+1D071 Byzantine Musical Symbol Psifistosynagma [Reckoned Gathering]

"A soft rolling of the voice in the throat." Also called Gurgurisma, "Purring".

U+1D072 Byzantine Musical Symbol Gorgosyntheton [Compound Swift]

The Gorgosyntheton doubles the rhythmic value of the gorgon according to Wellesz, and presumably corresponds to the later digorgon. According to

Tillyard a slur used with a particular kind of flourish.

U+1D073 Byzantine Musical Symbol Argosyntheton [Compound Slow]

U+1D074 Byzantine Musical Symbol Eteron Argosyntheton [Other Compound Slow]

The Argosyntheton is a double Argon.

U+1D075 Byzantine Musical Symbol Ouranisma [Heavening]

A Mordent/"turn".

U+1D076 Byzantine Musical Symbol Thematismos Eso [Placing In]

U+1D077 Byzantine Musical Symbol Thematismos Exo [Placing Out]

U+1D078 Byzantine Musical Symbol Thema Aploun [Simple Place]

Grouping signs or ornaments (Tillyard is not clear on these, and neither apparently are the sources). Accoding to Thibault the *Thematismoi* are 'Nana' mode modulants (see below). The Thema Aploun is described in the sources as "indicating a simple rhythm", whatever that may mean; Tillyard believes it marked a middle cadence with two or three descending notes. These symbols were borrowed in Russian notation as Fita (Theta), and indicated elaborate, improvisable flourishes.

U+1D079 Byzantine Musical Symbol Thes Kai Apothes [Place And Remove]

A sign indicating a final (Tillyard: middle) cadence.

U+1D0B6 Byzantine Musical Symbol Enarxis Kai Phthora Vou [Beginning and e Modulator]
ED Fthora: G, g

EphesiosMain: 4; EphesiosPhthora: x, Option-x

The Enarxis or Anarxis ('Commencement') or Diamphismos ('Separation') denoted the beginning of the melody after the initial intonation formula for a piece. The Unicode encoding conflates this pre-Modern sign with the Modern phthora for Vou (see below).

Wellesz also mentions a *Hemiargon* sign, apparently related to the Argosyntheton (Thibault considers them synonyms), but unattested in the treatises and found in only one manuscript.

As of this writing, I have found no information on the following hypostases, though the last three are clearly compounds:

U+1D057 Byzantine Musical Symbol Mikron Ison [Small Equal]

U+1D06B Byzantine Musical Symbol Tromikopsifiston [Trembling Reckoned]

U+1D06C Byzantine Musical Symbol Psifistolygisma [Reckoned Bending]
U+1D06D Byzantine Musical Symbol Tromikolygsima [Trembling Bending]

3.4. Phthoral Signs

The phthoral signs encompass all the signs dealing with altering the pitches of the notes. To clarify how they did so, I need to go through the basics of Byzantine modes.

3.4.1. Byzantine Modes

Byzantine music is organised around eight modes (*echos*, 'sound'). The conventional wisdom is that in Byzantium, the modes corresponded to the diatonic modes of Western mediaeval and Ancient Greek music, although recently Greek scholars have argued that chromatic modes were also in use. The eight modes are divided into Authentic and Plagal: (Authentic) First, Second, Third, Fourth, Plagal First, Plagal Second, Varys [Deep], and Plagal Fourth. The plagal modes started a fourth below the corresponding authentic modes. The modes correspond to the Western Dorian, Phrygian, Lydian, Mixolydian, Hypodorian, Hypophrygian, Hypolydian and Hypomixolydian; and their scales are d–e–f–g–a–b–c–d for the First, e–f–g–a–b–c–d–e for the Second, and so on: III starting on f, IV on g, Plagal I starting on a, Plagal II on b, Varys on c′, Plagal IV on d′. (This means that the Plagal Fourth ends up being the same scale as the First, transposed up an octave.)

Byzantine music had two further modes added, *nana* and *nenano* (so named after their intonation formulas). The precise nature of these modes is not clear; according to Chrysanthus and Thibault these were Medial modes of Modes II and IV (i.e. starting a third above their corresponding authentic modes); so Authentic II e–e and Plagal II b–b corresponded to Medial II g–g. Tillyard accepts only nenano as a distinct mode, and believed it was the only instance of a chromatic mode in Byzantine music (with the standard minor second, major third combination characteristic of the chromatic modes); the nana he considered synonymous with Plagal IV.

In the modern system, matters are more complicated.

- As of the 1881 Commission, the scale is divided into 72 intervals (termed *commas*), so that the sizes of intervals need not correspond to Western equal-tempered tones and semitones. The modern Western equal-tempered tone corresponds to 12 commas, and the equal-tempered semitone to 6 commas.
- The same mode may have different realisations of its intervals depending on the tempo—and even independently of it. There is also some flexibility on which note is the finalis (tonic) of the mode.
- Three new chromatic modes (*chroae*) have arisen which are not associated with the traditional eight. They are only used passingly in chants (Figure 20), rather than being the main mode of any piece, and have a range of only a fifth; any notes outside the fifth remain diatonic.
- There is also an overriding tendency, independently of the mode, for b and (less often) e to be flattened.

Modern theory sets up three types of scale: diatonic, chromatic, and enharmonic; these are named after the scale types of Ancient Greek music, based on the tone, semitone, and quarter-tone respectively. Each scale type is defined by a tetrachord (sequence of three

intervals); the tetrachord is repeated at the dominant, and the distance between subdominant and dominant is always 12 commas (an equal-tempered tone).

- The diatonic scale is used for Modes I and IV authentic and plagal. It runs from d to d′, and has the following sequence of intervals (in commas): 10, 8, 12, 12, 10, 8, 12, with the reference pitch c at 512 Hz.[16] (So e and c are two commas flatter than in the well-tempered scale).
- The chromatic scales are characterised by a minor second and major third, and are of two types.

  The soft chromatic scale is defined as c–c′: 8, 14, 8, 12, 8, 14, 8. (So d and a are four commas flat, while e and c are still two commas flat.)

  The hard chromatic scale is defined as a–a′: ascending 6, 20, 4, 12, 6, 20, 4; descending 4, 20, 6, 12, 4, 20, 6. (So ascending, b is a semitone flat and f is at its equal-tempered pitch, while c and g are eight commas sharp. Descending, c and g are only a semitone sharp, while b is eight commas flat and f is two commas flat—eight commas flatter than f♯.)

  Both scales are used in Modes II and II plagal; the authentic mode defaults to the soft chromatic, and the plagal to the hard chromatic.
- The enharmonic scale, used in Mode III and Barys, is 12, 12, 6, 12, 12, 12, 6—that is to say, it is identical to the Western well-tempered major scale (but only since the 1881 revision of the scale).

The division of the octave into seventy-seconds by the 1881 Commission are an attempt to rationalise the interval sizes in just intonation. Chrysanthus' original proposal was closer to just intonation: he had proposed the tetrachords 12, 9, 7 instead of 12, 10, 8 for the diatonic scale; 7, 12, 7 instead of 8, 14, 8 for the soft chromatic; 7, 18, 3 instead of 4, 20, 6 for the hard chromatic; and 12, 13, 3, 12, 12, 3, 13 for the enharmonic, with 68 rather than 72 commas per octave. (His soft chromatic scale does not add up to 68 commas, and Hourmouzios the Archivist later corrected it to 9, 12, 7.) So like the Ancient Greek enharmonic scale for which it was named, the Modern Byzantine enharmonic originally did contain quarter-tones.

The rationale of the unequally-tempered scale is to give the frequencies of adjacent tones a ratio expressible in small numbers: tones with values of 12, 10 and 8 correspond to 9:8, ca. 10:9, and 16:15 of the frequency of the preceding note.

The modern modes are thus as follows, with sharps and flats intended only as approximate values:

I: d–e–f–g–a–b–c–d. Diatonic. Finalis: d; in some genres a.

Plagal I: a–b–c–d–e–f–g–a. Diatonic. Finalis: a in fast tempo, d in moderate tempo. b is often flattened, particularly with the Agem phthora (U+1D0CB), so that the upper half

[16]Amusingly, Efthymiadis states that the difference between Byzantine a, 864 Hz, and the standard a of European music is a mere 6 Hz; he had not been informed that the ISO standard Western A was raised from 435 to 440 Hz in 1955 (a pitch already standard in Germany since 1816), so the difference is now 16 Hz. The pitch c = 512 Hz was one of the competing Western standards for concert pitch until the 19th century.

of the scale becomes enharmonic.

II: g–a♭–b–c–d♭–e–f–g. Chromatic, typically soft. Finalis: g, e or d.

Plagal II: d–e♭–f♯–g–a–b♭–c♯–d. Chromatic, typically hard. Finalis: g for soft (in which case it is termed 'Nenano', after the old mode); d for hard chromatic.

III: f–g–a–b[♭]–c–d–e–f. Enharmonic (though in practice, this requires enharmonic phthorae—the general sharp and flat or the agem, otherwise the scale is diatonic. The enharmonic phthorae are usually supplied). Finalis: f.

Varys: there are three variants of the mode. Enharmonic–Agem form: f–g–a–b♭–c–d–e–f. Enharmonic. Finalis: f. (This differs from III only in where the imperfect cadences tend to go.) Diatonic Varys form: b-c–d–e–f♯–g–a♯–b (8, 12, 10, 12, 8, 16, 6). (The deviation from the normal intervals at the high end of the scale is because of the 'law of attraction', enabling a♯ to be a true leading-tone.) Finalis: b. Proto-Varys form: b–c–d–e–f–g–a–b. Finalis: b.

IV: g–a–b–c–d–e–f–g. Diatonic. Finalis: Slow, d or g; Moderate or fast: e (the 'Legetos' mode, which like the chromatic modes has a minor second).

Plagal IV: c–d–e–f–g–a–b–c. Diatonic. Finalis: c. With Ni phthora, finalis: f, and b flattened. (The 1881 Commission raises the supertonic of IV and Plagal IV by two commas.)

The three chroae are:

Zygos scale: c–d♯–e–f♯–g. (18, 4, 16, 4; so d♯ is at well-tempered pitch, e is two commas flat, and f is eight commas sharp.)

Kliton scale: c–d–e–f♯–g. (12, 12, 14, 4; so e is at well-tempered pitch, and f is eight commas sharp.)

Spathi scale: (d–e–)f–g♯–a–b♭–c(–d). (20, 4, 4, 14; so g eight commas sharp, and b is eight commas flat.)

This presentation is somewhat distorted, as it is geared to the Western notion of a scale starting and ending with a tonic. The same tetrachords are used in Byzantine modes whatever the finalis. So Mode II is properly c–d♭–e–f–g–a♭–b–c, with the lowest note usually being e.

3.4.2. Differentiators

The Modern notation has introduced a series of accidentals which alter the pitch of a note by a specific interval; these are given under the rubric of *Alloioseis (Differentiators)*. The differentiators are a Chrysanthine innovation, and were revised by the 1881 Commission. Chrysanthus provides for quarter-tones, third-tones and semi-tones, while the 1881 Commission worked with sixths of tones. Other than the default accidentals, the precise divisions listed below are not seen outside theoretical discussions of scales (Figure 3).

Moreover, the default accidentals (U+1D0D0, U+1D0D4) do not have a fixed value.[17] In

[17]Chrysanthus explicitly stated that a semitone was not a division of a tone (12 or 10 commas) into two equal parts of 6 and 6 commas, but into 7 and 5, or 8 and 4. Greek theory manuals defend this lack of fixity by appealing to Ancient Greek musical theory (which split the tone unequally), and the Roman-era musician Gaudentius' Zen-like statement, τὸ ἡμιτόνιον οὐκ ἔστιν ἀκριβῶς ἡμιτόνιον, "the semitone is not exactly a

fact, the two differentiators generalised as the ‘General Sharp’ and ‘General Flat’ (U+1D0D8, U+1D0D9) are necessarily of different sizes (despite what most theory manuals state): the general flat lowers all b’s in a piece by six commas to b♭, whereas the general sharp raises all e’s in a piece from their diatonic pitch by two commas, to the equal-tempered (enharmonic) pitch of e. The other differentiators have only local effect.

U+1D0CB Byzantine Musical Symbol Fthora I Yfesis Tetartimorion [Quarter Tone Differentiator Or Flat]
ED Fthora: 0
EphesiosMain: Option-Shift-; EphesiosPhthora: c, C

1/3 tone flat in Chrysanthus.

U+1D0CC Byzantine Musical Symbol Fthora Enarmonios Antifonia [Enharmonic Antiphony Differentiator]
EphesiosPhthora: Option-q, Option-Shift-q

This sign is undocumented in my sources.

U+1D0CD Byzantine Musical Symbol Yfesis Tritimorion [Third Tone Flat] EphesiosMain: Option-; ; EphesiosPhthora: f, F

2/3 tone flat in Chrysanthus.

U+1D0CE Byzantine Musical Symbol Diesis Tritimorion [Third Tone Sharp] EphesiosMain: Option-' ; EphesiosPhthora: h, H

2/3 tone sharp in Chrysanthus.

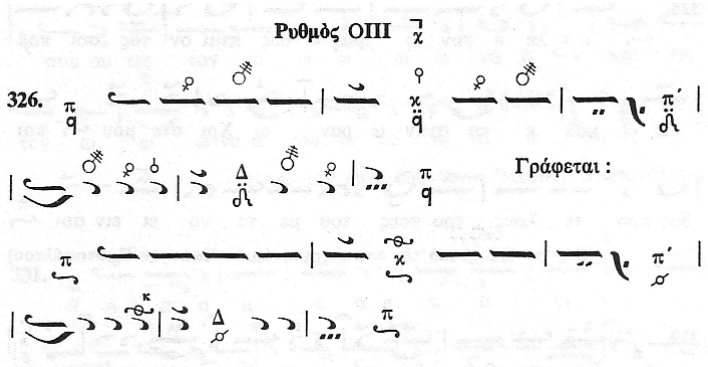


Figure 3. A paedagogical instance of use of differentiators (Efthymiadis 1988:261): differentiators are used over a diatonic Mode I scale to produce the intervals of the hard chromatic scale on d, written beneath it. The intervals 10, 8, 12, 12, 10, 8, 12 are modified by -4, +8, 0, 0, -4, +8, 0 ascending, to give the required 6, 20, 4, 12, 6, 20, 4.

U+1D0CF Byzantine Musical Symbol Diesis Tetartimorion [Quarter Tone Sharp]
EphesiosMain: "

1/3 tone sharp in Chrysanthus.

U+1D0D0 Byzantine Musical Symbol Diesis Apli Dyo Dodekata [Simple Sharp, Two Twelfths]
ED Fthora: +, =

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semitone”.

EphesiosMain: +; EphesiosPhthora: =, +

Raise by semitone in Chrysanthus, by two commas in 1881 Commission. Default, undefined sharp in practice. Placed under neume.

U+1D0D1 Byzantine Musical Symbol Diesis Monogrammos Tessera Dodekata [One-line Sharp, Four Twelfths]
EphesiosMain:]; EphesiosPhthora:], }

Raise by quarter tone in Chrysanthus, by four commas (1/3 tone) in 1881 Commission.

U+1D0D2 Byzantine Musical Symbol Diesis Digrammos Ex Dodekata [Two-line Sharp, Six Twelfths]
EphesiosMain: '; EphesiosPhthora: ',"

Raise by three quarter tones in Chrysanthus, by six commas (semitone) in 1881 Commission.

U+1D0D3 Byzantine Musical Symbol Diesis Trigrammos Okto Dodekata [Three-line Sharp, Eight Twelfths]
EphesiosMain: }; EphesiosPhthora: Option-', Option-Shift-'

Raise by eight commas (2/3 tone) in 1881 Commission.

U+1D0D4 Byzantine Musical Symbol Yfesis Apli Dyo Dodekata [Simple Flat, Two Twelfths]
ED Fthora: -

EphesiosMain: -; EphesiosPhthora: -, _

Lower by semitone in Chrysanthus, by two commas in 1881 Commission. Default, undefined flat in practice. Placed above neume.

U+1D0D5 Byzantine Musical Symbol Yfesis Monogrammos Tessera Dodekata [One-line Flat, Four Twelfths]
EphesiosMain: [; EphesiosPhthora: [, {

Lower by quarter tone in Chrysanthus, by four commas (1/3 tone) in 1881 Commission.

U+1D0D6 Byzantine Musical Symbol Yfesis Digrammos Ex Dodekata [Two-line Flat, Six Twelfths]
EphesiosMain: ;, :; EphesiosPhthora: ;, :

Lower by three quarter tones in Chrysanthus, by six commas (semitone) in 1881 Commission.

U+1D0D7 Byzantine Musical Symbol Yfesis Trigrammos Okto

`Dodekata` [Three-line Flat, Eight Twelfths]
EphesiosMain: {; EphesiosPhthora: Option-;, Option-Shift-;

Lower by eight commas (2/3 tone) in 1881 Commission.

`U+1D0D8 Byzantine Musical Symbol Geniki Diesis` [General Sharp]

ED Fthora: 3

Modulator which causes all e's in a piece to be sharp.

`U+1D0D9 Byzantine Musical Symbol Geniki Yfesis` [General Flat]

ED Fthora: 5

Modulator which causes all b's in a piece to be flat.

The 1881 Commission also devised flats and sharps with four lines, indicating a 10 comma interval; these have not been included in the encoding, and no Byzantine scale involves altering a pitch in another by ten commas.

3.4.3. Signatures

Each mode has associated with it an intonation formula (*echema* or *apechema*, 'sounding'). This is a phrase of a few notes, originally associated with a particular nonsense utterance (*nenano, ananeanes*, &c.), and intended to tune the choir in to the current pitch and mode. The intonation formula had a conventional abbreviation (Figure 4), which appeared at the start of most genres of pieces. It also surfaces sporadically in many pre-Modern manuscripts in the middle of pieces, and in the Late period also at their end. Raasted tentatively concludes that the medial formulas were originally sung, and were stylistically associated with festive music. He believes that the formulas were also used to indicate modulation to a different key before the invention of phthorae—which is why Middle pieces often have medial formulas that seem to be on the wrong pitch.

Increasingly, however, the formulas were no longer sung during performance. Instead they were used only as paedagogical devices, and as aides-de-memoire during performance (the signer singing the formula to himself to confirm that they were in key); the formulas themselves also became much abbreviated. Modern notation no longer indicates the formula per se, but merely the current pitch and mode; it is accordingly termed a signature (*martyria*, 'witness, indicator') instead. The mode signature appears at the start of the piece, and is followed by the pitch syllable of the finalis. The pitch syllable is often written above the neume for the interval between the expected finalis and the finalis of the piece (e.g. if the expected finalis is f and the actual finalis is d, the Pa syllable will appear over an

elaphron, which descends by a third: f to d). If there is a choice to be made between hard and soft chromatic scales, the appropriate phthora appears over the pitch syllable. The pitch indicators, serving as reminders of which pitch should be reached at any given point, mark cadences throughout the piece, including at its conclusion. (Some publications write the mode signature out in words instead.)

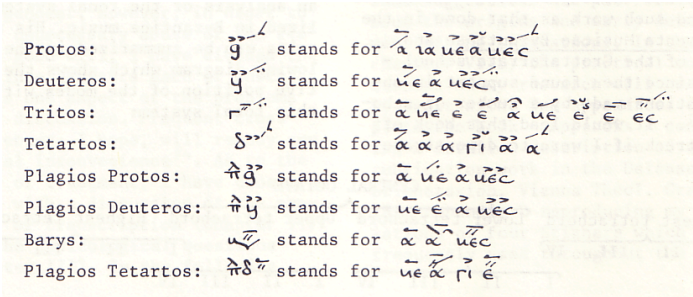

Figure 4. Middle intonation formulas: abbreviations and expansions. (Raasted 1966:8)

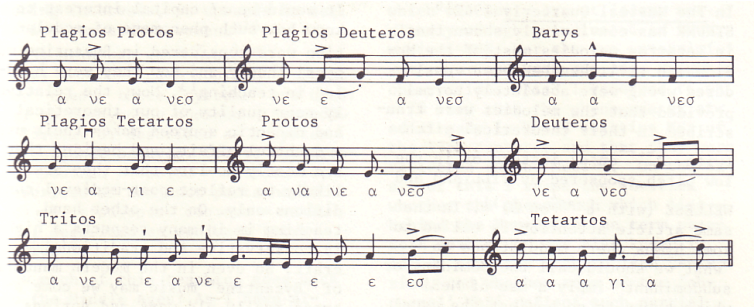

Figure 5. Western transcriptions of Middle intonation formulas. (Raasted 1966:9)

In accordance with their differing functions, the pre-Modern intonation formulas and the Modern signatures are notated differently.[18] In the pre-Modern system, the notation consists of a stylised Greek numeric letter corresponding to each mode (alpha for I and Pl. I, beta for II and Pl. II, gamma for III, delta for IV and Pl. IV, beta rho for Varys), with pi and lambda prefixed to the letter for plagal modes (I, II, IV). (The modal indicators are strongly stylised, and there is no compelling reason to unify them with their originating letters.) The two 'medial' mode intonation formulas, *nana* and *nenano*, are formed from a sequence of two stylised nus, and two stylised nus prefixed by a stylised nu-epsilon, respectively. (Figure 2); these nus resurface as the gorthmic nus (see below).

The pre-Modern intonation formula had its concluding notes adjusted to the following melody; so the notation for the formula (which was understood as an abbreviation for the formula itself) had written over it the neumes of its concluding notes (Figures 4, 6).

The usual forms of the formulas had the following neumes written over or at the top right of the modal indication:

I: apostrophos, apostrophos, oligon–ypsili

II: apostrophos, apostrophos, oligon with kentimata underneath,

[18]There has been some limited use of the pre-Modern formulae in modern notation, and the EphesiosArchtika font includes several of them.

III: oligon with dipli underneath, oligon with kentimata underneath
IV: apostrophos, apostrophos, oligon–ypsili
Pl. I: apostrophos, apostrophos
Pl. II: apostrophos, apostrophos
Varys: oligon with dipli underneath
Pl. IV: ison with dipli underneath
Nana: ison, ison
Nenano: ison with kentimata above, oligon, oligon with kentimata below

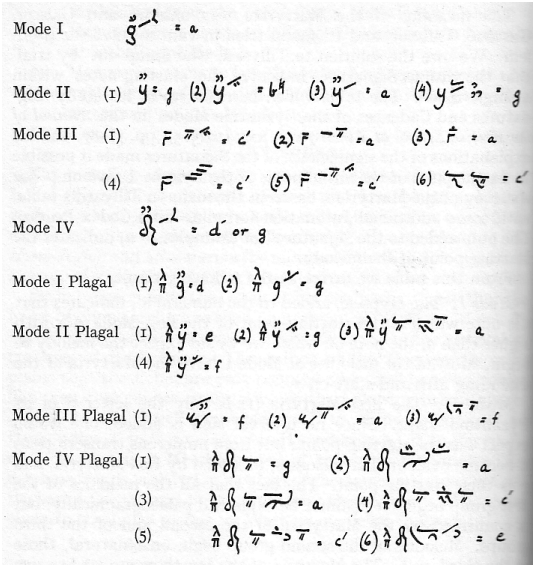

Figure 6. Martyriae in Late notation (Wellesz 1961:302).

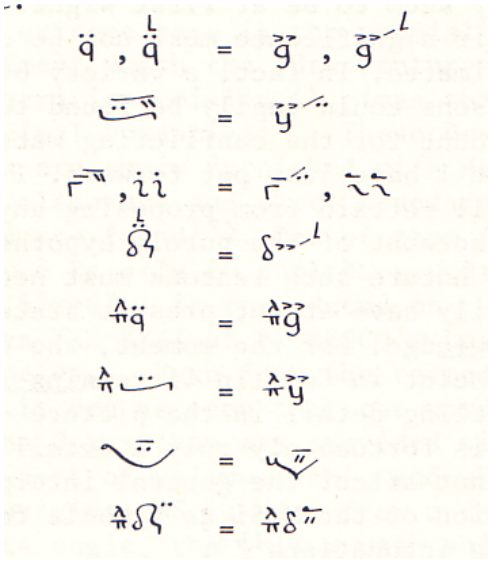

Figure 7. Modern (left) and Middle (right) diatonic modal signatures (Raasted 1966:148).

The glyph for U+1D0A6 includes both the gamma for Mode III and the sequence oligon with dipli underneath, oligon with kentimata underneath—indicating the concluding three

notes of the formula.

In the modern system, the signs have become further stylised, and merely conventional—although I do not believe they are so different to their Middle predecessors as to be disunified from them. (Figure 7) Modern authorities no longer connect them to the original neumes; Panagopoulos (1947:111) even identifies the stylised alpha of modern notation with the hemiphi of Ancient Greek Musical Notation (TLG proposed `U+1D203`, `Greek Vocal Notation Symbol 4`). The modern diatonic modes retain their alpha and delta as mode letters; the modern chromatic and enharmonic modes use the Nana, Nenano, and Legetos mode letters. The pitch indicators use the same mode letters as the mode signatures in the diatonic and enharmonic scales; the soft and hard chromatic scales have their own mode letter equivalents.

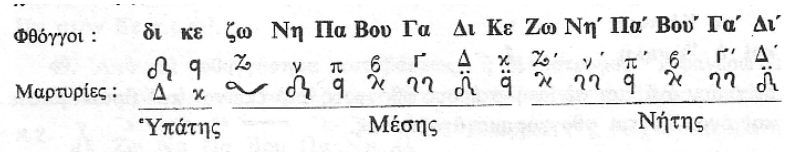

Figure 8. Modern pitch indicators (Efthymiadis 1988:21).

The Unicode encoding does not decompose the signatures in terms of their erstwhile neumes.[19] This approach is appropriate for the Modern signatures; but pre-Modern notation built its formula notations out of true neumes, allowing for variation, and should be so notated.

The neumes in the Modern signatures have atrophied to conventional markings, which appear in the initial mode signature of the piece. When the signature is used medially, as a pitch indicator (Figure 8), the modern notation adds the initial letter of the pitch syllable in question, instead of the neume remnant (although two dots—`U+1D0AD`—are retained over the delta and alpha of Di and Ke). This letter appears on top of the mode letter, except for the bottom octave (Hypate), where it appears beneath it. In the high octave (Nete), the letters take a prime. (EphesiosPhthora: `, ~, Option-Shift-`; in the EphesiosIson font, the letter–prime combination is a single codepoint: A B G D K Z N, and the EphesiosPhthoraExpert font contains the possible combinations in pitch signatures, including phthoric martyriae [see below].)

`U+1D0A2` `Byzantine Musical Symbol Martyria Protos Ichos` [First Mode Signature] EphesiosArchtika: 0

`U+1D0A3` `Byzantine Musical Symbol Martyria Alli Protos Ichos` [Other First Mode Signature]
ED Psaltica: V

EphesiosPhthora: 1, (raised) !

[19]The EphesiosArchtika font goes further, and codes each complete initial signature as a single codepoint: the normal combinations of pitch and mode signature are 1 q a z ! Q A Z.

𝅘𝅥𝅯

As far as I can tell, these two are merely glyph variants. The pre-Modern stylised alpha had a straight stem. Also used in the pitch indicator for diatonic Pa and Ke (d, a).

U+1D0A4 Byzantine Musical Symbol Martyria Deyteros Ichos [Second Mode Signature]

U+1D0A5 Byzantine Musical Symbol Martyria Alli Deyteros Ichos [Other Second Mode Signature]
ED Psaltica: ?

EphesiosPhthora: Option-2, (raised) Option-Shift-2

These are also presumably glyph variants. The pre-Modern stylised beta looked more like a *y*, which is close to how lowercase beta was written at the time. The modern form of U+1D0A5 is also the original stylised nu-epsilon of the nenano formula; the beta and the nu-epsilon appear to have been conflated in the Modern system.

Besides the mode signature for Mode II, this sign is also used in the pitch indicator for the chromatic tonic, mediant, dominant, and leading tone of Modes II (c–c) and II Plagal (d–d). In the hard chromatic scale, it appears alone; in the soft chromatic scale, it has U+1D0AD Byzantine Musical Symbol Apostrofoi Telous Ichimatos above it.

U+1D0A6 Byzantine Musical Symbol Martyria Tritos Ichos [Third Mode Signature]
EphesiosArchtika: a

Variant Modern signature for Mode III; contains the original neumes for two oligons, the first with dipli and the second with kentimata, intact. Variants of the signature exclude the dipli; this argues against the decomposition of U+1D0A6 into <gamma> U+1D0AF U+1D0B0.

U+1D0A7 Byzantine Musical Symbol Martyria Trifonias [Fourth Signature] ED Psaltica: N
EphesiosPhthora: 3, (raised) #

𝅘𝅥𝅰𝅘𝅥𝅰

The pre-Modern Nana Mode indicator (two nus). Used in the Modern signature for Mode III, and the diatonic pitch indicator for Ga and high Ni (f, c′).

U+1D0A8 Byzantine Musical Symbol Martyria Tetartos Ichos [Fourth

Mode Signature]
ED Psaltica: C

EphesiosPhthora: 4, (raised) $

𝅘𝅥

The pre-Modern sign was a simple lowercase delta, without a downward tail. Used in the Modern signature for Modes IV and Pl. IV, and in the diatonic pitch indicator for Ni and Di (c, g).

U+1D0A9 Byzantine Musical Symbol Martyria Tetartos Legetos Ichos [Tetartos Legetos Mode Signature]
ED Psaltica: B

EphesiosPhthora: 2

𝅘𝅥

Used as symbol of the Legetos IV mode; derived from λΓ, an abbreviation of Legetos (λέγετος). (The legetos can also be notated with the normal Mode IV signature, followed by a continuous elaphron and the syllable Vou, to indicate that the finalis goes down from the expected g to e.) Also used in the diatonic pitch indicator for Vu and Zo (e, b).

U+1D0AA Byzantine Musical Symbol Martyria Legetos Ichos
EphesiosArchtika: l

Alternative signature for the Legetos IV mode, a stylised abbreviation of λέγετος.

U+1D0AB Byzantine Musical Symbol Martyria Plagios Ichos [Plagal Mode Signature]
ED Fthora: S

EphesiosArchtika: i

Used in both pre-Modern and Modern signatures to indicate the plagal mode; a straightforward ligature of pi and lambda.

U+1D0AC Byzantine Musical Symbol Isakia Telous Ichimatos [Little Isons of the End of an Intonation Formula]

A reflex of the erstwhile two isons appearing over the signature for Mode III. In

the EphesiosPhthora font, the isakia are combined with the Mode III signature as the single codepoint Option-3, Option-Shift-3.

U+1D0AD Byzantine Musical Symbol Apostrofoi Telous Ichimatos [Apostrophes of the End of an Intonation Formula]
EphesiosArchtika: Option-=

A reflex of the erstwhile two apostrophes, appearing over the signature for Modes II, Pl. I, Pl. II, and the medial pitch indicator for diatonic Di and Ke (g, a), and hard chromatic Ni, Vu, Di, Zo (c, e, g, b) in Mode II. Though it also appears over the signature for Pl. IV, there it is a remnant of the dipli instead; the two are routinely conflated in the neume remnants (already in the 18th century), which is why they should not be conflated with their original neumes when used as signature formants in the modern system. The glyph very frequently is rendered merely as two dots.

In the EphesiosPhthora font, the apostrophoi are combined with the mode signature in one codepoint: Option-1 for the Mode I signature, Option-0 for the Mode II signature, Option-4 for the Mode IV signature (with Option-Shift for raised versions).

U+1D0AE Byzantine Musical Symbol Fanerosis Tetrafonias [Manifestation of Fifth]

A reflex of the erstwhile combination of two apostrophes and an ypsili, appearing over the signature for Modes I and IV. Since this is a unitary construct in Modern musical theory, there is little point in decomposing it, although it is clearly a combination of the U+1D0AD apostrophes and an ypsili.

U+1D0AF Byzantine Musical Symbol Fanerosis Monofonias [Manifestation of Second]
EphesiosArchtika: Option-Shift-o

A reflex of the erstwhile combination of oligon and dipli, appearing over the signature for Varys Mode.

U+1D0B0 Byzantine Musical Symbol Fanerosis Monofonias [Manifestation of Third]
EphesiosArchtika: Option-5

A reflex of the erstwhile combination of oligon and kentimata, appearing over the signature for Mode II.

U+1D0B1 Byzantine Musical Symbol Martyria Varys Ichos [Varys Mode Signature] ED Psaltica: >

EphesiosPhthora: 7, (raised) &

Stylisted beta-rho. The pre-Modern sign started with a *u*-shape (the old lowercase beta), rather than a loop. Used in the Modern signature for Varys Mode, and in the diatonic pitch indicator for low Zo (B).

U+1D0B2 Byzantine Musical Symbol Martyria Protovarys Ichos [Proto–Varys Mode Signature]
EphesiosArchtika: K, S

Signature for the Proto-Varys mode, regarded as a combination of Modes I and Varys. Accordingly, the signature combined U+1D0B1 and U+1D0A3, the signatures of the two modes.

U+1D0B3 Byzantine Musical Symbol Martyria Plagios Tetartos Ichos [Plagal Fourth Mode Signature]
EphesiosArchtika: Z

A combination of the plagal marker U+1D0AB, the Mode IV signature U+1D0A8, and the signature formant neume U+1D0AD.

U+1D0B4 Byzantine Musical Symbol Gorthmikon N Aploun [Gorthmic Single Nu] EphesiosIson:]; EphesiosArchtika: Option-y

U+1D0B5 Byzantine Musical Symbol Gorthmikon N Diploun [Gorthmic Double Nu] EphesiosIson: [; EphesiosArchtika: Option-m

These two glyphs are stylised versions of nu, used in melismatic passages where an extratextual nasalised *n* is inserted (to allow drawing breath without an obvious break). So a particularly long-drawn out *Kyrie* might be sung as *Kyyyyyyriii[n]iiie*. In that case, the inserted nu will be written with one of these glyphs. The nonsense-syllables of intonation formulas, which are thought of as wholly melisma, are also spelled with these glyphs—so that U+1D0A5 and U+1D0A7 are derived from gorthmic nus: *n(a)n(a)* and *n(enano)*. The 'double nu' (in Efthymiadis the *gorthmikon*) is the version used before epsilon and alpha-iota (both pronouced /e/), and thus in *nenano*; this is because the glyph originated as a nu-epsilon ligature. The 'single nu' (in Efthymiadis the *pelastikon*) is the version used before all other vowels and digraphs, and thus in *nana*.

The following are the eight pre-Modern intonation formulas, with ν_1 standing for single nu and ν_2 for double nu; note that when Raasted transcribed the formulas into Western notation (Figure 5), he used simple nu.

I: $\alpha\nu_1\alpha\nu_2\varepsilon\alpha\nu_2\varepsilon\varsigma$	Pl. I: $\alpha\nu_2\varepsilon\alpha\nu_2\varepsilon\varsigma$
II: $\nu_2\varepsilon\alpha\nu_2\varepsilon\varsigma$	Pl. II: $\nu_2\varepsilon\alpha\nu_2\varepsilon\varsigma$
III: $\alpha\nu_2\varepsilon\alpha\nu_2\varepsilon\varsigma$	Varys: $\alpha\nu_2\varepsilon\varsigma$
IV: $\alpha\gamma\iota\alpha$	Pl. IV: $\nu_2\varepsilon\alpha\gamma\iota\varepsilon$

3.4.3. Modulants

The Phthorae (here termed 'modulants', after Tillyard; lit. 'destroyers') indicate a change of scale within a piece. There are phthorae for each note on the diatonic scale, and for the bottom and top note of the chromatic tetrachords (which imply the chromatic modes II and II Plagal).[20] Phthorae are bound to particular notes; if they appear on the 'right' note in

[20]Some phthorae have effect only over one tetrachord, so it is possible for half the scale to be diatonic and the other half chromatic. For instance, in Plagal II, a chromatic mode, a diatonic Ke modulator would have scope only over a–d′.

a piece, they at most change the current scale (and therefore the mode). If they occur on other notes, they shift the finalis as well as the mode of the scale, effecting a transposition. For example, if a phthora associated with d occurs on the note b, the piece is transposed from b to d, and the key signature of intervals surrounding d shifts accordingly.

When a transposition takes place, the pitch letter appearing in the ensuing pitch indicators changes accordingly, and the modified pitch indicator is termed a *phthoric martyria*. So while normally the pitch indicator associates each pitch with its own mode letter, that association is disrupted in transposition. (So if we are in Mode I and transpose from Zo (b) to Pa (d), the next pitch indicator for a cadence on Zo would not have zeta over U+1D0B1, but over U+1D0A3—the mode letter normally associated with diatonic Pa.) If a piece is 'interloping' (ἐπείσακτον)—i.e. it is titularly associated with one mode but is in fact sung in another—then the pitch syllable with the appropriate phthora is inserted in the mode signature for the piece.

Phthorae are distinct from the differentiators: the differentiators alter the pitch of a specific note, corresponding to Western accidentals, whereas the modulators change the current mode, corresponding to Western key signatures. This can include shifting a single note globally through a piece, such as flattening b. However, modulators can be written either above or below a neume (wherever they will fit), so the distinction does not mean much for the positioning of the signs.

The initial letter of the pitch associated with the phthora occasionally appears over it. Phthorae usually appear over a neume, but can also appear over a pitch indicator, changing its scale. For example, the nenano phthora (U+1D0C7), appearing over the diatonic pitch indicator for g (U+1D0A8 U+1D0AD U+1D0EC), shifts the scale from that point forward from diatonic to hard chromatic.

The full phthoral system is Modern; the Nenano phthora dates from Middle notation, and the diatonic phthorae used to cancel chromatic mode and to modulate the finalis date from Late notation.

U+1D0B6 Byzantine Musical Symbol Enarxis Kai Phthora Vou [Beginning and e Modulator]
ED Fthora: G, g

EphesiosMain: 4; EphesiosPhthora: x, Option-x

Diatonic e Modulator (transpose current note to e); also used for the pre-Modern consonant sign Enarxis (see above).

U+1D0BA Byzantine Musical Symbol Fthora Diatoniki Pa [Diatonic d Modulator] ED Fthora: F, f

EphesiosMain: ~; EphesiosPhthora: o, O

Diatonic d Modulator.

U+1D0BB Byzantine Musical Symbol Fthora Diatoniki Nana [Diatonic ‘Nana’ Modulator]
ED Fthora: H, h

EphesiosMain: *; EphesiosPhthora: Option-8, (raised) Option-Shift-8

Diatonic f Modulator.

U+1D0BD Byzantine Musical Symbol Fthora Diatoniki Di [Diatonic g Modulator] ED Fthora: J, j
EphesiosMain: 6; EphesiosPhthora: 8, (raised) *

Diatonic g Modulator.

U+1D0FB Byzantine Musical Symbol Fthora Diatoniki Ke [Diatonic a Modulator] ED Fthora: K, k

EphesiosMain: ^; EphesiosPhthora: Option-o, Option-Shift-o

Diatonic a Modulator.

U+1D0C0 Byzantine Musical Symbol Fthora Diatoniki Zo [Diatonic b Modulator] ED Fthora: L, l

EphesiosMain: $; EphesiosPhthora: X, Option-Shift-x

Diatonic b Modulator.

U+1D0C1 Byzantine Musical Symbol Fthora Diatoniki Ni Kato [Diatonic Low c Modulator]
ED Fthora: D, E, d, e

EphesiosMain: `, Option-Shift-`; EphesiosPhthora: p, P

Diatonic c Modulator.

U+1D0C2 Byzantine Musical Symbol Fthora Diatoniki Ni Ano [Diatonic High c Modulator]
ED Fthora: 7

EphesiosMain: Option-Shift--; EphesiosPhthora: Option-p, Option-Shift-p

Diatonic high c Modulator. (Recall that the scale on high c is considered distinct from that on low c.)

U+1D0C3 Byzantine Musical Symbol Fthora Malakon Chroma Difonias [Soft Chromatic Third Modulator]
ED Fthora: 2

EphesiosMain: 0; EphesiosPhthora: 0, (raised))

Soft chromatic Di (g) Modulator (also used on Ni, Vou, Zo—c, e, b—without transposition). If used with another pitch, that pitch's signature is placed underneath the Modulator.

U+1D0C4 Byzantine Musical Symbol Fthora Malakon Chroma Monofonias [Soft Chromatic Second Modulator]
ED Fthora: $
EphesiosMain: Option-5; EphesiosPhthora: Option-5, (raised) Option-Shift-

5

Soft chromatic Ke (a) Modulator (also used on Ni, Vou, Zo—d, f, c—without transposition). If used with another pitch, that pitch's signature should be placed underneath the Modulator. Also used in the pitch indicator for Pa, Ga, Ke, Ni (d, f, a, high c) in the soft chromatic scale.

U+1D0C5 Byzantine Musical Symbol Fhtora Skliron Chroma Vasis [Hard Chromatic Base Modulator]
ED Fthora: 1

EphesiosMain: 7; EphesiosPhthora: 6, (raised) ^

Hard chromatic Pa (d) Modulator (also used on Ga, Ke, Ni—f, a, c—without transposition). Notorious in Unicode as a mispelling irrevocably enshrined in the standard.

U+1D0C7 Byzantine Musical Symbol Fthora Nenano ['Nenano' Modulator]
ED Fthora: 6

EphesiosMain: 5; EphesiosPhthora: 5, (raised) %

Hard chromatic Di (g) Modulator (also used on Ni, Vou, Zo, Pa—c, e, b, high d—without transposition). Also used in the pitch indicator for Ni, Vou, Zo, Di, Pa (c, e, g, b, d) in the hard chromatic scale. The nenano modulator was also used in pre-Modern notation, to indicate the Nenano mode.

U+1D0C8 Byzantine Musical Symbol Chroa Zygos ['Scales' Chroa]
ED Fthora: *

EphesiosMain: &; EphesiosPhthora: Option-z, Option-Shift-z

Chromatic Di (g) Modulator, causes d and f to be sharpened (the 'Zygos' chroa).

U+1D0C9 Byzantine Musical Symbol Chroa Kliton ['Inclined' Chroa]
ED Fthora: 9

EphesiosMain: 8; EphesiosPhthora: 9, (raised) (

Chromatic Di (g) Modulator, causes e and f to be sharpened (the 'Cliton' chroa).

U+1D0CA Byzantine Musical Symbol Chroa Spathi ['Sword' Chroa]
ED Fthora: `
EphesiosMain: Option-7; EphesiosPhthora: Option-7, (raised) Option-Shift-7

Chromatic Ke (a) Modulator, causes g to be sharpened and b to be flattened (the 'Spathi' chroa).

U+1D0CB Byzantine Musical Symbol Fthora I Yfesis Tetartimorion [Quarter Tone Differentator Or Flat]

ED Fthora: 0

EphesiosMain: Option-Shift-; EphesiosPhthora: c, C

The 'Agem' Modulator, written on Zo, Vou or Ga (b, e, f), causes b to be flattened in Mode I Plagal, serving as an indicator of the enharmomic scale. (The other notes of the enharmonic scale have the same phthorae as the in diatonic scale.) Also used as a flat differentiator (see above). This means the sign can modify both an interval sign—as do the other differentiators—and stand on its own as a modulator.

U+1D0D8 Byzantine Musical Symbol Geniki Diesis [General Sharp]

ED Fthora: 3

♂

Modulator which causes all e's in a piece to be sharp. The sign is named a sharp, as with other accidentals, and is included under the Differentiator rubric.

U+1D0D9 Byzantine Musical Symbol Geniki Yfesis [General Flat]

ED Fthora: 5

♀

Modulator which causes all b's in a piece to be flat. Can also appear over a pitch indicator, shifting its scale to enharmonic. The General Sharp and Flat produce an enharmonic scale, and are usual in Mode III pieces.

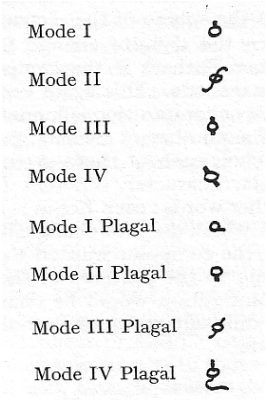

Figure 9. Phthorae in Late notation (Wellesz 1961:309).

While the full-fledged system of phthorae is modern, modulants were already in use in Late notation (Figure 9), where they were associated with modes rather than pitches. The modulants were: Mode I, U+1D0BF; Mode III, U+1D0BB; Mode IV, U+1D0BD; Mode II Plagal, U+1D0BA; Mode Varys, U+1D0C7; Mode IV Plagal, U+1D0C2. Of the two remaining modulants, that for II appears in the chart as U+1D0B9; that for Pl. I is absent.

U+1D0B9 Byzantine Musical Symbol Fthora Archaion Deyterou Ichou [Ancient Modulant of the Second Mode]

Modulant associated with Mode II.

Two further pre-Modern modulants are still uncertain in their denotation:

U+1D0B7 Byzantine Musical Symbol Imofonon [Half-voiced]

Unexplained in the source treatises; according to Thibault this is a modulant marking modulation away from the Varys Mode.

U+1D0B8 Byzantine Musical Symbol Imifthoron [Half-Modulant]

EphesiosArchtika: Option-Shift-p

Aparently a modulant marking modulation away from Mode IV Plagal.

I do not yet have information on U+1D0BC Byzantine Musical Symbol Fhthora Naos Ichos (EphesiosPhthora: j, J) or U+1D0C6 Byzantine Musical Symbol Fhthora Skliron Chroma Synafi (EphesiosPhthora: Option-6, Option-Shift-6).

3.5. Rhythmic Signs

The rhythmic signs are used to indicate the beat of the piece in Modern notation. Of these, the *diastolai* (measures) are kinds of bar line, while the *simanses* (soundings) are equivalent to time signatures, appearing at the start of a piece.

U+1D0DA Byzantine Musical Symbol Diastoli Apli Mikri [Simple Small Measure] EphesiosMain: |, Option-Shift-|; EphesiosIson: |

U+1D0DB Byzantine Musical Symbol Diastoli Apli Megali [Simple Large Measure]
EphesiosMain: \; EphesiosIson: \

The full bar (large measure) is more frequent; I am not aware of any semantic distinction between the two. Margaziotis uses the small barline, Panagiotopoulos, Efthymiadis and Theofilopoulos the large; this seems to be a matter of individual preference.

U+1D0DC Byzantine Musical Symbol Diastoli Dipli [Double Measure]
EphesiosMain: ?; EphesiosIson: /

The double barline is used to give the bars of compound metres, in order to contrast with the internal downbeat barline below.

U+1D0DD Byzantine Musical Symbol Diastoli Theseos [Downbeat Measure] EphesiosMain: Option-/; EphesiosIson: ?

Used to indicate next downbeat in compound metre, as with Western dotted barline; for instance a 3+2+2 metre would have a diastoli theseos for each subdivision of the bar. The diastoli theseos glyph may be regarded as a combination of diastoli and yfen.

The simanses are a sequence of omicrons and iotas, omicron indicating a downbeat, and iota an upbeat; apli, dipli &c. dots may appear over the signs, lengthening them. Thus:

U+1D0DE Byzantine Musical Symbol Simansis Theseos [Sounding of Downbeat] EphesiosArchtika: Shift-Option-5

One-beat downbeat.

U+1D0DF Byzantine Musical Symbol Simansis Theseos Disimou [Sounding of Two-beat Downbeat]
EphesiosArchtika: Shift-Option-6

Two-beat downbeat.

U+1D0E0 Byzantine Musical Symbol Simansis Theseos Trisimou [Sounding of Three-beat Downbeat]
EphesiosArchtika: Shift-Option-7

Three-beat downbeat.

U+1D0E1 Byzantine Musical Symbol Simansis Theseos Tetrasimou [Sounding of Four-beat Downbeat]
EphesiosArchtika: Shift-Option-9

Four-beat downbeat.

U+1D0E2 Byzantine Musical Symbol Simansis Arseos [Sounding of Upbeat] EphesiosArchtika: Shift-Option-0

One-beat upbeat.

U+1D0E3 Byzantine Musical Symbol Simansis Arseos Disimou [Sounding of Two-beat Upbeat]
EphesiosArchtika: Shift-Option-w

Two-beat upbeat.

U+1D0E4 Byzantine Musical Symbol Simansis Arseos Trisimou [Sounding of Three-beat Upbeat]
EphesiosArchtika: Shift-Option-r

Three-beat upbeat.

U+1D0E1 Byzantine Musical Symbol Simansis Arseos Tetrasimou [Sounding of Four-beat Upbeat]
EphesiosArchtika: Shift-Option-e

Four-beat upbeat.

So 4/4 is normally written as OIII: one down-beat, three up-beats. 3/2, which is seen occasionally, is written as ÓÏÏ: one double-length downbeat, two double-length upbeats. 7/4 = 3+3+2/4 would be written as OIIOIOI. Since the first beat is stronger, 7/8 could also be written as ÖÏÏ; but I have not seen this done. In fact, outside 3/2, I have not seen lengthened simanses used at all; folksong transcription, where the subtle indications of complex metrical structure could be useful, appears to avoid them.

Although the Unicode encoding gives the simanses distinct glyphs, all instances of the semanses I have seen in use conflate them with the Greek capital letters—even in manuscript.

Of the rhythmic signs, the simanses are relatively infrequent; exercises such as Figure 3 are the only genre where they are the norm. The metre of a piece is more often either written out in words (e.g. ῥυθμός τετράσημος, “four-beat metre”), or implied through the use of bars; more often, it is simply unstated.[21] Byzantine chant is traditionaly quite free in deviating from the set metre. The only barline seen with any frequency is the diastoli, and even that is not usual; the other barlines are restricted to paedagogical contexts. When the bar length is highly variable, an Arabic numeral for the number of beats in the given bar is occasionally added, particularly in paedagogical texts.

[21]The failure to state the metre explicitly can lead to trouble in folk music transcriptions; Dragoumis (1991:101) for example believes he has found in Phardys’ folk music transcriptions the first instances of rebetika music, dating from the 1870s—if he has reconstructed the 9/8 metre correctly.

4. Early Neumatic notation

Early neumatic notation remains problematic, not least because it was itself transitional between ecphonetic and neumatic notation. The early signs are gathered together under the *Melodimata (Melodics)* rubric, and most are duplications rather than conflations with the same signs in earlier or later use. (However no distinct Early sign has been devised for: U+1D012, U+1D048, U+1D04A, U+1D051, U+1D055, U+1D058, U+1D05C, U+1D061, U+1D066, U+1D06A, U+1D07A, U+1D080—presumably because the glyphs remained identical in Ecphonetic or Middle notation.)

I use Thibaut's (1976) discussion of the notation; Thibault's definitions are not always clear (I assume *relâchement* and *surtension* are really about pitch, in which case the neumes are often quite close to Middle and Modern), but I am not sure much can be done about that.

My impression from Palikarova Verdeil (1953) is that some of the many signs undocumented below belong to the short-lived Kontakarian notation; I would need more information before writing anything further.

U+1D012 Byzantine Musical Symbol Apostrofos Dipli

Known in Early notation as Double Apostrophe, Varia (Grave), and *Dyosyndesmoi* (Two Joined); compressed relaxation of voice with rhythmic lengthening.

U+1D015 Byzantine Musical Symbol Oligon Archaion [Old Slight]

Slight tensing or rising of voice; unaccented rising second.

U+1D016 Byzantine Musical Symbol Gorgon Archaion [Old Swift]

—

U+1D017 Byzantine Musical Symbol Psilon [High]

Direct modulation through discontinuous intervals.

U+1D018 Byzantine Musical Symbol Chamilon [Low]

Indirect modulation through discontinuous intervals.

U+1D019 Byzantine Musical Symbol Vathy [Deep]

—

U+1D01A Byzantine Musical Symbol Ison Archaion [Old Equal]

Normal chanting.

U+1D01B Byzantine Musical Symbol Kentima Archaion [Old Stitch]

Tensing of the voice through disjoint steps.

U+1D01C Byzantine Musical Symbol Kentimata Archaion [Old Stitches]

—

U+1D01D Byzantine Musical Symbol Saximata [Arrangements?]

—

U+1D01E Byzantine Musical Symbol Parichon [By-Sound]

—

U+1D01F Byzantine Musical Symbol Stavros Apodexia [Cross from the

left]

—

U+1D020 Byzantine Musical Symbol Oxeiai Archaion [Old Acutes]

—

U+1D021 Byzantine Musical Symbol Vareiai Archaion [Old Graves]

—

U+1D022 Byzantine Musical Symbol Apoderma Archaion [Old Giving]

—

U+1D023 Byzantine Musical Symbol Apothema [Placing Away]

—

U+1D024 Byzantine Musical Symbol Klasma [Breaking]

Also *Klasma Mikron* [Small Breaking]; lenghenting of note, less than for the *xiron klasma* (U+1D06A).

U+1D025 Byzantine Musical Symbol Revma [Flow]

—

U+1D026 Byzantine Musical Symbol Piasma Archaion [Old Catching]

—

U+1D027 Byzantine Musical Symbol Tinagma [Flinging]

—

U+1D028 Byzantine Musical Symbol Anatrichisma [Counter-Hair]

A 'body' (step) in Early notation; a melismatic figure in Late notation.

U+1D029 Byzantine Musical Symbol Seisma [Shaking]

Long trilled note. Tillyard reports it in use also in Middle notation, possibly as a tremolo.

U+1D02A Byzantine Musical Symbol Synagma Archaion [Old Gathering]

—

U+1D02B Byzantine Musical Symbol Synagma Meta Stavrou [Gathering with Cross]

—

U+1D02C Byzantine Musical Symbol Oyranisma Archaion [Old Heavening]

—

U+1D02D Byzantine Musical Symbol Thema [Placing]

—

U+1D02E Byzantine Musical Symbol Lemoi [?]

—

U+1D02F Byzantine Musical Symbol Dyo [Two]

—

U+1D030 Byzantine Musical Symbol Tria [Three]

—

U+1D031 Byzantine Musical Symbol Tessera [Four]

—

U+1D032 Byzantine Musical Symbol Kratimata [Holdings]

The *kratima*, which was a compound of the *dipli* and *petasma* alone (the top part of the *kratimata* glyph) indicated a musical formula whose first note was held. The *kratimata* is presumably an elaboration on this, but a distinct sign.

U+1D033 Byzantine Musical Symbol Apeso Exo Neo [Modern Inside Out]

Inverse melodic movements.

U+1D034 Byzantine Musical Symbol Fthora Archaion [Old Modulant]

Sign of modulation in general. There are various symbols for the modulation to the 'Nenano' mode in particular (*oxia* + *ypsili* + *kentema*; stylised nu + nu + omicron), which are not represented in the current encoding.

U+1D035 Byzantine Musical Symbol Imifthora [Semi-Modulant]

—

U+1D036 Byzantine Musical Symbol Tromikon Archaion [Old Trembling]

—

U+1D037 Byzantine Musical Symbol Katava Tromikon [Trembling Descent]

—

U+1D038 Byzantine Musical Symbol Pelaston [Neighbouring]

—

U+1D039 Byzantine Musical Symbol Psifiston [Reckoned]

—

U+1D03A Byzantine Musical Symbol Kontevma [Shortening]

—

U+1D03B Byzantine Musical Symbol Chorevma Archaion [Old Dancing]

—

U+1D03C Byzantine Musical Symbol Rapisma [Striking]

—

U+1D03D Byzantine Musical Symbol Parakalesma Archaion [Old Beseeching]

—

U+1D03E Byzantine Musical Symbol Paraklitiki Archaion [Old Supplicating]

Quick alternation of two notes; contrasts with *xiron klasma* (U+1D06A).

U+1D040 Byzantine Musical Symbol Nana ['Nana' Mode]

Modulation to the 'Nana' mode.

U+1D041 Byzantine Musical Symbol Petasma [Flinging]

Also called *Petasti*; lively raising of the voice.

`U+1D042 Byzantine Musical Symbol Kontevma Allo` [Other Shortening]

—

`U+1D043 Byzantine Musical Symbol Tromikon Allo` [Other Trembling]

—

`U+1D048 Byzantine Musical Symbol Oxeia Neo` [Modern Acute]

In Early notation, the acute represented tensing of the voice and a slight accent.

`U+1D04A Byzantine Musical Symbol Koufisma` [Hollowing]

Sing delicately; originally compound of petasma and klasma, which continued to modify two syllables in a row.

`U+1D051 Byzantine Musical Symbol Apostrofos Neo` [Modern Apostrophe]

Compressed relaxation of voice.

`U+1D055 Byzantine Musical Symbol Elafron` [Light]

Compressed relaxation of voice through discontinuous interval.

`U+1D058 Byzantine Musical Symbol Varia Neo` [Modern Grave]

Relaxation of voice, downbeat.

`U+1D05C Byzantine Musical Symbol Antikenoma` [Instead of Void]

A tie of a run of descending and ascending notes, corresponding to the Middle *Epegerma* (`U+1D068`).

`U+1D061 Byzantine Musical Symbol Kylisma` [Rolling]

A 'convolutionary' musical formula.

`U+1D066 Byzantine Musical Symbol Syrma`

Indicates a turn, same as Ecphonetic Syrmatiki (`U+1D008`).

`U+1D06A Byzantine Musical Symbol Xiron Klasma` [Dry Breaking]

Rhythmic elongation; compound of dipli and klasma.

`U+1D07A Byzantine Musical Symbol Katavasma` [Descent]

The *katavasma* of Early notation looks like the Ecphonetic *ypokrisis* or *ypokrisis dipli* (or a wavy vertical line), but is semantically to be identified with the later *yporroi*, a descent of two seconds (and is of course a compound of two apostrophes); *katavasma* and *yporroi* were synonymous in Middle notation.

`U+1D080 Byzantine Musical Symbol Dipli Archaion` [Ancient Double]

Compound of two *oxiai*; rhythmic lengthening.

Other compound symbols, such as the *anastama* ['raising': dipli + apostrophos + petasma + kentimata] are absent from the encoding, although they can be represented through codepoint combination. The *anastama* was also used in Late notation.

4.1. Late Miscellaneous

The Melodics rubric also includes several signs which are apparently Late ornaments, but which for some reason have not been included with the other hypostases. These ornaments may be Early, and some of the ornaments Thibault discusses do overlap

between the two periods; clarification is needed on why these signs were included in this rubric (and in this font for the reference glyphs). The signs in question are:

`U+1D008 Byzantine Musical Symbol Syrmatiki`

Same as in Ecphonetic and Early.

`U+1D028 Byzantine Musical Symbol Anatrichisma` [Counter-Hair]

A 'body' (step) in Early notation; a melismatic figure in Late notation.

`U+1D03F Byzantine Musical Symbol Ichadin` [Little sound]

A formula opposed to the double pelaston, involving two oxiai and two apostrophoi.

`U+1D044 Byzantine Musical Symbol Straggismata` [Drippings]

Consecutive falling thirds.

`U+1D045 Byzantine Musical Symbol Gronthismata` [Punchings]

The grothisma or bythogrothisma [Deep Punching] indicated *martellato* articulation. The Negorthmos and Gorthmos appear to have been variants of this.

Other Late signs absent from the current encoding include: the *Darmos* [Beating], the *Orthion* [Standing Up], the *Chairestismos* [Salutation], the *Kolaphismos* [Bellows], the *Krousma* [Striking, an attacco], the *Antikountisma* [Response], and the *Anapavma* [Repose].

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Appendix A. Illustrations.

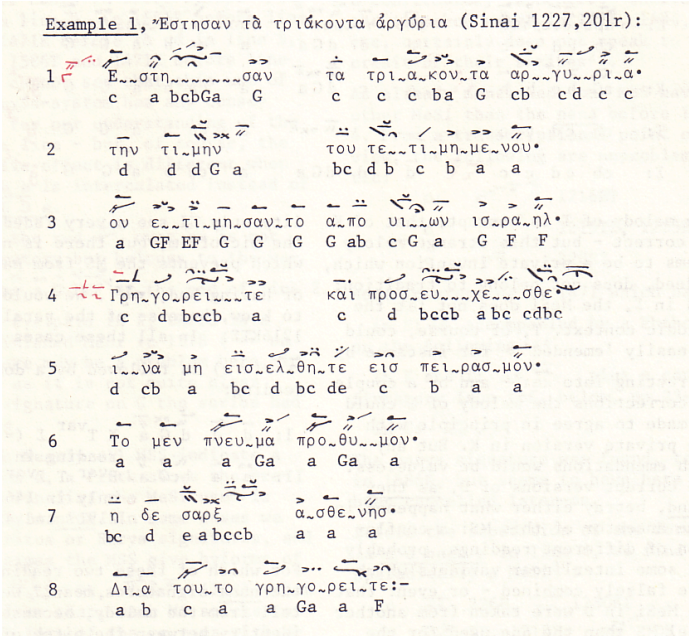

Figure 10. Illustration of Middle notation in modern scholarly transcription. (Raasted 1966:13): Ἔστησαν τὰ τριάκοντα ἀργύρια, "They set the thirty pieces of silver". Note: the multiple neumes over single hypostases; for instance, the oxeia, oxeia, elaphron, apostrophos, oligon, all around the kylisma on -στη- in the first line. Also: the intonation formulas (signatures) in red, at the start of the first and fourth lines, indicating III and Nana modes respectively.

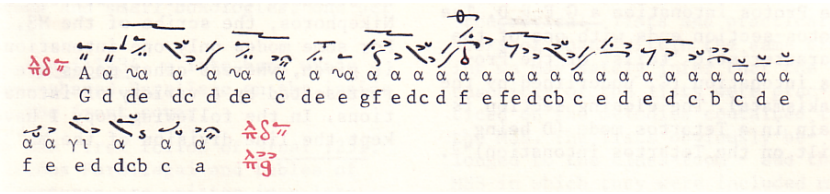

Figure 11. Another illustration of Middle notation (Raasted 1966:47)—this time with a modulant, associated in Middle notation with a, and transposing f to a. Again, abundant use of multiple neumes above and below hypostases.

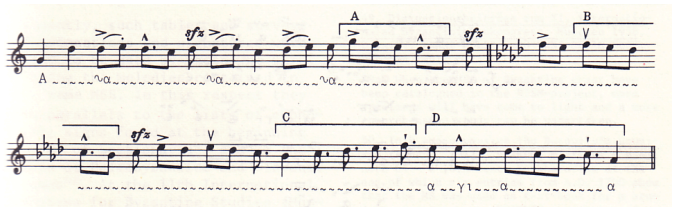

Figure 12. Raasted's transcription of Figure 11 into Western notation.

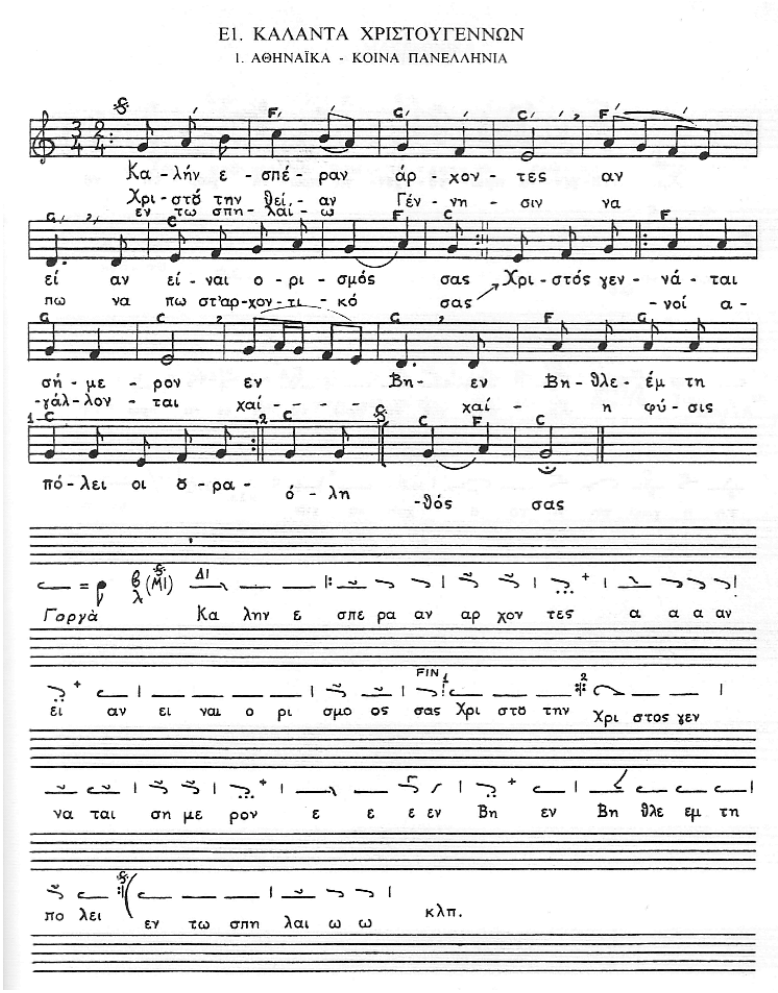

Figure 13. Modern use of Byzantine notation alongside Western. A transcription of the standard Modern Greek Christmas carol Καλήν εσπέραν άρχοντες, "Good Evening, My Lords". Western devices for indicating repeats have been imposed onto Byzantine notation. The tempo is spelled out (Γοργά, "swift"), and the pitch syllables for the starting note is given explicitly as a syllable, Di (g). The Western solfège for the finalis (Mi) is given as a gloss on the mode signature (Vou Legetos). Monotonic accentuation is used in the Western transcription but no accentuation is in the Byzantine; both transcriptions use the omicron-upsilon ligature (Χριστού appears as Χριστϑ) .

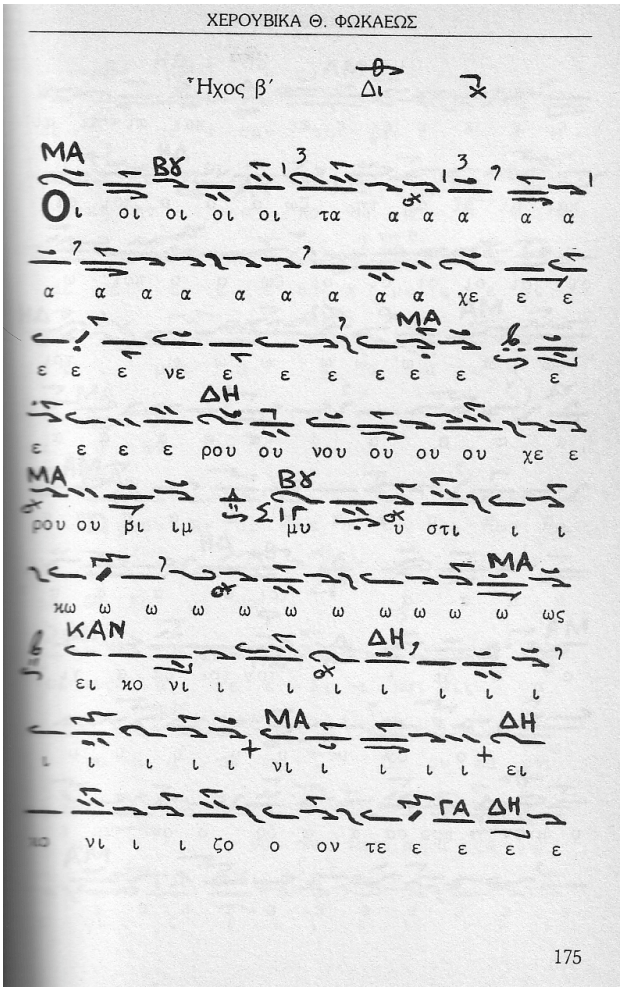

Figure 14. A cherubic hymn by the 19th century composer Th. Fokaefs (Kakoulidis 1984:175). The ison is indicated by the note syllables written over the neumes, with MA standing for μαζί, "togther"; the editor also introduces ΣΙΓ (σιγά, "softly") and KAN (κανονικά, "normally") as dynamic indications. The mode signature is spelled out (Ἦχος β΄, "Mode II"), followed by the syllable for g (Δι) with a soft chromatic third modulator, indicating that the finalis is g and that the scale is the soft chromatic. At the end of the signature is a slow conduit tempo marker. The Arabic numeral 3 gives the number of beats in the two initial bars (with short barlines).

In accordance with the slow tempo of cherubic hymns, the syllables are much drawn out; the text on this page is Οἱ τὰ χερουβὶμ μυστικῶς εἰκονίζοντες, "those that secretly imagine the cherubim". Extratextual nus have been inserted into the word χερουβίμ (χεεεεεε[ν]εεεεεεεεεεεερουου[ν]ουουουουχεερουουβιιμ), but the editor has used a normal nu instead of the proper gorthmic nu. The editor also makes a distinction between the *stavros* (only the soloists pause) and the Western breathing mark (the ison singers pause as well).

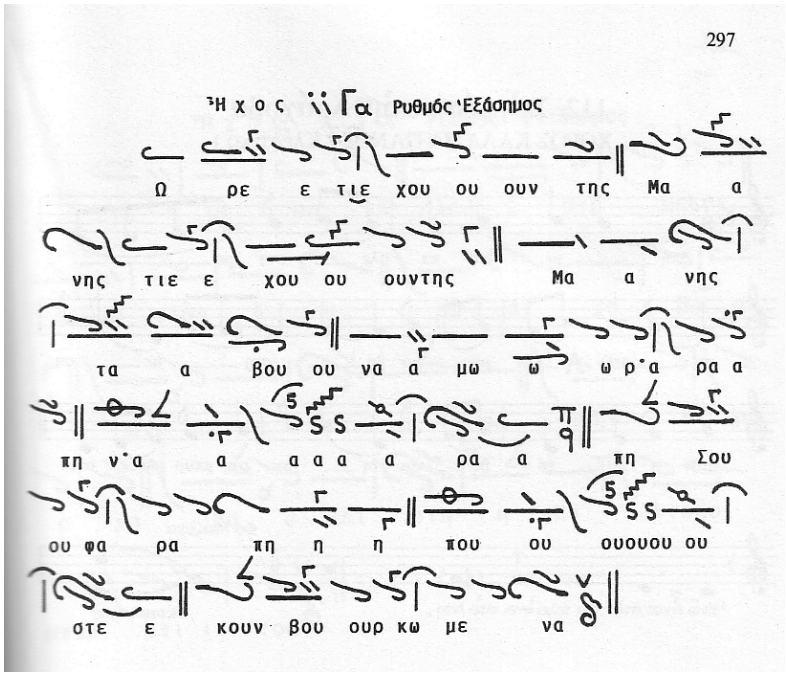

Figure 15. A folksong transcrption from the Peloponnese, *Τί ἔχουν τῆς Μάνης τὰ βουνά*, "What ails the mountains of Maina" (Kyriakopoulos 1992:297). The metre indication is spelled out (Ρυθμός Ἑξάσημος, "six-beat metre"). The double barline is used for the six beats, the downbeat barline for each three beats. The trigorgon and tetragorgon is used extensively, the latter with a clarifying numeral 5. The soft chromatic modulants on the fourth and fifth lines change the scale, and are cancelled out by the subsequent diatonic g modulants. Note the straight lines in the glyph for the Mode III letter (U+1D0A7).

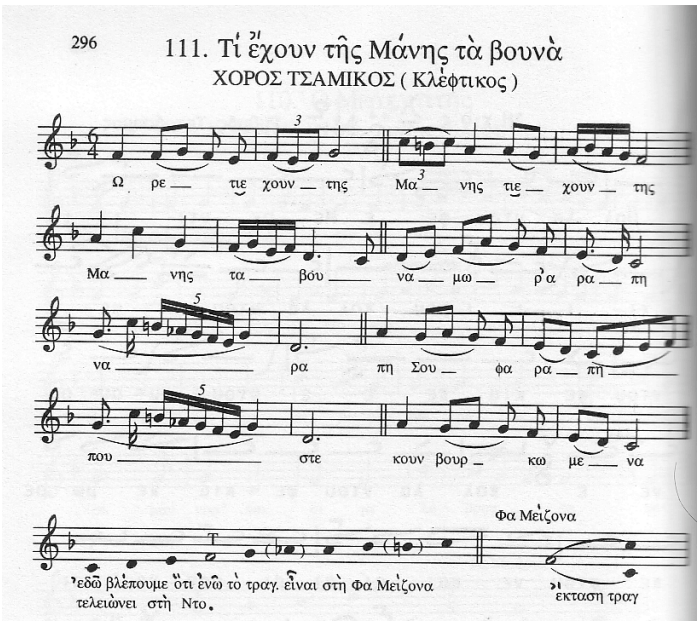

Figure 16. Western transcription of the same song (Kyriakopoulos 1992:296) . The punctuated gorgon is transcribed as a dotted eighth note–sixteenth note. The omalon grace note is incorporated into the run of sixteenth notes in the fourth half-bar (which is a triplet in the Byzantine transcription).

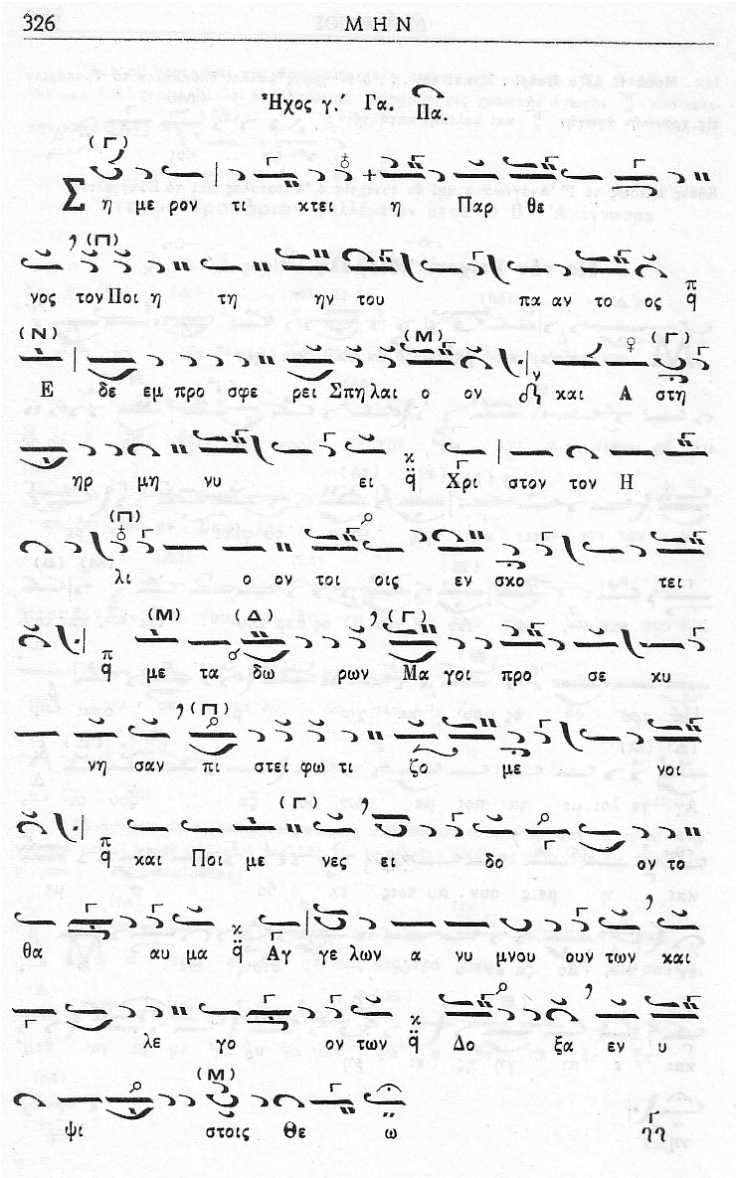

Figure 17. An example of liturgical printed notation: the Christmas hymn Σήμερον τίκτει ἡ Παρθένος, "Today the Virgin gives birth". (Karamanis 1965:326) The mode signature is spelled out (Ἦχος γ΄, Mode III). The finalis syllable Γα is followed by an elaphron and Πα, meaning that the true finalis is d, not f (and that the piece is in d minor, not f major). This is an old anomaly remarked on in Panagiotopoulos (1986:195), who recommends ignoring it; the final pitch indicator in the piece is the expected f. The piece features the conventional use of the general flat and sharp, converting the scale to enharmonic, and a few instances of normal flat over b. The editor also distinguishes between stavros and Western breathing mark.

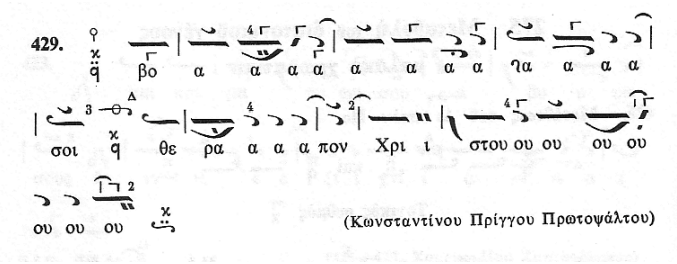

Figure 18. An involved instance of a phthoral martyria, used as an exercise in Efthymiadis (1988:302). The initial pitch indicator is Ke (a) diatonic, with a Pa (d) modulant (a transposed to d). The second pitch indicator accordingly has Ke over the mode letter for Pa; but in turn it has the soft chromatic phthora above it, with its pitch delta for Di (g)—so what was originally diatonic a, transposed to diatonic d, is now transposed in turn to soft chromatic g. The final pitch indicator is Ke over the mode letter for the beginning of a soft chromatic tetrachord (c–f or g–c)—in other words, Ke has been transposed to soft chromatic g. (The ambiguity of the chromatic modulator between c and g is why the delta was inserted over the modulator.)

Baroque though this may seem, the phrase is taken from an actual piece by Head Cantor Constantine Pringos (and proves once and for all that Byzantine notation is not intended for sight-reading). Note the pelastikon nu in the first line (βοαααααααα[ν]αααα σοι θερααααπον Χριστουουουουουουουου = βοᾷ σοι θεράπον Χριστοῦ, "he cries out to thee, Servant of Christ"). Like other exercises in Efthymiadis, the number of beats in the bar is given as a small Arabic numeral. Efthymiadis switches from a full barline to a short barline (including downbeat barlines) before note sequence neumes (hyporroi, kentimata + oligon).

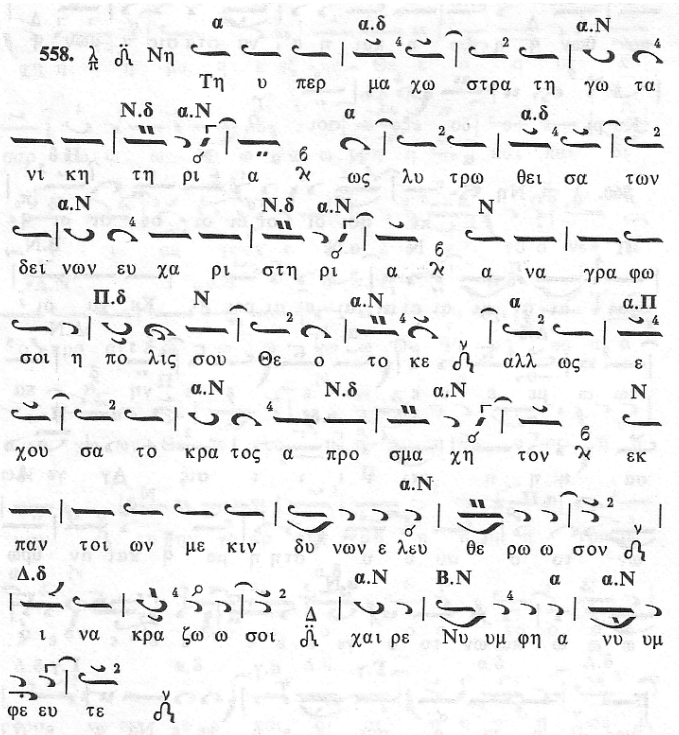

Figure 19. The hymn Τῇ Ὑπερμάχῳ Στρατηγῷ, "To the Leader Above all Battles", used to illustrate split ison (Efthymiadis 1988:479).

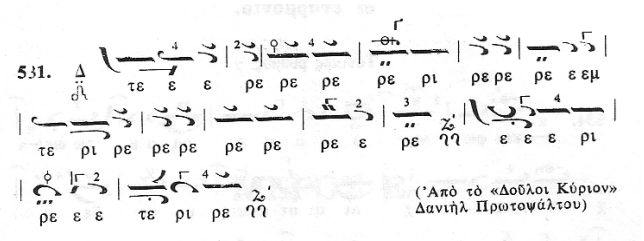

Figure 20. An example of the use of the Spathi chroa (Efthymiadis 1988:339). The excerpt of the hymn Δοῦλοι Κύριον, "Ye servants, the Lord" by Daniel the Head Cantor, uses the filler word τεριρέμ. The Spathi has the clarifying pitch letter for Ga (f) over it; the shape of the gamma has been kept distinct from that of the gorgon.

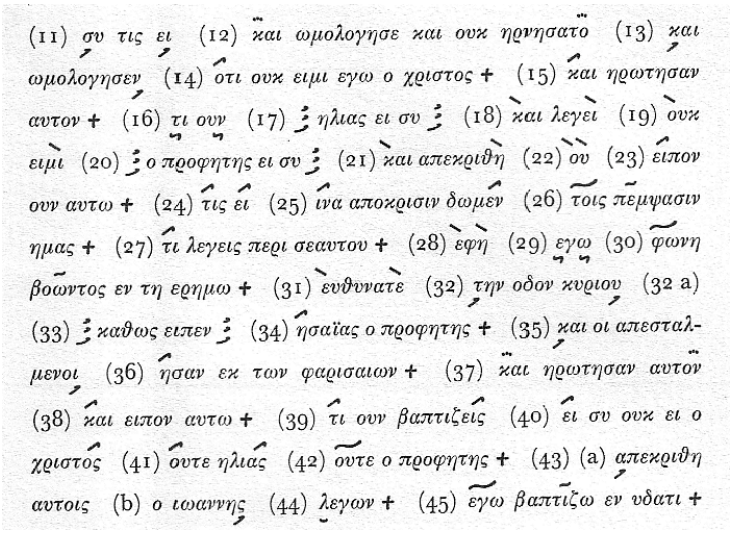

Figure 21. A transcription of ecphonetic notation: John 1:11–45. (Höeg 1935:95)

Appendix B. Modern Notation Codepoints

The following codepoints are those an implementor will need to include to support the modern notation system.

```
1D046 ; [*0C54.0020.0002.1D046] # BYZANTINE MUSICAL SYMBOL ISON NEO
1D047 ; [*0C55.0020.0002.1D047] # BYZANTINE MUSICAL SYMBOL OLIGON NEO
1D048 ; [*0C56.0020.0002.1D048] # BYZANTINE MUSICAL SYMBOL OXEIA NEO
1D049 ; [*0C57.0020.0002.1D049] # BYZANTINE MUSICAL SYMBOL PETASTI
1D04E ; [*0C5C.0020.0002.1D04E] # BYZANTINE MUSICAL SYMBOL KENTIMATA NEO ANO
1D04F ; [*0C5D.0020.0002.1D04F] # BYZANTINE MUSICAL SYMBOL KENTIMA NEO ANO
1D050 ; [*0C5E.0020.0002.1D050] # BYZANTINE MUSICAL SYMBOL YPSILI
1D051 ; [*0C5F.0020.0002.1D051] # BYZANTINE MUSICAL SYMBOL APOSTROFOS NEO
1D053 ; [*0C61.0020.0002.1D053] # BYZANTINE MUSICAL SYMBOL YPORROI
1D055 ; [*0C63.0020.0002.1D055] # BYZANTINE MUSICAL SYMBOL ELAFRON
1D056 ; [*0C64.0020.0002.1D056] # BYZANTINE MUSICAL SYMBOL CHAMILI
1D058 ; [*0C66.0020.0002.1D058] # BYZANTINE MUSICAL SYMBOL VAREIA NEO
1D05A ; [*0C68.0020.0002.1D05A] # BYZANTINE MUSICAL SYMBOL PSIFISTON NEO
1D05B ; [*0C69.0020.0002.1D05B] # BYZANTINE MUSICAL SYMBOL OMALON
1D05C ; [*0C6A.0020.0002.1D05C] # BYZANTINE MUSICAL SYMBOL ANTIKENOMA
1D060 ; [*0C6E.0020.0002.1D060] # BYZANTINE MUSICAL SYMBOL ETERON PARAKALESMA
1D07B ; [*0C89.0020.0002.1D07B] # BYZANTINE MUSICAL SYMBOL ENDOFONON
1D07C ; [*0C8A.0020.0002.1D07C] # BYZANTINE MUSICAL SYMBOL YFEN KATO
1D07D ; [*0C8B.0020.0002.1D07D] # BYZANTINE MUSICAL SYMBOL YFEN ANO
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1D07E ; [*0C8C.0020.0002.1D07E] # BYZANTINE MUSICAL SYMBOL STAVROS
1D07F ; [*0C8D.0020.0002.1D07F] # BYZANTINE MUSICAL SYMBOL KLASMA ANO
1D085 ; [*0C93.0020.0002.1D085] # BYZANTINE MUSICAL SYMBOL APLI
1D086 ; [*0C94.0020.0002.1D086] # BYZANTINE MUSICAL SYMBOL DIPLI
1D087 ; [*0C95.0020.0002.1D087] # BYZANTINE MUSICAL SYMBOL TRIPLI
1D088 ; [*0C96.0020.0002.1D088] # BYZANTINE MUSICAL SYMBOL TETRAPLI
1D089 ; [*0C97.0020.0002.1D089] # BYZANTINE MUSICAL SYMBOL KORONIS
1D08A ; [*0C98.0020.0002.1D08A] # BYZANTINE MUSICAL SYMBOL LEIMMA ENOS CHRONOU
1D08B ; [*0C99.0020.0002.1D08B] # BYZANTINE MUSICAL SYMBOL LEIMMA DYO CHRONON
1D08C ; [*0C9A.0020.0002.1D08C] # BYZANTINE MUSICAL SYMBOL LEIMMA TRION CHRONON
1D08D ; [*0C9B.0020.0002.1D08D] # BYZANTINE MUSICAL SYMBOL LEIMMA TESSARON CHRONON
1D08E ; [*0C9C.0020.0002.1D08E] # BYZANTINE MUSICAL SYMBOL LEIMMA IMISEOS CHRONOU
1D08F ; [*0C9D.0020.0002.1D08F] # BYZANTINE MUSICAL SYMBOL GORGON NEO ANO
1D090 ; [*0C9E.0020.0002.1D090] # BYZANTINE MUSICAL SYMBOL GORGON PARESTIGMENON ARISTERA
1D091 ; [*0C9F.0020.0002.1D091] # BYZANTINE MUSICAL SYMBOL GORGON PARESTIGMENON DEXIA
1D092 ; [*0CA0.0020.0002.1D092] # BYZANTINE MUSICAL SYMBOL DIGORGON
1D093 ; [*0CA1.0020.0002.1D093] # BYZANTINE MUSICAL SYMBOL DIGORGON PARESTIGMENON ARISTERA
    KATO
1D094 ; [*0CA2.0020.0002.1D094] # BYZANTINE MUSICAL SYMBOL DIGORGON PARESTIGMENON ARISTERA
    ANO
1D095 ; [*0CA3.0020.0002.1D095] # BYZANTINE MUSICAL SYMBOL DIGORGON PARESTIGMENON DEXIA
1D096 ; [*0CA4.0020.0002.1D096] # BYZANTINE MUSICAL SYMBOL TRIGORGON
1D097 ; [*0CA5.0020.0002.1D097] # BYZANTINE MUSICAL SYMBOL ARGON
1D098 ; [*0CA6.0020.0002.1D098] # BYZANTINE MUSICAL SYMBOL IMIDIARGON
1D099 ; [*0CA7.0020.0002.1D099] # BYZANTINE MUSICAL SYMBOL DIARGON
1D09A ; [*0CA8.0020.0002.1D09A] # BYZANTINE MUSICAL SYMBOL AGOGI POLI ARGI
1D09B ; [*0CA9.0020.0002.1D09B] # BYZANTINE MUSICAL SYMBOL AGOGI ARGOTERI
1D09C ; [*0CAA.0020.0002.1D09C] # BYZANTINE MUSICAL SYMBOL AGOGI ARGI
1D09D ; [*0CAB.0020.0002.1D09D] # BYZANTINE MUSICAL SYMBOL AGOGI METRIA
1D09E ; [*0CAC.0020.0002.1D09E] # BYZANTINE MUSICAL SYMBOL AGOGI MESI
1D09F ; [*0CAD.0020.0002.1D09F] # BYZANTINE MUSICAL SYMBOL AGOGI GORGI
1D0A0 ; [*0CAE.0020.0002.1D0A0] # BYZANTINE MUSICAL SYMBOL AGOGI GORGOTERI
1D0A1 ; [*0CAF.0020.0002.1D0A1] # BYZANTINE MUSICAL SYMBOL AGOGI POLI GORGI
1D0A2 ; [*0CB0.0020.0002.1D0A2] # BYZANTINE MUSICAL SYMBOL MARTYRIA PROTOS ICHOS
1D0A3 ; [*0CB1.0020.0002.1D0A3] # BYZANTINE MUSICAL SYMBOL MARTYRIA ALLI PROTOS ICHOS
1D0A4 ; [*0CB2.0020.0002.1D0A4] # BYZANTINE MUSICAL SYMBOL MARTYRIA DEYTEROS ICHOS
1D0A5 ; [*0CB3.0020.0002.1D0A5] # BYZANTINE MUSICAL SYMBOL MARTYRIA ALLI DEYTEROS ICHOS
1D0A6 ; [*0CB4.0020.0002.1D0A6] # BYZANTINE MUSICAL SYMBOL MARTYRIA TRITOS ICHOS
1D0A7 ; [*0CB5.0020.0002.1D0A7] # BYZANTINE MUSICAL SYMBOL MARTYRIA TRIFONIAS
1D0A8 ; [*0CB6.0020.0002.1D0A8] # BYZANTINE MUSICAL SYMBOL MARTYRIA TETARTOS ICHOS
1D0A9 ; [*0CB7.0020.0002.1D0A9] # BYZANTINE MUSICAL SYMBOL MARTYRIA TETARTOS LEGETOS ICHOS
1D0AA ; [*0CB8.0020.0002.1D0AA] # BYZANTINE MUSICAL SYMBOL MARTYRIA LEGETOS ICHOS
1D0AB ; [*0CB9.0020.0002.1D0AB] # BYZANTINE MUSICAL SYMBOL MARTYRIA PLAGIOS ICHOS
1D0AC ; [*0CBA.0020.0002.1D0AC] # BYZANTINE MUSICAL SYMBOL ISAKIA TELOUS ICHIMATOS
1D0AD ; [*0CBB.0020.0002.1D0AD] # BYZANTINE MUSICAL SYMBOL APOSTROFOI TELOUS ICHIMATOS
1D0AE ; [*0CBC.0020.0002.1D0AE] # BYZANTINE MUSICAL SYMBOL FANEROSIS TETRAFONIAS
1D0AF ; [*0CBD.0020.0002.1D0AF] # BYZANTINE MUSICAL SYMBOL FANEROSIS MONOFONIAS
1D0B0 ; [*0CBE.0020.0002.1D0B0] # BYZANTINE MUSICAL SYMBOL FANEROSIS DIFONIAS
1D0B1 ; [*0CBF.0020.0002.1D0B1] # BYZANTINE MUSICAL SYMBOL MARTYRIA VARYS ICHOS
1D0B2 ; [*0CC0.0020.0002.1D0B2] # BYZANTINE MUSICAL SYMBOL MARTYRIA PROTOVARYS ICHOS
1D0B3 ; [*0CC1.0020.0002.1D0B3] # BYZANTINE MUSICAL SYMBOL MARTYRIA PLAGIOS TETARTOS ICHOS
1D0B4 ; [*0CC2.0020.0002.1D0B4] # BYZANTINE MUSICAL SYMBOL GORTHMIKON N APLOUN
1D0B5 ; [*0CC3.0020.0002.1D0B5] # BYZANTINE MUSICAL SYMBOL GORTHMIKON N DIPLOUN
1D0B6 ; [*0CC4.0020.0002.1D0B6] # BYZANTINE MUSICAL SYMBOL ENARXIS KAI FTHORA VOU
1D0BA ; [*0CC8.0020.0002.1D0BA] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI PA
1D0BB ; [*0CC9.0020.0002.1D0BB] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI NANA
1D0BD ; [*0CCB.0020.0002.1D0BD] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI DI
1D0BE ; [*0CCC.0020.0002.1D0BE] # BYZANTINE MUSICAL SYMBOL FTHORA SKLIRON DIATONON DI
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1D0BF ; [*0CCD.0020.0002.1D0BF] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI KE
1D0C0 ; [*0CCE.0020.0002.1D0C0] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI ZO
1D0C1 ; [*0CCF.0020.0002.1D0C1] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI NI KATO
1D0C2 ; [*0CD0.0020.0002.1D0C2] # BYZANTINE MUSICAL SYMBOL FTHORA DIATONIKI NI ANO
1D0C3 ; [*0CD1.0020.0002.1D0C3] # BYZANTINE MUSICAL SYMBOL FTHORA MALAKON CHROMA DIFONIAS
1D0C4 ; [*0CD2.0020.0002.1D0C4] # BYZANTINE MUSICAL SYMBOL FTHORA MALAKON CHROMA MONOFONIAS
1D0C5 ; [*0CD3.0020.0002.1D0C5] # BYZANTINE MUSICAL SYMBOL FHTORA SKLIRON CHROMA VASIS
1D0C6 ; [*0CD4.0020.0002.1D0C6] # BYZANTINE MUSICAL SYMBOL FTHORA SKLIRON CHROMA SYNAFI
1D0C7 ; [*0CD5.0020.0002.1D0C7] # BYZANTINE MUSICAL SYMBOL FTHORA NENANO
1D0C8 ; [*0CD6.0020.0002.1D0C8] # BYZANTINE MUSICAL SYMBOL CHROA ZYGOS
1D0C9 ; [*0CD7.0020.0002.1D0C9] # BYZANTINE MUSICAL SYMBOL CHROA KLITON
1D0CA ; [*0CD8.0020.0002.1D0CA] # BYZANTINE MUSICAL SYMBOL CHROA SPATHI
1D0CB ; [*0CD9.0020.0002.1D0CB] # BYZANTINE MUSICAL SYMBOL FTHORA I YFESIS TETARTIMORION
1D0CC ; [*0CDA.0020.0002.1D0CC] # BYZANTINE MUSICAL SYMBOL FTHORA ENARMONIOS ANTIFONIA
1D0CD ; [*0CDB.0020.0002.1D0CD] # BYZANTINE MUSICAL SYMBOL YFESIS TRITIMORION
1D0CE ; [*0CDC.0020.0002.1D0CE] # BYZANTINE MUSICAL SYMBOL DIESIS TRITIMORION
1D0CF ; [*0CDD.0020.0002.1D0CF] # BYZANTINE MUSICAL SYMBOL DIESIS TETARTIMORION
1D0D0 ; [*0CDE.0020.0002.1D0D0] # BYZANTINE MUSICAL SYMBOL DIESIS APLI DYO DODEKATA
1D0D1 ; [*0CDF.0020.0002.1D0D1] # BYZANTINE MUSICAL SYMBOL DIESIS MONOGRAMMOS TESSERA
    DODEKATA
1D0D2 ; [*0CE0.0020.0002.1D0D2] # BYZANTINE MUSICAL SYMBOL DIESIS DIGRAMMOS EX DODEKATA
1D0D3 ; [*0CE1.0020.0002.1D0D3] # BYZANTINE MUSICAL SYMBOL DIESIS TRIGRAMMOS OKTO DODEKATA
1D0D4 ; [*0CE2.0020.0002.1D0D4] # BYZANTINE MUSICAL SYMBOL YFESIS APLI DYO DODEKATA
1D0D5 ; [*0CE3.0020.0002.1D0D5] # BYZANTINE MUSICAL SYMBOL YFESIS MONOGRAMMOS TESSERA
    DODEKATA
1D0D6 ; [*0CE4.0020.0002.1D0D6] # BYZANTINE MUSICAL SYMBOL YFESIS DIGRAMMOS EX DODEKATA
1D0D7 ; [*0CE5.0020.0002.1D0D7] # BYZANTINE MUSICAL SYMBOL YFESIS TRIGRAMMOS OKTO DODEKATA
1D0D8 ; [*0CE6.0020.0002.1D0D8] # BYZANTINE MUSICAL SYMBOL GENIKI DIESIS
1D0D9 ; [*0CE7.0020.0002.1D0D9] # BYZANTINE MUSICAL SYMBOL GENIKI YFESIS
1D0DA ; [*0CE8.0020.0002.1D0DA] # BYZANTINE MUSICAL SYMBOL DIASTOLI APLI MIKRI
1D0DB ; [*0CE9.0020.0002.1D0DB] # BYZANTINE MUSICAL SYMBOL DIASTOLI APLI MEGALI
1D0DC ; [*0CEA.0020.0002.1D0DC] # BYZANTINE MUSICAL SYMBOL DIASTOLI DIPLI
1D0DD ; [*0CEB.0020.0002.1D0DD] # BYZANTINE MUSICAL SYMBOL DIASTOLI THESEOS
1D0DE ; [*0CEC.0020.0002.1D0DE] # BYZANTINE MUSICAL SYMBOL SIMANSIS THESEOS
1D0DF ; [*0CED.0020.0002.1D0DF] # BYZANTINE MUSICAL SYMBOL SIMANSIS THESEOS DISIMOU
1D0E0 ; [*0CEE.0020.0002.1D0E0] # BYZANTINE MUSICAL SYMBOL SIMANSIS THESEOS TRISIMOU
1D0E1 ; [*0CEF.0020.0002.1D0E1] # BYZANTINE MUSICAL SYMBOL SIMANSIS THESEOS TETRASIMOU
1D0E2 ; [*0CF0.0020.0002.1D0E2] # BYZANTINE MUSICAL SYMBOL SIMANSIS ARSEOS
1D0E3 ; [*0CF1.0020.0002.1D0E3] # BYZANTINE MUSICAL SYMBOL SIMANSIS ARSEOS DISIMOU
1D0E4 ; [*0CF2.0020.0002.1D0E4] # BYZANTINE MUSICAL SYMBOL SIMANSIS ARSEOS TRISIMOU
1D0E5 ; [*0CF3.0020.0002.1D0E5] # BYZANTINE MUSICAL SYMBOL SIMANSIS ARSEOS TETRASIMOU
1D0E6 ; [*0CF4.0020.0002.1D0E6] # BYZANTINE MUSICAL SYMBOL DIGRAMMA GG
1D0E7 ; [*0CF5.0020.0002.1D0E7] # BYZANTINE MUSICAL SYMBOL DIFTOGGOS OU
1D0E8 ; [*0CF6.0020.0002.1D0E8] # BYZANTINE MUSICAL SYMBOL STIGMA
1D0E9 ; [*0CF7.0020.0002.1D0E9] # BYZANTINE MUSICAL SYMBOL ARKTIKO PA
1D0EA ; [*0CF8.0020.0002.1D0EA] # BYZANTINE MUSICAL SYMBOL ARKTIKO VOU
1D0EB ; [*0CF9.0020.0002.1D0EB] # BYZANTINE MUSICAL SYMBOL ARKTIKO GA
1D0EC ; [*0CFA.0020.0002.1D0EC] # BYZANTINE MUSICAL SYMBOL ARKTIKO DI
1D0ED ; [*0CFB.0020.0002.1D0ED] # BYZANTINE MUSICAL SYMBOL ARKTIKO KE
1D0EE ; [*0CFC.0020.0002.1D0EE] # BYZANTINE MUSICAL SYMBOL ARKTIKO ZO
1D0EF ; [*0CFD.0020.0002.1D0EF] # BYZANTINE MUSICAL SYMBOL ARKTIKO NI
1D0F0 ; [*0CFE.0020.0002.1D0F0] # BYZANTINE MUSICAL SYMBOL KENTIMATA NEO MESO
1D0F1 ; [*0CFF.0020.0002.1D0F1] # BYZANTINE MUSICAL SYMBOL KENTIMA NEO MESO
1D0F2 ; [*0D00.0020.0002.1D0F2] # BYZANTINE MUSICAL SYMBOL KENTIMATA NEO KATO
1D0F3 ; [*0D01.0020.0002.1D0F3] # BYZANTINE MUSICAL SYMBOL KENTIMA NEO KATO
1D0F4 ; [*0D02.0020.0002.1D0F4] # BYZANTINE MUSICAL SYMBOL KLASMA KATO
1D0F5 ; [*0D03.0020.0002.1D0F5] # BYZANTINE MUSICAL SYMBOL GORGON NEO KATO
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