

# Greek pronunciation

(from ancient to modern)

Luciano Canepari – © 2018

1.1. *Ancient Greek* (Hellenic, IĒ), or *Classical Greek*, had five vowels, both short and long (actually monotimbric diphthongs), with different qualities, as well as the thirteen phonemic diphthongs given in the second vocogram. Their nature and quality result from comparisons between the different (often conflicting) opinions of present-day and past scholars, as also from loanwords in Greek (and from Greek), including those from central- and eastern-Asian languages.

1.2. Considering the importance the Greek language has had for Western culture, we present here a list of the graphemic correspondences (including their transliteration), which should be of help to those who do not know (yet) the Greek alphabet. Some numbered notes follow, with explanations and some useful examples, although these phonosyntheses are quite concise.

α	<i>a</i>	[ɐ] /ɐ/	ν	<i>n</i>	[n] /n/
	<i>a/ā</i>	[a(a)] <sup>1</sup> /aa/	ξ	<i>ks</i>	[ks] /k+/s/
ε	<i>e</i>	[e] /e/	π	<i>p</i>	[p] /p/
η	<i>ē</i>	[ɛ(ɛ)] <sup>1</sup> /ɛɛ/	ρ	<i>r</i>	[r] /r/
ι	<i>i</i>	[i] /i/	ῥ	<i>rh</i>	[r] /r/
	<i>i/ī</i>	[i(i)] <sup>1</sup> /ii/	ῥῥ	<i>rrh</i>	[rɾ] /rɾ/
ο	<i>o</i>	[o] /o/	σ, -ς	<i>s</i>	[s] /s/ (word-finally, ς)
ω	<i>ō</i>	[ɔ(ɔ)] <sup>1</sup> /ɔɔ/		<i>s</i>	[z] /s/ + β, γ, δ;
υ	<i>y</i>	[ʊ] /ʊ/ (←[u]) <sup>2</sup>		<i>s</i>	[z] /s/ + λ, μ, ν, ρ
	<i>y/ȳ</i>	[ʊ(ʊ)] /ʊʊ/ (←[uu]) <sup>2</sup>	τ	<i>t</i>	[t] /t/
β	<i>b</i>	[b] /b/	φ	<i>ph</i>	[ph] /p+/h/
γ	<i>g</i>	[g] /g/; <i>g</i> [ŋ] /n/ + μ, ν (but γν-, <i>gn-</i> [gn] /gn/);	χ	<i>kh</i>	[kh] /k+/h/
	<i>n</i>	[ŋ] /n/ + γ, κ, ξ, χ;	ψ	<i>ps</i>	[ps] /p+/s/
δ	<i>d</i>	[d] /d/	ϝ	<i>h</i>	[h] /h/
ζ	<i>z</i>	[z, VzzV] /z, zz/ (←[dz]←[zd]) <sup>2</sup>	Ϛ		[∅] / / 'zero'
θ	<i>th</i>	[th] /t/ + /h/	ϛ		[ˈ] /ˈ/ (mid level tone)
κ	<i>k</i>	[k] /k/	Ϝ		[ˌ] /ˌ/ (low level tone)
λ	<i>l</i>	[l] /l/	ϝ		[ˋ] /ˋ/ (mid-to-low falling tone)
μ	<i>m</i>	[m] /m/	Ϟ		[ˊ] /ˊ/ (low level weak tone).

V<sub>l</sub> V<sub>i</sub> [V<sub>l</sub>] /V<sub>l</sub>/: α<sub>l</sub>, a<sub>i</sub> [ɐ<sub>l</sub>] /a<sub>l</sub>/; ε<sub>l</sub>, e<sub>i</sub> [ɛ<sub>l</sub>] /ɛ<sub>l</sub>/; ο<sub>l</sub>, o<sub>i</sub> [o<sub>l</sub>] /o<sub>l</sub>/; υ<sub>l</sub>, y<sub>i</sub> [ʊ<sub>l</sub>] /ʊ<sub>l</sub>/

V<sub>υ</sub> V<sub>υ</sub> [V<sub>υ</sub>] /V<sub>υ</sub>/: α<sub>υ</sub>, a<sub>υ</sub> [ɐ<sub>υ</sub>] /ɐ<sub>υ</sub>/; ε<sub>υ</sub>, e<sub>υ</sub> [ɛ<sub>υ</sub>] /ɛ<sub>υ</sub>/; ā<sub>υ</sub>, ā<sub>υ</sub> [aa<sub>υ</sub>] /aa<sub>υ</sub>/; η<sub>υ</sub>, ē<sub>υ</sub> [ɛɛ<sub>υ</sub>] /ɛɛ<sub>υ</sub>/; ω<sub>υ</sub>, ō<sub>υ</sub> [ɔɔ<sub>υ</sub>] /ɔɔ<sub>υ</sub>/; but ο<sub>υ</sub>, ο<sub>υ</sub> [ʊʊ] /ʊʊ/, which is the natural phonetic way of showing what different scholars describe as corresponding to /oo, ou, uu/, by optimizing their articulatory space in the vocogram)<sup>2</sup>

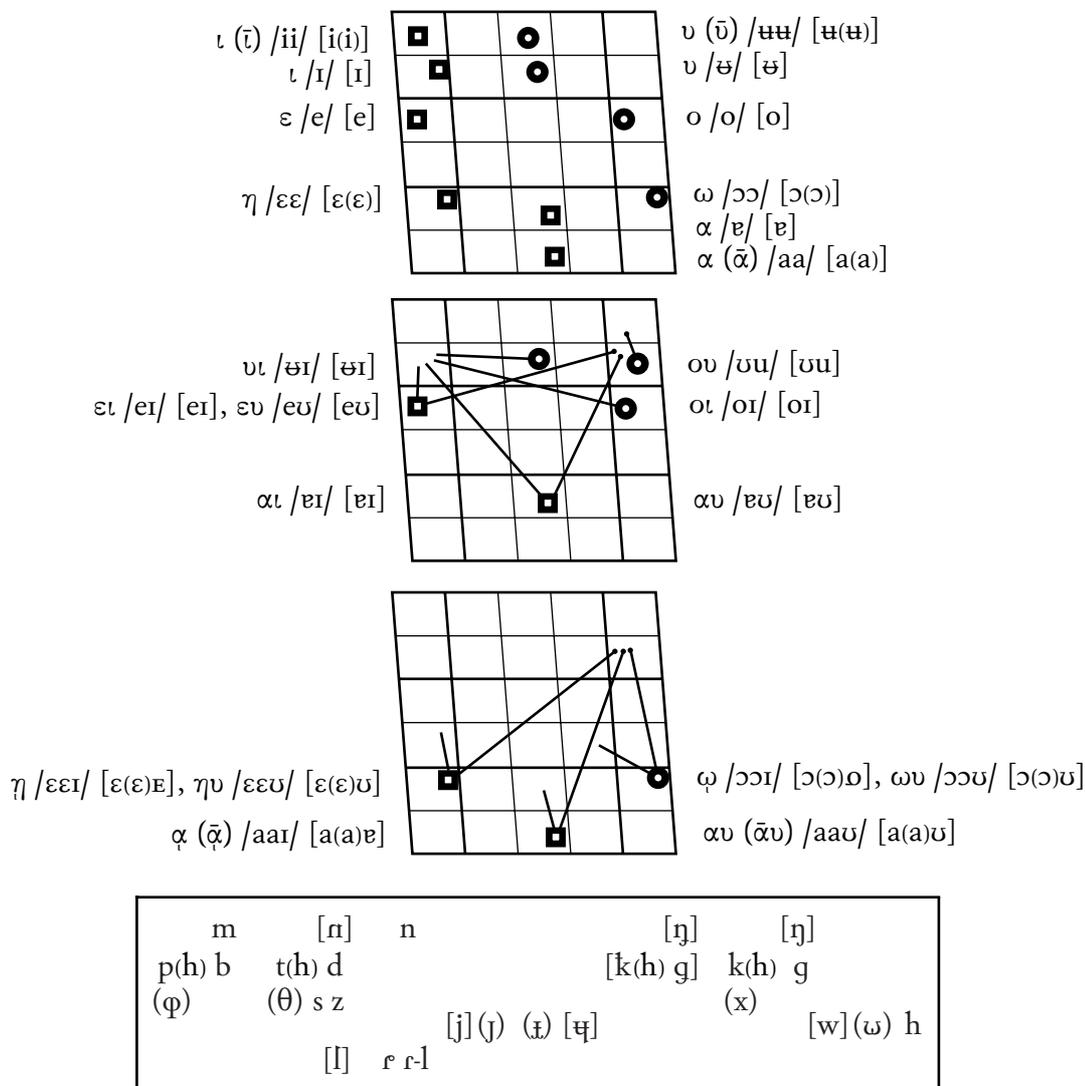
V̄ V̄ V̄ [V̄V̄(̄)]<sup>3</sup>: ᾱ, ā̄ [a(a)ɐ] /aa(̄)/; η̄, ē̄ [ɛ(ɛ)ɛ] /ɛɛ(̄)/; ω̄, ō̄ [ɔ(ɔ)ɔ] /ɔɔ(̄)/

V<sub>l</sub>V V<sub>i</sub>V [V<sub>l</sub>jV] /V<sub>l</sub>(<sup>#</sup>)V/, V<sub>υ</sub>V V<sub>υ</sub>V [V<sub>υ</sub>wV] /V<sub>υ</sub>(<sup>#</sup>)V/ (within or between words).

<sup>1</sup> Unstressed ‘long’ vowels become short monophthongs, keeping their normal timbres, [i, ε, a, ɔ, ɯ], which were different from true short vowels, [ɪ, e, ɐ, o, ʊ].

<sup>2</sup> At earlier times these vowel timbres and the articulation of ζ were as indicated after ‘←’. Between vowels, ζ was geminated, [zz] /zz/. The previous intermediate stage, [dz] /dz/ (not a stopstricative, [dʒ]), from a former [zd] /zd/, originated by metathesis and made up a consistent series with [ps] /ps/ and [ks] /ks/, in spite of its being ‘intrinsically’ voiced (structurally, a voiceless sequence, /ts/, would have been more plausible, much like ψ and ξ, but no reliable traces or records of it have been found).

<sup>3</sup> On the other hand we get: ᾠι (for ᾠ̂; different from Αῖ, αῖ)... In fact, α, η, ω, were still ‘long’ though very narrow diphthongs, as shown: [a(a)ɐ, ε(ε)ɛ, ɔ(ɔ)ɔ]; but, if followed by a vowel, ‘ stood for [ɹ, ʝ], as in: ῥάων *hráion* [ˈraa.ɹɔn], κλήϊω *klēiō* [ˈklɛɛ.ɹɔ], πατρῶος *patrōios* [pɛ.tɹɔɔ.jos], τῶ ὄντι *tōi ónti* [tɔˈjɔn.tɪ]. For [ɹ, ʝ, ω], see § 1.10.



1.3. Besides, we had Vī Vī [Vɪ] and Vū Vū [Vʊ] with independent ι, υ (also stressable, ἄϊσσω *aíssō* [ˈɛɪs.sɔ]): ἱρήϊον *hirēion* [ˈhɪrɛɪ.jɔn], ἄϋτμη *aytmē* [ˈɛʊtˈmɛɛ].

In addition, intervocalic /i, u/ (in /Vi, Vu/ + /V/ sequences, cf the second vocogram) were: [ɹj, ʝw], ie VɪV ViV [VɹjV]: [ɛɹjV, eɹjV, oɹjV, ɛɹjV]: πλεῖος *plēios* [ˌplɛɪ-

jos]. Also:  $V_0V VuV [V_0wV]: [\epsilon_0wV, \epsilon_0wV, \epsilon\epsilon_0wV, \omega_0wV]$ ; with  $ouV ouV [\epsilon_0wV]:$  βουλεύω *bouléuō* [ˌbɔuˈleu.wɔ].

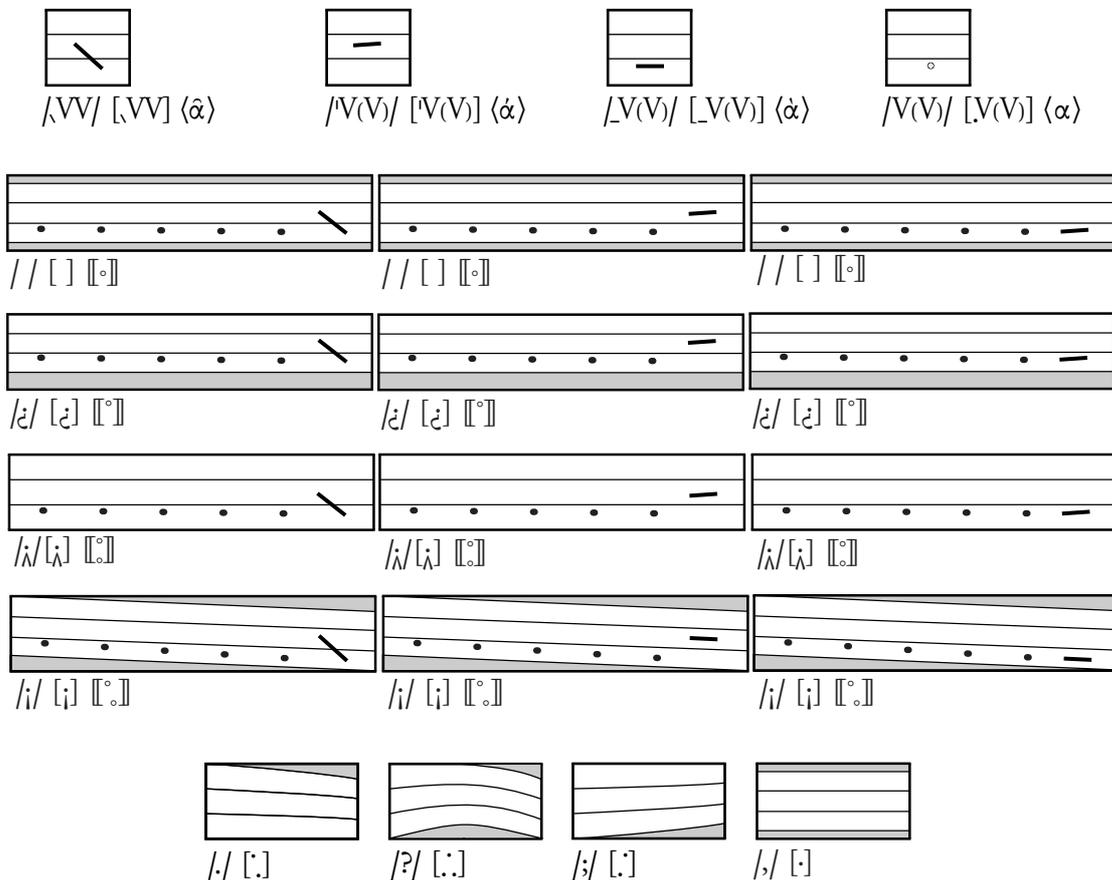
In *diphthongs* the accent mark –much like the possible *breathing* (either ‘rough’, ‘*h* [h] /h/, or ‘smooth’, ‘ [Ø] //)– is marked on the second element, even though it goes without saying that phono-tonetically (as also in its transliterated form) it is on the first one: αἶμα *hâima* [ˌhɛi.mɛ]. As we know, usual spelling does not distinguish between short ([ɛ, ɪ, ɛ]) and long ([aa, ii, ɛɛ]): α, ι, υ.

To end with, θ, φ, χ are voiceless ‘aspirated’ stops; when in sequence, both can be ‘aspirated’, mostly in careful speech: διφθογγος *diphthongos* [ˈdɪp(h).θɔŋ.gos] (colloquially, also [φ, θ, x] are possible [ˈdɪφ.θɔŋ.gos]). Notice also that, except for γγ *ng* [ŋg], doubled consonants are truly geminated (as ζ also was [zz], between vowels): βάλλω *bállō* [ˈbɛl.lɔ], ἵππος *híppos* [ˈhɪp.pos], περίζωμα *perízōma* [peˈɾɪz.wɛ].

1.4. The tonetic illustrations which follow explain the nature of the Greek *accent*. It combined stress (*ie* intensity) and pitch (*ie* tonality). Words with a circumflex written accent have a falling movement from a mid pitch to a low one, as shown. Those with an acute written accent have a mid pitch, very slightly ascending. The words with a grave written accent have a low pitch.

Since this highly debated matter is still partially unsettled, and not to complicate things, it is probably better to consider the three stressed tonemic patterns, as shown in the figure.

All these tonetic movements were superimposed on the dotted lines shown in the (larger) tonograms, giving the unmarked four protunes, with theoretically all unaccented syllables.



Of course, they modified those overall structures, by partially raising the pitch on their last syllable.

The first four tonograms show this change with the circumflex accent, [ ] /|/ ^, while the middle four ones show it with the acute accent, [ ] /|/ ' ; the last four ones show it with the grave accent, [ ] /|/ `.

The four tonograms at the bottom of the tonetic illustration show the realizations of the four tunes, with their clear movements, which further modify the tonetic structures just seen.

*Some considerations about spelling, pitch, music, verse, other literary dialects, and numerals.*

1.5. Since we live and do phonetics in the third millennium, what will follow is thought to be necessary, in order to solve and resolve scientifically the problem of spelling and pronunciation.

Unfortunately, the Middle Ages are famous both for their serious studies and absurd rigmaroles, with incredible officialdom and many useless productions.

Sadly enough, in Greece nothing happened similar to what *Pāṇini* did, in ancient India, in earlier times, for rather scientific phonetics. The Greeks did know some kind of an ancient 'letter', derived by cutting H, which was quite suitable for an adequate representation of their phoneme /h/: Ϝ, ϝ. Later on, this sign became the rough breathing, ϝ̣, while the other part, Ϝ, ϝ, became the smooth breathing, ϝ̣̄.

But it seems that they were not sufficiently smart as to use that 'letter' conveniently: as a normal consonantal letter. Instead, they 'preferred' not to indicate their phoneme, which –it is true– was rather marginal, almost a second-hand consonant.

When /h/ definitely disappeared from the Greek language, and its spelling was fixed by people who did not have it in their own language, nor had a clear idea of what it actually could be, it was again considered as something less important than a real consonant, either phonically or graphically.

As a matter of fact, in verse, both ϝ̣ and φ, θ, χ had no legitimate place as real phonemic segments, as on the contrary they certainly are: [h], [ph, th, kh, kh]! So, absurdly, initial /h/ was not considered to be a true consonant (both phonically and graphically), but some kind of unfortunate feature belonging to the vowels, calling it *rough breathing*. In fact, in compounds, when /h/ was at the beginning of the second element, it was dropped: ἔξοδος [ˈɛk.so.dos], from ὁδός [hoˈdos].

1.6. Thus, instead of using a convenient and economical consonant (like Ϝ, ϝ, or any other, possibly better), a highly inconvenient diacritic was put over lower-case vowels: ϝ̣ (for all seven vowels). Of course, it was also to be combined with the three kinds of accent, giving ϝ̣̄, ϝ̣̄, ϝ̣̄̄ – again, for all vowels, including the three ones with the *iota subscript*: ϝ̣̄̄̄.

As already hinted at above, although φ, θ, χ were certainly [ph, th, kh], however, in verse, they were degraded to something like simple [p, t, k], and written with simple letters, instead of: πϜ, τϜ, κϜ (more scientifically, indeed).

And what is more, as if not enough damage had already been done, they also 'invented' the extremely useless *smooth breathing*, meant to indicate the absence

of the *rough* one. But, in case, to indicate a phonic ‘zero’, [∅] (or simply [], certainly not [ʔ], which might have required a true consonantal phonic –and perhaps also graphic– segment), they should have used Ͱ, ͱ, which they already had in previous times.

So the number of combinations of vowels and diacritics was doubled, quite unnecessarily. Luckily, upper-case vowels were not ‘sentenced’ the same way. In any case, there are 112 useless combinations of vowels and inconvenient diacritics!

1.7. However, the unfortunate and unhappy story of the Greek spelling is not ended. In fact, although phonic diphthongs are quite clearly stressed on their first vowel element, like [ai] (*ie ái*), they are ‘ingenuously’ written like *ái*, as if they were actually [a’i]!

In modern Greek, although now only the acute accent is written, the current spelling still uses such an inconvenient way of showing the stress. Let us consider a simple example, in modern Greek, where a word like [kaθa’rɛvʊsa] is still amazingly written *καθαρεύουσα* (with an accent over what is now a consonant).

1.8. The medieval bureaucratic obsession also brought scholars to put a grave accent on any unaccented syllable, thus, producing full sequences of such grave accents. Later on, however, the grave accent was only put on the final syllable in given known cases.

Of course, in accurate phonotonic transcriptions, any unstressed syllable must be indicated by means of a low dot, because they are uttered on a low pitch. This tonetic structure is somehow similar to that of Japanese, where (in addition to *pro-tune* and *tune* modifications, as in Greek, too) two essential pitches are used: *low* and ‘non-low’, which is *mid*, not ‘high’ as it is still called and described.

So, a tone mark like [˘] is certainly excessively too high, while [˙] (*ie* [˘-]), not to be confused with ‘-’, *ie* a normal hyphen) is the one to be used.

When the Greek acute accent is described as the movement from a low pitch to a ‘high’ one, it has to be interpreted as a movement from low to *mid*, but not on the same syllable, even if long, so certainly neither [˙] nor [˘].

Instead, it means that from a low-pitched unstressed syllable [˘] the voice raises to the mid-pitched stressed syllable [˙] (*ie* [˘-]), again) for the acute accent, [˙˙] (*ie* [˘-˙]). On the other hand, for the circumflex accent the movement is from the mid pitch falling to the low one, within the same syllable, [˘˘].

Arguably, it would be extremely ridiculous to pass to a true high pitch even in Japanese, which has very similar tone patterns. So, even in Greek, the real pattern must be within the unmarked low pitch band to the marked mid one (as shown in our tonograms), either steady, [˙] (*ie* [˘-]), or falling [˘˘].

1.9. As a matter of fact, those ‘experts’ who made Greek recordings using high pitches, believing to be actually reproducing what it was, in reality, made fools of themselves.

It is sufficient to quickly listen to some of the cartoon-like recordings made by Stephen G. Daitz, who passed for a renowned celebrated model to be followed.

In Greek, as in Japanese, the high pitch band is exclusively used for *intonation*, which is superimposed to pitch accents, for the interrogative and suspensive tunes, or for some paraphonic reasons.

Arguably, as Greek verse was generally accompanied by *music*, certainly with wider tonal movements than in real spoken language (otherwise it would be almost useless), we may consider ‘normal’ to deform and distort utterances in order to follow the musical pattern.

It is the same even in modern contemporary songs, with (even considerable) segmental lengthenings, to say nothing about opera, where some phonemes may be completely ignored, as the distinction between Italian /e, ε/ and /o, ο/.

But, to insist in believing that real ancient Greek had to be practically ‘sung’ is something which nobody can actually trust.

1.10. Passing to some requirements (very queer, indeed) that *verse* demand, in order to ‘satisfy’ metrical patterns (although completely unfamiliar in comparison with actual true language), let us consider, now, some of the forced deviations from normality.

Of course, they were accurately classified and named, otherwise –certainly– they could not be imposed, as if they were actually necessary.

So, when true language did not match with *metrical structures* (real superstructures, indeed), *dieresis* was introduced, as when normal παίς [ˈpɛis], had to be deformed into παῖς (which could be passed off as a legitimate disyllabic word, something like [pɛ̃is], by doing violence to actual language).

On the contrary, when there were too many ‘syllables’, while just one could be accepted, *synizesis* had to be invented, as when μῆ οὐ [ˈmɛu], had to be made to ‘seem’ to be monosyllabic (as if it was not already such).

Let us end with *syneresis*, when words like θεοί [ˈthɛoi] or πόλεως [ˈpo.leɔs] had to be passed off as monosyllabic or bisyllabic, respectively, having to introduce new consonantal taxophones, as in [ˈthɔi, ˈpo.lɔs] (and [ɣ, ω] for ‘consonantalized’ [a, o], α, ο: [ɣ, ω]).

Of course, in Natural Phonetics, πόλεως [ˈpo.leɔs] is already bisyllabic. In the case of θεοί [ˈthɛoi] (as a monosyllabified word, seen above), the -oi and -ai endings were sometimes forced to ‘become short’ (or, rather, to be considered as ‘short’). For instance, the -ai of the imperative (τίμησαι [ˈti.me.sɛi]) and infinitive (τιμῆσαι [ˈti.me.sɛi]) forms had to be considered as being something like [ɣ], while the optative form (τιμήσαι [ˈti.me.sɛi]) ‘remained normal’.

Frankly, it must be said that, if those endings were really different, in the long history of grammatical Greek treatises, a way to show that fact would certainly have been devised (however crazy, as so many others).

1.11. However, it is true that, in singing verse with music, as a form of art in the ancient world, long vowels were certainly pronounced as diphonic diphthongs even when unstressed, [ii, εε, aa, oo, uu], not as [i, ε, a, o, u] (as in real spoken language, where they still remained different from their short counterparts, [ɪ, e, v, o, ʊ], thanks to their timbres).

We must add that a language like ancient Greek certainly *syllabified* its words in a more natural way than the verse ‘rules’ would make us believe, including in word formation.

Thus: πόνος [ˈponos], τιμάω [ˈti.maɔ], ἀπ’ ἐμοῦ [ˈe.pe.mu], ἀγγέλλω [ˈeŋˈgɛl.lɔ],

πένθος [ˈpeɪ̯.tʰos], πότης [ˈpo.tʰos], ἀκτίς [ˈek.tʰis], πέφασμαι [ˈpe.pʰɛz.meɪ], βλάπτω [ˈblɛp.tɔ], δάκνω [ˈdɛk.no], μιμνέσκω [ˌmimˈnes.kɔ], ἄρκτος [ˈɛr.k.tos], Βάκχος [ˈbɛk.kʰos], Σαπφώ [ˌsɛpˈpʰɔ], συνέρχομαι [ˌsɛˈnɛɪ.kʰo.meɪ], ἐξετάζω [ˌɛk.sɛˈtɛz.zɔ], ἐπράχθη [ˌɛp.rɛk.tʰɛ, ˌɛp.rɛx.tʰɛ], ἐθρέψασθε [ˌɛθˈrɛp.s.tʰɛ], γέγραφε [ˈgɛ.gɾɛp.tʰɛ, ˈgɛ.gɾɛp.tʰɛ], τεθνήξω [ˌtɛθˈnɛk.sɔ], ἐσθλός [ˌɛsˈθlos].

1.12. The *Greek literary dialects* had always been a kind of artificial languages. In fact, the ‘dialects’ used by all authors did not depend on their ethnic origin, but on the literary genres they chose.

Therefore, the *Attic dialect* was used for *prose, philosophy, oratory, historiography, and theatrical dialog*. The *Ionic dialect* in *elegy, epigram*, and (together with the *Aeolic dialect*) in *monodic lyric*. The *Doric dialect* in *choral lyric* and lyrical parts of *tragedy and comedy*. Here are some of the most peculiar phonic differences between these literary dialects.

While *Attic* changed former /uu, u/ into /u̯u̯, u̯/ (where /uu, u/ derived both from /ou/ and contracted or compensatory lengthened /oo/, but were still different from /ɔɔ/), other dialects kept /uu, u/. In addition, *Attic* maintained /h/, while, for former /VssV/ it had three possibilities: /VssV, VsV, VttV/.

Generally, *Ionic* changed /uu, u/ into /u̯u̯, u̯/, /o/ into /ou/, but /ei/ into /e/ (although apparently irregular); it often lost /h/, while, for former /VssV/ it had two possibilities: /VssV, VttV/, and geminated /m, n, l, p, t, s/ for metrical reasons.

*Aeolic* changed /ei/ into /ɛɛ/ (sometimes into /ii/); contracted /ee/ and /oo/ became /ɛɛ, ɔɔ/, while original /ɛɛ/ was generally replaced by /aa/ and /ou/ by /uu/. It completely lost /h/, while keeping former word-internal [zd].

*Doric* changed original /ei, ou/ into /ee, oo/; it often had /aa/ instead of /ɛɛ/, and sometimes [jɛ, jo] instead of /ea, eo/ for metrical reasons. Besides, it kept [zd, ss].

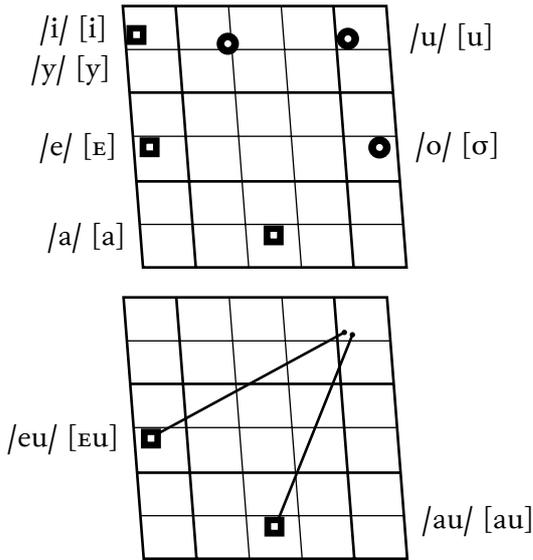
1.13. Now, a short note about the way of representing *numerals* in ancient Greece is thought to be necessary. Philosophy, astronomy, and all possible arts (except cinema and music recording, of course) were certainly treated deeply, even mathematics and geometry.

But, let us state frankly that the way in which numbers were written is decidedly far from ideal. It is also undeniably true that, in the Roman world, numbers were shown in an even worse way...

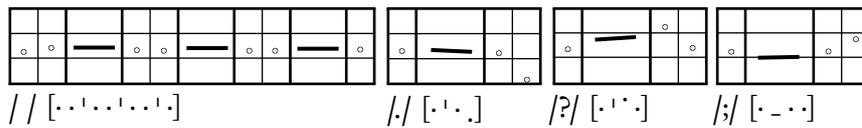
2. *Hellenistic Greek* (Hellenic, 1E) had six short vowels and two diphthongs (which had not yet become /af, av; ef, ev/ yet). It had the given xenophonemes (in round brackets) for loanwords, the sequences /ps, ts, dz, ks/, and [n≡C]. There was no prenasal voicing yet, and the (ancient) tonemes had disappeared, but the opposition C ≠ CC was preserved.

Although belonging to (quite) different situations and epochs, these rather synthetic descriptions are clear enough.

For spelling, see the last phonopsis (on Modern Greek).

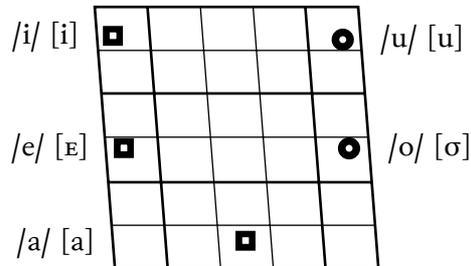


m	[m]	[n]	n	[l]	[ŋ]
p (b)		t (d)		[k (g)]	k (g)
	f v	θ s ð z		[x ɣ]	x ɣ
		[l]	r-l	j	

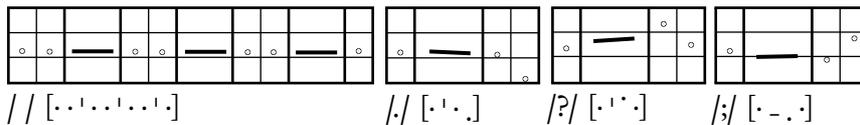


3. *Byzantine Greek* (Hellenic, 1E) only had the five short vowels typical of present-day Greek. It preserved three xenophonemes and presented some palatalized consonant taxophones.

After nasals, diphonic consonants were already voiced /N<sub>2</sub>C/ [N<sub>2</sub>C], with [n≡C]. Consonant gemination had been lost, and αυ, ευ were already as they are in present-day Greek, ie sequences of /VC/ [Vf, Vv].



m	[m]	[n]	n	[ɲ]	[ŋ]
p (b)		t (d)		[ç j]	k (g)
	f v	θ s	ð z	[ç̣ j̣]	x γ
		[l]	r-l	[ʃ]	





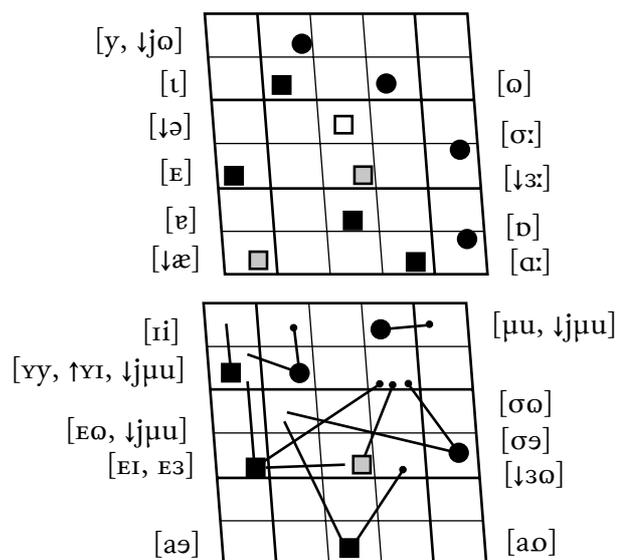
5. *English 'Academic' Greek* (Hellenic, IE) is the most possible far away 'reality', in comparison with all other phonopses given in this paper, it is rather more complicated. All that, in spite of being a simplified version, ie with fewer taxophones than actually used in scientific and medical usages nowadays in English.

The first vocogram shows the 'monophthongs' (including some less favorable diphthongal variants given in the second vocogram): υ [y, ↓jω], ι [ɪ], ε [E], α [e, ↓æ], ᾱ [α, ↓EI], ο [ɒ], ω [σ:, ↓ɜ:]. Furthermore, ↓[ə, ɜ:] are also included for frequent use in unstressed and stressed syllables, in accordance with typical British English practice.

The second vocogram gives the typical diphthongal realizations: αι [aə, ↓aə(jV)], αυ [aɔ, ↓aɔ(wV)] (including ᾱυ), ει [EI, ↓EI(jV)], ευ [Eɔ, ↓Eɔ(jV)], ↓↓jμυ (including ηυ), οι [σə, ↓σə(jV)], ου [μυ], η [E, ↑Eɜ], ῑ [ii], ῡ [yy, ↓jμυ], υι [yy, ↑yɪ, ↓yy(jV), ↓jμυ(jV)], ωυ [σɔ].

As for the *consonants*, let us notice: τ [t(h)], δ [d], θ [θ], φ [f], ψ [ps, ↓#s], ξ [ks], ζ [z, zd], λ [lV, †C, †#], ρ [r, ↓r], ρ̄ [r, †hr, ↓(h)r], and homorganic ν [n≡C] followed by a consonant, [n; m, m̄, n, ↓n, ŋ, η]; σ [s] (but: σμ [zm], σβ [zb], σδ [zd], σγ [zg]).

Geminates are rendered as [C] (or, possibly, as [†CC]). A phonic zero corresponds to 'rough breathing' (´), but some people may choose to insert /h/ [†h, h̄].



m	[m̄]	[n]	n	↓[ŋ]	[ŋ]	[ŋ]	
p b		[t d]	† d	↓[t d]	[k g]	k g	[ʔ]
	f	θ				x	
		s z			↓[ɹ]	j	w h [h̄]
			r				
		[†]	l [†]				

