Vocables for learning the Aristides scales

An experimental composition with diagrams & commentary by Barnaby Brown

for anyone interested in gaining a practical understanding of the elite musical culture of Classical Greece, particularly fifth-century tragedy

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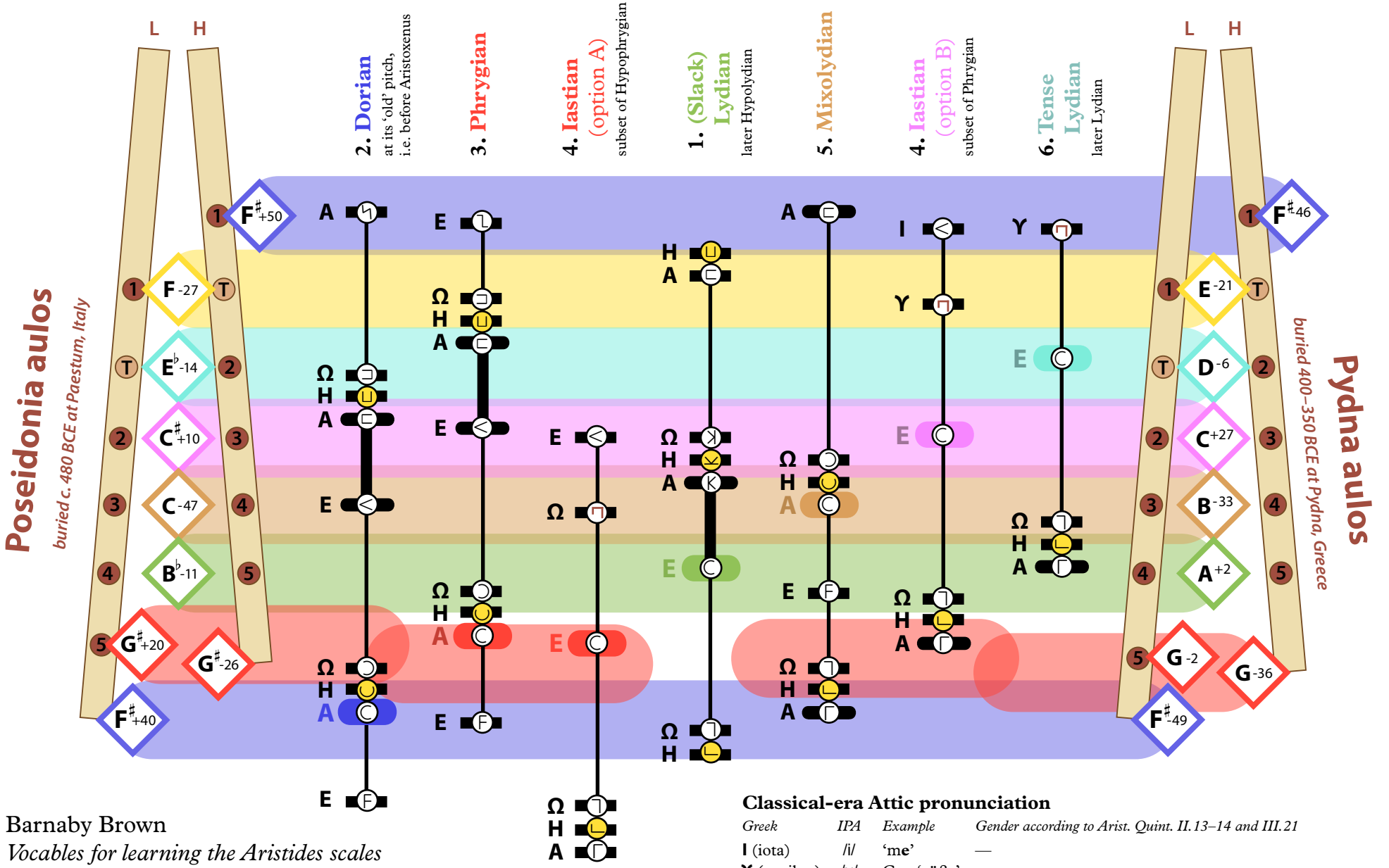
The Aristides scales with possible solmisation vowels, ordered with notation symbol ⊂ on ascending fingerings

The vowels and pitch relations between scales are a hypothesis for the practice of auletes in the fifth century BCE. Other solutions are possible and past realities were plural and evolving. The scholarly edition of these scales is Winnington-Ingram 1963, pp. 19–20.



Barnaby Brown

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Diagram 1

Version 1.1 (20 June 2018) | DOI: 10.6084/m9.figshare.7034489
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Classical-era Attic pronunciation

Greek	*IPA*	*Example*	*Gender according to Arist. Quint. II.13–14 and III.21*
Ι (iota)	/i/	'**me**'	—
Υ (upsilon)	/y/	Ger. '**süße**'	—
Ε (epsilon)	/e/	'**m**e**n**'	*female with a slight tinge of the male*
Ω (omega)	/ɔ/	'**m**o**re**'	*active and manly*
Η (eta)	/ɛ/	'**ma**y'	*liquid, in general emotional and of a female character*
Α (alpha)	/a/	'**m**a**n**'	*mostly male; male in contrast to eta, female in affinity with eta*

Introducing the 7-tone circle of fifths

A classroom excercise demonstrating how Classical-era auloi work and how the 7-tone system suggested by their hole boring differs from the 12-tone system of Aristoxenus and staff notation. Composed in Athens, 22 June 2018

Archaeological finds of auloi played in the fifth-century BCE divide the octave into seven roughly equal steps. This suggests that the pitch relations between Dorian, Phrygian and Lydian in aulos-based music – and between the Aristides scales – involved a single interval category, smaller than a tone, larger than a semitone. In practice, tone sizes would vary and intervals would be lipped into tune (see the Commentary in Volume 2, *Descending Equi-heptatonic Circuits*). In this score, the written pitch roughly corresponds to the Pydna aulos. The Poseidonia sounds about a semitone higher, the Elgin about a tone lower.

The musical meaning of the terms Aeolian, Lydian, etc. changed over time. The usage here and the approach to modulation are hypotheses for that of innovative auletes like Lasus of Hermione in Athens in the late sixth century BCE. Each term is attached to an enharmonic tetrachord bounded by the notes *hypatē* and *mesē*. The Descending cycle takes the *synemmenon* (conjunct) route and the pitch creeps sharper: the C in bar 5 equals the C♯ in bar 6. The Ascending cycle takes the *diezeugmenon* (disjunct) route and the pitch gradually sinks: the C♯ in bar 13 equals the C in bar 14. A pitch creep of 14 cents per bar is surprisingly easy; the thing to practise is landing back at the pitch you started (E). To approach the pronunciation of Classical-era Attic Greek, try substituting the English words 'Dan day door den' (Descending) or 'den door day Dan' (Ascending).

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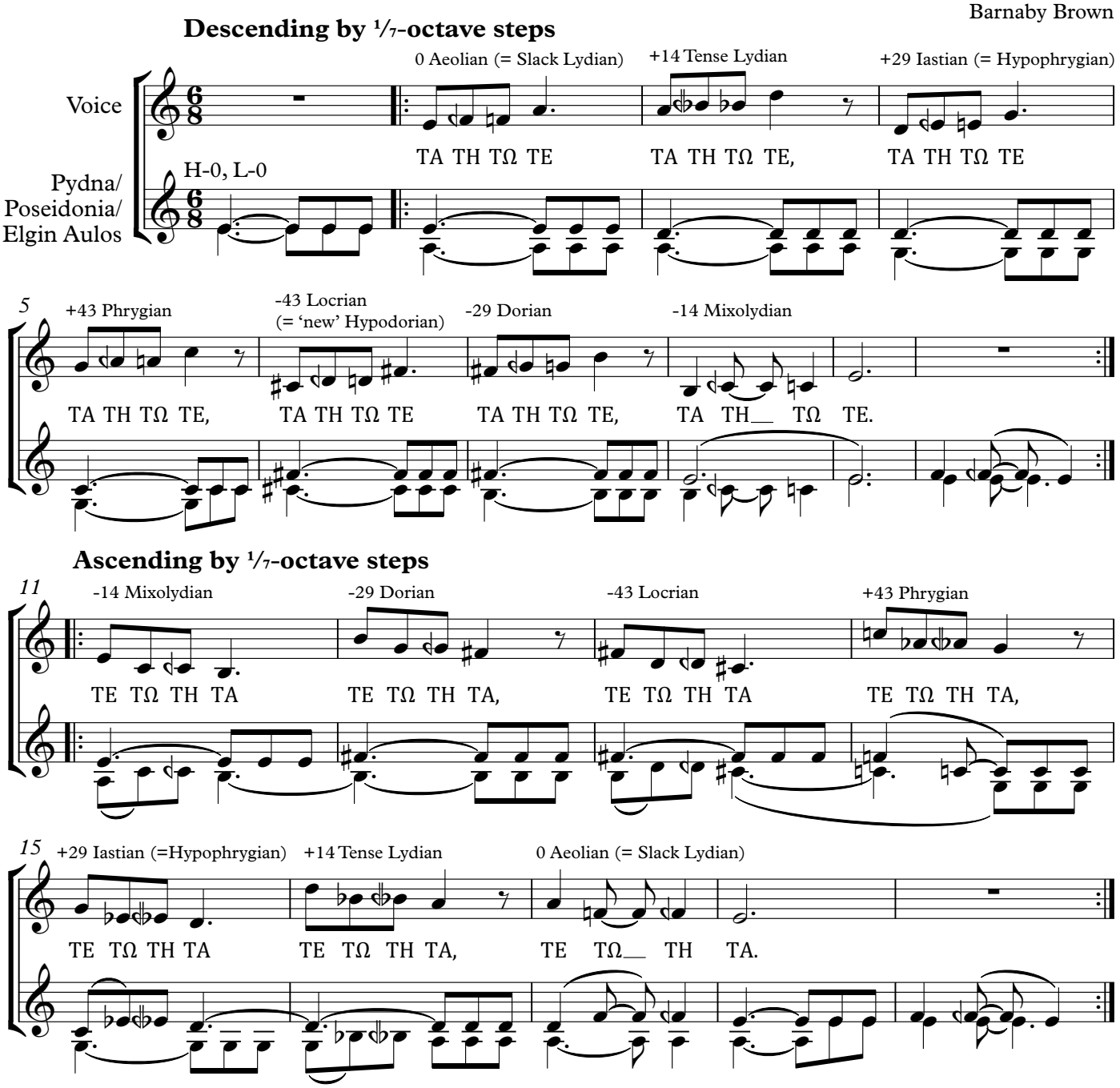

Dedicated to Emiliano Li Castro and the organisers and participants of the 1st Euterpe doublepipe school

Vocables for learning the Aristides scales

Composed in Cambridge and Athens, 27 May – 24 June 2018

These six melodies draw their rhythm and structure from Pindar's 12th Pythian Ode, composed to celebrate the victory of Midas of Acragas in the panhellenic aulos-playing competition of 490 BCE. This metrical solution is different from the one published in Volume 4 of this series: rather than changing time signature between 3/2 and 7/8, it allows for the syncopation of word rhythms against a stable 7/4 cycle. The pitch shifts in cents (+29, +14, etc.) show the discrepancy between equidistant 12-tone and equidistant 7-tone divisions of the octave (see the *Warm-up* above and *Commentary* below). A 7-tone system is auletic, rather than kitharodic, because the notes require breadth. To produce pure consonances between pipes, the aulete bends pitches slightly and these adjustments are different in each *harmonia*. Fixed-pitch instruments are excluded from this versatile tone-system, but singers' notes are as flexible as those of auletes. The breadth required is only about 14 cents and singers should simply tune to the aulos.

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Phrygian +29

TA - NE TA - PΩ-NE TA - PΩ - H TA TE TA - PΩ-NE TA - PΩ - H TA,

3

TA - PΩ - NE TA - PΩ - H TA TE TH - PΩ - NA TE - PΩ - H TA, TE

4

TΩ - H - PΩ TE - PΩ - NH TA TE TA - PΩ - NA___ TE TΩ - H - PΩ,___

5

TA - PΩ - NE TA - PΩ - H TA TE TH - PΩ - NA TE - PΩ - H TA, TE

6

TΩ - H - PΩ TE - PΩ - NH TA TA TE - PA - NE___ TA TA - PΩ - NA___ TE

7

TΩ - H - PΩ TE - PΩ - NH TA TE TA - PΩ - NA___ TE TΩ - H - PΩ,___

8

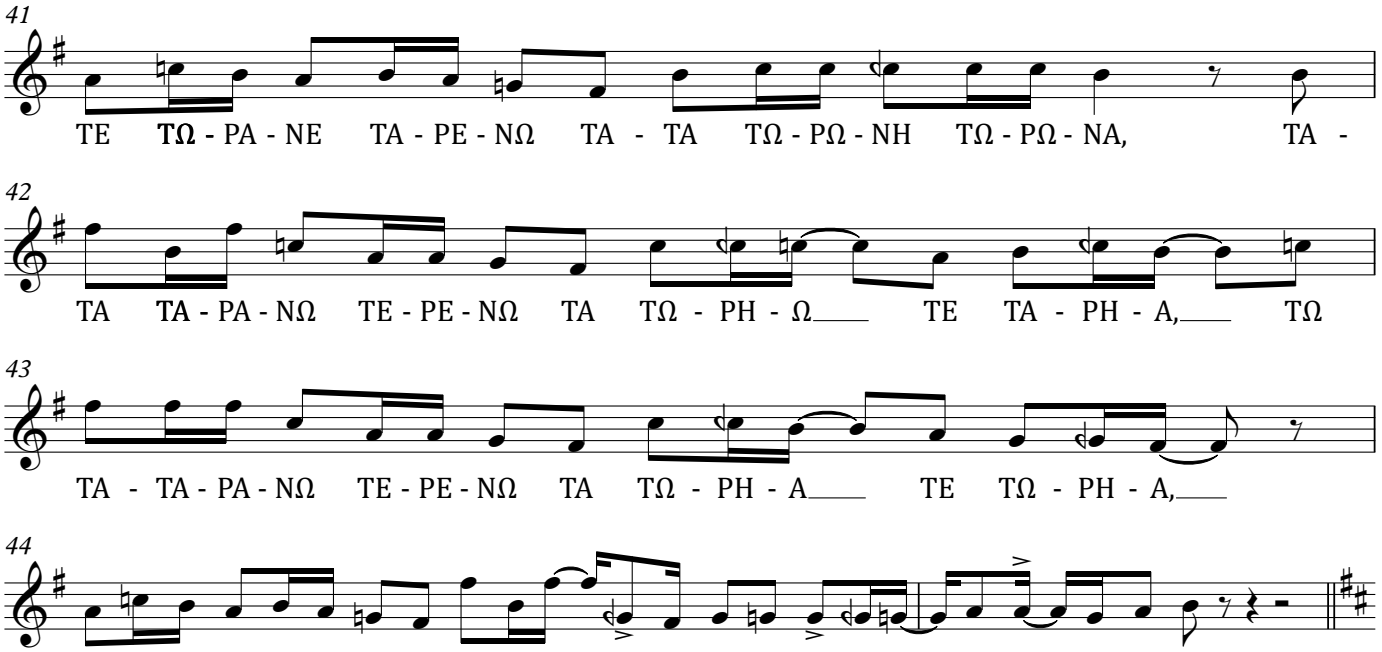
TA-PΩ-NE TA-PΩ - H TA TE TA - H - Ω_TE-PΩ-NA TΩ TA-PE-NΩ___ TE TΩ - PA-NE TA.

10 **Iastian (option A)** +14

TE - PΩ - NA TE - PΩ - ΛH TE - PΩ - NA TΩ - ΛH TΩ - PE - ΛΩ TE - PΩ - NA,

12
TA TE - PΩ - NH TE - PΩ - NA TΩ - ΛH TΩ - PE - ΛΩ TΩ - PΩ - NA, TE -
13
NE TΩ - PE - NE TE - PE - NE TΩ TH - PΩ - ΛE TH TΩ - PE - ΛΩ,
14
TA TE - PΩ - NH TE - PΩ - NA TΩ - ΛH TΩ - PE - ΛΩ TΩ - PΩ - HA, TE -
15
NE TΩ - PE - NE TE - PE - NE TΩ TE - PE - NE TΩ TΩ - PE - NE,
16
TE TΩ - PE - NE TE - PE - NE TΩ TH - PΩ - ΛE TH TΩ - PE - ΛΩ,
17
TA TE-PΩ-NH TE-PΩ-NA TΩ-TE-PΩ-NΩ, TE-TE-PE TE TΩ-TΩ-PΩ TΩ TA - TH-PA TE.
19 Tense Lydian 0
TΩ - NE TE TΩ-NΩ-ΛE TΩ-NH-ΛA NE - TE TΩ-NH-ΛA TH-NΩ-ΛE,
21
TE TΩ - NΩ - ΛE TΩ - NH - ΛA NE - TE TΩ - NH - ΛA TH - NΩ - ΛE, NE -
22
ΛE TY - NY - ΛE TΩ - NH - ΛA NY TY - PE - ΛΩ NE TE - PΩ - ΛA,
23
TE TΩ - NΩ - ΛE TΩ - NH - ΛA NE - TE TΩ - NH - ΛA TH - NΩ - ΛE, NE -
24
ΛE TY - NY - ΛE TΩ - NH - ΛA NY TY - PE - ΛΩ NΩ TΩ PE - ΛY,
25
NE TY - NY - ΛE TΩ - NH - ΛA NY TY - PE - ΛΩ NE TE - PΩ - ΛA,

26
ΤΕ ΤΩ-ΝΕ-ΛΕ ΤΩ-ΝΗ-ΛΑ ΝΥ-ΤΥ-ΡΕ-ΛΥ_ ΤΩ-ΝΥ-ΛΕ-ΤΕ ΤΗ-ΝΥ-ΛΕ - ΤΕ ΤΑ - ΝΥ-ΛΕ-ΤΕ.
28
(Slack) Lydian -14
ΤΕ - Α ΤΕ ΤΩ - ΡΑ - ΛΕ ΤΑ - ΡΕ - ΛΩ - Η - Ω ΤΩ - ΡΗ - ΛΩ ΤΩ - ΡΑ - ΛΕ,
30
ΤΕ ΤΩ - ΡΑ - ΛΕ ΤΑ - ΡΕ - ΛΩ - Η - Ω ΤΩ - ΡΗ - ΛΩ ΤΑ - ΡΕ - ΛΑ, ΤΩ -
31
ΝΗ ΤΑ - ΡΕ - ΛΑ ΤΕ - ΡΩ - ΛΕ ΤΩ ΤΗ - ΡΩ - ΛΕ___ ΤΩ ΤΗ - ΡΩ - ΛΑ,___
32
ΤΕ ΤΩ - ΡΑ - ΛΕ ΤΑ - ΡΕ - ΛΩ - Η - Ω ΤΩ - ΡΗ - ΛΩ ΤΑ - ΡΕ - ΛΑ, ΤΩ -
33
ΝΗ - ΤΑ - ΡΕ - ΛΑ ΤΕ - ΡΩ - ΛΕ ΤΩ ΤΗ - ΡΩ - ΛΕ___ ΤΑ ΤΕ - ΡΑ - ΛΗ___ ΤΩ -
34
ΝΗ - ΤΑ - ΡΕ - ΛΑ ΤΕ - ΡΩ - ΛΕ ΤΩ ΤΗ - ΡΩ - ΛΕ___ ΤΩ ΤΗ - ΡΩ - ΛΑ,___
35
ΤΕ ΤΩ-ΡΑ-ΛΕ ΤΑ-ΡΕ-ΛΩ - Η ΤΗ-ΡΑ-ΛΗ_ ΤΑ-ΡΩ-ΛΑ ΤΑ ΤΩ-ΡΕ-ΛΩ___ ΤΩ ΤΑ - ΡΕ-ΛΗ ΤΕ.
37
Mixolydian -29
ΤΩ - ΡΑ ΝΕ ΤΩ - ΡΑ - ΝΕ ΤΑ - ΡΕ - ΝΩ ΤΑ - ΤΑ ΤΩ - ΡΩ - ΝΗ ΤΩ - ΡΩ - ΝΑ,
39
ΤΕ ΤΩ - ΡΑ - ΝΕ ΤΑ - ΡΕ - ΝΩ ΤΑ - ΤΑ ΤΩ - ΡΩ - ΝΗ ΤΩ - ΡΩ - ΝΑ, ΤΑ -
40
ΤΑ ΤΑ - ΡΑ - ΝΩ ΤΕ - ΡΕ - ΝΩ ΤΑ ΤΩ - ΡΗ - Α___ ΤΕ ΤΩ - ΡΗ - Α,___


41
TE ΤΩ - PA - NE TA - PE - NΩ TA - TA ΤΩ - PΩ - NH ΤΩ - PΩ - NA, TA -
42
TA TA - PA - NΩ TE - PE - NΩ TA ΤΩ - PH - Ω TE TA - PH - A, ΤΩ
43
TA - TA - PA - NΩ TE - PE - NΩ TA ΤΩ - PH - A TE ΤΩ - PH - A,
44
TE ΤΩ-PA-NE TA-PE-NΩ TA-TA-PA-NA_ TH-PA-NH ΤΩ ΤΩ-PH-NΩ_ TE TE - PΩ-NE TA.

Dorian -43

46
TA - NΩ TAN TE - PΩ - ΛE ΤΩ - PH - A TE TAN - TA - PA - ΛΩ TA - PE - ΛΩ,
48
TAN - TE - PΩ - ΛE ΤΩ - PH - A TE TAN - TA - PA - ΛΩ TA - PE - ΛA, TAN
49
ΤΩ - NA - PE - ΛA TE - PΩ - ΛE TA NH - PΩ - ΛE TA NH - PΩ - ΛA,
50
TAN - TE - PΩ - ΛE ΤΩ - PH - A TE TAN - TA - PA - ΛΩ TA - PE - ΛA, TAN
51
ΤΩ - NA - PE - ΛA TE - PΩ - ΛE TE NA - PH - Ω TE NA - PH - Ω, TAN
52
ΤΩ - NA - PE - ΛA TE - PΩ - ΛE TA NH - PΩ - ΛE TA NH - PΩ - ΛA,
53
TAN-TE-PΩ-ΛE ΤΩ-PH-A TE NA-PH-Ω_TAN-TE-PA ΤΩ TAN-TE-PA TE ΤΩN-TE-PE TA.

Commentary

This commentary is aimed at an inter-disciplinary audience including singers, aulos learners, composers, music directors, Classicists and musicologists. These groups have different needs and very different levels of understanding in each other's fields; I beg the reader's patience with my attempts to accommodate such a diverse audience.

All preconceptions regarding the musical meaning of the terms 'Dorian', 'Phrygian', etc. must be discarded: their usage here is a hypothesis for that of aulos players c. 500 BCE. At every stage in history, these terms have acquired new meanings. For an overview of the evolving usage in antiquity, see Volume 2, Diagram 2.

ARISTIDES QUINTILIANUS describes six ancient scales in his only surviving work, *De Musica,* probably written in the third century CE. He tells us that they were 'used for the *harmoniai* by people of distant antiquity' and that 'it is these that the divine Plato mentions in the *Republic* (Aristid. Quint. I.9, p. 18–20; *GMW* ii, pp. 419–20). Plato wrote his *Republic* sometime around 380 BCE, six centuries before Aristides wrote his treatise. The names of the scales are Lydian, Dorian, Phrygian, Iastian, Mixolydian and Syntonolydian ('tense Lydian'). Iastian and Ionian are used interchangeably by Classical writers. Neither Plato nor Aristides mention a Locrian or Aeolian *harmonia*.

In his 2009 book, *Ancient Greek Music: A New Technical History*, Stefan Hagel describes these scales as 'the most archaic tonal systems for which we have reasonably reliable information' (p. 370), concluding that 'little argues against the acceptance of the Aristides scales as genuine fifth-century evidence' (p. 391). Hagel accepts Andrew Barker's hypothesis that 'Their source is probably a lost work of Aristoxenus, rather than a commentary on Plato's *Republic*' (Hagel 2009, p. 18). Barker suggests that Aristoxenus acquired his information on the scales from the diagrams of *harmonikoi* – harmonic theorists who dealt exclusively with enharmonic scale structures (Barker 2007, pp. 10, 40 and 45–8). The diagrams Aristoxenus had access to would have been developed during the lifetimes of Plato and Aristotle (428–322 BCE). For more on the diagrams of these shadowy *harmonikoi*, see Hagel 2009, pp. 373–8; Barker 2007, pp. 40–3; and *GMW ii*, pp. 124–31 and 145.

The reason the *harmonikoi* focused on enharmonic interval structures is that these carried the greatest respect and prestige. All six of the Aristides scales are enharmonic because they contain *pykna*, or 'clusters' of quartertones. They do not belong to ordinary music making but to the high-status tradition of a musical elite. The following fragment is believed to have been written in the region of 380 BCE:

> *For who does not know that the Aetolians and the Dolopes and all the [...], who use diatonic music, are much braver than tragedy-singers, who always follow the practice of singing in the enharmonic?*
>
> *P. Hib.* I.13–22; Barker 2007, pp. 69–70

Tragedy was not the only musical environment in which the enharmonic style flourished, but it was probably the leading one. The fact that tragedy singers were exclusively accompanied by the aulos helps us to interpret the pitch relations between the Aristides scales: they probably belong to an auletic tonal system, not a kitharodic one.

Aristides presents the scales in two forms – first as interval lists, then 'for the sake of clarity' in a diagram. The choice of notation symbols in his diagram is puzzling. Hagel shares the suspicions of previous scholars that the symbols were added later, 'possibly even by Aristides himself', but a compelling solution to the riddle has proved elusive. Why are they notated in this particular manner? Hagel's major advance is to propose pitch relations between five of the

scales. He stops short of fitting Iastian into a cosmopolitan fifth-century tone-system, regarding it as an exotic outsider that was only assimilated into panhellenic musical culture in the fourth century (2009, pp. 33–6 and 390–6).

Diagram 3 orders the six scales so that the notation symbol ⊂ falls on ascending aulos fingerings. This submits for distributed testing a new hypothesis: that the symbol ⊂ indicates the focal tone – a melodic centre of gravity or the principle drone on the other aulos pipe. A rationale for Aristides' order has not been detected. This hypothesis does not completely solve the riddle, but may help others to do so. Aristides follows the convention in Roman-era handbooks of pairing vocal and instrumental symbols; Diagram 3 only shows the older instrumental symbols, which Hagel suggests were invented not long after 500 BCE (pp. 443–5). Originally, and in many contexts well into late antiquity, these symbols did not indicate absolute pitch but were functional in meaning, like 'Do' in movable-Do solfège.

Aims

The purpose of this compositional experiment is to give performers a practical and rewarding means of internalising all six scales. In the first instance, this serves embouchure training, so that aulos learners have in mind the intonation to aim for prior to practising the scales on the instrument. Ultimately, however, the point of internalising the Aristides scales is to become more skilful and fluent using them to compose and improvise new music. With the aulos revival gathering pace and interest in the performance of Classical-era texts accompanied by period instruments growing, the time is ripe to make the enharmonic tonal system which these scales represent more accessible to composers. In addition to becoming familiar with the scales individually, this means understanding how to modulate from one to another. This is necessarily experimental – some of the pitch relations are provisional because they involve scholarly guesswork.

Internalising the tonal system of fifth-century tragedy is best done vocally for the following reasons: regardless of era or culture, singing appears to be the most successful approach to learning high-status musical traditions; absorbing the system vocally saves a composer from having to learn to play the aulos, an instrument that demands years of training; large numbers can participate (community choirs and classrooms of students); but perhaps most importantly, the voice is pitch-flexible, like the aulos. These scales open a doorway to a highly refined culture of tuning and hearing intervals, a world of dramatic modulation that is exclusively auletic. If one respects the finger-hole boring of Classical auloi and accepts the scholarly consensus that the scalar divisions of Plato's friend Archytas (with pure fifths, fourths and thirds) are an accurate reflection of musical practice (*GMW ii*, pp. 47–52), then this tonal system is incompatible with that of any fixed-pitch instrument. The pitch of every note needs to be actively fine-tuned in the course of performance because the octave is divided differently: seven functionally-equidistant tones instead of twelve.

The 7-tone circle of fifths

In Volume 2, I suggested that the functionally-equidistant 7-tone tuning of xylophones in mainland Southeast Asia and West Africa was what fifth-century auletes were aiming for in their pitch relations between *harmoniai*. The Aristides scales evidently belong to the enharmonic musical culture of tragedy singers, who were exclusively accompanied by auloi. For singers, as for auletes, bending a note by 14 cents is not just easy but difficult to avoid. I was surprised to discover that singing all the way round a 7-tone circle of fifths led by a Pydna aulos is no more difficult than singing round a 12-tone circle of fifths led by a piano. All it requires is faith: a switch of allegiance from the keyboard to the aulos. 7-tone music is no big deal, as the classroom exercise on page 2 hopefully demonstrates. There are just a couple of things to be aware of. First, staff notation was not designed for a 7-tone grid in which

keys are separated by multiples of (on average) 171 cents. The pitch offsets make it look more scary on the page than it is in practice. Secondly, rehearsals must be led by an instrument that divides the octave into seven roughly equal steps, ideally a pitch-flexible one like the aulos that can bend notes into tune.

On the traditional lyres of the Classical era, we know that changing *harmonia* meant retuning. The fact that the aulos was able to bend any pitch on the fly made it a 'panharmonic' instrument, able to modulate not only between sections of a piece but in mid-phrase. This opened up a world of chromaticism and tonal theatricality that was inaccessible to the kithara. As a result of the popularity of the colourful auletic solos and exploitation of this instrument's harmonic flexibility by composers of dithyrambs and dramas, it was the aulos that led musical developments for Greek culture as a whole between about 530 and 450 BCE. Kithara players found ways to emulate the crowd-pleasing 'exharmonic' twists of auletes, to the consternation of philosophers like Socrates and Plato. The first symptom of this 'aulisation' of the kithara was an increase in the number of strings, from seven to eleven. In Volume 2, I argue that this increase was followed by a paradigm shift in harmonic theory: the 7-tone grid of aulos-based music, which requires pitch-bending to achieve pure concords, was superseded by the 12-tone grid familiar to musicians today. This is compatible with harps and lyres because pitch bending is not required. According to this historical model, the traditional auletic system was gradually supplanted by the kitharodic system that defined the 'New Music'. This would have happened after the rejection of the aulos by Alcibiades, which can be dated to about 437 BCE (Vickers 2008, pp. 26–7).

As the warm-up exercise on page 3 above demonstrates, both the 7-tone and 12-tone systems supported extensive modulation. For any performance in which the aulos and kithara played simultaneously, a special *kitharistērios* aulos would be necessary because their gridlines do not coincide. If this conjecture is correct, then the incompatible grids collapsed into one: the auletic 7-tone system was displaced the 12-tone kitharodic system. The strongest evidence we have for this conjecture is the finger-hole boring of archaeological finds and Aristoxenus' complaint that Lasus of Hermione and certain followers of Epigonus 'thought that a note has breadth' (see Volume 2, p. 24). In aulos-based music, modulation requires pitch bending and there are seven possible focal tones. In kithara-based music and theoretical conceptions of tonal space, the octave has twelve equidistant divisions, not seven. After the fourth century BCE, most music-making still operated with seven *tonoi*, but the pitch relations between them were no longer equidistant. The chaos this caused in the nomenclature of modes and keys was tidied up by Aristoxenus. The crucial thing to note is that the pitch of the fifth-century Dorian *harmonia* appears to have been mapped to the pitch of the Aristoxenian Lydian *tonos* (see Volume 2, Diagram 2).

A broader goal of this experiment is to submit this historical model for testing and development by a wider community of performers. Through a process of trial and error, perhaps we can edge a little closer towards the sound of high-status Greek music in the Classical era. Distributed testing avoids the problem of confirmation bias that blights experiments conducted by individuals and teams whose members share a similar cultural outlook or disciplinary training.

The pitch of Iastian

In order to achieve the goal of internalising all six scales, a solution for Iastian is necessary. The scholarly consensus is that, before the fourth century, Iastian had not been assimilated into a commensurable tone-system; to play in Iastian, an aulos player would need to put down one instrument and pick up another. For the reasons explained in Volume 2, I consider this unlikely. Classical auloi can play any scale. What limits modal possibilities is not the instrument but the player's training.

For Iastian, we have at least three practical options. In Diagram 3, I propose

two ('option A' and 'option B'). These combine to form a *systēma ametabolon*, or 'Unmodulating System', one aulos scale-step lower than the Unmodulating System that combines 'Slack' (*chalara*) and 'Tense' (*syntono)* Lydian. These Unmodulating Systems are essentially keys a finger-hole apart, with tonal dynamism provided by the contrast between disjunct and conjunct tetrachords (Hagel 2009, pp. 5–6; Barker 2007, pp. 15–16).

The lower position of Iastian (option A) has three points in its favour: first, Plato states that 'The Iastian and some of the Lydian *harmoniai* are called "slack" [*chalarai*]', which could mean a lower pitch, or lower standards of behaviour, or both (*GMW i*, p. 131); secondly, according to Aristides, the tone-system of Aristoxenus had 'two Phrygians, one low, which is also called Iastian, and one high' (*GMW ii*, p. 421); thirdly, Option A fills a gap in the 7-tone circle of fifths (see Experiment 1, Diagram 1). The higher position (option B) has two points in its favour: the practical advantage of fitting within the low-register range of the Poseidonia and Pydna auloi; and the fact that the notation symbol C – the only symbol occurring in all six scales – falls on a different fingering in each *harmonia*.

Option A is selected for this compositional experiment because option B is a subset of Phrygian and I conjecture that a *hyperteleios* aulos (at least after Pronomus) would have had the notes below the range of the two finds illustrated in Diagram 1, which I suspect are *teleioi* auloi (see Volume 2, pp. 16–19). Option B, however, potentially offers a rationale for the puzzling choice of notation symbols in Aristides' diagram. This proposal involves stepping back to see a bigger ethnographic picture. To inform interpretations of fragmentary traces of a cultural tradition long dead, experimental archaeologists often take into account traditions that are still alive, or have left a richer body of evidence, doing so with caution and in a controlled way. Making sense of the notation symbols in Aristides' diagram, two observations on other musical traditions may be relevant. First, the instruments played by elite professionals generally support multiple modes: it is possible to change mode without changing instrument. Secondly, changing mode typically involves settling on a different focal tone, or pair of focal tones; this produces a distinctive pitch hierarchy, which Aristides calls *petteia,* 'distribution' (see below, p. 17). These two observations on classical music traditions that we see more clearly, from the Hebrides to Japan, lead me to suggest three premises: (1) that all six *harmoniai* could be played and were potentially developed on an aulos of the Poseidonia/Pydna type; (2) that each *harmonia* had a different primary focal tone; and (3) that the symbol C was assigned to this focal tone. There are other ways of explaining why C is the only symbol found in every scale, but I find this interpretation more satisfactory because it conveys something of practical importance to the performer: it identifies the 'tonic' that the melody returns to, or that might be sustained on the other pipe at the start and end of a piece. It is consistent with Barker's supposition that the ultimate source for these scales is one of the diagrams produced by the *harmonikoi* (Barker 2007, p. 48). As Aristoxenus mentions the diagrams of his predecessors three times, there is no reason to believe that the notation symbols were added later (*El. Harm.* 2.15, 7.32, 28.1; *GMW ii,* pp. 127, 131, 145).

Rhythm & structure

I have composed one melody for each scale using an identical rhythm for each melody. Reducing the number of variables in this way will I hope elicit a better understanding of the relationship between scalar structure and *ethos*, or melodic 'character'. The rhythm is that of a strophe from Pindar's 12th Pythian Ode, composed to celebrate the victory of an aulos player in the panhellenic games of 490 BCE. It is an experimental interpretation of the metrical pattern that Pindar repeats with unusual regularity in strophes 2–4 (see Volume 4). Each melody respects the internal pattern of repetition in this 16-bar rhythm, disregarding the pitch accents, which vary from strophe to strophe. This rhythmic

pattern may be schematised AABA BBAB′, with a development in the final eighth (B′) that generates a sense of culmination. This geometrical procedure has a parallel in Scottish bagpipe music: an identical pattern was used as a cognitive schema supporting the composition and oral transmission of 165 pibrochs (Brown 2016). The second half of the pattern, BBAB′, is the binary complement of the first, AABA. I have followed the example of pibroch by giving the opposing structural units A and B a different focal tone, one scale-step apart. Harmonic shuttles of this kind find strong support in ancient Greek musical notations as well as in a wide range of living traditions believed to be archaic, such as the pyrrhic dance (*pyrrhichios choros*) of the Pontus region.

Vocables

The vocables in this experiment are based on two Roman-era accounts. The first is found in the same treatise that contains the scales, Aristides' *De Musica*:

> Τοῦ δὴ πρώτου συστήματος, ὅ ἐστι τετράχορδον, ὁ μὲν πρῶτος διὰ τοῦ ε̄ προῄκται φθόγγος, οἱ δὲ λοιποὶ κατὰ τὸ ἑξῆς ἀκολούθως τῇ τάξει τῶν φωνηέντων, ὁ μὲν δεύτερος διὰ τοῦ ᾱ, ὁ δὲ τρίτος διὰ τοῦ η̄, ὁ δὲ τελευταῖος διὰ τοῦ ω̄, εὐπρεπῶς κατὰ τὸ πολὺ τῶν ἤχων δι᾽ ἀμεσότητος ἀλλήλους διαδεχομένων.
>
> *In the primary systēma, which is a tetrachord, the first note is produced through the* Ε [*epsilon*], *the others following the order of the vowels: the second through the* Α [*alpha*], *the third through the* Η [*eta*], *and the last one through the* Ω [*omega*], *which makes sense because due to their substantial resonance they can follow upon each other without any intermission.*
>
> Arist. Quint. II.14, pp. 79.26–80.2 W.-I.
> trans. Hagel (2018, pp. 158–60)

The second is found in a compilation of didactic materials that appears to have come straight out of a music classroom:

> τῶν δεκαπέντε τρόπων οἱ προσλαμβανόμενοι λέγουσι τῳ̄, αἱ ὑπάται τᾱ, αἱ παρυπάται τῃ̄, οἱ διάτονοι τῳ̄, αἱ μέσαι τε, αἱ παράμεσοι τᾱ, αἱ τρίται τῃ̄, αἱ νῆται τᾱ.
>
> *Of the fifteen keys* [tropoi], *the proslambanomenoi say* ΤΩ, *the hypatai* ΤΑ, *the parypatai* ΤΗ, *the diatonoi* ΤΩ, *the mesai* ΤΕ, *the paramesoi* ΤΑ, *the tritai* ΤΗ, *and the netai* ΤΑ.
>
> Bellermann's *Anonymi*, § 77
> trans. Hagel (2018, p. 143)

These accounts agree on two significant points: the ascending order of vowels in a diatonic tetrachord was Α Η Ω Ε; and the close vowels /i y u/ were excluded. The restriction to four vowels can be explained by the ancient conceptualisation of tonal space as a system of tetrachords. This way of thinking is probably rooted in the four-stringed Homeric lyre of the eighth century BCE. But why use a restricted part of the vowel spectrum? The sound /i/ is used extensively in Sardinian and Scottish traditions of vocabelising pipe music (D'Alessandro and Brown; Chambers). Perhaps aulos teachers found that a more homogenous, open set of vowels imitated the sound of their instrument more successfully. As Hagel observes, vowels 'that involve a considerable restriction of the resonating space in the mouth are excluded' (2018, p. 158, n. 58).

Applying this sonorous vowel scheme to the Aristides scales proves both practical and compelling. There are simply three issues to keep in mind. First, both accounts concern the popular diatonic genus, whereas the Aristides scales belong to an elite enharmonic style of music that went out of fashion in the late-fifth century BCE. Secondly, our witnesses disagree on the vowel for the *proslambanomenoi*: according to Aristides they say ΤΕ, but according to Bellerman's *Anonymi* they say ΤΩ. Thirdly, both schemes concern the Dorian *harmonia* expanded to the two-octave structure called the 'Greater Perfect System'. What had been a set of modes with *different* interval structures (the Aristides scales) became a system of keys with the *same* interval structure (that of Dorian).

These three issues mean we will never know how the Aristides scales were

vocabelised. There is value, however, in developing multiple hypotheses. Well-designed experiments can test the historical model to identify weaknesses and provoke new insights. In the emerging discipline of Very Early music, such experiments require performers who are highly-skilled using the tools and techniques of the time, place and activity under investigation. Fluency vocabelising the Aristides scales increases performers' competence in ancient Greek music considerably. Our two Roman-era accounts usefully narrow down what are otherwise infinite options and, as both are to some extent influenced by Classical-era writings, there is a reasonable chance they point us in the right direction.

Pronunciation

Classical-era Attic Greek had seven long vowels. Although pronunciation was diverse and evolving, a vast body of evidence gives historical phonologists confidence that the sounds were /aː eː ɛː iː yː uː ɔː/ (Horrocks 2010, p. xvii; Petrounias 2007, pp. 556–9). Not all of these sounds are used in English, so the pronunciation guide in Diagram 3 gives examples in German for /e/ and /y/. The IPA symbols provide a more reliable reference. At this moment in time (June 2018), the audio resource for learning IPA symbols by Eric Armstrong and Paul Meier is considerably more helpful than the equivalent resource on Wikipedia because each vowel is pronounced on a flat tone, as well as on a glide, by the same speaker. Differences between Roman-era and Classical-era pronunciation need not concern us here because the same four letter shapes are likely to have been transmitted from the fourth century BCE. Like the Aristides scales, the most likely route of transmission appears to be from the historical writings of *harmonikoi* via lost works of Aristoxenus to our two Roman-era witnesses (*GMW i*, p. 221; Barker 2007, p. 48). This hypothesis finds some support in an early fifth-century painting of an Amazon blowing a trumpet. On either side of her appear the vocables TOTH TOTOTE (Pöhlmann and West, pp. 8–9). These vocables predate the Athenian reform of the Greek alphabet (403/2 BCE), when omega was formally adopted, so the only vowel missing is A.

The normal sound of 'T' in ancient Greek is unaspirated. English native speakers aspirate 'T' by default. To practise unaspirated 'T's, hold the back of your hand close to your mouth while saying 'to to to to': you should not feel any little puffs of air. Try something closer to a 'D' but lighter and nimbler with the tongue. It should sound foreign, not English.

Filling the gaps

The Aristides scales contain a total of 45 notes. Vowels can be assigned to 38 of them by assuming that Classical-era musicians used the same vowel system in enharmonic and diatonic melodies, and that this vowel system was transmitted by Aristoxenus to Aristides. On a scale of 1–5, my confidence level that these assumptions are correct scores about 3. They are plausible and the result has practical merits, which for the aims of this experiment set out above is sufficient. Armand D'Angour suggests that the differences in intrinsic vowel pitch make it easier to sing the quartertones accurately and I am inclined to agree (D'Angour 2016, pp. 278–9). Where our witnesses differ, I follow Aristides because his account is the more detailed and appears to have a closer relationship with Classical-era writings.

We can assign a vowel to another note, bringing the total to 39, by treating the central pitches of the Mixolydian *harmonia* E A H Ω as a segment of Dorian, transposed down a tone or up a fourth. This solution is suggested by a passage in the Plutarchian treatise, also called *De Musica*, which states that the Mixolydian was adopted by composers of tragedies and linked 'with the Dorian, since the latter expresses magnificence and dignity, and the former emotion' (1136e–d; *GMW i*, p. 221). This particular combination of *harmoniai* lies at the heart of the Unmodulating System, which became a pillar of Aristoxenan music theory. The approach of applying the vowels E A H Ω to a unique intervallic structure, moveable to any pitch, is consistent with the earliest and most

persistent usage of the ancient notation symbols, which is to convey musical function rather than absolute pitch. This particular molecule also occurs in the Phrygian and Lydian *harmoniai*; using a different set of vowels for it would increase the difficulty for learners, then and now, for no apparent gain. Interpreting it as a molecule that occurs in different *harmoniai* is also consistent with the fifth-century style that permits 'exharmonic' twists inside the strophes of dithyrambs and theatre music, regarded as degenerate and vulgar by aesthetes like Plato (*GMW ii*, p. 218, n. 95, and pp. 236–7).

We can assign vowels to another three notes by applying the principle of octave equivalence. Our witnesses offer some support for this: in Aristides' vowel scheme, epsilon 'stands alone at the beginning both of the first octave [*proslambanomenos*] and of the second, [*mesē*]' (II.13); and in Bellermann's *Anonymi*, both the *hypatai* and the *netai* (an octave higher) say 'TA'.

For the last three notes, at the top of the Iastian and Tense Lydian *harmoniai*, confidence levels drop to 1 on our scale of 1–5. We are in the dark. In the other four scales, there is a musical logic and a cognitive advantage to fixing a vowel sequence to a tonal molecule that floats to any pitch, but with Iastian and Tense Lydian this approach fails because their interval structures have no internal repetition. Iastian spans a minor seventh with seven pitches, Tense Lydian a minor sixth with six. Given that there are so few pitches, the case for assigning a different vowel to each one is strong. For this experiment, I introduce the close vowels I and Y on the basis that habits of vocabelising were diverse and evolving; that fifth-century conceptions of tonal space were not exclusively tetrachordal; and that these *harmoniai* had not been assimilated to the Dorian interval structure. Although these assumptions are relatively safe, other solutions are equally possible and should be tried in future experiments.

Consonants

The vocabelising in recent centuries of master pipers in India, Sardinia and Scotland gives us reason to suspect that the vocables of a teacher like Pronomus two-and-a-half thousand years ago would have employed more than one consonant. The use of 'T' is testified by three ancient witnesses: the painter of the trumpet-playing Amazon, Aristides and the author of Bellermann's *Anonymi*. The use of 'N' is supported by the phonology of Classical-era Attic-Ionic, which introduces it at the end of some words that would normally end in a vowel in order to prevent two vowels in a row; 'N' is also the most prominent consonant in the vocabelising of Scottish pibroch, known as *canntaireachd*. Ethnographic studies of elite piping traditions suggest that more than two consonants are likely to have been used to convey shades of stress and subtleties of articulation. This experiment therefore expands the set for which ancient evidence is strong ('T' and 'N') by adding 'R' and 'L'. The Sardinian launeddas master Luigi Lai uses this set of four consonants extensively in his vocabelising, with 'D' and 'P' used less frequently (D'Alessandro and Brown 2011).

A quality of vocabelising that is easier to appreciate in sound recordings than in written documents is its expressive variability. This is a sensitivity to musical and phonological considerations that pulls the practitioner away from rigid consistency. This variability is often unconscious and causes irritation to students and systematising editors, who are prone to eradicate ambiguity. Having different ways to express the same thing, however, makes vocabelising a more complex, human activity, which may be central to its global success in learning and teaching. In the four traditions that I am best acquainted with (Japanese taiko, Indian tabla, Sardinian launeddas and Scottish pibroch), vocables are highly nuanced, adding a layer of musical expression that makes it easier for students to grasp the inner sense of the notes. In order to convey a deeper meaning that awakens

interpretative insight, non-lexical vocables become like words and phrases. The idiom I have begun to develop here is merely a starting point for refinement by historical phonologists, singers and aulos learners in the years ahead.

Testing & development

Testing all the ways something may have been done is one of the tenets of experimental archaeology. This is where the emerging discipline of Very Early music, partly incubated by the European Music Archaeology Project, stands to make a significant contribution. Very Early music experiments provide a way of identifying weaknesses in interpretations that are developed in single-culture, single-discipline environments. Stronger results emerge when practitioners are involved in a collaborative research process in which the academics are learning as much as the performers. This is especially valuable when evidence is sparse and theories may unwittingly reflect inappropriate cultural conditioning or suffer from low levels of expertise outside the academics' areas of specialism. Philologists, archaeologists and musicologists need specialist performers, composers and instrument makers just as much as the makers of Very Early music need the detectives who assemble and interpret evidence.

It troubles me deeply that the vocables, pitch relations between scales, and rhythmic interpretation of Pindar's words published here might become establishment thinking. They are experimental hypotheses distributed for rigorous testing in which interdisciplinary and intercultural collaboration is key. How well do they serve the aims articulated above? To summarise, these aims are to internalise a tone-system contemporary with Pythagoras, Socrates and Plato, prior to improvising and composing, creating new music fluently; and to bring into focus the weaknesses or strengths of the hypotheses set out above. On the basis of the reproductions I currently possess (Poseidonia, Pydna and Elgin auloi), dividing the octave into seven functionally-equal steps makes better sense of our Classical-era evidence than any other solution, either reconstructed from the Aristides scales or currently in use around the world – but this is controversial and is submitted for distributed testing and development.

Everyone who uses these materials, especially those who are moved to make them better, is invited to provide feedback and share their revisions via the 'Updates & discussion' page, doublepipes.info/vocables-for-the-Aristides-scales. Every aspect of this experiment is published with the Creative Commons license CC-BY 4.0 so that it is easier for others to make changes and share something more compelling, either as historical hypothesis or contemporary music. Both endeavours are valuable. In fact, they are co-dependent – two sides of one coin. To guard against wishful thinking, it is vital to keep words like 'experiment', 'hypothesis', 'contemporary' and 'new' in the forefront of our minds. How music sounded before the age of audio recording is out of reach. Developing a stronger connection with history, however, is healthy and experiments of this nature are invigorating for all, specialists and general public alike.

Tuning the soul

The Aristides scales belong to a cultural environment alien to most people today. The following excerpts illuminate, and perhaps elaborate in Aristides' own way, the therapeutic and educational roles attached to them by Plato and his successor Aristotle. Both philosophers regarded these *harmoniai* as powerful tools for treating human suffering and elevating citizens' morality. The words of Aristides speak for themselves – I have simply added a few clarifications and cross references in square brackets. The translation is by Andrew Barker.

Aristides Quintilianus
De Musica (c. third century CE)
Book I

Chapter 6 … *the characters that flow upon the higher notes are different from those that flow upon the lower notes, and those that flow upon the* parypatoeideis *are different from those that flow upon the* likhanoeideis.

The *likhanoeideis (likhanoi)* are the notes that say 'ΤΩ' in the lower part of each scale (see Diagram 1). A quartertone higher are the *parypatoeideis (parypatai)*, which say 'ΤΗ'. *Parypatē* literally means 'next to *hypatē*', the 'principal' note, which is missing in the Slack Lydian scale, the primary focal tone of which is its *mesē*, 'ΤΕ'. The diatonic inflection of *likhanos*, a tone higher, was called *diatonos*.

Book II

Chapter 6 … *no other activity has so great a capacity both for establishing a community and for sustaining it once it is established. When a constitution has already begun to incline in one direction or the other, the other activities* [*depraved or disciplined*] *follow in is wake: but music directs all such changes. Of all branches of learning it is first in order and in power, and with its melodies it moulds the will of each man in suitable ways from his earliest youth.*

… from fine song emerge good words, characters and habits, noble impulses and most excellent deeds. Thus it was that in the earliest times, when political institutions were nowhere firmly established, the cultivation of music in association with virtue corrected civil discord and put an end to hostilities with neighbouring cities and races.

Chapter 12 … *Our account of* harmonia *must begin from the smallest elements, which are called 'notes'* [phthongoi]. *Notes, too, differ from one another in the way which we defined at the outset as a difference of character* [at *I.6 above*]. *Some of them are hard and male, others relaxed and female. Others again lie between them, and are mixtures of both, but belong to a greater or lesser degree to one class or the other …*

Chapter 13 *Since the character of a melody, both in song and in instrumental pieces, is grasped through its similarity to the sounds produced by our vocal organs, I have made a selection of the letters that are suitable for use in vocalising melodies.* [*Note Aristides' use of the first person.*]

… alpha [Α] *displays both affinity and contrast with eta* [Η]*: so far as it is adopted for a use opposite to that of the latter it is male, while so far as it produces a similar signification it is female. This is shown by the contrasting dialects, Doric and Ionic, whose differences correspond to the opposing characters of the two races* [*an opposition embedded in the names of the Dorian and Iastian* harmoniai *– see* GMW i, *pp. 281–3*]. *Doric avoids the female quality of the eta, and in practice generally converts it into a male alpha, while Ionic shrinks from the hardness of the alpha and settles on the eta. The epsilon* [Ε] *is female for the most part… but because when it is prolonged it produces a sound similar to the diphthong written* ΑΙ, *it acquires through the alpha a very small trace of the male.*

Chapter 14 *Four of the vowels, those that are readily prolonged by the singing voice, turned out to be useful for representing the notes.* [*Note his use of the past tense here, in contrast to the first person above.*] *Since a consonant had to be added to them, to avoid the hiatus which would be produced by a sound consisting of vowels alone, we adopt tau* [Τ], *the most attractive of the consonants …*

Given this starting point, the notes sung to the letter eta [Η] *are liquid, and in general emotional and of a female character. Those sung to the omega* [Ω] *are active and manly: and of the intermediates* [*i.e. mixed-gender notes*] *those sung to the alpha* [Α] *have more maleness, those sung to the espilon* [Ε] *more femaleness …*

In the primary systēma, *which is a tetrachord, the first note is sung to the letter epsilon* [Ε], *while the remainder follow the order of the vowels. Thus the second note is sung to alpha* [Α], *the third to eta* [Η], *and the last to omega* [Ω] *…*

The note attached to epsilon [Ε], *which stands alone at the beginning both of the first octave* [proslambanomenos] *and of the second, gives us* mesē *on the basis of the octave-unison it makes with* proslambanomenos. *We shall explain later why this is so [at III.21 below].*

Now systēmata *derive their qualities either from the notes between which they lie, or from those occurring most often, or from those which are predominant in both of these respects, or from two different groups, each having one of these features, and exerting their influence jointly as a mixture; and from* systēmata *arise the* harmoniai. *If you use harmoniai in the ways we have explained, applying them to each soul on the basis either of their similarity or of their opposition to it, you will disclose the bad character that lurks*

within it, and cure it, and replace it with a better… If it is obscure and hard to diagnose, you should begin by applying whatever melody comes to hand. If this is effective in influencing the soul, you should persist with it, but if the patient remains unaltered you should introduce a modulation; for it is likely that someone who is resistant to one sort of melody will be attracted by its opposite.

The harmoniai, *as I was saying, resemble either the intervals which are commonest in them, or the notes that bound them: and the notes in turn resemble the movements and emotions of the soul. The fact that it is through similarity that the notes – even the notes of a continuous melody – both instil a character previously absent, in children and in older people too, and draw out a character that lay hidden within, was demonstrated by the followers of Damon. Certainly, in the* harmoniai *which he handed down* [N.B. *the attribution to Damon may derive from the historical works of the* harmonikoi *(Barker 2007, pp. 47–8)*], *we can see that of the movable notes it is sometimes the female and sometimes the male that are in the majority, or else are used less or not at all. The reason is clearly that the usefulness of a* harmonia [*as a treatment for the citizen stirred up by emotions*] *depends on the character of each individual soul. Hence the most important part of melodic composition is that known as 'distribution'* [petteia], *which consist in the selection of the notes most appropriate on each occasion.*

Book III

Chapter 21 … *the globe of the Moon, which is diffuse and damp, and especially responsible for all bodily generation, emits the note that is sung to the letter epsilon* [E], *which is female with a slight tinge of the male.*

GMW ii, pp. 410, 479–83 and 521

Origins

To what extent are these gender associations and the mapping of vowels to note functions Aristides' original ideas? Barker writes:

> *The project of attaching the solmisation to a theory of the 'characters' of notes, and using it as a sort of 'ethical notation', seems to be Aristides' own (unless, as is just conceivable, it stems from Damon…).*
>
> *GMW ii*, p. 479, n. 120

We know that Aristides had access to early writings from these two passages in his treatise:

> *Virtually none of the ancient writers put together their accounts of music as a complete whole in a single study: instead, they discussed particular topics piecemeal in disconnected writings. They said nothing about most of its principles and natural causes [which Aristides deals with in Book III], and more or less confined their attention to technical matters [dealt with in Book I, where we find the ancient scales in Chapter 9] and to the subject of the use of melodies [dealt with in Book II].*
>
> I.2; *GMW ii*, p. 401

> *It is now time to explain what kinds of melody and rhythm will discipline the natural emotions. I shall set out what some ancient writers said, and also some things which have not previously been discussed – not, however, because the writers were ignorant or malicious. That would be a quite improper thing to say of philosophers initiated in the mysteries of music. The fact is rather that while they expounded some things in their writings, they reserved the more esoteric secrets for their discussions with one another.*
>
> II.7; *GMW ii*, p. 469

We can say little more than that Aristides had access to a number of manuscripts by different authors. Some of his information may have been transmitted in writing from the Classical period without significant alteration, but what we probably have is a synthesis of many ideas from different centuries: a mixture of derivative and original ideas, written and oral transmission, that is impossible to separate. The notion that the set of six scales 'used for the *harmoniai* by people of distant antiquity' stems from Damon rests on precariously thin evidence. It may be slightly safer to associate Damon with the theory surrounding their use in therapy and education, disciplining the emotions and instilling good citizenship, but not much. Hagel cautions:

> *The reception of "Damon's musical teaching" in later times is deeply rooted in Plato's* Republic. *If Aristides identifies those scales with Damon (which is likely but not certain), I suspect he might have fallen into*

> *the trap of projecting all musical ideas in* Republic *back to Damon despite him being associated only with rhythm and political theory there.*
>
> (by email, 8 June 2018)

Martin West's label 'The Damonian scales' (West, p. 174) is rightly rejected by Barker and Hagel. Regarding the origin of the vowels, D'Angour has focused on Aristides' use of the first person at the start of II.13, prompting him to suggest 'that Aristides is formulating, at least to some degree, his own idiosyncratic view of the matter rather than presenting a generally recognised scheme of vocabelisation'; and further, that his scheme was 'amended by the author of Anonymus Bellermanni, who may have had Aristides as a source' (D'Angour 2016, p. 278). The nature of our evidence, however, makes it impossible to ascertain whether this is 'Aristides' own wayward exposition of vocalic ethos' (*ibid.*, p. 284) or if, as is suggested by Aristides' use of the past tense at II.14, it was familiar to Plato.

Oral transmission is likely to complicate the Classical reality. It may be nearer the truth to imagine an intermingling between Damon's teaching, the historical writings of the *harmonikoi* mentioned by Aristoxenus, and Plato's own ideas – that these evolved through oral teaching and debate as well as through manuscript transmission. After all, it is said that 'Plato had studied musical science most carefully, and had been taught by Dracon of Athens' (ps-Plut. *De Musica* 1136f) and that Dracon was a pupil of Damon (Olympiod *Vit. Plat.* 2; *GMW i*, p. 222). Like Plato, the *harmonikoi* can hardly have escaped the influence of Damon.

Conclusions

Our low confidence levels regarding how Classical-era auletes vocabelised, or what they believed about using musical pitches to tune the soul, are no good reason not to vocabelise today. Creativity filling the gaps is vital and constitutes respectable scholarship when we have defined goals, identified limitations and disciplined ourselves to follow best-practice guidelines such as those formulated in the *Introduction to the EMAP Resources for Euterpe* (Volume 1, p. 6). We are not attempting to be historical, sounding like the fifth-century authorities Pronomus or Damon. Instead, we are training ourselves to become more competent performers and co-investigators in the discipline of Very Early music. Composing and improvising new music in the twenty-first century generates new knowledge, breaking through a scholarly impasse. A means of internalising these scales, however uncertain, is worthwhile because (1) they are 'the most archaic tonal systems for which we have reasonably reliable information' and (2) practical experiment invigorates both our research and our cultural life in potentially valuable ways.

This experiment serves musicians who belong to a performing tradition that is contemporary. Instead of getting entangled in false claims, allowing audiences, journalists and promoters to merge fact and fantasy – and instead of allowing scholarly theories to escape the scrutiny of other-discipline, other-culture expertise – I believe that we should be assertively original, daringly experimental and collaborate in ways that transport us outside our comfort zone. The aulos revival is about deepening our connection to things that are remote, historically and culturally. We do this best by complementing our expertise with that of others, taking a few risks and creating music that is excitingly new.

Bibliography

BARKER, A. (2007) *The Science of Harmonics in Classical Greece*. Cambridge: Cambridge University Press.

BROWN, B. (2016) *Data underpinning 'A map of the pibroch landscape, 1760–1841'*, Version 7. Dataset available at http://www.altpibroch.com/tunes/.

D'ALESSANDRO, C., and BROWN, B. (2011) *Maestro Luigi Lai.* Video available at https://youtu.be/1FGHzem-cvE.

D'ANGOUR, A. (2016) 'Vocables and Microtones in Ancient Greek Music'. *Greek and Roman Musical Studies 4,* pp. 273–285.

CHAMBERS, C. K. (1980) *Non-lexical Vocables in Scottish Traditional Music.* PhD dissertation, University of Edinburgh.

GMW i = Barker, A. (1984), *Greek Musical Writings I: The Musician and his Art*. Cambridge: Cambridge University Press.

GMW ii = Barker, A. (1989), *Greek Musical Writings II: Harmonic and Acoustic Theory*. Cambridge: Cambridge University Press.

HAGEL, S. (2009) *Ancient Greek Music. A New Technical History.* Cambridge: Cambridge University Press.

—— (2018) ''Musics', Bellermann's *Anonymi*, and the Art of the Aulos'. In *Greek and Roman Musical Studies 6*, pp. 128–176.

HORROCKS, G. (2010) *Greek: A History of the Language and its Speakers*. 2nd edn. Chichester/Malden, MA: Wiley-Blackwell.

PETROUNIAS E. B. (2007) 'The pronunciation of Classical Greek'. In A-F. Christidis (ed.), *A History of Ancient Greek: From the Beginnings to Late Antiquity*. Cambridge: Cambridge University Press, IV.3, pp. 556–70.

PHILLOMEN P. (2009) 'Phonology'. In E. Bakker (ed.), *A Companion to the Ancient Greek Language.* Chichester/Malden, MA: Wiley-Blackwell, pp. 85–103.

PÖHLMANN, E. and WEST, M. L. (2001) *Documents of Ancient Greek Music.* Oxford: Oxford University Press.

VICKERS, M. (2014) *Sophocles and Alcibiades: Athenian Politics in Ancient Greek Literature* Abingdon/New York: Routledge.

WEST, M. L. (1992) *Ancient Greek Music*. Oxford: Oxford University Press.

WINNINGTON-INGRAM, R. P. (ed.) (1963) *Aristides Quintilianus. De Musica*. Leipzig: B. G. Teubneri.