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THE INTERPRETATION OF GREEK MUSIC: AN ADDENDUM

THE main object of this addition to the paper published under the above title in *JHS* xlii. 133, is to make known a new discovery in the shape of an unanswerable argument leading to the same solution as before of the problem presented by the Greek notation. This problem is still considered to overshadow all other problems.¹ After the conclusion of the argument the writer proposes to make a few necessary corrections in the former paper, and to lay further emphasis on certain points.

It is an unfortunate circumstance in the music of to-day that performers and composers alike, even those destined to spend their lives as devotees of opera and symphony, begin their careers with little or no acquaintance with the most important branch of musical knowledge, the theory of intonation. They have been taught to think in terms of a scale tuned by fifths (whether tempered or true makes no practical difference), and *au fond* their instructor is the piano tuner. This is quintal music, to borrow a term used by historians in speculation regarding primitive origins. Tertian music on the other hand is derived not only from the quint but from the true major and minor thirds and is, therefore, the basis of harmony. The quintal scale has no common chords; its triads are all discordant. The music of the organ and piano pretends that its dissonant triads are common chords, and claims therefore to have six of them in the major scale. No tertian major scale can have more than five; two have only three apiece. Nevertheless, since both systems are taught indiscriminately from the same text-books, tertian music uses six, frequently without any thought to the intonational consequences. The importance of intonation is overlooked, and the subject cheerfully abandoned to the acoustician. We have not yet discovered that intonation is concerned with ideals, and acoustics with brute measurements. Acousticians who have entered the field of music have left behind them a trail of misconceptions, out of which five may here be quoted:—(1) that Indian music is founded on caprice;² (2) that definite inferences regarding intonation can be drawn from measurements of holes and frets;³ (3) that travellers' tales and primitive theories can be treated as evidence of fact; (4) that there is one 'just major'; (5) that, in the melodic descending form, there is one 'just minor.'

Greek theory was mainly concerned with intonation. From Pythagoras it received the most exact intonational notation that the world has ever known. Little use, however, was made of it. To grasp the

¹ See the introduction to Düring's *Ptolemaios und Porphyrios*, Göteborgs Hogskolas Arsskrift XI (1934), I.

² The music meant is that of the hereditary Durbar

singers, not that of the bazaar or theatre, or the efforts of harmonium-trained amateurs.

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facts with which we are concerned, it is necessary to know how this came to pass. The theory, as in India, seems to have begun with an attempt to classify scales on the basis of an imaginary division of the octave into equal parts. The invention of the monochord or *kanon* by Pythagoras in the sixth century B.C. was destined in the long run to cause these speculations to be superseded by accurate measurements in terms of comparative string-lengths. Presumably with the help of the musician, he measured the national scale and reduced its intervals to quintalised substitutes, that is, intervals that could be got from fifths and octaves, and whose string-length ratios could therefore be put in the form $2^x 3^y$. This was essential to his plan, because he intended to put his notation in the form of a structure built of tetrachords, carrying its own meaning to the musician, without any explanation whatsoever. Possibly he was inspired by the monuments of Egypt. He took at the same pitch the octave scales of the C mode, D mode, E mode, and their corresponding *hypo*-modes with finals F, G, A. (The B mode was added on the same plan, before the time of Aristoxenos, by the men who carried on the traditions of the school he founded.) He dissected his six modal scales into E mode tetrachords in the usual Greek manner. He picked out their *meses*, and strung them in order of pitch in a scale. He adjusted that scale to quintal tuning. This led to a slight readjustment of the pitch of the Lydian and Hypolydian scales (C and F modes) already plotted out. The quintal scale of the *meses* seems to have become known as the *thetic* scale.⁴ It acquired importance in the theatre as the basis of the tuning method, for we learn that the theatre used all the six modes of Pythagoras.⁵ It is probable that an eight-stringed kithara was tuned to the thetic scale; the mese as required was picked out and the rest of the modal scale tuned from it. This could be quickly done, and all the modes in turn could be got at about the same pitch. The next step taken by Pythagoras in devising his notation was to take his six scales and extend each one from the mese up and down so that they became a complete two-octave system in the A mode. They now looked like six exactly similar two-octave systems at pitches that differed by fourths; they were to all appearance transposition-scales. They were in the modulating system, having a *synemmenon* tetrachord. Each of these systems was now called a *tonos* and named after the mode hidden within it. To the musician, the name disclosed the mode, and the *synemmenon* tetrachord the intonation. These *tonoi* were exhibited with symbols to represent the notes. The twenty-four letters of the Ionian alphabet were used for the singing notation, and another series, called the instrumental notation, consisting of certain letters in three positions, erect, recumbent, and averted, was added for the use of the kithara player. Thus a mighty weapon for the advancement of harmony was forged. But it had no immediate success. Pythagoras was persecuted, and his followers killed or dispersed. More than a century later, Timaeus and Archytas among others were gathering up the remains of the musical activities of Pythagoras. Plato

⁴ Aristoxenos, *Harm.* III. 69; Ptolemy, *Harm.* II. 10, 11.

⁵ Anon. § 28, ed. Bellermann, Berlin, 1841.

was much interested in their work, but seems to have learnt nothing beyond the most elementary facts of intonation. The mention of the term *apotome* by those interested in the revival of Pythagorean learning⁶ gives rise to inferences favourable to the hard or tertian diatonic as opposed to the soft or septimal. The *apotome* was the quintalised just semitone, and could be derived in three ways: (1) seven fifths up less four octaves, (2) three octaves up less seven fourths, (3) the tone less the leimma. Its ratio in the form $2^x 3^y$ was $3^7 2^{-11}$. In his *tonoi*, Pythagoras took the interval in descent as three octaves less seven fourths, as will be demonstrated. It will of course be remembered that the use of fifths and fourths alternately amounts to the same thing as the use of fifths and octaves or fourths and octaves. Archytas put forward certain septimal scales. They are put out of court as explanatory of the notation, because his soft semitone could not be quintalised. His diatonic, the *toniaion*, was probably already in existence, but his enharmonic has the appearance of having been invented to explain the six *tonoi*. It is an impossible scale, suggested evidently by the erroneous idea that was then shaping itself that the enharmonic should divide the lowest interval of the E mode tetrachord into approximately equal parts. The note added by the enharmonic genus was in essence a grace note close in pitch to the note it ornamented. And that is what the notation gives us. We have the same thing. Our tetrachord is the C mode tetrachord; we think in terms of the major scale. The result is that we enharmonically ornament the D's and A's instead of the F's and C's. But the modern theorist has not yet awakened to the fact. When he does he will perhaps embody it in a new genus. When Aristoxenos appeared on the scene, the seventh *tonos*, the Hyperdorian, had been added. This *tonos* destroyed the symmetry of the scheme by mixing enharmonic and chromatic tetrachords. It acted as a bridge to the later *tonoi*, most of which came into existence in the time of Aristoxenos. They had no enharmonic; they consisted of diatonic and chromatic. When the whole notation was given to the world by Alypius in the second century A.D., the enharmonic and chromatic were not distinguished, one being a copy of the other. It may be observed that the first seven *tonoi* gave the whole notation. No note was ever added. It is also worthy of notice that the additional *tonoi* were inserted between the original ones with consummate skill. We are forced to the conclusion that the men responsible were conversant with the meaning of the notation, and the intonation of all the common scales in use. Aristoxenos devoted his attention to music after the death of Aristotle in 322 B.C. He bitterly opposed the practice of the notation and the use of the monochord. He seems to have made common cause with the professional. He tried to justify his attitude.⁷ The idea that students and amateurs should be enabled to acquire in a few days the knowledge and experience of a lifetime was repugnant to him. He therefore revived the obsolete pre-Pythagorean methods. For this and other reasons, Ptolemy, five hundred years later, condemned him as both stupid

⁶ Vide Gaudentius, *ed.* Jan, p. 343; pseudo-Philolaus, *ap.* Boethium, *Mus.* III. 8.

⁷ *Harm.* II. 41.

and insincere.⁸ Shortly before Ptolemy came Didymus, who, like Archytas, seems to have tried to explain the tetrachords of the first six *tonoi*. He had the distinction of being the first writer correctly to interpret the diatonic tetrachord ($\frac{1}{1}\frac{6}{8}, \frac{1}{9}\frac{9}{8}, \frac{9}{8}$).⁹ Ptolemy was the first to introduce us to the scales of Archytas and Didymus, and to give us the measurements of the *syntonon*, the favourite plain diatonic scale in the Alexandria of his day. Except for the philosophy of the third book, his *Harmonik* is in substance an elaborate and closely argued plea for the adoption of an eight-stringed kanon capable of giving the modes of any scale in exact intonation. He shows how scales

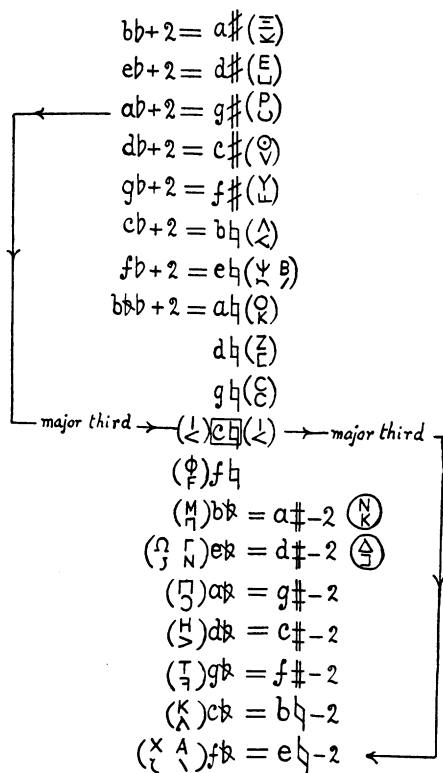


DIAGRAM I.

The figure 2 designates approximately 2 cents.; + means 'sharper by' and - 'flatter by.'

The symbols in circles are those of the duplicate notes.

may be invented with the help of a monochord, and gives the principles which, in his opinion, should govern the process. He does not admit apparently that scales derive from the analysis of living melody. Melody always precedes grammar and scale. His principles are also ill-founded. Like all the Greek scribes, he knows nothing of the final and dominant that define a mode and have more influence than anything else on the construction of its scale. He bestows too little attention in common with his predecessors on the plain tertian diatonic scales. Absorbed in the sup-

⁸ *Harm.* I. 9, 10.

⁹ Also named the *syntonon*.

posed rigidity of the E mode tetrachord he does not realise that it may sometimes be a false tetrachord, as in the Ionian.

Through all these centuries of idle controversy, the peasantry at their daily tasks were singing in the old ἀρμονία. That was the music that passed into the Church and laid the foundations of modern music. The modes had four parent-scales, the double syntonon, the double syntheton, the syntonon followed in ascent by the syntheton, and the false tetrachord, just semitone, major tone, major tone, followed by the syntonon, with the tone of conjunction a minor tone. The last is the *śadja grāma* of India, one of the most widely spread of all scales, the scale of the epitaph of Seikilos, the Ionian scale.

The synemmenon, we have said, gave the clue to the intonation of the six tonoi. It modulates to the nearest 'key' on the flat side. In the process (see Diagram 2), Doh is flattened and becomes the Soh of the new key. If the scale had been the syntonon, called by us in the C mode the 'just major,' Ray would have been flattened and made Lah. This turns on the false fifth. Every harmonic (or tertian) scale, consisting of three major tones, two minor tones, and two just semitones regularly placed, must have one fifth embracing both the minor tones. This can be proved mathematically or by simple trial. In acoustics it is called the grave fifth, but, in the theory of intonation, false is a better epithet because falsity is its main property, not size. A true fifth holds two major tones and one minor tone, whereas a false fifth holds two minor tones and one major tone. The false fifth is smaller by a comma. It is the scale-maker of tertian music. Any scale of the kind under consideration can be completely reconstructed if its false fifth is properly described; no other datum is necessary. The two true fifths that separate the semitones, and the remaining three fifths, also true, have merely to be fitted into their places. The false fifth Ray-Lah defines the syntonon, and the false fifth Doh-Soh the syntheton. In change of key, the false fifth is necessarily shifted, the original one being made true. Modulating on the flat side lowers its lower note; modulating on the sharp side sharpens its upper note.

In the proof we shall use the same notation as before, making $\angle$ our pitch note. The four 'strings of fifths' mentioned on p. 136 in my former paper may now be called the four quintal series, and named: the low sharp series, the low series, the straight series, and the high series. The first we shall not need; for it will be seen from Diagram 3 that, where two notes have been coupled by a tie, the second is now identified with the first, whereas by an error in the former paper the second was made a comma lower. These notes are here referred to as the 'duplicated' notes (*vide* Diagram 1, note). As regards the properties of a quintal series, it may be remembered that any seven consecutive members of such a series form a quintal scale when brought together, and that alternate members are always separated by a major tone, provided they come together in the same octave. A reference to Diagram 1 shows that the series on the left is derived from the straight series in the centre by the major third. Middle C (c') enclosed in a square is identified with $\angle$, the mese

[illegible]

Vocal: T Y U A B G D E Z H O I K L M N O P Q R S T V W X Y Z
Instrumental: A C F J L N P R S T V W X Y Z

[illegible]

DIAGRAM 3.

‘+ 2’ means that the actual pitch of the Greek note is 2 cents sharper than the accidental; ‘- 2’ means that the actual pitch is 2 cents flatter. The duplicates are marked by slurs, and, in the intervals, by the figure 0.

fell two octaves, and finally rose three more fourths. That is a rise of 7×498 , and a fall of 3600, a net fall of 114, the apotome. And this very pair of notes forming the apotome constitutes the lowest interval in the Dorian synemmenon. On the second assumption above, that interval can be traced right through the tetrachords under consideration. Every tetrachord therefore in accent begins with the apotome. Secondly, since two fourths subtracted from an octave leave a major tone, the interval ΦC in the Hypophrygian is a major tone. It appears in the Lydian as the upper interval in tetrachord (a). On the second assumption above, that interval can also be traced in all the tetrachords. The diatonic tetrachord of Pythagoras was therefore apotome, quintalised minor tone, major tone, in cents, 114, 180, 204. Diagram 1 traces all the notes under consideration as a κοινωνία κατὰ τετράχορδα,¹⁰ and shows how they may be rationalised, or dequintalised.

The duplicated notes next fall to be discussed. From the diatonic we have discovered the meaning of 22 notes out of those covered by the letters of the alphabet in the vocal notation. The remaining two, Δ and Ν, appear, not in the diatonic, but in the enharmonic-cum-chromatic as it should be called. Δ is in the Lydian, and Ν in the Hypolydian. Ν appears in the Dorian synemmenon, and both appear in the Hyperdorian, meson and synemmenon. With the exception of these three named tetrachords, every tetrachord in the enharmonic-cum-chromatic takes its pyknon in the instrumental form erect, recumbent, averted. Where the symbols used are among those we have just identified from the diatonic, the cent order of the intervals of the pyknon is + 114, - 24. We may assume that the pyknons in the Lydian and Hypolydian which contain the symbols Δ and Ν, are in the same form. This establishes Δ and Ν, by analogy, as duplicates of the erect notes Γ and Μ respectively. The Dorian synemmenon introduces abnormally a tetrachord beginning with an averted instead of an erect sign. The next erect sign is taken to make up the apotome, but the further flattening could not be indicated with the symbols in hand. The difficulty was overcome by proceeding to the next averted sign, making the tetrachord chromatic in the syntono-chromatic colouring. Thus was the progression apotome-leimma *concurrent* turned into the progression apotome-leimma *consecutive*. If the *tonoi* be taken in the order given by the synemmenon tetrachords, which we may suppose to have been intended, it will be found that this latter arrangement is continued through the additional *tonoi* until the point where they begin to complete the harmonic circle and return to the Hypolydian.

The diatonic synemmenon of the Hypoionian is $\begin{smallmatrix} X \Phi C O \\ \gamma F C K \end{smallmatrix}$; the cent intervals are 114, 204, 204. This is the false fourth. The same interval separates the proslambanomenoi of the Hypoionian and Ionian *tonoi*. It is here, therefore, that the correction of the comma is inserted. Who-

¹⁰ Vide Aristides, *Meibom.* p. 25.

ever performed this operation may be regarded as an unknown musician who knew more about his art than all the theorists combined.

Diagram 3 gives the whole range of notes. The lowest line gives the accidentals of exact pitch; the middle line gives those which exhibit the instrumental notation to the best advantage, and the upper line indicates the possibility of vocalising the notes in their order. The differences involved in these several aspects of the notation are partly due to the fact that the low flats were sometimes used as such and sometimes as sharps. The difference is one of function, the sharp being associated with the idea of ascent by means of a semitone made familiar by constant use, and the flat being associated with the idea of a similar descent. The notes with erect instrumental signs are emphasised as crotchets.

The instrumental notation was evidently meant for the lyre or kithara. Vase paintings shew both instruments with a bar for altering the pitch,

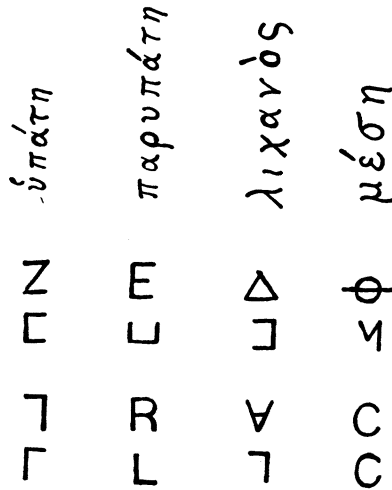


DIAGRAM 4.

but the bar was not invariably attached to them, not 'standard' to use a modern expression. To quote from Plato: 'in all lyre-playing the pitch of each note is hunted for and guessed; so that it is mixed with much that is uncertain, and contains little that is steady'.¹¹ We may safely assume that the erect letter stood for the open string, the recumbent for the just semitone (rather than the quintalised apotome) obtained by a full turn of the bar through a right angle to the left, and the averted to an incomplete turn resulting in the quintal semitone or leimma. Aristoxenos, in dissecting the tetrachord, assumes that the mese, lichanos, parhypate, hypate invariably followed the order of pitch. Centuries earlier, the player, having plucked the topmost string or hypate with the thumb, gave a full turn to the bar, and again plucked the string with the thumb, sounding the parhypate. He played the lichanos with his forefinger on the next open string. It could, however, be got from the first string by the

half turn. That would mean three strokes on the hypate followed by a leap over the next two strings to the mese.¹² In Diagram 4, the symbols for the lichanos agree with Alypius and Aristides, but not with most recensions of the three manuscript hymns. The latter prefer the open string. Again it is important to notice that Alypius studiously avoids the term lichanos in the diatonic. Perhaps the extension of the notation to auletic led to the abandonment of the fingering tradition in favour of the idea of pitch. The line of pitch does not suit the enharmonic genus, for the simple reason that it is not easily vocalised. The chorus from Orestes gives both progressions, that of Pythagoras and that of the post-Pythagorean theorists, the zigzag and the straight line. The zigzag is used first in the chorus and is more favoured.

In lyre-playing it seems to have been the practice when tuning the Lydian mode to slacken all the strings as a preliminary. That would undoubtedly be the quickest method, because all the notes of the scale are low except the final C and its fourth F. There may have been some contrivance to limit the slackening to the comma. The final and its fourth could then be tuned up to their original pitch.

It is to be hoped that in future more attention will be paid to the notation and the surviving music, for more is to be learnt from them than from the theorists.

The main correction to be made in the former paper is in the treatment of the duplicated notes. The correction makes no difference to the music; moreover it removes the difficulties there discussed. For example, the instrumental passage from the chorus becomes a striking corroboration instead of an anomaly. As regards the barring of the music of the manuscript hymns it may be pointed out that the only pieces with rhythmic signs, namely the chorus and epitaph, are seen to be barred if their rhythm be closely examined. The writer is pleased to find that he is strongly supported by the opinions expressed in 1880 by Dom Pothier (*Mémoires Grégoriennes*, Tournai), who says, on p. 125: 'to ignore accent and keep to quantity was never the mode with any language, *accentus anima vocis*.' A point of detail of considerable importance is the meaning to be attached to the three signs allotted to the falling tone at the end of the epitaph. The middle sign is a cross; it is not meant for a note. The common error of putting three notes to the falling tone in this instance, and thereby depriving the melody of all meaning, has been copied by a famous modern composer. Lastly, it was noticed that the extant music sometimes makes the mese the final and the hypate and nete the dominants. The inference was not clearly expressed that the prefix 'hypo-' served to indicate this exchange of functions. If this important inference be accepted, it makes the mode of Nemesis the Hypophrygian. It is supported by Ptolemy's assertion that in the beginning there were three modes only, but too much importance should not be attached to that.

¹² One stroke with the glide is a probable alternative. Lyre-playing could be supremely beautiful.

Anyone who heard Mushraf Khan on the bina would understand.

There are a few corrections to be made in the music. The more important are the following:—Calliope: on the first syllable of μόλπης, substitute *ab* for *f*. The falling tones on the words δονείτω and μουσῶν need adjustment. Nemesis, eighth bar: the second syllable of θνατῶν should take both the notes Γ and υ. In that hymn, the notes Γ and Λ, as used in the several recensions, have been taken to be intended for Γ and Δ, now known to be duplicates.

In striving to avoid the cutting of fresh type, the writer conceived the idea of using capitals for the straight or quintal notes and small letters for the low *e* of the major third *Ce*, and the quintal series of low notes derived from it. The result is here shewn in the four primary scales of ancient Greece:—

E mode:	Dorian or Syntheton:	e F g a b C' d' e'.
	Syntonon:	e F G a b C' D' e'.
C mode:	Aeolian:	C d e F G a b C'.
D mode:	Ionian:	D e F G A b C' D'.

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