
The Science of Harmonics in Classical Greece by Andrew Barker

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In the vast field of Greco-Roman music—a topic that has recently seen a dramatic increase in publications notwithstanding the difficulties that it offers to those who choose to take it up—the so-called ‘science of harmonics’ plays a particularly relevant role. It may be regarded as the logical premise of the whole of music theory, its task being to investigate the relations between differently pitched sounds from both a rational (or mathematical) and a physico-perceptual perspective, so that it becomes possible to establish which intervals and scales are acceptable in musical performances and which are not. This makes harmonics an intriguing border territory between philosophy, the history of science (mathematics in particular), and musicology.

It is not surprising, then, that harmonics has been given considerable room in almost every discussion of ancient Greek music, from François-Auguste Gevaert’s groundbreaking *Histoire et théorie de la musique de l’Antiquité* [1875–1881] to Martin L. West’s *Ancient Greek Music* [1992] and Thomas J. Mathiesen’s *Apollo’s Lyre* [1999], to mention just the most representative examples.

Andrew Barker himself focused on harmonics in the second volume of his *Greek Musical Writings* [1984–1989]. Though conceived as a handbook, this work is still indispensable for the quality of its translations of the original texts and for its brief introductions and footnotes to these texts, where many an issue was raised that would occupy discourse through the following decades. Almost 20 years later, and after having gained a reputation as one of the most renowned scholars in the field, Barker provides a new study of harmonics as

¹ An Italian version of this review is to be published in *Il saggiautore musicale*.

a whole, whose achievements and novelties I shall try to discuss in what follows.

To begin, a simple glance at the book's proportions tells us that Greek harmonics has never hitherto been treated so thoroughly as a subject *per se*; moreover, as the very title makes clear, the research focuses almost entirely on the classical period, that is, on the less than two centuries ranging from the Pythagoreanism of Philolaus' time to Theophrastus. Accordingly, the whole discussion gravitates towards the two poles of the theoretic debate in the classical period: the so-called empiricist approach to the problem of the measurement of musical intervals (Part 2: 'Empirical Harmonics'), and the mathematical approach, which can be traced back to the Pythagoreans and reappears in Platonic thought (Part 3: 'Mathematical Harmonics').

Since the book is meant to address not only specialist readers but also classicists and musicologists as well as learned readers in general, there are explanatory sections which unravel abstruse technicalities in a perfect balance of clarity and accuracy. This is the case with the preliminary section which is divided into an introduction [3–18] and a chapter entitled 'Beginnings, and the Problem of Measurement' [19–30], in which Barker elucidates the problem of what musical intervals are and how ancient theorists tried to measure them.

As for the bulk of the volume, at least two points of novelty can be singled out that are quite likely to catch the reader's attention: first is Barker's decision to discuss the empiricist approach *before* the mathematical one; and second, the unexpectedly thorough treatment of the so-called *ἄρμονικοί*. Many is the time that the empiricists' position has been explained as if it were just a consequence of Aristoxenian thought—as if Aristoxenus was the first to argue for the primacy of perception in assessing intervals—because of the tendency to pigeonhole intervals according to mathematical or numerological categories. Such simplification does not take into account those theorists whose activity has wrongly been overlooked only because it is not very well accounted for in our sources, theorists who are usually referred to as *ἄρμονικοί* and who are strongly criticized by Plato in his *Republic*.² An accurate reading of the sources allows Barker to go

² The relationship between Plato and the *ἄρμονικοί* has recently been discussed by Angelo Meriani [2003: see my review, 2006]. See also my review [2005, esp. 115n4] of Murray and Wilson's *Music and the Muses* [2004].

beyond Plato's ironic dismissal of these people, whom he portrays as strongly concerned not only with theoretical research but also with practical music performance and even with the invention of new musical instruments (as was the case with Ion of Chios' hendecachord [98ff.]). Plato's reason for belittling the ἄρμονικοί was, probably, their refusal to abandon empiricism in favor of building 'a theoretically well-organised scheme' in accordance with an epistemological attitude which Barker compares, with reason, to that displayed in the Hippocratic treatise *On Ancient Medicine* [104 and n58].

Barker's remarkably accurate discussion of Aristoxenus is preceded by a useful outline of Aristotelian epistemology ('Interlude on Aristotle's Account of a Science and its Methods' [105–111]) and a clarification of his own view of the unity of Aristoxenus' extant work. Far from considering the so-called first book of the *Elementa harmonica* as a half-baked sketch of what we read now as book 2, Barker sees book 1 as a work separate from books 2–3 and thus detects an evolution in Aristoxenus' thought ('[Aristoxenus'] approach to harmonic science may have shifted during the intervening years' [117]).

The section on Aristoxenus himself leaves the reader with more than one nice surprise, even where—as is the case with such a well-known and thoroughly studied work as the *Elementa harmonica*—one could reasonably not expect any. As for Aristoxenus' distinction between continuous and discrete voice, Barker emphasizes the fact that it is not meant to have an ontological value; rather, it is the perception on the part of the listener that plays an important role in attributing to what is heard the characteristics of the former or the latter [145]. Aristoxenus' alleged empiricism is described in accordance with its philosophical (essentially Peripatetic) background and distinguished from any anachronistic interpretation as a forerunner of modern psychoacoustic theories. His conception of naturalness in the development of melody is effectively linked to Aristotelian biology: a melody can be defined as natural, Aristoxenus says, if it moves in such a way that the role of each note—be it μέση, παραπάτη, and so on—is made understandable to the listeners' ears [161 ff., 184 ff.].

The following chapters, dedicated to books 2 and 3 of the *Elementa*, account for such basic concepts as διάνοια, μνήμη, and δύναμις [168 ff.]; nevertheless, there is room left for more general issues related to the cultural environment of Aristoxenus' time (e.g., Barker's

remarks on the purposes of scientific activity and his comparison between ancient philosophers and modern scholars [182 ff.]). The so-called theorems that occupy book 3—actually a series of descriptions of those characteristics that make melodies acceptable and melodic—are analyzed with an eye to the difference between what Aristoxenus was trying to do here and other cases of axiomatization in Greek science, such as Euclidean geometry. On the one hand, there is no doubt that Aristoxenus was attempting to give an axiomatic form to harmonic science in order to make it ‘something it had never been before, a science whose credentials were as recognisable and legitimate as those of any other’ [229: see Brancacci 1984]. On the other hand, his system is not entirely compatible with what could be defined as a ‘Euclidean’ model, since the general principles were not only expected to be coherent with one another, they also had to comply with data coming from sense perception: accordingly, ‘the demonstrations... depend heavily on unstated assumptions... which have not been explicitly integrated into the axiomatic framework of Book III’ [203].

The idea that harmonics cannot be reduced to a system of propositions linked to one another by relations of consequentality brings the most notable results in the important chapter, ‘Contents and Purposes of Aristoxenus’ Harmonics’ [229–259], which ends the second part of the book. It is here, at least in my opinion, that the reader can savour the real novelty of Barker’s thought on Aristoxenus. In a new interpretation of the clause *ὅτι πειρώμεθα ποιεῖν τῶν μελοποιῶν ἑκάστην* found in a well-known apologetic passage in book 2 [Da Rios 1954, 40.16–17]), Barker gives the verb *ποιεῖν* the meaning of ‘composing’ (‘we are trying to make (*poiein*) each of the *melopoiiai*’ [231]) and thus depicts Aristoxenus as a composer rather than a pure theorist. He is aware of the problems that this interpretation entails and honestly admits that he does not have answers to all the questions that it may raise [232]. His position should, however, be welcomed in so far as it knocks a healthy nail into the coffin of the *cliché* that the whole of Greek music theory was totally indifferent to music as performed and heard.

A separate and delicate issue is that of the making of musical judgment. It is particularly relevant not only to our understanding of Aristoxenus and his relationship with Plato and Aristotle, but also to our locating Aristoxenus in the mainstream of Western musical

thought. The scanty evidence of this theme in the *Elementa harmonica* might lead us to think that Aristoxenus was not concerned with the problem of *ethos* as such, which might make him the first advocate of the autonomy of musical beauty—a Greek Hanslick, as it were. By looking at the evidence coming to us indirectly from our sources, that is, from the Aristoxenian passages in the pseudo-Plutarchan *De musica*, Barker avoids this anachronistic simplification and distinguishes two kinds of judgment in Aristoxenus' thought, the critical and the evaluative one.

As for the former, Aristoxenus' conception of the *ethos* of melody seems to be more mature than Plato's or Aristotle's. For him, the *ethos* comes as a result of the way in which the composer assembles the different elements of which the composition consists—not only the intervals, but also the rhythms and perhaps even timbre—rather than being mechanically determined by some preliminary choices on the part of the composer, such as that of the tetrachordal genre. The role played by the listener in the process of the understanding of music is thus strongly emphasized.

As for the latter kind of judgment, the evaluative one, it obviously implies a moral conception of music within the polarity of good *versus* evil, whereby it is possible to label one melody or musical composition as better than another on the grounds of characteristics that are neither formal nor technical. According to Barker, Aristoxenus is not very inclined towards Damon's and Plato's idea that music can directly affect people's character and behavior; at the most, it can display some of its intrinsic *ethos* through a process of signification that the listener has to decode. The moral evaluation of this meaning falls into the realm of philosophy and has little to do with musical expertise.

The third part of the volume, which is about the mathematical approach, opens in a definitely unexpected way. Instead of an introduction to Pythagoreanism, to which this approach is historically linked, the reader encounters a thought-provoking reading of Philolaus' famous fragment [Diels and Kranz 1951, Fr. 44B6] on the basic musical intervals [264–288]. *Pace* the commonplace according to which the Pythagoreans were only capable of mathematically measuring the intervals, Barker shows convincingly that the vocabulary used here by Philolaus testifies to an earlier phase of Pythagorean music theory—Philolaus is the first Pythagorean whose dates can

be historically determined—in which arithmetical speculations have neither overwhelmed the sensible data nor undone the links between the philosophers' research and the musicians' practical skills. Thus, the fifth is still called *σπλαβά*, the fourth *δὲ ὄξειᾶν*, and the octave *ἄρμονία*. The intrinsic nature of Pythagorean tradition, which makes it particularly resistant to diachronic approaches, can often lead scholars to treat it as if it were a coherent and monolithic whole [see Musti 1990]. Such analyses as that carried out here by Barker are a good antidote to this tendency. Barker deals with Archytas' divisions of the tetrachord (as they are described by Claudius Ptolemy) in the same way, by paying sharp attention to the links between mathematical speculation and musical reality. He concludes that Archytas' musical thought is 'a turning-point in the story of Pythagorean harmonics, a shift from a focus on exercises in mathematical cosmology to a direct engagement with the details of musical practice' [295].

After Philolaus and Archytas, Barker turns to Plato [308–327]. A brief introduction to Plato's epistemology [311–315] precedes discussion of the well-known musical passages in Plato's work. In the *Republic*, Barker explains, harmonics is referred to within the broader context of the evaluation on the basis of mathematical criteria of what is good and what is not [315–318]. As for the *Timaeus*, Barker provides a remarkably clear account of the famous scale [318–323] and of the implications of harmonics for psychology [323–326]; but most importantly, he emphasizes the esoteric nature of the *Timaeus*. It is with Plato's Academy, in his view, that there comes into existence a place where intellectuals talk to each other in a jargon inaccessible to outsiders. Since harmonics itself is involved in this process, it ends up, as the last chapter's title reads, 'in the ivory tower'.

The section on Plato, though not particularly innovative—nor could it have been, given the outstanding stature of this philosopher and the enormous relevance of the issues concerning his view of harmonics—is definitely helpful and well thought out as a whole. As for Plato's alleged dismissal of experimental procedures in music theory, Barker seems to rely vastly on the scholarly mainstream represented, for instance, by Mourelatos' contributions [315n12]. However, it would have been interesting, in my opinion, if Barker had taken into account the issues raised by Andrew Gregory, who has recently and convincingly tried to reduce the extent to which it is possible to speak of anti-empiricism in Plato [see Gregory 2000, 48–60].

The section dedicated to Aristotle opens with a provocative reading of pseudo-Plutarch, *De musica* c. 23, the contents of which—an account of the symmetries within the interval of octave—is attributed directly to the philosopher, including the inconsistencies in the text. According to Barker, Aristotle is himself responsible for these inconsistencies, not the anonymous compile: for Barker, though Aristotle knew the Pythagoreans' musical doctrine, he did not understand it thoroughly.

Barker writes here an important chapter in the study of the sources of the *De musica* ('An Aristotelian Fragment on Pythagorean Harmonics' [329–338]). He takes chapter 3 of the *De sensu*, in which the making of colors is accounted for in a way that is closely reminiscent of musical ratios, as evidence for the fact that at the end of the 4th century the system of consonant intervals began to include the so-called compound intervals (that is, those greater than an octave). As for the problem of a unit of measurement for the intervals, Barker shows that the search for it is incompatible with the basic assumptions of Pythagorean thought, whereby many an interval cannot be divided into equal parts. Barker's conclusion could hardly be more straightforward: 'There is no point in beating about the bush; so far as this aspect of the subject is concerned, Aristotle did not understand what he was talking about' [353]. The major merit of this section lies, in my view, in its showing that no later than the 4th century BC the relationship between the two main approaches to harmonics was quite far from being dogmatically polarized; on the contrary, in spite of a declared belligerency, 'a great deal of diplomatic activity was going on behind the scenes' [362].

The first treatise in harmonics, properly speaking, is the so-called *Sectio canonis*, which Barker, after a detailed account of the *status quaestionis* on the work's chronological placement, authorship, and unity of composition, dates to about 300 BC. As usual, Barker's way of approaching the text is quite unconventional: although the *Sectio* is often treated as an example of geometric thought applied to harmonics, Barker approaches the text from an arithmetic point of view rather than from a geometric one. As he sees it, some propositions, namely, those implying the insertion of new notes within a given interval, seem to originate from mathematical reasoning and to have been integrated into a geometric-oriented context only at a later stage. Moreover, some incoherencies in the work's axiomatic

structure are accounted for by Barker as a result of the compiler's activity. Most importantly, Barker opportunely points out that the author of the *Sectio* does not manage to escape the theoretical *cul-de-sac* intrinsic to every mathematical approach to harmonics, that is, the impossibility of establishing any relation of undeniable necessity between the quality of the consonance granted to some intervals by perception and some formal characteristics belonging to the ratios corresponding to those intervals.³ Such a relation is denied by the fact that there are intervals which are not consonant albeit their ratios are multiple, and that there are consonances whose intervals are neither multiple nor epimoric. However, the historical value of the *Sectio* lies, in Barker's opinion, in the attempt by its anonymous compiler to establish the fundamentals of harmonics according to an axiomatic procedure, thus enabling the 'mathematicians' to counter the analogous activity that Aristoxenus was carrying out in enemy quarters, as it were, more or less in the same years.

The last part of the volume is devoted to Theophrastus' position against quantitative inquiries in harmonics [411–436], a topic Barker has dealt with in the past [1977]. Our only source for Theophrastus' musical thought is a lengthy fragment quoted by Porphyry in his *Commentary on Ptolemy's Harmonics* [Fortenbaugh 1992, Fr. 176]. He seems to think that the soul can generate the melody through a kind of activity which he refers to as a *κίνημα* (movement), where this movement cannot be evaluated in terms of quantity and so cannot correspond to a ratio of whole numbers (as the Pythagoreans require). According to Barker, the target of Theophrastus' theory of the *κίνημα* might be Archytas himself. As for the hypothesis that Theophrastus is polemicizing in this passage against Aristoxenus, Barker is particularly convincing in ruling it out and in suggesting that the target could be Plato's *ἄρμονικοί*.

Barker's comparison of Theophrastus and Aristoxenus reveals several similarities: they are both interested in the nature of what is melodic (*τὸ ἡρμωσμένον*), which is thought to have its own foundation in itself rather than in some mathematical principle. While Aristoxenus' conception of the *ἡρμωσμένον* seems to be an immanent one, Theophrastus pictures it as if it mirrored the inner movement of the soul, thus making the melody, somehow platonically, a reflected

³ E.g., its epimoric form, $(n + 1)/n$, or its multiple form, pn/n with $p \geq 2$.

image of some other reality. Barker provides here the most thorough analysis Theophrastus' fragment has ever received, so far as this reviewer knows, and his interpretative skills make even more regrettable the loss of Theophrastus' *Harmonica* and of the light this work would have shed on both harmonics and acoustics in the 4th century.

With Theophrastus the span of time referred to in the volume's title is exhausted; nevertheless, the brief 'Postscript: The Later Centuries' [437–449] is quite useful especially for the non-specialist reader, as it helps to place harmonics in a wider chronological and cultural context. Once again, Porphyry turns out to be an indispensable resource for filling the gap between the 4th century BC and the treatises from the Roman and Imperial ages. It is in his *Commentary* that we find the fragments of Ptolemaïos and Didymus, who probably date back to the first century AD. In particular, the latter might be the initiator of the traditional opposition between Pythagoreans and Aristoxenians—at least if it is true that Ptolemy derived from him the terms in which he describes this opposition in his *Harmonics*. Barker takes this polarity as a guideline for his rapid outline of the following centuries, up to Porphyry himself.

This *coda* exhaustively illustrates the increasing divide between mathematical speculation *per se* and harmonics as a science of sounds. With Porphyry, a pupil of Plotinus, such a separation reached quite an advanced stage. His *Commentary* on Ptolemy covers only the first chapters of the treatise, which deal with the mathematical grounds of the discipline, while the commentator seems to quickly lose interest in the text as soon as it addresses specifically musical technicalities. Harmonics tends to become a speculation on a music that is not audible any more, rather than a means to bring order, problematic as the task may be, into the realm of concrete sounds; and the beautiful verses from *The Tale of Orpheus and Euridice his Quene* by the Scottish *makar* Robert Henryson (15th century), with their visionary depiction of musical intervals causing 'the moving of the hevin', sound an effective conclusion to the skyward path of this science.

The bibliography, though admittedly selective, is definitely up-to-date and in accordance with the book's scope. The indexes are accurately compiled and easy to use.

All things considered, what we have here is a *summa*. Works like this leave no doubt that the study of harmonics has left what only

a few decades ago seemed to be an academic limbo and has reached its full maturity; and it is easy to predict that further inquiries will hardly achieve any serious accomplishments without making the most of this volume.

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