Book II

30 It may be as well to explain in advance the kind of study this is, so that knowing beforehand the road, as it were, which we are to travel, and understanding which part of it we are on, we may walk the more easily, and not adopt unwittingly a misconception of the project.[1] This, as Aristotle used to recount, was what happened to most of those who heard Plato's lecture on the good.[2] They all came, he said, supposing that they were going to acquire one of the things which people commonly consider good, such as wealth, health, strength – in general, some astounding happiness or other. But when the discourse turned out to be about the mathematical sciences, about numbers and geometry and astronomy, and its conclusion to be that the good is one,[3] it seemed to
31 them, I imagine, altogether contrary to their expectations, so that some of them belittled it while others found fault. And why? Because they did not know in advance what the subject was, but like eristics rushed open-mouthed towards what was nothing but the name.[4] But I take it that if an overall account of the subject had been presented in advance, the prospective listener could either have abandoned it, or if he found it attractive, he could have continued to hold the conception of it which he had acquired. Aristotle himself, so he said, used to give introductions for just these reasons, explaining to those who intended to listen to him what the investigation was, and what it was about.[5] And to us too, as we said at the beginning, foreknowledge seems preferable.

People sometimes make mistakes in either of two directions. One group imagines that this science is of huge significance, some of them even supposing that listening to a discourse on harmonics will make them not just experts in music, but morally better men. These people have misunderstood what we said in our public lectures: 'What we are trying to do is to show for each kind of melodic composition and for music in general that such and such a type damages the character while such and such another improves it': and while misunderstanding that, they have altogether failed to hear our qualification 'in so far as music is capable of yielding such benefits'.[6] Others imagine it to be insignificant, of no importance, and yet profess themselves not to be ignorant

[1] On the relationship between Books I and II see the introduction to this chapter. This opening sentence already shows the more expansive style and the greater willingness to linger over general methodological issues that characterise the second book.

[2] The reference to a 'lecture' on the good has provoked endless controversy. For a brief discussion see Guthrie *History* vol. 5 (1978), pp. 424–6.

[3] The sense might alternatively be 'and that limit is the good, a unity', conceivably an allusion to *Philebus* 16c. See Guthrie, p. 424, n. 2.

[4] 'Eristic' is the abusive title given by Plato and others to those whose arguments were based on verbal tricks and ambiguities, and who aimed at victory in debate rather than truth. See, for example, Plato *Rep.* 454a–b, *Sophist* 225c, 231e, Aristotle *Soph. El.* 171b35.

[5] The tenses in this sentence seem to indicate quite clearly that by the time of writing, Aristotle was dead.

[6] It is not clear how far Aristoxenus accepted theories concerning the effect of music on character, but the present passage shows that he did not reject them altogether. See the Aristoxenian discussion in ps.-Plut. *De Mus.* 1142f–1144e.

of what it is.[7] Neither of these positions is correct. The science is not to be
32 despised by anyone of intelligence: that will become clear as our discussion progresses: nor is it so important as to be sufficient on its own for everything, as some people think. Many other things are needed, as we are constantly saying, to make a man a musical expert. Harmonics is only a part of the musician's accomplishment, as are the sciences of rhythm, metre and instruments.[8]

We must therefore give an account of harmonics and its parts.[9] It is to be understood, speaking generally, as the science which deals with all melody, and enquires how the voice naturally places intervals as it is tensed and relaxed. For we assert that the voice has a natural way of moving, and does not place intervals haphazardly. We try to give these matters demonstrations which conform to the appearances, not in the manner of our predecessors, some of whom used arguments quite extraneous to the subject, dismissing perception as inaccurate and inventing theoretical explanations, and saying that it is in ratios of numbers and relative speeds that the high and the low come about. Their accounts are altogether extraneous, and totally in conflict with the appearances.[10] Others delivered oracular utterances on individual topics, without giving explanations or demonstrations, and without even properly enumerating the perceptual data.[11] We, on the other hand, try to adopt initial principles

[7] Macran emends *apeiroi*, 'ignorant', to *empeiroi*, 'cognisant', and translates 'and yet prefer to remain totally unacquainted even with its nature and aims'. But the people Macran's version describes would hardly have attended Aristoxenus' lectures, and if we take *boulomenoi einai* in the sense 'professing to be', the text can stand. (For this usage see, for example, Plato *Rep.* 595c8, Aristotle *Eth. Nic.* 1119b34, 1125b33.)

[8] Cf. 1.22–2.7 with nn. 1 and 4 on that passage.

[9] The list does not begin until 35.25. It is prefaced by an important excursus on method, and on the theoretical grounds of the science.

[10] This refers to the procedures of Pythagoreans and Platonists, and it assumes their allegiance to the 'velocity' theory of pitch first enunciated in 1.19 Archytas frag. 1. Their explanations are 'theoretical' in the sense that they base their analyses of scalar structures, and their accounts of the reasons why some arrangements of notes and not others are harmonically proper, on propositions from the mathematics of ratio and proportion, not on laws inductively abstracted from the musical phenomena. (See particularly 2.1, 2.3 Plato *Rep.* 531c, *Tim.* 35–6, and cf. the Appendix to chapter 1. The best example of the genre Aristoxenus has in mind, though its theory of pitch is different, is 8 Eucl. *Sect. Can.*) Their claims conflict with the 'appearances' in two ways. First, melodic sequences do not present themselves to perception as strings of items that differ in quantity, and in perceiving them as forming a melody we do not perceive their relations as constituted by numerical ratios; yet that is how these theorists describe them (cf. 6 Theophrastus ap. Porph. *Comm.* 61.22ff.). Secondly, their principles give rise to various specific theorems that are flatly at odds with what, on Aristoxenus' view, perception reveals. For examples see 8 Eucl. *Sect. Can.* propositions 14, 15, 16, 18, and 11 Ptol. *Harm.* Book 1 ch. 6; cf. also 9.10–9.14 Ptolemaïs and Didymus ap. Porph. *Comm.* 22.22ff. Aristoxenus holds that these people's procedures are beside the point: cf. 9.2ff., 12.4ff., ps.-Plut. *De Mus.* 1144e. On the Aristotelian basis of his view, and the way it differs from that of 3.6, 3.7 Arist. *Post. An.* 75a–b, 78b–79a, see the introductions to chapter 3 and to this chapter. The word 'extraneous' in the present sentence indicates Aristoxenus' reliance on the 'same domain' rule discussed there.

[11] Aristoxenus now turns his fire on a different school of theorists, those *harmonikoi* whose empirical researches he recognises as precursors of his own. For the sharp distinction between such 'schools' see 2.1 Plato *Rep.* 531a–c, cf. 3.7, 3.9 Arist. *Post. An.*

33 which are all evident to anyone experienced in music, and to demonstrate what follows from them.[12]

Taken as a whole, our science is concerned with all musical melody, both vocal and instrumental. Its pursuit depends ultimately on two things, hearing and reason. Through hearing we assess the magnitudes of intervals, and through reason we apprehend their functions [*dynameis*].[13] We must therefore become practised in assessing particulars accurately. While it is usual in dealing with geometrical diagrams to say 'Let this be a straight line', we must not be satisfied with similar remarks in relation to intervals. The geometer makes no use of the faculty of perception: he does not train his eyesight to assess the straight or the circular or anything else of that kind either well or badly: it is rather the carpenter, the wood-turner, and some of the other crafts that concern themselves with this. But for the student of music accuracy of perception stands just about first in order of importance, since if he perceives badly it is impossible for him to give a good account of the things which he does

78b–79a, *Metaph.* 1053a, 6 Theophrastus ap. Porph. *Comm.* 62.1–3, and see also 9.10–9.14 Ptolemaïs and Didymus ap. Porph. *Comm.* 22.22ff., whose classification of theorists is more complex. This remark about the neglect of demonstrations (*apodeixeis*: see the introduction to chapter 3) is echoed in what they say about people they call *organikoi*, but it is a frequent complaint of Aristoxenus against all his 'harmonicist' predecessors. So too is the accusation that they failed to perceive the phenomena accurately. They adopted a very limited form of empiricism which does nothing to explain its findings; and they were bad empiricists, incapable even of getting the facts right. See, for example, his remarks about Eratocles, 6.12ff.

[12] This neatly summarises Aristoxenus' methodological outlook. The initial principles must be accepted without demonstration (this is often insisted on in Aristotle's *Post. An.*, e.g., 72b5ff.). They are abstracted from perceptual experience ('evident' in this sentence translates *phainomenas*, whose full sense here is probably 'perceptually evident'), not however that of just anybody, but of people whose perceptual discrimination has been trained to accuracy. (Cf. 33.9–26. On the process of abstraction or 'induction' see Arist. *Post. An.* 99b15ff., cf. 88a2–5.) Their truth is also to be checked against perceptual experience, not against metaphysical postulates or scientific hypotheses about the causes of experience. What can be demonstrated from them, however, must be so demonstrated, and thus displayed in its proper relation to the unified nature of melodic attunement, if it is to count as scientifically understood: cf. Arist. *Post. An.* 71b16ff., 76a33–4. On these issues see also 43.27–44.20 below.

[13] The roles to be assigned to perception and to reason are much discussed in later authors, particularly in their comparisons between Aristoxenian and Pythagorean method. (See especially Ptolemaïs and Didymus, cited in n. 11 above, and 11 Ptol. *Harm.* Book I chs. 1–2.) This sentence, and the comparison with geometry that follows, is probably the source of what Didymus says at 9.14 Porph. *Comm.* 28.6–19, but the scope of reason here goes beyond the demonstrative derivation from first principles that he and Ptolemaïs discuss, and which Aristoxenus uses throughout Book III. Intellectual understanding of the *dynameis* of notes and intervals is indeed articulated through such derivations, but must be preceded by rational reflection on perception, to generate principles and definitions. See 38.27–44.20, 47.8–50.14. These passages are also central to the study of Aristoxenus' conception of *dynamis*, melodic 'function' (see the introduction to this chapter, and especially 39.4–40.24 for the thesis that an understanding of *dynameis* is the major goal of the science). This pivotal conception is not even mentioned in Book I. Macran emends 'their functions' to 'the functions of the notes', on the grounds that Aristoxenus never ascribes function to intervals. But Aristoxenus' usage is more flexible than that: see, for example, 39.26ff., 69.6–18. When he is dealing with intervals without reference to function, he usually makes the point by speaking of their 'magnitudes': see, for example, 34.1ff., 36.5, 69.6.

not perceive at all.[14] This will become clear in the course of our investigation itself.

Further, we must not forget that musical understanding involves the simultaneous grasp of one thing that remains constant and another that changes, and that this holds, to speak broadly, throughout music as a whole and all its parts. For instance, we perceive differences of genera when the bounding notes remain fixed while the intermediate ones change:[15] or again, while the magnitude remains constant we call one interval that between *hypatē* and *mesē*, and another that between *paramesē* and *netē*, since the functions [*dynameis*] of the notes can change while the magnitude remains the same.[16] Again, there can occur several arrangements of the same magnitude, of the fourth, for example, or the fifth, and the rest: and in the same way, when a given interval is placed in one position modulation occurs, while when the interval is placed in another, it does not.[17] Further, we see many similar things happening in matters to do with rhythms. For instance, while the ratio remains constant – the ratio by reference to which the genera are distinguished – the magnitudes of the feet are altered by the character of the tempo [*agōgē*], and while the magnitudes remain constant the feet become dissimilar: and the same magnitude can function either as a foot or as a conjunction of feet. It is clear that distinctions of division and of arrangement also depend on a fixed unit of magnitude. In general, while rhythmic composition employs many varied kinds of movement, the feet by reference to which we indicate rhythms have simple movements that are always the same.[18] Since the nature of music is like this, it is necessary also in matters concerning harmonic attunement [*to hērmosmenon*] to train our reason and our perception to assess properly that

[14] The intention of the last phrase is unclear. Aristoxenus might be referring to the very small, melodically unusable intervals by which, for example, the chromatic diesis exceeds the enharmonic, or to the functional attributes of notes and intervals which are 'apprehended by reason'. More probably the phrase is dismissive: the man cannot give a good account of things which he does not even perceive correctly.

[15] The 'bounding notes' are the fixed notes bounding a tetrachord: cf., for example, 21.32ff.

[16] *Hypatē* here is *hypatē mesōn*, *nētē* is *nētē diezeugmenōn*. The magnitude of the interval is in each case a fourth. They are functionally different, in that they play different roles in the melodic structure. If a note is *mesē*, for instance, that implies that it stands to other notes in the system in a certain set of relations, different from those in which *nētē* stands to its melodic surroundings.

[17] On modulation see 7.10ff. with n. 34. If 'interval' here means 'magnitude', the point is straightforward. For example, if in a melody in tense diatonic we move upwards by a semitone from a note that the context has established as *hypatē*, there need have been no modulation. If we do so from *parhypatē*, the note reached does not belong to the original *systēma*, and a modulation of some sort must be involved. But 'interval' may here be contrasted with 'magnitude' and defined functionally, by its place in a *systēma*. In that case, the point is that if we move, for example, through an interval whose sequel identifies it as that between *mesē* and *paramesē*, then if its lower boundary is the *mesē* of the *systēma* to which the previous part of the melody belonged, there has been no modulation. If in relation to that *systēma* this boundary is a note other than *mesē*, modulation has taken place.

[18] Of Aristoxenus' works on rhythm, only a few pages survive (see the Appendix to this chapter). For a treatment based on this see 12 Arist. Quint. *De Mus.* Book 1 chs. 13ff.; and for the special issues raised here see Arist. Quint. 32.13 with n. 165.

which remains constant and that which changes.[19] What is called harmonics, then, straightforwardly considered, is a science of the kind we have described; and it can be divided into seven parts.[20]

One of them, and it is the first, is that which distinguishes the genera, and makes clear what remains constant and what changes when these distinctions occur.[21] No one has previously dealt with this matter in any adequate way; for they paid no attention to two of the genera, and studied nothing but the enharmonic.[22] Those who worked on instruments, admittedly, did perceptually discriminate each of the genera, but none of them ever even addressed himself to the question when it is that a form of the chromatic begins to emerge from the enharmonic. For their perceptual discrimination did not grasp each of the genera in every one of its shades, because they were neither experienced in every style of melodic composition, nor trained in defining such differences accurately.[23] They did not even grasp the fact that there are particular ranges [*topoi*] belonging to the notes which move in changes between the genera.[24] These, then, are the reasons why the genera have not previously been defined, and it is obvious that they must be defined if we are to understand the differences which occur among melodies.

That, then, is the first of the parts of harmonics. The second is the discussion of intervals, in which we must not overlook, so far as we can avoid it, any of the distinctions that exist among them.[25] Broadly speaking, one may say that the majority of them have never been studied: but we must realise that whenever we are in the presence of one of the distinctions which have been overlooked and not scientifically investigated, we shall fail to grasp the differences in actual melodies which depend on it.

Since intervals by themselves are insufficient to give us an understanding of notes – every magnitude of interval, broadly speaking, being common to several functions [*dynameis*] – the third part of the science as a whole must be that which deals with notes, and explains how many there are, by what means they are recognised, whether they are pitches, as most people suppose, or functions, and also just what a function is. Of such things as these, not one is thoroughly and faultlessly understood by those who work on subjects of this sort.[26]

[19] Compare the importance assigned to memory, 38.26–39.3. This paragraph may owe something to Aristotle's reflections on change, e.g., *Physics* 189b30ff.

[20] The list that follows is clear and straightforward, by contrast with the rather ramshackle presentation of a programme in Book I, 3.5–8.2. See the introduction to this chapter.

[21] See 46.19–52.32.

[22] Compare 2.7ff.

[23] It is not clear whether these people are instrumental performers or theorists who based their propositions on facts about instruments: for the latter see 39.8–11, 41.24–43.24, and cf. 9.12, 9.13 Ptolemaïs and Didymus ap. Porph. *Comm.* 25.14–16, 26.6–14. On the perceptual basis of discrimination between genera see 48.9–49.21, and cf. 23.4–23.

[24] On these ranges see especially 22.24–27.14, and cf. 46.24–47.8.

[25] Nothing in Book II corresponds to the elaborate set of distinctions at 16.16ff. Probably some material has been lost just before the discussion of concords at 44.27ff.

[26] Since intervals of the same size are often bounded by functionally different pairs of notes, the character of a note is not exhausted by a description of the magnitudes of

The fourth part is the study of *systēmata* – how many there are, what they are like, and how they are put together out of intervals and notes. This part has not been investigated by earlier writers in either of the two possible ways. For neither has there been any research into the question whether *systēmata* are put together in just any way from intervals, no combination being contrary to nature, nor has anyone completely enumerated all the distinctions between *systēmata*.[27] Of the melodic and unmelodic[28] our predecessors have given no account whatever, while as to the distinctions between *systēmata*, some people did not even attempt to enumerate them, devoting their research only to the seven octachords which they called *harmoniai*;[29] whereas others made the attempt, but by no means achieved a complete enumeration, these being people
37 like the followers of Pythagoras of Zacynthos and Agenor of Mytilene.[30] And yet the order which relates to the melodic and unmelodic is similar to that concerned with the combination of letters in speech: from a given set of letters a syllable is not generated in just any way, but in some ways and not in others.[31]

The fifth part concerns the *tonoi* in which the *systēmata* are placed when they occur in melody.[32] Nobody has said anything about them, neither how they are to be discovered, nor what one must look to in order to establish their number. The exposition of the *tonoi* by the harmonicists is just like the way the days of the month are counted, where, for example, what the Corinthians call the tenth the Athenians call the fifth, and others again the eighth. In just the same way, some of the harmonicists say that the Hypodorian is the lowest of the *tonoi*, the Mixolydian a semitone higher, the Dorian a semitone above that, the Phrygian a tone above the Dorian, and similarly the Lydian another tone above the Phrygian. Others add below the ones mentioned the Hypophrygian

which it is a boundary. See particularly 47.8–50.14, cf. 68.13–69.28. These passages, together with the hint given here, make it clear that for Aristoxenus in Books II and III a note is a 'function', and not merely a point of pitch. Contrast 15.13–23: in Book I the notion of melodic function does not appear. In what survives of this work Aristoxenus does not fulfil his undertaking to explain 'just what a function is'. Nor does he say how many note-functions there are, or list their names; see the lists in, for example, 10 Nicomachus *Ench.* chs. 11 and 12, and in 12 Arist. Quint. *De Mus.* Book I ch. 6.

[27] That is, no one has investigated the principles on which they are constructed, and from which theorems about the legitimacy or illegitimacy of particular types may be demonstratively derived; nor have they even listed all the types to which such theorems would refer (cf., for example, 32.29–31). The main principles are enunciated in 29.1ff., 53.33ff.; details are derived in Book III. On the main kinds of distinction between *systēmata* see 17.1ff.

[28] That is, of the principles mentioned in the previous note.

[29] *Hepta octachordōn*, 'seven octachords', is the emendation accepted by most editors for the MSS *heptachordōn*, 'heptachords': see 2.15–18, and for the principle underlying these theorists' constructions see 6.19–31. On these same *harmoniai* see 12 Arist. Quint. *De Mus.* 15.8ff.

[30] This Pythagoras is not the celebrated sage of that name, but a musician probably active in the mid fifth century. He invented a complex instrument called the *tripous* (Athenaeus *Deipn.* 637b–f), to whose construction and performance an understanding of different patterns of attunement would have been essential. Agenor belongs to the early fourth century, and was a respected teacher and performer, but nothing specific is known about him.

[31] For this analogy see also 27.18ff.

[32] Aristoxenus' treatment of the subject is lost: see nn. 3 and 34 to Book I.

aulos; while others again, with an eye to the boring of the finger-holes of *auloi*, separate the three lowest *tonoi*, the Hypophrygian, the Hypodorian and the Dorian, by three dieses from one another, and the Phrygian from the Dorian by a tone, placing the Lydian at a distance of another three dieses from the Phrygian, and the Mixolydian at the same distance from the Lydian. But what
38 the grounds are on the basis of which they have persuaded themselves to separate the *tonoi* in this way, they have not told us.[33] It will become clear in the course of our investigation that *katapyknōsis* is unmelodic and altogether useless.[34]

Since some melodies are simple and others modulating, modulation must be discussed. First we must say what modulation is and how it comes about – where by 'modulation' I mean what happens when the order belonging to the melody undergoes a certain kind of qualification – and then how many modulations there are in all, and at how many intervals they occur. No one has said anything about any of these matters, with or without demonstration.[35]

[33] The names of the *tonoi* mentioned in these two lists are familiar from later accounts of structures analysed in Aristoxenus' time or before him. They appear in lists of *harmoniai* (e.g., 12 Arist. Quint. *De Mus.* 15.11ff.) and of *tonoi* (e.g., 11 Ptol. *Harm.* Book II ch. 10, 12 Arist. Quint. *De Mus.* Book I ch. 10). Those writers regularly mention at least seven *tonoi*, of which Hypolydian is missing here. Their ordering from low to high reflects that of other lists, except that Hypodorian is usually below Hypophrygian, and Mixolydian is oddly placed in the first series (cf. the controversies hinted at in ps.-Plut. *De Mus.* 1136d). This order is usually associated with a conception of each as an identical interval-series, whose origin is placed at a different relative pitch in each *tonos*: that is, the 'origins' of the various *tonoi* (whether their *proslambanomenoi* or their *mesai*) stand at set intervals above and below one another. This also has the effect that each projects onto a given range of pitch a different series of intervals (cf. n. 34 to Book I). No other writer gives the spacings mentioned here. In the first series those between Dorian, Phrygian and Lydian are the usual ones (e.g., 11 Ptol. *Harm.* Book II ch. 10), but the others are eccentric. The second group is based (or so I suggest) on three pairings, Mixolydian with Dorian, Lydian with Hypodorian, Phrygian with Hypophrygian, in which the members of each pair are separated by a fourth – an interval at which modulation is easy and acceptable (see, for example, 12 Arist. Quint. *De Mus.* 22.15ff.). The reference to *auloi* (cf. 41.24–43.24) suggests that the pairings correspond to three kinds of pipe, where each was designed to be playable in both of two *tonoi* a fourth apart: this arrangement would minimise the number of extra finger-holes required to admit a modulation, and would effectively allow for a shift, in the lower *tonos*, between the tetrachords *diezeugmenōn* and *synēmmenōn* (see 11 Ptol. *Harm.* Book II ch. 6). The relations between the pitches of the Dorian-Mixolydian pipe and the Phrygian-Hypophrygian one are probably determined by the conventionally accepted interval between Dorian and Phrygian; the Lydian-Hypodorian pipe is pitched exactly midway between the other two. These suggestions are wholly conjectural, and do not solve all the problems. But the heavy irony of the last sentence relieves us of the task of finding any fully systematic theory behind these spacings. Aristoxenus' plain insinuation is that there is none. (Armed with her complex and original theories about *auloi* and their scales, Schlesinger was often prepared to explain away claims made by Aristoxenus about them, arguing that he was largely ignorant of the instrument. But even her ingenuity failed her here, and she could only conclude that Aristoxenus was somehow misrepresenting the facts: Schlesinger (1939), p. 193.)

[34] The proper disposition of *tonoi*, according to Aristoxenus, is determined by the rules governing the possibility of modulation: see the next paragraph. That *katapyknōsis* does nothing to relate them in this way is already argued at 7.22–33.

[35] The sort of modulation (*metabolē*) intended here is probably what was later called 'modulation of *systēma*', whose study is inseparable from that of the *tonoi* (see 11 Ptol.

The last part of the science is that concerned with melodic composition itself. Since many forms of melody, of all sorts, come into existence in notes which are themselves the same and unchanging, it is clear that this variety depends on the use to which the notes are put: and this is what we call melodic composition. Thus the science concerned with harmonic attunement, after working through the parts which have been mentioned, will find its completion here.[36]

It is clear that understanding melodies is a matter of following with both hearing and reason things as they come to be, in respect of all their distinctions: for it is in a process of coming to be that melody consists, as do all the other parts of music. Comprehension of music comes from two things, perception
39 and memory: for we have to perceive what is coming to be and remember what has come to be. There is no other way of following the contents of music.[37]

As to the objective that people assign to the science called harmonics, some say that it lies in the notation of melodies, claiming that this is the limit of the comprehension of each melody,[38] while others locate it in the study of *auloi*, and in the ability to say in what manner and from what origin each of the sounds emitted by the *aulos* arises.[39] But to say these things is a sign of complete misunderstanding. So far from being the limit of harmonic science,

Harm. Book II ch. 7, 12 Arist. Quint. *De Mus.* Book I ch. 11). No full discussion survives in the *El. Harm.*: cf. 7.10–8.2.

36 The thesis that the study of composition (*melopoiia*) is part of harmonics contrasts with the standpoint of 1.34–2.6 (cf. ps.-Plut. *De Mus.* 1142f–1143a, 1143c): see the introduction to this chapter. But the difference may be one of perspective, rather than a flat contradiction. In 12 Arist. Quint. *De Mus.* composition is placed outside harmonics and then inside it within a single page of text (6.21, 7.12), and in the context there need be no real inconsistency. For a glimpse of what a treatment of composition within harmonics might involve see 12 Arist. Quint. 28.10–30.24.

37 With this paragraph compare 33.1–34.30, ps.-Plut. *De Mus.* 1143f–1144c. The emphasis on 'coming to be' may conceal a thrust against Pythagorean theory, whose mathematical representations deal only with relations between notes located at specific pitches: they say nothing of the melodic implications of different sequences of movement through such pitches. The laws of harmonics are, centrally, laws of sequence, and are not fully captured in the abstract presentation of frozen structures. Macran comments on the uncomfortable brevity of this paragraph, but it is unnecessary to postulate a gap in the text before the word 'comprehension'.

38 What this implies, as the sequel shows, is that we have 'understood' a melody when we have found a way of writing down what is heard in a way that represents the sizes of its intervals. Almost everything we know about notation in this period comes from this passage. It was evidently a tool of theorists rather than composers. It may well have been associated with the harmonicist's diagrams (see 2.11–18, 7.31–2, 28.1–6, cf. 12 Arist. Quint. *De Mus.* 12.5ff.), and perhaps one of their main aims was to develop a usable notation.

39 This refers to attempts to infer proper harmonic relations from the physical structure of instruments (cf. n. 33 above). Aristoxenus' criticisms (41.24ff.) seem apt enough, but for the contrary view see Schlesinger (1939), pp. 57ff., 193–5. These theorists are perhaps the *organikoi* of 9.12, 9.13 Ptolemaïs and Didymus ap. Porph. *Comm.* 25.14–16, 26.6–14. Their procedures were probably related to the researches in physical acoustics undertaken by Pythagoreans and Peripatetics: for relevant references to *auloi* see, for example, 1.19 Archytas frag. 1, 4.19 ps.-Ar. *Probs* XIX.23, 5 *De Audib.* 800b, 802a, 804a, 6 Theophrastus ap. Porph. *Comm.* 63–4, 10 Nicomachus *Ench.* chs. 4 and 10, 9.7 Aelianus ap. Porph. *Comm.* 33–4, 9.10 Ptolemaïs ap. Porph. *Comm.* 23.1.

notation is not even a part of it, unless writing down metres is also a part of the science of metre. But if what applies there – that the man who can write down the iambic metre is not necessarily the one who best understands what the iambic really is – applies also to melodies (for the man who has written down the Phrygian *melos* is not necessarily the one who understands best what the Phrygian *melos* really is), then it is clear that notation cannot be the limit of the science in question.[40] That what we have said is true, and that the practitioner of notation needs nothing more than a perceptual grasp of the magnitudes of intervals, will be clear to those who consider the matter.[41] A person who sets out signs to indicate intervals does not use a special sign for each of the distinctions which exist among intervals – for instance, for the several divisions of the fourth produced by the differences between the genera, or for the several arrangements produced by alteration in the order of the combination of the incomposite intervals.[42] We shall say the same thing about the functions [*dynameis*] which the natures of the tetrachords create, for the interval from *nētē hyperbolaia* to *nētē* and that from *mesē* to *hypatē* are written with the same sign, and the signs do not distinguish the differences in their functions; so that their scope extends only to the magnitudes, and no further.[43] But we said at the beginning that the mere discrimination of magnitudes by the senses is no part of a complete understanding of the subject,[44] and what we are about to say will make the fact even easier to see. For through the magnitudes as such, no knowledge is forthcoming of the functions of either the tetrachords or the notes, or of the distinctions between the genera, or, to put it briefly, of the distinctions between the composite and the incomposite, of the simple and the modulating, of the styles of melodic composition,[45] or, in a word, of anything else at all.[46] If the so-called harmonicists adopted this supposition out

[40] Aristoxenus returns to these points at ps.-Plut. *De Mus.* 1143c–d. To write down the iambic metre is to represent the relative quantities of its syllables (on the science of metre see 12 Arist. Quint. *De Mus.* 40.28ff.): to write down the Phrygian *melos* is to notate the pattern of notes and intervals, the *systēma*, within which the Phrygian melodies can be composed. On the ambiguity of *melos* see n. 1 to Book 1.

[41] The point is that the capacity to notate requires only the identification of intervallic magnitudes, and that this tells us at most only one of several things relevant to understanding the role and implications of a given interval in its place in a melody: see the immediate sequel.

[42] This implies that the same sign or signs are used for the same size of interval, no matter to what genus its subdivisions belong, and no matter what order they come in.

[43] The text of this sentence is problematic, but the general sense is the same whichever editorial emendation is adopted (I translate that of Laloy, followed by da Rios). The intervals in question are both fourths. They are therefore identically notated even though their positions in the system, and their implications for the nature and the musical dynamics of their melodic surroundings, are entirely different.

[44] The remark might be a pardonable exaggeration. More probably it has the precise sense that perception of magnitudes constitutes raw data from which we may proceed to understanding: cf. 33.1ff.

[45] On the different 'styles' see 12 Arist. Quint. *De Mus.* 28.10–30.24.

[46] On the general point being made here compare 33.1ff., 47.8–50.14, 68.13–69.29. Can anything be inferred from this passage about the notation at which Aristoxenus' remarks are directed? One possibility is that the signs merely expressed the sizes of intervals, perhaps by numbers indicating so many dieses. This would fit Aristoxenus'

of ignorance, there would be nothing perverse about their procedure, but their ignorance must have been powerful and profound. But if they propounded the doctrine while fully aware that notation is not the limit of the present science, aiming to please the general public and to give them some end-product visible
41 to the eye, then they are to be condemned, instead, for gross perversity in their method. The reasons are, first, that they suppose that the layman should be set up as judge of the sciences – since for the same person to be learning and judging the same thing would be an absurdity – and secondly that in putting a perceptible product in the position of the limit of understanding, as their conception has it, they are reversing the proper order, since the limit of everything visible is understanding: for that is the ruling principle and judge of everything. If anyone supposes that hands, voice, mouth and breath are much more than inanimate instruments, he is quite mistaken; and if the understanding is buried somewhere in the soul, and is not immediately tangible or apparent to most people, as are the products of the hands and other things like that, this is no reason for imagining that what we have said is wrong. We shall have missed the truth if we make that which judges neither the limit nor the ruling principle, and make into the limit and ruling principle that which is judged.

No less absurd than this is the conception relating to *auloi*. The greatest and most preposterous of errors is to make the nature of harmonic attunement depend on an instrument. It is not because of any of the properties of instruments that harmonic attunement has the character and arrangement which it does. It is not because the *aulos* has finger-holes, bores,[47] and other
42 such things, nor because it admits operations of the hands, and of other parts naturally adapted to raising and lowering its pitch, that the fourth, the fifth and the octave are concords, or that each of the other intervals has its own appropriate magnitude. For even though all these factors are present, auletes

polemic, and corresponds to the method of marking metres: compare the manner in which the set of 'ancient scales' is introduced at 12 Arist. Quint. *De Mus.* 18.5ff. But no other source encourages the belief that a purely intervallic notation existed. A second possibility is that it designated each note by a symbol indicating its place in a series of pitches set out in a diagram (cf. n. 38 above). One might object that this procedure would after all reveal, for example, the difference between intervals mentioned at 40.7–8, but this would not be so on a diagram that represented all the different arrangements of the octave in the same theoretical range of pitch (see n. 34 to Book I, and cf. 47.8–25 with n. 70). Such a system might be the source of the notational diagram at 12 Arist. Quint. *De Mus.* 12.15ff. The third possibility, assumed in Macran's notes, is that it is the 'Alypian' system, or an early version of it. But it cannot possibly be said of this system that it discriminates nothing but magnitudes. (A discussion of Alypian notation cannot be undertaken here. It is preserved in the *Eisagoge* of Alypius, written in about the third century A.D. See also 12 Arist. Quint. 23.6ff., with the diagrams. For modern accounts see, for example, Monro (1894), pp. 67–77, Macran (1902), pp. 45–61, Gombosi (1939), chs. 3 and 5, Winnington-Ingram (1956), Henderson (1957), pp. 358ff., Barbour (1960), Pöhlmann (1970), pp. 141ff., Chailley (1979), pp. 120–139, with the tables on pp. 184–190.)

[47] 'Bores' translates *koilias*. The word generally refers to the main pipe of an instrument, and editors have found the fact that it is plural here troublesome. Probably the sense is roughly 'the *aulos* (taken generically) has a plurality of different sizes of bore...'

for the most part fail to attain the proper order of attunement, and for all these efforts produce the proper results only rarely, despite employing such techniques as separating and bringing together,[48] increasing and decreasing tension with the breath,[49] and all the other causal expedients. It is clear, then, that it is no more correct to say that excellence is inherent in *auloi* than to say that what is bad is so. But this ought not to have been so, if there were any value in basing harmonic attunement on an instrument, since one would only have to submit a melody to the *aulos* for it to be at once immutable, infallible and correct. But in fact neither *auloi* nor any other instruments will ever provide the foundation for the nature of attunement. Each of the instruments participates, so far as it can, in the marvellous organisation which belongs to the nature of attunement as a whole, under the direction of perception, to which are referred both these and all other matters to do with music. If anyone imagines that because he sees that the finger-holes are the same every day, and that the strings have the same tension, he will therefore find the attunement permanently fixed in them and maintaining the same organisation, he is
43 thoroughly simple-minded. Just as there is no attunement in the strings unless someone brings it to them by manual adjustments, no more is there in the finger-holes, unless someone brings it to them by manual adjustments. It plainly needs no arguing, since it is obvious, that no instrument tunes itself, but that perception is the authority in this matter. It is strange that when people have seen these facts they have not abandoned this sort of conception, noticing that *auloi* change, and never remain the same; for any sound produced by the *aulos* alters in accordance with the agencies through which it is produced. It is clear, then, that there is no reason for basing the study of melody on the *aulos*, since this instrument cannot establish the true order of attunement: and even if someone supposed that the basis should be located in some instrument or other, it should not have been located in *auloi*, since they are especially susceptible to variation, introduced through the craft of *aulos*-making, through manual techniques, and through their own peculiar nature.[50]

These, then, are the things that should be dealt with in an introduction to the science known as harmonics: but now that we are on the point of setting out on the study that deals with the elements,[51] we must notice in advance the

[48] Plutarch, *Non Posse Suaviter* 1096a, indicates that the effect of bringing the two pipes of a pair of *auloi* together was to lower the pitch, that of drawing them apart was to raise it. The method probably depended on the way these movements altered the positioning of the two double reeds between the player's lips: cf. Schlesinger (1939), p. 62.

[49] See, for example, 5 *De Audib.* 804a, cf. 3.17 Aristotle *De Gen. An.* 788a, 4.4 ps.-Ar. *Probs* XI.13, Theophrastus *Hist. Plant.* IV.11.4–5.

[50] *Auloi* are in general less reliable even than stringed instruments, since though both have to be attuned in advance by physical adjustments made on the basis of perception, once a *lyra* or a *kithara* is tuned, normal methods of playing do not introduce further variations in the pitch produced by each string. With the *aulos* it is different: the same fingering on the same instrument will not always produce the same sound. Cf. Plato *Philebus* 55–6 with Barker (1987).

[51] This may be a reference to axiomatic derivations, like those of Book III: cf. 28.33–29.1. Alternatively, it may merely mark the advance from introductory discussions to more detailed ones. See the introduction to this chapter.

following points.[52] This study cannot be successfully completed unless three conditions which I shall mention are already fulfilled. They are firstly, that the 44 appearances are accurately perceived; secondly, that those of them which are prior are correctly discriminated from those which are derivative; and thirdly, that what follows and is implied is viewed together in the proper manner.[53] Since every science which consists of more than one proposition should adopt first principles from which the things dependent on these principles can be demonstrated, we must adopt such principles, bearing the following two points in mind. We must ensure, first, that each of the fundamental propositions is true and evident, and secondly that each is such as to be accepted by perception as belonging among the primary parts of harmonic science: for whatever demands demonstration is not fundamental.[54] And in general we must be very careful, as we set out, not to slip into extraneous territory by beginning from a conception of sound as a movement of the air,[55] and equally not to turn back too soon and leave out many things which belong to the subject.[56]

Melodies fall into three genera, the diatonic, the chromatic and the enharmonic.[57] The differences between them will be specified later: but let us assume that every melody is either diatonic or chromatic or enharmonic, or a mixture of these, or common to them.[58]

The second distinction to be made is that some intervals are concordant and others discordant.[59] The two distinctions between intervals which seem to be best known are their differences in respect of magnitude, and the difference between the concordant and the discordant: but the latter distinction is

[52] With the reflections of this paragraph compare 32.10–33.26. Aristoxenus' attachment to the principles of Aristotle's *Posterior Analytics* is again clear.

[53] On the need for accurate perception see, for example, 33.1ff. On the distinction between what is prior and what is derivative and to be demonstrated, see n. 12 above. The third condition seems to be new: Macran's translation, 'thirdly, our conclusions and inferences must follow legitimately from the premises' misrepresents the Greek (though no doubt Aristoxenus would accept the point). The suggestion seems to be that when legitimate inferences have been made, their results must be 'viewed together', that is, understood in their proper relations to one another and to the initiating principles, so as to generate a grasp on the 'nature of attunement' as a single, coordinated whole. For somewhat similar ideas in a different theoretical context see Plato *Philebus* 14c–19a, and compare *Rep.* 531c–d.

[54] See n. 12 above, with its references to the *Post. An.* 'By perception' is almost a parenthesis. Perception cannot decide whether or not something is in this sense primary. The phrase serves to remind us that the content of the principles is abstracted from perception and must not conflict with it.

[55] Cf. 32.20–8. The reference to 'extraneous territory' points to the claims of Aristotle's 'same domain' rule: see the introduction to chapter 3.

[56] 'Turn back too soon': a metaphor from the race-course.

[57] Macran marks a lacuna before this sentence, which lacks a connective. The transition is certainly abrupt, but what is lost may be no more than a phrase or two. The programme of Book II places the study of the genera first (35.1). Details appear later (46.19ff.), and Aristoxenus may have given only a bare outline here. Compare the procedure of Book I (outline at 19.17ff., details at 21.32ff.).

[58] On mixtures of genera see 7.3, cf. Cleonides *Eisagoge* 189.15–18. A melody 'common to the genera' is one using only notes that several genera share, and in the extreme case only fixed notes.

[59] A more substantial passage has probably been lost before this sentence. The 'first distinction' will have been that in respect of magnitude (see the next sentence and cf. 16.16ff.).

45 included in the former, since any concordant interval differs in magnitude from any discordant one. There being many distinctions between concords, let us first consider the best known of them, that in respect of magnitude.[60]

Let us assume that there are eight magnitudes of concords. The smallest is the fourth: that it is the smallest is determined by the nature of melody itself. This is shown by the fact that we sing many intervals smaller than the fourth, but all of them are discordant. The second is the fifth: every magnitude which there may be between these two will be discordant. The third is the sum of the two concords mentioned, the octave, all magnitudes between the fifth and the octave being discordant. What we have said so far has been handed down by our predecessors: but we must give an analysis of the remainder for ourselves. We must explain first that the addition of any concordant interval to the octave makes the magnitude resulting from them concordant. This is a quality intrinsic and peculiar to the concord of the octave, for whether the concord added is smaller than it or equal or greater, the result of the combination is concordant.[61] This is not the case with the first concords,[62] for if either is added to its equal it does not make the whole concordant, nor does either if it is added to the interval composed of itself and an octave, but the result of these combinations will always be discordant.

46 The tone is that by which the fifth is greater than the fourth:[63] the fourth is two and a half tones.[64] Of the parts of the tone the following are melodic: the half, which is called the semitone, the third part, which is called the least chromatic diesis, and the quarter, which is called the least enharmonic diesis. No interval smaller than that is melodic.[65] But two things must not be overlooked: first, that many people have mistakenly supposed us to be saying that a tone can be divided into three equal parts in a melody. They made this mistake because they did not realise that it is one thing to employ the third part of a tone, and another to divide a tone into three parts and sing all three.[66] Secondly, we accept that from a purely abstract point of view there is no least interval.[67]

The differences between the genera are found in a tetrachord such as that

[60] With the subsequent discussion compare 19.30–21.19. Aristoxenus again makes no attempt to analyse or even to describe the phenomenon of concord (see n. 60 to Book I).

[61] Compare the use made of this principle at II Ptol. *Harm.* 13.3ff.

[62] That is, the fourth and the fifth, which are not only first in the list above, but (a) first in magnitude, being smallest, and (b) first in that they are primary, all other concords being combinations of them. The expression 'the first concords' is common in this sense.

[63] Compare 21.22, 62.1–11.

[64] Cf. 24.4–10. Aristoxenus tries to show how this (controversial) proposition may be confirmed at 56.13ff.

[65] Compare 21.23–31.

[66] The translation of this last phrase, which I have borrowed from Macran, expands the Greek slightly, but makes its sense clear. Quarter-tones and thirds of a tone occur in melody, but no more than two such small intervals are ever successive (cf. 28.6–17, 62.34ff.). Hence, no tone is divided into three or more equal parts by notes proper to a single *systēma*.

[67] Cf. the complementary proposition at 15.7–12.

between *mesē* and *hypatē*, where the extremes remain fixed, and either one or both of the intermediate notes move.[68] Since a moving note must move within some range [*topos*], we must find the determinate range of each of the notes mentioned. It appears that the highest *lichanos* is that which lies at a tone from *mesē*, and creates the diatonic genus; and the lowest is that at a ditone from *mesē*, which belongs to the enharmonic. Hence it is clear that the range of *lichanos* is a tone. That the interval between *parhypatē* and *hypatē* cannot be
47 less than an enharmonic diesis is obvious, since the enharmonic diesis is the smallest of all melodic intervals: that it too will increase to double the size remains to be shown. When *lichanos* in its descent and *parhypatē* in its ascent reach the same pitch, the range of each evidently arrives at its limit, so that it is plain that the range of *parhypatē* is not greater than the smallest diesis.[69]

Some people find it baffling that the note remains *lichanos* when any one of the intervals between *mesē* and *lichanos* is altered. Why, they ask, is there one interval between *mesē* and *paramesē*, and similarly between *mesē* and *hypatē* and between all the other notes which do not move, and yet we must insist that the intervals between *mesē* and *lichanos* are many? It is better, they say, to change the names of the notes, and no longer to call the other ones *lichanoi*, supposing that the one at a ditone from *mesē*, or one of the others, no matter which, is given that name. Notes which bound different magnitudes, they say, must be different notes; and the converse must also be true, that notes bounding equal magnitudes must be included under the same names.[70] Against these views we have advanced the following arguments. First, to recommend that each different note has a magnitude of interval peculiar to it is revolutionary: for we see that *nētē* and *mesē* are different from *paranētē* and *lichanos* in respect of function [*dynamis*], as are *paranētē* and *lichanos* from
48 *tritē* and *parhypatē*, and these again from *paramesē* and *hypatē*, which is why the members of each pair are given their own special names: but the interval involved in every case is the same, a fifth.[71] Hence it is clear that it is impossible for differences in the magnitudes of intervals always to follow upon differences in notes.[72] That the converse relation does not hold either can be seen from the

[68] See 21.31ff.

[69] For a more elaborate study of the ranges of *lichanos* and *parhypatē* see 22.24–27.14.

[70] The proposal initially seems to be that N and M are different notes, deserving different names, if and only if they stand at different distances from a given fixed note, e.g., *mesē*. This is contrary to Greek practice, since, for example, *lichanos* may stand anywhere between a tone and a ditone below *mesē*. Its identity as *lichanos* depends on its melodic function (*dynamis*), as Aristoxenus explains below. But the proposal turns out to be still more radical: it makes a note's identity depend only on the sizes of the intervals surrounding it, without reference to the names of the other notes that are these intervals' boundaries. Aristoxenus has no difficulty in making the suggestion seem nonsensical, but it may have had a real basis in the harmonicists' diagrams and their attempts at notation. See 39.30–40.24 with n. 46.

[71] The intervals in question are those from *nētē diezeugmenōn* to *mesē*, from *paranētē diezeugmenōn* to *lichanos mesōn*, from *tritē diezeugmenōn* to *parhypatē mesōn*, and from *paramesē* to *hypatē mesōn*.

[72] By implication this answers the question, raised at 36.9–12, whether notes are pitches or *dynameis*.

magnitudes do, but remains the same:[78] and while the genus remains constant it is reasonable to suppose that the functions [*dynameis*] of the notes do too.[79] After all, with which of the people who argue about the shades of the genera should one agree? Not everyone looks to the same division when tuning the chromatic or the enharmonic, so why should the note a ditone from *mesē* be called *lichanos* rather than one a small amount higher? To perception it seems to be the enharmonic in both of these divisions, yet plainly the magnitudes of the intervals are not the same in each of them. But the form of the tetrachord is the same, so that we must say that the boundaries of the intervals are the same too.[80] To speak quite generally, so long as the names of the bounding notes remain constant, the higher of them being called *mesē* and the lower *hypatē*, the names of those inside the boundary also remain constant, the higher being called *lichanos* and the lower *parhypatē*; for perception always treats the notes between *mesē* and *hypatē* as *lichanos* and *parhypatē*. But to suppose that equal intervals ought to be bounded by notes of the same name, or unequal ones by notes with different names, is to quarrel with the evidence of the senses. For the interval between *hypatē* and *parhypatē*, as it occurs in melody, is sometimes equal and sometimes unequal to that between *parhypatē* and *lichanos*.[81] It is obvious that two successive intervals cannot each be bounded by notes with the same names, unless the note in the middle is to have two names.[82] The absurdity is also obvious where the intervals are unequal, for it is not possible for one of the names to remain fixed while the other changes, since they get their names from their relation to each other:[83] for just as the fourth note from *mesē* is called *hypatē* by virtue of its relation to *mesē*, so the

[78] The analysis of 'ranges' at 22.24–27.14 was designed to reveal the points at which the genus does change; the results are summarised at 46.24–47.8.

[79] While a note retains the same perceived character and melodic function, it remains the same note. See 47.26ff., cf. 36.6–12.

[80] Cf. 23.1–23, 26.10–27, ps.-Plut. *De Mus.* 1143e–f. Every *lichanos* lower than the chromatic range is enharmonic (26.9–11). Since the lowest chromatic *lichanos* is two thirds of a tone above *hypatē* (24.15–21), and no *lichanos* is less than a semitone from *hypatē* (22.27–30), we may infer that the range of movement of enharmonic *lichanos* is one sixth of a tone.

[81] Equal in most of the divisions analysed by Aristoxenus, unequal in the soft diatonic (51.24–8).

[82] On the system Aristoxenus is criticising, a note with equal intervals above and below would have both the name proper to a note below such an interval, and that proper to a note above it.

[83] Aristoxenus' precise meaning is obscure. If we focus on the thesis that one note-name cannot remain fixed while another changes, the point might be this. Take four consecutive notes, M, N, O, P. If the size of the interval between O and P changes, both O and P must acquire new names. But then so must N, since even though its relation to M and O has not changed, what was O now has a different name, and notes get their names from their relations to other (named) notes. Alternatively, we might focus on the posited inequalities of the intervals between M, N and O. If the note-name 'N' is taken to have the meaning, for example, 'note separated from its neighbour by a tone', then this note must have another name too, designating its relation to the other note. But it is hard to resist the conclusion that Aristoxenus must somehow be misrepresenting his victims' intentions.

one which follows *mesē* is called *lichanos* by virtue of its relation to *mesē*.[84] Let that, then, be our reply to this difficulty.

Let us use the term '*pyknon*' for every case where, in a tetrachord whose extremes form the concord of a fourth, the two intervals put together occupy a smaller range [*topos*] than the one.[85] Of the divisions of the tetrachord, the ones which are divided into familiar magnitudes of interval are themselves familiar and most noteworthy.[86] One of these divisions is enharmonic, in which the *pyknon* is a semitone and the remainder a ditone.[87] Three divisions are chromatic, those of the soft, the hemiolic and the tonic chromatic.[88] The division of the soft chromatic is that in which the *pyknon* consists of two of the smallest chromatic dieses, and the remainder is measured by two units of measurement, by the semitone three times, and by the chromatic diesis once.[89]
51 It is the smallest of the chromatic *pykna*, and this *lichanos* is the lowest in this genus. The division of the hemiolic chromatic is that in which the *pyknon* is one and a half times that of the enharmonic, and each of its dieses is one and a half times the corresponding enharmonic diesis.[90] It is easy to see that the

[84] Aristoxenus here relies on the ways in which note-names were actually assigned in normal Greek practice, and his remarks might cut little ice with people proposing a new system. It is unclear whether he means to imply that *mesē* is the primary note from their relations to which others get their designations, but the fact that *mesē* was conceived as in some sense foundational is well documented, if little understood. See, for example, Aristotle *Metaph.* 1018b29, ps.-Ar. *Probs* XIX.20, cf. 11 Ptol. *Harm.* 64.16ff., Cleonides *Eisagoge* 201.14–202.5. Cleonides clearly states that it is from their relations to *mesē* that the other notes' *dynameis* are derived.

[85] See n. 76 above.

[86] Aristoxenus proceeds to analyse six divisions of the tetrachord, according to genera and shades. He repeats many of the results given in Book I (22.24–27.14), but the two passages have different purposes. In the first book his aim is to mark the extent and boundaries of the ranges inhabited by the moveable notes, overall and in each genus. Here he seeks to identify the points in these ranges at which the moveable notes lie in the genera and shades most commonly used in practice (cf. 11 Ptol. *Harm.* Book I ch. 16, Book II ch. 16). He is not claiming that these divisions are the only legitimate ones, or even the best. Within each range there is an indefinite number of permissible positions for each note (see, for example, 26.11ff., 47.8ff., and for some examples 52.12ff.). Only his enharmonic and his tense diatonic have a special status, in that their moveable notes have respectively the lowest and the highest possible positions in the tetrachord. It seems clear, then, that Aristoxenus is at least trying to analyse the phenomena of actual musical practice. For the analyses to be successful it would not, of course, be necessary for them to represent exactly what one might hear in any performance. The test would be whether an expert musician would agree, on listening attentively to melodies played with just the intonation Aristoxenus describes, that they were indeed based on the attunements at which he would aim, when playing in 'familiar' musical styles.

[87] This is Aristoxenus' preferred enharmonic, the *pyknon* being divided into two equal dieses. From the bottom of the tetrachord it runs $\frac{1}{4}$, $\frac{1}{4}$, 2.

[88] 'Soft', *malakon*, implies a lowering of pitch; in this shade the moveable notes lie as low as they can in a chromatic tetrachord. 'Hemiolic' means 'half and whole': one interval is hemiolic with respect to another if it is one and a half times as great. (The word is standardly used by Pythagoreans and Platonists to refer to the ratio 3:2.) The usage here is explained at the beginning of 51. 'Tonic' refers to the interval of a tone, the compass of the *pyknon* in this shade.

[89] The (smallest) chromatic diesis is one third of a tone (see, for example, 21.29–30). This division is therefore $\frac{1}{3}$, $\frac{1}{3}$, $\frac{11}{6}$. Aristoxenus computes the upper interval as $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{3}$ in order to represent it in terms of 'familiar' magnitudes.

[90] An enharmonic diesis is a quarter-tone. This division is therefore $\frac{3}{8}$, $\frac{3}{8}$, $\frac{7}{4}$.

hemiolic *pyknon* is greater than that of the soft chromatic, for the former falls short of being a tone by an enharmonic diesis, the latter by a chromatic diesis. The division of the tonic chromatic is that in which the *pyknon* consists of two semitones and the remainder is three semitones. Up to this division, both the notes move, but after this *parhypatē* stays still, since it has travelled through its whole range [*topos*],[91] while *lichanos* moves through an enharmonic diesis, and the interval between *lichanos* and *hypatē* becomes equal to that between *lichanos* and *mesē*, so that in this division the *pyknon* no longer occurs.[92] The *pyknon* disappears in the division of the tetrachord simultaneously with the first occurrence of the diatonic genus. There are two divisions of the diatonic, those of the soft diatonic and the tense.[93] The division of the soft diatonic is that in which the interval between *hypatē* and *parhypatē* is a semitone, that between *parhypatē* and *lichanos* is three enharmonic dieses, and that between *lichanos* and *mesē* is five dieses.[94] That of the tense diatonic is that in which the interval between *hypatē* and *parhypatē* is a semitone, and each of the others is
52 a tone.[95] There are thus as many *lichanoi* as there are divisions of the tetrachord, and two fewer *parhypatai*, since we use that which stands at a semitone both for the diatonic divisions and for that of the tonic chromatic. Of the four *parhypatai*, the enharmonic one is peculiar to the enharmonic genus, while the other three are common to the diatonic and chromatic.[96]

Of the intervals in the tetrachord, that between *hypatē* and *parhypatē* is, in melody, either equal to or smaller than that between *parhypatē* and *lichanos*, but never greater.[97] That it can be equal is evident from the division of the enharmonic and those of the chromatic, and that it can be smaller is evident from those of the diatonic; but one could also grasp this from the chromatic divisions, if one took as *parhypatē* that of the soft chromatic, and as *lichanos* that of the tonic chromatic: for such divisions as these are also perceived as melodic.[98] An unmelodic result would come from taking them in the opposite

91 See 23.25ff.

92 In tonic chromatic, *lichanos* lies a tone above *hypatē*. When *lichanos* is moved up by a quarter-tone, the magnitude spanned by the two lower intervals of the tetrachord together becomes equal to the remaining interval, that between *lichanos* and *mesē*. Hence the pair of intervals at the bottom no longer constitutes a *pyknon* (see 24.11–14, 48.26–31, 50.15–19).

93 'Soft' translates *malakon*: see n. 88 above. 'Tense' translates *syntonon*, as literally as possible: it indicates a high or 'tense' pitch for the moveable notes. Translators often render it as 'sharp', which is more natural English, but blurs the associations of the Greek.

94 That is, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{4}$.

95 This may fairly be called the 'standard' form of diatonic. It corresponds fairly closely to the form most commonly discussed by Platonists and Pythagoreans (e.g., at 1.12 Philolaus frag. 6, 2.3 Plato *Tim.* 35b–36b), though since they do not allow that the fourth is $2\frac{1}{2}$ tones, or indeed that the tone can be halved (e.g., 8 Eucl. *Sect. Can.* propositions 15 and 16), they do not represent the lowest interval as exactly a semitone. In general, when an author mentions the diatonic without qualification, it is usually to this form that he is referring, in either its Aristoxenian or its Pythagorean guise. For a useful compilation of different quantifications of the generic tetrachords see 11 Ptol. *Harm.* Book II ch. 14.

96 See 26.29–27.1.

97 This important and underived rule is also stated at 27.2ff.

98 The division would be $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{2}$.

order, if one took as *parhypatē* that which stands at a semitone, and as *lichanos* that of the hemiolic chromatic, or as *parhypatē* that of the hemiolic, and as *lichanos* that of the soft chromatic; for such divisions are perceived as harmonically ill-attuned [*anharmostoi*].[99]

The interval between *parhypatē* and *lichanos* may be equal, in melody, to that between *lichanos* and *mesē*, or unequal in either direction.[100] It is equal in the tenser diatonic, and smaller in all the others: but it is greater when one uses as *lichanos* that of the tensest diatonic, and as *parhypatē* one of those which are lower than that which stands at a semitone.[101]

After this we must give an account of succession [*to hexēs*], first explaining
53 in outline the method according to which we should agree that the task of defining it is best pursued. To speak generally, succession is to be sought by reference to the nature of melody, and not in the way in which continuity used to be explicated by those who looked to *katapyknōsis* for their evidence. They appear to treat the proper course [*agōgē*] of melody with contempt, as is clear from the quantity of dieses they place in succession, since the voice cannot put together as many as three. Thus it is evident that succession is not always to be sought in the smallest intervals, nor in equal or unequal ones, but that it is the nature [of melody] that we must follow.[102] It is not easy at this stage to give an accurate account of succession, before we have expounded the ways in which intervals are combined;[103] but the fact that there is such a thing as succession could be made clear even to someone totally ignorant of the subject through an argument of the following kind. The claim that there is no interval which we divide *ad infinitum* in melody is one that commands assent: there is some greatest number of parts into which melody divides each of the intervals. Whether we say just that this commands assent or that it is necessarily true, it is plain that the notes bounding the parts which make up this number are successive with one another. Among such notes are, apparently, those which we have used from earliest times, such as *nētē* and *paranētē*, and those which immediately succeed them.[104]

99 These improper divisions would be $\frac{1}{2}$, $\frac{1}{4}$, $\frac{7}{4}$, and $\frac{3}{8}$, $\frac{7}{24}$, $\frac{11}{6}$.

100 Stated also at 27.5–7.

101 Aristoxenus gives a specific example at 27.9–11, where the *parhypatē* is that of the lowest chromatic: the division would be $\frac{1}{3}$, $\frac{7}{6}$, 1. On the rules stated in this passage see 11 Ptol. *Harm.* 32.23ff., cf. 33.22ff.

102 On *to hexēs* see 27.15ff. On the sense of the remark about *katapyknōsis* see 28.1ff., and nn. 34 and 116 to Book I. On the voice's inability to put together more than two dieses, see 28.6ff. with n. 117, cf. 46.8ff. On the last sentence see 28.18ff. with n. 120.

103 This is the task undertaken in Book III.

104 The proposition is concerned with intervals defined by the *dynameis* of their bounding notes, not with 'magnitudes'. Aristoxenus appeals to the fact of experience that in any melodic system there is some determinate number of notes that stand between any given pair of notes. This implies that there are some notes that count as standing next to one another, between which, in that system, no note can be inserted. The size of the intervals between adjacent notes, and even the number of notes within a given interval, will vary from one system to another. (For a more elaborate expression of this point see 60.10ff.) What determines the maximum number of subdivisions in a given interval is the number of melodic functions that can be expressed, in any one system, by notes between its boundaries. Aristoxenus seems confident that the system of fixed notes marking the boundaries of conjoined and disjoined fourths, each fourth being divided into three

We must next give an account of the first and most indispensable of the 54 conditions that bear upon the melodic combination of intervals. Let it be accepted that in every genus, as the melodic sequence progresses through successive notes both up and down from any given note, it must make with the fourth successive note the concord of a fourth or with the fifth successive note the concord of a fifth. Any note which fulfils neither of these conditions must be considered unmelodic relative to all the notes with which it fails to form concords in the numerical relations mentioned.[105] But one must not overlook the fact that the principle we have stated is not enough by itself to ensure that the construction of *systēmata* out of intervals is melodic.[106] It is quite possible that even though the notes form concords in the numerical relations specified, the *systēmata* are unmelodically constructed; but if this condition is not fulfilled there is no help to be had from the others. Let this, then, be posited as first in the order of principles: if it is not fulfilled, the harmonic attunement [*to hērmosmenon*] is destroyed.[107]

Similar to it, in a way, is the principle which governs the positioning of tetrachords in relation to one another. Tetrachords that belong to the same *systēma* must have one or other of two properties. Either they must be concordant with one another, so that each note of the one forms some concord with the corresponding note of the other, or they must both be concordant with the same tetrachord, each of them being continuous with the one with which they are concordant, but not in the same direction.[108] This prlnciple, also, is not enough by itself to ensure that tetrachords belong to the same *systēma*, since 55 other conditions are needed in addition, of which we shall speak later:[109] but without this one the rest are useless.

intervals by two moveable notes, exhausts the number of distinct melodic functions that there can be.

105 This repeats the fundamental law stated at 29.6ff., used as the most important axiom in Book III.

106 One further principle is stated below; for others see 29.1ff. All of these, however, are very closely related to the previous one. The only plainly independent principles on which Aristoxenus relies are those governing the order of greater and smaller intervals in a tetrachord, stated at 52.8ff.

107 Yet on occasion in Book III (e.g., 66.22–5) he speaks as if conformity to this one rule were sufficient to make a sequence melodically permissible.

108 That is, if they are not concordant with one another, they must both be concordant with one that lies between them, and is continuous with the lower end of one and the upper end of the other: cf. 59.16–60.9. (Tetrachords are said to be concordant with one another when each note of one is concordant with the note in the equivalent position in the other.) In the GPS every tetrachord is concordant with every other; in the LPS the first tetrachord is not concordant with the third, but each of them is concordant with the second.

109 It is not clear what these conditions are. Aristoxenus might have in mind the rule that successive tetrachords must be either conjunct or disjoined by a tone (58–9), but this, as he makes clear himself, is derivable from the principle stated at 54.2ff. Macran suggests the rule that conjunctions and disjunctions must alternate in any extended *systēma*, but this will not do as it stands, since it does not apply to the LPS. (There is no suggestion in Aristoxenus, as in 11 Ptol. *Harm*. Book II ch. 6, that the LPS is not properly a single system, but combines parts of two through a form of modulation. It is natural to read, for example, 63.20ff. as implying that where progressions to disjunction and to conjunction are legitimate alternatives, the two systems generated are of equal status.)

Of the magnitudes of intervals, those of the concords appear to have either no range of variation [*topos*] at all, being determined to a single magnitude, or else a range which is quite indiscernible, whereas those of the discords possess this quality to a much smaller degree. Hence perception relies much more confidently on the magnitudes of concords than on those of discords.[110] The most accurate way of constructing a discordant interval will therefore be by means of concords.[111] Thus, if we have the task of constructing from a given note a discord such as a ditone downwards (or any of those which can be constructed by means of concords) we should construct from the given note a fourth upwards, from there a fifth downwards, then another fourth upwards, and then another fifth downwards. In this way the ditone downwards from the given note will have been constructed. And if the task is to construct the discord in the opposite direction, the concords should be constructed the opposite way round.[112]

Further, if a discord is subtracted from a concordant interval by means of concords, the remainder will also have been found by means of concords. For instance, let the ditone be subtracted by means of concords from the fourth. It is clear that the notes bounding the remainder by which the fourth exceeds the ditone have also been constructed, by means of concords, in their relation to
56 one another. The notes bounding the fourth are themselves concordant. From the higher of them we find a note concordant at a fourth above, from that note another a fifth below, then again one a fourth above, and then from that note another a fifth below. The last of these concordant intervals falls on the higher of the notes bounding the remainder in question: and it is thus clear that if a discord is subtracted from a concord by means of concords, the remainder will also have been found by means of concords.

The question whether we were correct in the assumption, which we made in

[110] Aristoxenus assimilates concordant and discordant intervals to the class of 'functionally' apprehended phenomena. They are not constituted by their magnitudes as such, but by the character under which they are experienced: cf. 39.30–40.24, and especially 48.15ff. But just as the special sound of the *pyknon* is perceived only in intervals within a certain range, so is that of each specific concord and discord. Aristoxenus suggests here, correctly, that there is a small but nevertheless real range of variation in magnitude within which the sound of a discordant interval will continue to be heard as 'functionally' the same discord. The range assignable to any given concordant interval, by contrast, is either so small as to be indiscernible, or else is actually of zero extension, the characteristic sound of, for example, the fifth being restricted (in fact, but not a priori) to one determinate magnitude.

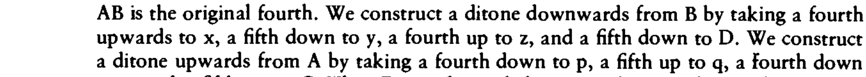
[111] This method of tuning a complete scale by the construction of fourths and fifths is still familiar. Aristoxenus uses it for theoretical purposes only, but it is certainly derived from the ways in which practical musicians tuned their instruments. The 'method of concords' appears as freely in Pythagorean writings as in Aristoxenian. (See, for example, 8 Eucl. *Sect. Can.* proposition 17; it links also with the mathematical operations of 2.3 Plato *Tim.* 35b–36b. On its relevance to the divisions of Archytas see the Appendix to chapter 1.) The procedure cannot be used, in Aristoxenus' system, to construct intervals other than the semitone and its multiples. He therefore seems to have no method that is reliable even by his own standards for showing that the other intervals in his tetrachordal divisions are of exactly the sizes he asserts. Yet he insists elsewhere that the incapacity of the method of concordance to construct these intervals is no good reason for denying them a place in melody (ps.-Plut. *De Mus.* 1145b–c).

[112] See the diagrams given in n. 114 below.

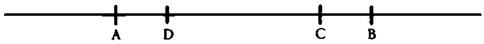
our introduction,[113] that the fourth consists of two and a half tones, can be investigated most accurately in the following way. Take a fourth, and starting from each of its extremes in turn, mark off a ditone by means of concords. It is clear that the remainders are equal, since equals have been taken from equals. Next, take a fourth upwards from the lower bounding note of the upper ditone, and take another fourth downwards from the upper bounding note of the lower ditone. It is clear that next to each of the notes which bound the resulting *systēma* there will be two consecutive remainders which must be equal, for the reasons stated before. When this construction has been set up, we must bring to the judgement of perception the outermost of the notes that have been located. If they appear to perception as discordant, it will be evident that the
57 fourth is not two and a half tones: but if they sound the concord of a fifth, it will be evident that the fourth is two and a half tones. For the lowest of the notes constructed was tuned to make the concord of a fourth with the upper bounding note of the lower ditone, and the highest of the notes constructed has turned out to form the concord of a fifth with the lowest; so that since the difference is a tone, and since it is divided into equal parts, each of which is a semitone and is also the excess of a fourth over a ditone, it is clear that the fourth consists of five semitones. It is easy to see that the extremes of the *systēma* constructed will not form any concord but the fifth. In the first place it must be understood that they do not form the concord of a fourth, since there is an excess added in both directions to the fourth which was originally taken. Next we must state that it cannot accommodate the concord of an octave. The magnitude formed by the sum of the remainders is less than a ditone, since the fourth exceeds the ditone by less than a tone: for everyone agrees that the fourth is greater than two tones and smaller than three. Thus the total added to the fourth is less than a fifth, which makes it clear that the combination of them cannot be an octave. But if the extremes of the notes constructed form a
58 concord greater than the fourth but smaller than the octave, the concord which they form must be the fifth: for this is the only concordant magnitude between the fourth and the octave.[114]

[113] See 24.4–10, 46.1–2.

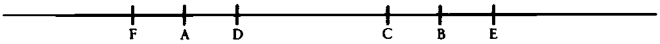
[114] The argument is most easily followed with the help of diagrams. First, we take a fourth and construct ditones inwards from its extremities, by the method given at 55.13ff.



AB is the original fourth. We construct a ditone downwards from B by taking a fourth upwards to x, a fifth down to y, a fourth up to z, and a fifth down to D. We construct a ditone upwards from A by taking a fourth down to p, a fifth up to q, a fourth down to r, and a fifth up to C. Then D is a ditone below B, and C is a ditone above A.



The remainders, that is AD and CB, are evidently equal. We next take the fourth upwards from D, to E, and the fourth downwards from C, to F.



Since CF is a fourth and CA is a ditone, FA is the remainder of the fourth when a ditone