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BARKER, A.
1991

In: *The second range, Studies in
harmony and musical form*
Plato and Aristoxenus on the Nature of μέλος¹

ANDREW BARKER

Introduction

When we identify a sequence of sounds as a melody or a fragment of a possible melody, we implicitly distinguish it from other sequences that are not, in this sense, melodic. It would be rash to claim that the distinction is sharp, or that in standard cases it is based on clear and universally accepted criteria. Nevertheless we make it; and at the heart of the musicological speculations and analyses that have come down to us from the ancient Greeks there lies a distinction of a very similar sort. It is true that Greek ears accepted into the category of μέλος some sequences which Mozartian sensibilities, for example, would find melodically incomprehensible, and that some sequences which would probably have struck a Greek musician as alien to μέλος can present themselves to a modern ear as melodically well formed. But it seems fair to assume, at least as a working hypothesis, that when Greek writers claim the status of μέλος for some sound-patterns and reject it for others, the distinction they are drawing is broadly analogous to the one with which we are familiar: and I make no apology for using the terms 'melody', 'melodic', 'unmelodic' and so on in the following discussion.

All relevant Greek sources agree on two simple preliminary points. First, no audible sequence can be melodic unless it is built from a series of elementary sonorous constituents, each of which maintains for an appreciable time some single, determinate pitch. No sound that lacks identifiable pitch, like a thud or a clatter, can be an element in μέλος, and neither can one whose pitch shifts continuously like the howl of a wolf, or any temporal segment of that howl. Hence if glissandi had any place in Greek musical practice, it was not as proper parts of any μέλος.¹ Secondly, the fulfilment of this first condition is insufficient by itself to qualify a sequence as melodic. It will be so only if certain further conditions are met, not by each of its constituent sounds considered individually, but by the relations in which their pitches stand to one another. Some kinds of relation—roughly speaking, some intervals, διαστήματα—are such that they can be used in μέλος, while others are not. Again, even those that are melodically usable may be associated with one another in melodic or unmelodic ways: not every sequence of melodically acceptable intervals is itself melodic.²

* For bibliographical abbreviations and comments on the sources see Appendix.

¹ See, for instance, Aristoxenus, *Elementa harmonica* 8.13–10.10; Nicomachus, *Enchiridion* 2; Aristides Quintilianus, *De musica* 5.24–6.7 (translated in *GMW*), II, pp. 132–3, 248–50, 404). That non-melodic sounds could nevertheless have a place in musical performances is strongly (and disapprovingly) suggested by such passages as Plato, *Republic* 397A, *Lysis* 669C–D (*GMW*, I, pp. 128, 154).

² On melodic intervals see, e.g., Aristoxenus, *Elementa harmonica* 46.2–18, and Prolemy, *Harmonics* 1.7 and 1.5 (*GMW*, II, pp. 160, 288–90, 306–11). On their melodic combinations there are many relevant passages in both these authors. In Prolemy the most illuminating is again 1.15; in Aristoxenus see, e.g., *Elementa harmonica* 5.2–29, 27.15–29.1, and the whole of book III (*GMW*, II, pp. 129–30, 144–6, 170–84). A sketchier but still unmistakable reference to the two sorts of issue is at Plato, *Philebus* 17D (*GMW*, II, p. 64).

So much is common ground. When we look at the details of the distinctions drawn by different authors, however, we find not only conflicts of opinion about the identity of the intervals and the nature of the interval patterns that constitute genuinely melodic sequences,³ but also differences that lie much deeper and are reflected in radically different views about the manner in which these subjects should be approached. As a preface to a discussion of these differences we should first recognize that most Greek musical writers sought to draw the relevant boundaries more rigidly than we might think appropriate, offering an absolute distinction between the melodic and the unmelodic, and sharp criteria to be applied in drawing it. Thus when Aristoxenus is considering the credentials of various sorts of sequence, he says flatly, of each member of a whole series of examples, οὐ μελωδεῖται, 'it is not sung'. This does not mean 'it is never uttered by the voice', but 'it is not uttered melodically'; that is, its utterance can under no circumstances form part of any melody. Sometimes he describes such a sequence as ἀδύνατον, 'impossible' (*Elementa harmonica* 66.11–12), or asserts that the voice is wholly incapable of singing it (28.6–17). In neither case does he mean that these things are physically impossible: they are 'melodically impossible', impossible in the context of μέλος. (This is made clear, for instance, at 66.15–16, where the 'impossibility' referred to at 66.11–12 is demonstrated by an argument whose conclusion is that the sequence is ἐκμελές, 'unmelodic'.) Conversely, he says of any sequence that meets his criteria, μελωδεῖται, 'it is sung', that is, 'it is a sequence that can occur in melody'; and he speaks of such sequences as being 'melodically put together' (ἐμμελῶς συγκεῖσθαι) out of intervals (e.g., 54.13–14).

Turning now to Plato, the other main focus of the present investigation, we find frequent suggestions in his works too that the distinction between what is μέλος and what is not is absolute and capable of being grasped by the scientific understanding. A passage in the second book of the *Laws*, for instance (667B–671A), repeatedly returns to the topic of melodic 'correctness' (ὀρθότης). This correctness is something that it is possible to understand (γινώσκειν); such understanding demands an acute capacity for perception and an intellectual grasp on the nature of the ἁρμονία (670B). A melody will be correct, he goes on, if its elements are 'appropriate' (προσήκοντα) and not otherwise, so that one cannot understand whether a given sequence is melodically correct or not unless one knows 'what it contains', what its elements really are (670C). Most people's musical training has consisted merely in being 'drilled in singing to an accompaniment and stepping in rhythm', and they have no understanding of what they do: they do not even realise that they do not understand (670B–C). Plato has identified two tasks, those of discovering what elements a sequence contains and determining whether or not they are 'appropriate'. Probably they are to be linked to the two items he has specified as preconditions of understanding, acute perception and a knowledge of the ἁρμονία. Through careful perception we grasp the features of each element in a sequence presented to our ears. The ἁρμονία, as Plato conceives them, are primarily the various patterns of relations

³ Such disagreements are paraded and discussed, for instance, in Ptolemy, *Harmonics* 1.12–14 (*GMW*, II, pp. 301–6); see also the tables representing harmonic divisions proposed by five different authors in II.14 (*GMW*, II, pp. 346–50).

into one or other of which the elements of a sequence must be organized if it is an instance of 'correct' μέλος (see, e.g., *Philebus* 17D–E). Then we come to understand whether a given element in a sequence, identified by perception, is or is not 'appropriate', when we have determined whether it fits, together with the others, into the system of organization proper to some ἁρμονία. (There are of course other dimensions to Plato's notions of 'appropriateness' and 'correctness', some of which will be considered below; but they supplement, rather than displace, the present level of analysis.)

It is clear that in this passage Plato is treating the distinction between the melodically correct and the incorrect as a real one, neither arbitrary nor merely conventional. In Plato's view, distinctions of the latter sort are incapable of being intellectually grasped and understood. The distinction cannot be drawn on the basis of ordinary familiarity with musical practice. It demands a thorough analysis of the contents, the elements or constituents (no noun occurs in the Greek) of any sequence whose credentials are to be assessed; and it demands the formation of a judgement concerning the appropriateness of each element, a judgement that will be grounded in knowledge of the nature of each kind of ἁρμονία.

At a superficial level there are obvious similarities between the claims made by Plato and by Aristoxenus in the texts we have so far reviewed. Each wishes to draw a rigid distinction, placing the 'melodic' or 'melodically correct' on one side and the 'incorrect' or 'unmelodic' on the other. Each holds that the distinction can be drawn scientifically, as a matter of knowledge and not merely of convention or prejudice. But behind these similarities, as I shall try to show, there is a world of difference. It is not just that they give different answers to the questions they propose. The more significant differences lie in the senses they attach to the questions themselves and in the manner in which they set out to tackle them.

Plato

The passages in Plato's dialogues in which the distinctions we are considering appear most prominently are ones that deal with the education of children's characters in a civic context and with the formation and preservation of attitudes that strengthen the community's social bonds. The central texts are the third book of the *Republic* and the second book of the *Laws*. It is immediately obvious that Plato's main concern in these passages is not to find ways of distinguishing between what his contemporaries were prepared to count as μέλος and what they were not, but to draw a distinction within the recognized domain of μέλος, or more generally within that of μουσική, a distinction designed to mark off 'good', 'beautiful', 'correct' or 'appropriate' musical productions from their opposites. These musical excellences are not themselves to be identified simply on the basis of commonplace aesthetic intuitions, or even those of technically expert musicians. Different people enjoy different kinds of music (e.g., *Laws* 655B–C), and musicians can be perfect in their craft without knowing which of their skilfully wrought constructions is 'good', in Plato's sense—that is, ethically good and socially desirable—and which is not (*Laws* 670E). Plato's initial question, then,

is not 'What distinguishes something that strikes us as a μέλος from something that does not', but 'What distinguishes a genuinely admirable μέλος from others?' In the *Republic*, similarly, his discussion begins (398C) from a classification of the various ὁρμονίαι that provide the patterns or relations out of which all μέλη are contrived, and goes on to distinguish melodic forms that are ethically and socially good from those that are not.

At first sight, then, we might be inclined to treat these discussions as irrelevant to the subject in hand. They seem to bear less on a distinction between the melodic and the unmelodic than on a division between two classes of the melodic, the admirable and the despicable. The criteria Plato applies to make even this distinction seem to be moral and social, rather than 'aesthetic' in a sense we would recognize. He appears to be concerned much less with the way something sounds than with the effects that hearing or performing it have on a person's character and dispositions. 'Good' music is indeed that which is enjoyed, but not that enjoyed by the public at large, or by artistic connoisseurs: it is that which is enjoyed by people of sound moral character, and only those who are 'outstanding in excellence and education', and 'possess moral wisdom of all kinds, especially courage', are qualified to judge its credentials (*Laws* 658E–659A).

To us, perhaps, there might seem to be at least four distinct questions at issue. What distinguishes the melodic from the unmelodic? What criteria do we apply in describing a melodic composition as technically well crafted? What is the difference between an aesthetically satisfying melody and one that strikes us as musically displeasing? Finally, if we are prepared even to ask the question pervading the *Republic* and the *Laws*, what is the difference between a melody that influences the character for its moral good and one that corrupts or destroys it? For Plato, in at least some of his moods, the second question is indeed a separate one. But the third cannot be answered until we have a satisfactory solution to the fourth; and the first and the fourth are inextricably and inevitably fused.

This fusion is perhaps most clearly detectable in a passage of the third book of the *Republic*. When the subject of melody is first introduced, Socrates begins by dividing melodic structures, ὁρμονίαι, into different groups on the basis of their ethical characteristics (398E–399E) and goes on to adumbrate comparable distinctions between classes of rhythm (399E–400C). Some ὁρμονίαι promote an admirable character, while others undermine it with excessive 'tension' or 'relaxation'; and rhythm may similarly be classified as ethically good or bad. But as soon as these distinctions have been outlined, the language of the discussion changes, and in three emphatic speeches (400D–E) the contrasts are revealed not just as ones between ethically good ὁρμονία or good rhythm and bad, but as dividing off the 'well harmonized' (τὸ εὐᾶρμωστον, εὐᾶρμωστίᾳ) or the 'well rhythmized' (τὸ εὐρυθμον, εὐρυθμίᾳ) on the one hand, from the 'unharmonized' or the 'unrhythmic' (τὸ ἀνᾶρμωστον, τὸ ἄρρυθμον) on the other. Again at 401B it is ἀρρυθμία and ἀνᾶρμωστίᾳ, not merely 'undesirable' ὁρμονία and rhythm, that are said to be akin to bad speech and bad character. At 402D the admirable lover of noble-souled people is designated, not as the devotee of a special kind of noble music, but simply as the μουσικός, the musical person; and his foil is not the person of degenerate or vulgar musical taste, but the ὁσύμφωνος, the person whose character is 'discordant', altogether unmusical. What all these passages

betray is an assimilation of 'bad' melodic structure and 'bad' rhythm to the wholly unmelodic and unrhythmic, and of the person whose musical tastes Plato finds ethically objectionable to the class of people who have no musicality in them at all. What has previously appeared as bad melody, bad rhythm, bad music is now treated as non-melodic, non-rhythmical, non-musical.

We might be tempted to dismiss these turns of phrase as mere rhetoric. But that, I think, would be a mistake. Plato means what he says, and has given enough clues in his text for us to grasp the general shape, at least, of the considerations that are at work behind it.

At the heart of the matter are the uses Plato makes of the notion of μίμησις, imitation. The importance of this concept in Plato's accounts of the arts is of course well known, especially from its pervasive role in *Republic* book X. It is equally fundamental in specifically musical contexts. Here, for example, is the way in which the Athenian speaker in the *Laws* introduces his discussion of musical 'correctness': 'Now this at least is a claim about music with which everyone would agree, that all its compositions are imitation (μίμησις) and representation (ἀπεικασία). Wouldn't everyone agree to that, composers and listeners and performers alike?' (*Laws* 668B–C). Whether everyone would in fact have agreed or not, for Plato the thesis is not merely an obvious and unarguable truth about music generally, but one from which many of his most important conclusions are drawn. The whole of the discussion of correctness in this passage of the *Laws* turns on it. So too, for instance, does his rejection of purely instrumental music as an acceptable form of art, on the grounds that if it is music it must be μίμησις, but that in the absence of words 'it is impossibly difficult (παγγάλεπον) to understand what it means (ὅτι βούλεται), and what worthwhile imitation (μίμημα) it is like' (*Laws* 669E). Again, music becomes incoherent when it 'puts together in the same piece the sounds of wild beasts and men and instruments, and noises of all sorts, as though in imitation of (μιμούμεναι) a single object'.⁴

Nothing, then, can be music unless it is μίμησις. We cannot understand its significance unless we know what it imitates. It cannot have a coherent meaning unless the object imitated is itself simple and unified, and it cannot be good unless the object imitated is good (e.g., *Laws* 668B). But we need to ask precisely what objects of imitation Plato has in mind, and in what respects the μιμήσεις are reckoned to be 'like' the originals. These questions are not as easy as they look. Sometimes, as we have seen, he speaks of music imitating such things as animal noises or the squeaking of axles and pulleys. In more serious vein, at *Republic* 399A–C, his Socrates asks that there be left in the ideal community ὁρμονίαι that will imitate the 'voices and intonations' (φθόγγους τε καὶ προσωδίας) of brave men facing adversity and of moderate and self-controlled persons in times of prosperity. Here it seems that what music imitates is always some actual sound and that it imitates it simply by sounding like it. But as we read on we find that this is no more than a preliminary approximation to Plato's real meaning,

⁴ *Laws* 669C–D: Plato's target here is similar to that of *Republic* 397A, where we hear of performers who imitate 'thunder and the noises of winds and hail and axles and pulleys, and the voices of trumpets and reed-pipes and Pan-pipes and instruments of every sort, and even the sounds of dogs and sheep and birds'.

introduced, perhaps, only to make his talk of 'imitation' accessible to the uninstructed reader.

To discover his true intentions we must follow the *Republic's* treatment of musical μίμησις through three stages, of which the one just sketched is the first. The second develops gradually in 400D–401B. It begins from the claim that good rhythm and lack of rhythm, good ἁρμονία and lack of ἁρμονία, 'follow' noble diction (ἀέλις) or its opposite by resembling it (ὁμοιοῦμενον, 400D). Here it might still be a sound that is 'resembled', not, however, a sound extrinsic to the musical composition (a brave man's voice or the noise of thunder), but that of its own leading element, the words. Next we are told (400D) that the style of diction gets its character, in turn, by 'following' the character of the soul; and since the other musical elements 'follow' the diction, 'good diction, good ἁρμονία, gracefulness and good rhythm follow good character' (400D–E). Finally, it is made explicit that this 'following' is still a matter of imitation: 'gracefulness and lack of rhythm and lack of ἁρμονία are sisters of bad diction and bad character, whereas their opposites are sisters and imitations (μιμήματα) of the opposite, of a restrained and good character... Then we must give orders to our composers and compel them to implant in their compositions an image (εἰκὼν) of good character, or else to do no composing in our city' (401A–B).

Here, then, the object of imitation on which the status of the music depends is human character, good or bad. This passage does nothing to explain just how melody and rhythm can 'imitate' or 'resemble' character. But it is not Plato's last word on the subject. The third phase of his treatment begins at 402A. Socrates sets out to identify the qualifications a person must have if he is to be truly μουσικός; it becomes clear from the context that the term refers here to someone who understands music and is not merely a competent performer or a devoted listener. His discussion is based on a comparison. We have adequate understanding about letters and writing, he says, when we can identify the 'elements' (στοιχεῖα, that is, the letters), which are relatively few, in all the many instances where they are scattered about (περιφερόμενα) in all the things (the words and phrases) where they exist. Until we can do this we are not γραμματικοί. Further, he continues, we must grasp the letters themselves before we can identify their 'images' (εἰκόνες), as these appear in water or in mirrors: the same skill equips us to recognize both (402A–B). At this point he turns to the musical counterpart of this understanding. We might expect the analogues of the 'elements' of writing, the letters, to be such things as notes and intervals. But Socrates develops his comparison in a different way. 'Similarly, then', he says, 'we shall not be μουσικοί...until we grasp the forms (εἶδη) of moderation and courage and liberality and nobility and their kin and their opposites as they are scattered about (περιφερόμενα) everywhere and can identify them in the things in which they are, both them and their images (εἰκόνες),...since both belong to the same skill... In that case', he concludes, 'wherever there are noble dispositions in the soul, and in visible appearances ones that are in agreement and concord with them, sharing in the same mould (τύπος), that will be the most beautiful sight for anyone capable of seeing' (402B–D).

In this comparison, then, the musical counterparts of the elements of γραμματική are not notes and intervals, but—surprisingly—virtues. There are three

aspects to the capacities of someone who is truly μουσικός. First, what he is able to identify are the forms (εἶδη), the general or abstract essences of these virtues and their opposites. Next, he must be able to identify them not merely in the abstract, intellectually, but πανταχοῦ περιφερόμενα and ἐνόντα ἐν οἷς ἐνέσταιν (402C), that is, in all their actual appearances and combinations in concrete instances, just as the γραμματικός must identify the letters ἐν ἅπασιν οἷς ἔστι περιφερόμενα (402A), in all their reshufflings as they occur in words and phrases, and not merely 'in themselves' as elements of an abstract alphabet. Finally, just as the account of the γραμματικός refers, rather artificially perhaps, to 'images' of letters in water and mirrors, so the μουσικός must recognize not only the virtues themselves in their transient occurrences, but their images too: and each kind of expert is able to recognize the images just because he is able to recognize the originals. These two sorts of recognition are closely related: nevertheless Plato has distinguished quite sharply the occurrence in particular instances of the forms themselves from the occurrence of their images. He means, plainly enough, that the forms of the virtues are themselves instantiated only in states of the soul. The present passage alludes to what is probably an example of their images when it speaks of a bodily appearance that is in 'agreement and concord' with a soul's virtuous disposition. But we have seen already that music is an 'image' or 'imitation' of psychic character, so that it too must belong to the category of images envisaged here.⁵ It will be an image, not of any individual character, but of the form shared by all souls whose character is of some specific sort; and it will have this status, just as a bodily appearance does, by sharing in the τύπος that makes the relevant character what it is. Music, bodily appearance and psychic character are three quite different things, but each can be formed, like clay, bronze and silver, in the same mould.

We can now begin to see why it is that Plato denies to ethically abhorrent 'music', as it is commonly called, the title of being music at all, and why a 'melody' grounded in an ethically improper ἁρμονία is ἀνάρμοστος—'non-harmonic'—not genuinely μέλος. If a sequence of sounds is to be μέλος, it must first be imitation; otherwise it has no musical standing at all. Secondly, it must have a certain coherence, as an 'imitation of a single object'; otherwise it will not be μέλος, but at best a fragmentary association of different μέλη. But thirdly, this demand for coherence spills over into a requirement laid on the object of imitation itself. It too must be 'musically' well formed; for if it is not, neither will be the putative melody that is its image and shares in its τύπος. The ultimate object of musical imitation is the form that appears in the character of a soul; and this musical coherence belongs only to virtuous character. All others are ἀνάρμοστοι or ἀσύμφωνοι; hence no imitation of them, however technically accomplished and however grateful to the ears of the vulgar, can properly be classed as melodic.⁶

⁵ The distance separating all artistic productions from the realities of which they are 'images' is heavily emphasized in *Republic* X. There they are described as standing at two removes from the real originals: see, for instance, *Republic* 598A–599A.

⁶ That complete excellence of character consists in an appropriate 'harmonization' of psychic elements or impulses and that bad character is disorderly and 'unharmonious' are common themes in Plato. See, for instance, *Gorgias* 503D–508A, *Republic* 443C–444A.

Genuine μέλη, then, are distinguished from other, superficially similar sequences of sounds by being cast in the same mould and exhibiting the same form as a noble and virtuous soul. One might be forgiven for treating this thesis as high-minded but vacuous; and it must evidently be so if no further description of the relevant form is forthcoming. As it stands, it offers us no way of deciding whether or not this form is present in actual specimens of melodic composition or performance. Now if we begin from a study of Plato's analyses of the virtues, we shall certainly find nothing to our purpose. To yield adequate criteria for distinguishing true μέλος from its spurious counterfeits, such analyses would have to be expressed with sufficient abstract generality to allow them to be transferred to the musical sphere and with sufficient precision to give us a reliable procedure for determining, in specific instances, whether the requirements they lay down are met. Plato's account of the virtues, in *Republic*, book IV, for example, fulfil neither of these conditions.

We may do better, however, if we follow the route to which Plato himself directs his fledgling philosophers. No amount of dialectical discussion of moral issues, of the kind exhibited in much of the *Republic* itself, will lead them to an understanding of what is good and beautiful, unless it is prefaced, first by a rigorous training of character, and secondly, as Socrates explains at length in the seventh book, by a long and arduous programme of investigations in mathematics. The question why mathematics is required cannot be pursued in detail here. But it is clearly Plato's view that the propositions and arguments of mathematics are approximations—ultimately inadequate, but sound and true as far as they go—to the higher truths and demonstrations concerned with absolute reality and value which are the philosophers' final goal.⁷

The fifth and last of the mathematical disciplines that Plato prescribes for study is harmonics (*Republic* 530C–531D), the science concerned with the elements, relations and structures that form the basis of μέλος.⁸ His discussion here is confined to a general characterization of the science as he conceives it, together with sharp criticism of two alternative approaches. It enunciates none of the propositions that the science would contain, and thus falls short of answering the question we are addressing: it does not tell us what distinguishes μέλος from anything else. But it leaves us in no doubt about two crucial points. First, the reason why harmonics must take the special form which Plato idiosyncratically attributes to it is that only if it does so will it be 'useful...in the search for the beautiful and the good', pursued in any other way it is useless' (531C). That is, if and only if harmonic investigations are conducted in Plato's way, their results will give some clue to the real nature of beauty and goodness. No doubt these results will be in some degree defective and incomplete. But that is not, I think, because they are inaccurate or misleading: it is because through harmonics alone, or in combination only with other mathematical disciplines, they will remain imperfectly understood, in need of supplementation through dialectic. There is no

reason to doubt Plato's conviction that the account of the nature of beauty and goodness which harmonics can provide is true and that it will yield an accurate description of the form of excellence or virtue which we have set out to discover. The description will be inadequate only in so far as the conceptions through which it is framed and the assumptions in which it is founded are themselves less than ultimate, requiring analysis and explanation at a still higher level of abstraction.⁹

The second point that becomes clear in this passage is simply that the harmonic enquiry into the nature of this form belongs to the domain of mathematics and, more precisely, to a science concerned finally with nothing but numbers. Other theorists had indeed treated harmonics quantitatively: the Pythagoreans, Socrates says, had sought to discover the 'numbers' in concords that are heard. He is referring, plainly enough, to attempts to express concordant (and other, legitimately 'melodic') relations between pitches as ratios of numbers, identifying the octave with the ratio 2:1, the fifth with the ratio 3:2, and so on, in a way that by now was tolerably familiar.¹⁰ But these theorists, according to Plato's Socrates, had neglected a crucial question. Some relations between pitches are concordant, others are not. Correspondingly, some relations between numbers, and not others, are themselves 'concordant': since it is because they stand in certain numerical relations to one another that some pairs of sound are concordant, there must be something about those ratios themselves, conceived purely as ratios of numbers, that marks them off from other number-pairs as concords are marked off from discords. What, then, is this special mathematical feature? This is the question neglected by the Pythagoreans: 'They do not ascend to problems, to investigate which numbers are concordant and which not, and in each case why' (531C). They may have identified correctly each numerical ratio to which a perceptible concord corresponds; but they have not given a mathematically intelligible description of the class of concordant ratios, an account of the mathematical 'form' which they share, nor have they explained why, from a mathematical point of view, this class of ratios should have special significance.¹¹ We need not be troubled by the fact that Plato confines his question to the subject of relations that are 'concordant' (συμφωνοί). In technical harmonic theory, the primary concords are the octave, the fifth and the fourth, and the term embraces no interval smaller than these or intermediate between them.¹² An

⁹ This is clearly implied by Plato's treatment of the five mathematical disciplines in *Republic* 521C–531D and is already hinted at in his simile of the divided line, specifically in its references to mathematical 'violet', *Republic* 509D–511E. For a helpful analysis of Plato's views about the relations between mathematics and philosophical dialectic see Julia Annas, *An Introduction to Plato's Republic* (Oxford, 1981), chapter XI; note especially p. 282, and see the articles by R. M. Hare and C. C. W. Taylor cited on p. 293.

¹⁰ For a review of the evidence about these early Pythagorean investigations see W. Burkert, *Loire and Science in Ancient Pythagoreanism* (Cambridge, Mass., 1972), pp. 369–86. This important book is a translation by E. L. Minar, Jr., of Burkert's *Weisheit und Wissenschaft: Studien zu Pythagoras, Philolaos und Platon* (Nuremberg, 1962). Translations of some relevant texts are collected in *GMW*, II, chapter 1.

¹¹ The relation between Plato's comments here and the work of Archytas is discussed in an appendix to *GMW*, II, chapter 1, pp. 46–52. Attempts to find an appropriate classification of ratios, and to account for the special importance of certain classes of them, appear for instance in Euclid, *Scripta canonis* 149.11–24, Ptolemy, *Harmonics* 1.5–7 (*GMW*, II, pp. 192–3, 284–90). For a detailed mathematical treatment potentially but not explicitly related to harmonics see Theon Smyrniensis, *Expositio rerum mathematicarum ad legendum Platonem initium*, edited by E. Hilfer (Leipzig, 1878), pp. 106.12–111.9.

¹² See, for instance, Aristoxenus, *Elementa harmonica* 19.30–21.19 (*GMW*, II, pp. 139–40).

⁷ See especially *Republic* 510B–511D.

⁸ For general accounts of the scope and aims of harmonic science see, for instance, Aristoxenus, *Elementa harmonica* I.11–2.6, 32.10–34.34, with the descriptions of its parts at 3.5–8.12, 34.34–38.26 (*GMW*, II, pp. 126, 149–52 with 127–32, 152–53); Ptolemy, *Harmonics* I.1–2, III.3 (*GMW*, II, pp. 276–9, 371–3); Aristides Quintilianus, *De musica* 1.4–5 (*GMW*, II, pp. 402–6).

account of the mathematical nature of concordance might therefore seem inadequate, by itself, to the task of explaining what constitutes a properly melodic relation, since Greek μέλος, and Greek systems of melodic attunement, made use of many relations that were not concords. The problem can be resolved in either of two ways. First, the word σύμφωνος, outside of technical contexts, can often carry a more general sense, and Plato might mean by it no more than 'melodically satisfactory'.¹³ Secondly, even if it is the stricter sense that he intends here (as I think is more probable), this need not mean that a mathematical account of συμφωνία would fail to meet our requirements; for as we shall see shortly, a properly formed melodic structure, as Plato conceives it, is indeed one that can be fully described by reference to concatenations and interweavings of relations that are 'concordant' in the restricted sense.

The admirable form exhibited by genuine μέλος is thus something that can be precisely articulated as a set of relations between numbers; and its excellence is a mathematical excellence. Mathematical reasoning is to show us not only 'which numbers are concordant and which are not', but also 'in each case, why'. This apparently means that we are to look for a set of conditions that mathematical intuition will recognize as bringing different numbers together in a supremely well co-ordinated, unified or 'harmonious' way. Numbers related in ways that fulfil these conditions will be 'concordant'; and groups of sounds will count as genuinely concordant—irrespective of how they strike the ear—if and only if they are related to one another in the same way, sharing in the same form or mould. The criterion of concordance is one accessible to reason, not to perception, and we are not to 'prefer our ears to our minds', like one (non-Pythagorean) group of theorists whose procedures Plato waspishly caricatures.¹⁴

There may seem to be a large gap between this mathematical conception of perfect harmonic relations, whose perfection stems from their conformity to an abstract mathematical principle, and the earlier thesis that genuine μέλος exhibits a formal structure identical to that of the best and noblest soul. The fact that in Plato's mind the two conceptions converge appears most clearly on the one occasion in his works where the structure of a perfect ἁρμονία is described in detail. The description occurs in a famous passage of the *Timaeus* (35B–36B). Here we find a precise mathematical analysis of the form of a ἁρμονία, together with an account of the mathematical principles that govern it and give it its 'concordant' unity; and the description is applied, not to any audible musical product, but to the most perfect of created souls, the soul of the living universe.

¹³ In poetry there is often no reason to assign the term its precise technical meaning, and sometimes that meaning would be positively inappropriate, as for instance in line 51 of the Homeric *Hymn to Hermes* (where the MSS reading should be accepted), and Sophocles, *Oedipus Tyrannus*, v. 421. In Plato, the terms συμφωνία and ἁρμονία are sometimes used interchangeably, or even said explicitly to refer to the same thing, as at *Cratylus* 405D: here the sense is quite broad, 'melodiousness'.

¹⁴ *Republic* 531A–B. It should be emphasized that the investigations pilloried in this paragraph and the first five lines of the next are sharply distinguished by Socrates from those of the Pythagoreans (to whom, however, a milder version of the same criticism is applied at 531B–C). For their exponents' identity see *GMW*, II, pp. 55–6 n. 3, where the passage is translated. Many later writers held that the evidence of the senses could come into conflict with the conclusions of reasoning in the field of harmonics: see, for instance, the extracts from the writings of Ptolemaeus and Didymus at Porphyry, *Commentary on Ptolemy's Harmonics* 22.22–28.26 (*GMW*, II, pp. 239–44). Ptolemy held that such apparent conflicts betray only the (rational or perceptual) incompetence of the theorists in whose work they are generated: see, for instance, *Harmonics* I.2, 6, 7, 10 (*GMW*, II, pp. 278–9, 286–90, 295–8).

It would be inappropriate here to pursue the minutiae of this construction and of the principles underlying it. Summarily, those principles depend, from a mathematical perspective, on the maximally economical application of a theory of means and proportions.¹⁵ A perfect ἁρμονία, capable of providing the framework for genuine μέλος, genuine 'imitation of the beautiful', is one in which an orderly scheme of proportions governs the division of the whole into its elements and links these elements into a coherent unity.¹⁶ From a musical point of view, the system's most notable feature is that every note in it can be reached, from any starting point, by movements through the concordant intervals of fourths, fifths and octaves. In conforming to a mathematically 'concordant' pattern of proportions, it comes to exhibit audible musical concordance in the highest degree. Concretely, it is a 'diatonic' system of attunement either identical with or closely related to one that was indeed in practical use.¹⁷ It represents perfect melodic attunement because, in its musical instantiations, it shares the structure of the paradigm of created beauty, the most perfect soul: at the highest level, that structure is modelled on the intelligible perfection of uncreated eternal form.

It will be clear from all this that Plato's conception of that which constitutes something as genuine μέλος, and marks it off from the 'unharmonic' and unmelodic, has little to do with the way it sounds. Certainly he holds that true concordance gives pleasure to its hearers; but not all sequences that give such pleasures are melodic, and it is not because they give pleasure that they have this status.¹⁸ So much is now obvious; but one further step remains to be taken.

The description of the cosmic system in the *Timaeus*, like the harmonic analysis of all later Platonist and Pythagorean writers, is couched in the mathematical language of ratios, and the principles governing its structure are ones concerned with relations between numbers. The octave, for instance, is represented by the ratio 2:1. But this cannot be construed as a direct description of the relation between two audible items, two sounds or pitches, as they occur in a listener's field of awareness. Pitch-relations are not experienced through the ear as relations between quantifiable amounts of something: when we hear one sound as an octave above another, we do not hear it as possessing twice the quantity of

¹⁵ The theory is derived from Archytas: it is set out in his fragment 2 (Porphyry, *Commentary* 93.6–17 in *GMW*, II, p. 42). On its relevance to Archytas's own harmonic divisions see *GMW*, II, pp. 47–9.

¹⁶ The conception of ἁρμονία as binding together things of different natures, so as to form a coherent unity, is already at work in some (possibly genuine) fragments of Philolaus, particularly fragment 6 (*GMW*, II, pp. 36–7).

¹⁷ Its tetrachords contain two intervals of a whole tone each, ratio 9:8, and a residue, the λεῖμμα, constituted by the difference between a ditone and a perfect fourth: its ratio is 256:243. Tetrachords of this form are implied in Philolaus, fragment 6 (*GMW*, II, p. 37), the Euclidean *Sectio canonis*, propositions 19–20 (*GMW*, II, pp. 205–7), and in many later Platonist sources. In Ptolemy they are treated as convenient approximations used by players of string instruments to the slightly different tetrachords of a system that is theoretically preferable and is actually used by singers (*Harmonics* 39.14–40.20 in *GMW*, II, pp. 312–14). Its relation to the Aristoxenian diatonic division of tone, tone and semitone is unclear; but since Aristoxenus treats his 'tone' as identical with the difference between a fourth and a fifth (e.g., *Elementa harmonica* 21.20–23 in *GMW*, II, p. 140), which in mathematical harmonics would give it the ratio 9:8, the two divisions may be closely related or identical. (See also *Elementa harmonica* 55.2–58.5, and compare Euclid, *Sectio canonis*, prop. 17 in *GMW*, II, pp. 168–9, 203.) Tetrachords of the Platonist form do not appear among the divisions of Archytas, but have a role to play in their construction: see *GMW*, II, pp. 49–51; Burkert, *Logic and Science* (n. 10 above), pp. 388–9; and R. P. Winnington-Ingram, 'Aristoxenus and the Intervals of Greek Music', *Classical Quarterly*, 26 (1932), pp. 195–208.

¹⁸ See, for instance, *Laws* 658E–659A (*GMW*, I, p. 147), and *Timaeus* 80B (*GMW*, II, pp. 62–3).

some audible variable, in the way that we can see one thing as twice the height of another, or feel it as having twice the weight.¹⁹

Platonist and Pythagorean analyses of melodic systems are therefore not analyses of anything we hear; and the principles they identify as governing properly melodic relations do not directly describe an ordering of the contents of any auditory experience. The ratios were probably first discovered as the ratios between those lengths of a true string that yield, when plucked, sounds heard as related in the octave, the fifth and so on. As such, they were simply ratios of lengths, not of anything intrinsic to sound itself. Later these correlations were extended, sometimes fancifully, to other sound-sources—lengths of pipe, thicknesses of metal discs, volumes of vessels and other such things.²⁰ But to support the notion that the octave, for instance, 'is' the ratio 2:1 whenever it occurs, it was necessary to develop a general acoustic theory, identifying a single variable whose different values are always responsible for the different pitches of sounds, no matter from what source they arise, and the relations between whose values, expressed as ratios, correlate one to one with each perceptibly distinct 'size' of interval. The first clear attempt at such a theory, so far as we know, was that of Archytas in the early fourth century. Variants of it were adopted by Plato and many other writers, and though several rival theories emerged, the Archytas hypothesis, according to which the pitch of a sound is fixed by the speed of its transmission through a medium, remained influential throughout antiquity.²¹ But it is of little consequence for our purposes which of the various theories is adopted in this role. The point remains the same. When harmonic analyses are set in terms of ratios, the ratios do not express relations between items contained in the auditory experience of a musical listener, but relations between values of a variable not encountered by the ear in the guise assigned to it by the mathematical theorist, though allegedly responsible for perceived differences of pitch. Hence when these theorists adduce principles to which, so they claim, the ratios must conform if they are to constitute a melodic system, they are not saying anything directly about the manner in which sequences of sounds must strike the ear if they are to be reckoned melodic. Truly melodic relations exist in a realm not detected by ear; and the ordering that must be achieved when μέλος is made perceptible is an ordering of unheard elements objectively present in the physical events underlying the experience, not an ordering of the audible elements of the experience itself.

¹⁹ For vigorous arguments to this effect see Theophrastus, fragment 89 (Wimmer) and a passage from Panaetius 'the Younger', both quoted by Porphyry, *Commentary* 61.22–65.15 and 65.21–67.10 (*GMW*, II, pp. 111–18, 237–9). I have discussed the Theophrastus fragment in 'Music and Mathematics: Theophrastus against the Number Theorists', *Proceedings of the Cambridge Philological Society*, n.s., 23 (1977), pp. 1–15, and more recently (with some modifications in my interpretation) in 'Theophrastus on Pitch and Melody' in *Theophrastus of Eresus*, edited by W. Fortenbaugh et al. (New Brunswick etc., 1985), pp. 289–324.

²⁰ These 'experimental' results are referred to in many sources. For some examples see *GMW*, II, pp. 30–2, 92–3, 97, 217–20.

²¹ The Archytas fragment (fragment 1) is translated in *GMW*, II, pp. 39–42. For references to Archytas's influence on later Greek acoustic theory, and to alternative hypotheses about the causation of pitch, see the notes *ad loc.* Doubts about the authenticity of the fragment were raised by Burkert, *Lore and Science* (n. 10 above), p. 379 n. 46. Criticism of his arguments and interpretative discussions of the passage appear in two valuable papers: A. C. Bowen, 'The Foundations of Early Pythagorean Harmonic Science: Archytas Fragment 1', *Ancient Philosophy*, 2 (1982), pp. 79–104; and C. A. Huffman, 'The Authenticity of Archytas Frag. 1', *Classical Quarterly*, n.s., 35 (1985), pp. 344–8.

Aristoxenus

The approach we have described is well suited to the interests of Plato, since his concern is with the structure of sets of events that impress themselves on the listener's soul and mould it in accordance with their form, not with the aesthetic qualities of the contents of his experience during the time in which this process of psychic 'moulding' is in train. Similar attitudes and concerns characterize the bulk of the later Platonist and Pythagorean tradition. Only one theorist, Aristoxenus, proposed a significant and fully independent alternative. (I deliberately refer here to Aristoxenus rather than the 'Aristoxenians', since few if any of his followers seem to have understood the aspects of his work that will mainly concern us.)

Unlike the Platonists and Pythagoreans, Aristoxenus was largely uninterested in the nature of the physical and psychological processes that may be causally responsible for our hearing of sounds and melodies. At least in the *Elementa harmonica*, his focus is on the content of melodic experience itself; and his aim is to identify the features which the object of our hearing must itself display in so far as it is grasped as melodic. He raises no questions about soul-structures and their affinities with melodic structures, and he dismisses all speculations about the physical determinants of sounds, or about the mathematical interrelations of factors causally responsible for differences of pitch, as entirely irrelevant to his field of study.²² The science of harmonics, on his understanding of it, is one that seeks to describe the elements found in melodies themselves, and the forms of regularity and order to which they conform, where the 'melodies themselves' are not marks on a piece of paper, or sets of measurable movements of the air, but precisely the phenomena as they present themselves to the ear of a perceptive and attentive listener. Μέλος is essentially and necessarily something heard, and it is therefore the nature and structure of what is heard as melody, simply as such, that is the harmonic scientist's concern.²³

We hear melodies: Aristoxenus aims to explicate the nature of the property 'being melodic' which all melodies share. We also hear melodies as being of one kind or another—as enharmonic, chromatic or diatonic, for example—and it is part of his task to explain what is involved in being a melody of this or that sort. The explanations will come in the form of rules, including, on the one hand, laws that all melodies as such obey and, on the other, more detailed specifications characterizing the progressions of melodies of each special type. The properties articulated in this way are all perceptibly present in the individual melodies that we hear: the science proceeds by abstraction of what is universally true from repeated experience of examples.²⁴ It does not seek to explain the acceptability of one kind of progression and the unacceptability of others by reference to the unperceived physical or psychological processes involved in their production and

²² See, for instance, *Elementa harmonica* 12.1 ff., 32.18 ff. (*GMW*, II, pp. 134–5, 149–50).

²³ Thus Aristoxenus reminds us several times that his descriptions are to be construed 'in relation to [or 'according to'] the representation of perception' (πρὸς [or κατὰ] τὴν τῆς αἰσθήσεως φαντασίαν), *Elementa harmonica* 8.23, 9.2–3, 48.21–2 (*GMW*, II, pp. 132, 162).

²⁴ See, for instance, *Elementa harmonica* 33.1 ff., 43.25 ff. (*GMW*, II, pp. 150–1, 159).

reception: it aims only at analysing the perceptible character of the melodic, no matter what its causal basis may be.

This limitation of the scope of harmonics is not arbitrary. In Aristoxenus's view, 'the melodic' is in fact an independent nature or form of existence, whose character is not a function of anything other than itself. Here he speaks as a convinced Aristotelian (indeed, for reasons I shall not go into here, as a more single-minded Aristotelian than Aristotle himself).²⁵ Aristotle held that any instance of a natural kind, any individual of an organic species such as a dandelion, for example, is indeed materially constituted out of elements each of which has its own determinate character and behaviour; but a dandelion is something which, additionally and essentially, develops and engages in activity specific to its own kind, determined by its own quite distinct and independent nature and not just by mechanical interactions of its material constituents. It uses these constituents to actualize its own special way of being: they do not determine what that way of being is.²⁶ Similarly, for Aristoxenus, melodies are indeed actualized in physical events: sounds are their 'matter', the stuff they are made of. But the form that must be imposed on these materials if they are to constitute melody is not one that will be revealed by a natural scientist's study of the physical properties of sounds. It is not because their properties as movements of the air are related in patterns significant from a mathematician's or a physicist's perspective that they constitute a melody. Perceived sequences that exemplify the appropriate form are melodies, not because some acoustic, psychological or mathematical laws determine that this is so, but simply because that is what a melody is. It is through attention to the properties of melodies, as they present themselves to his perception, and through inductive abstraction from these observations, that the harmonic scientist will progressively uncover the nature of the melodic, and the kinds of regularity and order that are intrinsic to it. When that is achieved, his work is done. He cannot go on to derive his results or explain them by reference to facts or principles belonging to another, more fundamental, domain: no such principles exist. Genuine explanations of the fact that specific kinds of sequence are melodic consist only in demonstrations that they conform to the co-ordinated mode of order which has been identified as characteristic of μέλος in general.

With these important preliminaries in mind, we can now look at the form which Aristoxenus's analyses take. This is not the place for an examination of the details: I shall be offering only a general description of the sort of thing it is, in his opinion, that is set before us when we hear a melody and recognize it as such.

There is, to begin with, a pair of obvious contrasts with analyses of a Platonist or Pythagorean flavour. The latter schools treat notes as quantities, magnitudes of some variable, and intervals as ratios between such quantities. We have already remarked that their licence to conceive notes in this way is not directly authorized by reflection on the guise in which notes present themselves to the ear: it comes from their correlation of auditory experiences with things that are not heard—string lengths and the like—and their subsequent theories about the causal determinants of pitch. The numbers, and the ratios between them, are direct

measures of a physical variable underlying the perceived phenomenon of difference of pitch, rather than being measures of pitch itself.²⁷ Certainly it seemed clear to Aristoxenus that they gave no description of the way in which pitch differences actually strike the ear and hence can become elements in μέλος: in hearing one pitch as higher than another we do not hear them as differing in speed or size or in any other form of quantity. Rather, we hear them as differing in location within a dimension of pitch, analogous in the audible realm to a spatial dimension in the visible realm. Insofar as they are pitches, notes are sounds standing at determinate points in this dimension.²⁸ To us, this conception is thoroughly familiar, and receives a more or less graphic representation on the musical stave. The Greeks had no notation of that sort, and Aristoxenus's account of height and depth of pitch was not supported in any obvious way by the standard intuitions embedded in current language. Metaphors of 'up' and 'down' are rare in this connection in the Greek of his time: the commonest terms for our 'high' and 'low' were ὀξύς and βαρύς, 'sharp' and 'heavy', and the words most frequently used to express movement through the continuum of pitch were to do with tension and relaxation, not raising and lowering. In Aristoxenus's day, then, his account was in no way banal; but at the same time it was explicitly designed as a description of the guise in which pitch differences are quite ordinarily perceived. It was not an abstruse, scientific hypothesis about their causation, or about some aspect of their nature that is hidden from the untutored ear.

Secondly, though they refer to physical movements, the harmonic analyses of Pythagoreans and Platonists are in a certain sense static. They describe patterns of organization into which well-ordered melodic elements fall: their rules govern the shape of an abstract framework in which notes stand side by side, ready for use. Concretely, they may be conceived as describing the pattern of attunement present in the strings of an instrument such as the lyre, when accurately adjusted in preparation for the performance of a melody in a specific ἁρμονία. Aristoxenus's rules, by contrast, are dynamic. Notes, the elements of melody, are not to be construed as discrete items standing in a rigid, abstract framework of organization. They are locations reached by the voice, or by the sound of an instrument, in the course of its movement through a melodic sequence;²⁹ and it is this orderly and progressive movement, not the static attunement of a stringed instrument, whose characteristics the Aristoxenian scientist sets out to reveal. We perceive this voice or sound as a single entity, travelling from point to point through tonal space. (Its motion is not itself perceived directly, since in melody, unlike speech, the voice makes its movements between pitches silently and instantaneously, sounding only the pitches at which it comes to rest.)³⁰ The laws of harmonics are descriptions of the patterns in which this entity can move: given that the voice has moved through a certain sequence, there are determinate ways in which it can melodically proceed further. Then to hear something as a note in a

²⁷ See the passages cited in n. 18 above; compare Adrastus *apud* Theon Smyrnaeus, *Expositio* (n. 11 above), 65.10–66.12; Ptolemy, *Harmonics* 1.3 (GMW, II, pp. 221, 279–82); and Porphyry, *Commentary* 58.5 ff.

²⁸ On the 'space' of pitch and points within it see *Elementa harmonica* 8.13–13.30 (GMW, II, pp. 132–5) and the discussion of Annie Bélis, *Aristoxène de Tarente et Aristote: Le Traité d'harmonique* (Paris, 1986), chapter IV. For this definition of 'note' (ᾠή) see 15.13–23, but contrast 36.2–14 (GMW, II, pp. 136, 152).

²⁹ See especially *Elementa harmonica* 8.13 ff. (GMW, II, pp. 132–5).

³⁰ This point is most clearly made at *Elementa harmonica* 8.25–9.1 (GMW, II, p. 132).

²⁵ I discuss this matter in 'Aristoxenus's Harmonics and Aristotle's Theory of Science' in *Science and Philosophy in Classical Greece*, edited by A. C. Bowen, forthcoming. See also GMW, II, pp. 67–8, 123–4.

²⁶ See, for example, Aristotle, *Physics* II.9.

melody is not simply to perceive it as having a position in a fixed structure. It is rather to grasp it, and its melodic context, as implying certain possibilities for continuation, and ruling out others. Virtually all Aristoxenus's harmonic laws are therefore expressed as rules of progression. Our science, he says, deals with the way in which the voice can place its intervals in rising and falling; for we insist that it moves in a form of progression determined by its nature and does not place an interval just anyhow (32.10–17). To hear a note as a note is thus to hear it as part of an orderly progression, as something dynamic, moving towards a continuation that falls within the determinate set of possibilities that its nature implies. These possibilities are governed, in general, by laws describing the kind of progression that can constitute a melody and, more specifically, by the note's being grasped as a stage in the progress of a melody of some particular sort, whose possible continuations are limited by laws defining that special melodic type.³¹

When we identify the kind of melodic progression to which a note belongs, and the implications carried within that note, in that context, for its possible continuations, we are grasping the role or function of that note within the prevailing pattern of movement. Aristoxenus calls a note's 'function', in this sense, its *δυνάμις*, literally 'power' or 'potentiality': the term is a further indication of the 'dynamic' character belonging to notes in their role as melodic elements. They are not just sounds of certain relative pitches. Aristoxenus insists most vigorously that a merely quantitative analysis of the structure of a melodic progression, describing it by reference to the sizes of its intervals—tones, semitones and so forth—is far from being the complete goal of harmonic science and fails to reveal the real nature of the melodic form presented to our hearing: 'for neither the *δυνάμεις* of the tetrachords nor those of the notes, nor the distinctions between the genera, nor the difference between the composite and the incomposite, nor that which is simple and that which involves modulation, nor the styles of melodic composition nor anything else, to put it bluntly, becomes understood through the sizes of the intervals themselves' (40.16–24).

It is important to recognize that these dynamic, non-quantitative characteristics are conceived as actually present in the sonorous data encountered by our hearing. If they were not, they would have no place in Aristoxenian analysis, since it proceeds by abstracting and generalizing features that are perceived, not by inventing others that our hearing cannot detect. Of course, when we hear something as a melody, we do not do so by conducting an Aristoxenian analysis of it. The point is that the analysis articulates distinctions of which we are aware,

³¹ See, for instance, the discussions of melodic succession and continuity at *Elementa harmonica* 27.15 ff., 52.33 ff., each of which is followed by statements of the 'most fundamental' rules of melodic order, 29.1 ff., 53.33 ff. (*GMW*, II, pp. 144–7, 166–7). Almost all the theorems demonstrated in book III are propositions about the sequences through which the singing voice can and cannot progress in its melodic travels. It should be re-emphasized here that these 'rules' or 'laws' are not mere conventions, ratified only by their acceptance within a particular human society. In Greek thought, convention (*νόμος*) is standardly contrasted with nature (*φύσις*). In the *Elementa harmonica* the word *νόμος* does not occur (the single occurrence of one of its derivatives, at 30.21, is in an entirely different context); but *φύσις* and its etymological relations are very common, especially in passages where the general status of harmonic principles is in question. They are 'natural' principles, that is, they express the real nature of *μέλος* or *τὸ ἡμωσμένον*, which is as it is 'by nature', independently of any human decisions or conventions. The system of combination that governs melodic sequences of notes and intervals is 'natural', *φυσική* (*Elementa harmonica* 7.28–32; see also 32.14–17 in *GMW*, II, pp. 145, 149; there are many comparable examples).

perhaps vaguely and inarticulately, in our own experience, or else features that we can be trained to become aware of in a more refined perception of melodies:³² it introduces nothing that is not already there in the content of what we either do hear or could hear. This means that when we hear a melody and recognize it as such, we are actually hearing the notes as *δυνάμεις*, as bearers of implications about their melodic context and its continuation: these implications are part of what we hear. It is not the case that we hear only sounds of certain relative pitches, and that the concept of *δυνάμις* is merely an intellectual construct. Aristoxenus's position is comparable to the view that when we study a painting, the properties of balance, harmony, order and dynamic tension among its colours, shapes and masses are just as genuinely objects of the sense of sight as are the colours, shapes and masses themselves.³³

There is, to be sure, one sentence in which Aristoxenus seems to deny this. 'By hearing we judge the sizes of the intervals, and by reasoning we understand their *δυνάμεις*' (33.6–9). But however this remark is to be construed, the passage that follows makes it absolutely clear that it is not a repudiation of the view that 'dynamic' properties are objects of hearing, since it goes on to list a series of such properties which, he asserts, we do indeed perceive, and whose perceived character, as he vehemently emphasizes, cannot be expressed through quantitative analysis alone (32.32 ff.). The same point is made still more directly later, in a flurry of bad-tempered criticisms, where he attacks the notion that the development of a quantitative notation can reveal the true nature of melodic forms. A system that attempts to represent, for example, the relations between the notes *λιχάνος* and *μέση* merely as an interval of a certain definite size is bound to be useless. Certain notes are grasped, by perception, in the roles of *λιχάνος* and *μέση*; but their identities, and the perceptible character of the relation between them, can remain constant even when the size of the interval is altered. 'Not everyone looks to the same division when attuning either the chromatic or the enharmonic, so why should we select the *λιχάνος* that stands at a ditone [from *μέση*] rather than one where the interval is slightly smaller? For it presents itself to perception as enharmonic in both these divisions, whereas the sizes of the intervals are obviously not the same in each' (49.10–19). More broadly, 'in concentrating on equality and inequality [of intervals] we shall throw away our grasp on similarity and dissimilarity [of perceived character], so that we shall not call anything a *πυκνόν* if it is not of a certain determinate size, nor "enharmonic" or "chromatic" either: yet these too are comprised within a certain range [of quantitative variation]. It is plain that none of these suggestions [those of the proponents of a quantitative notation] accords with the way things appear to perception. For perception looks to the sameness of a certain form in identifying the chromatic and the enharmonic, not to the magnitude of a single interval: it finds the character of a *πυκνόν* wherever the two intervals [the two lowest in a tetrachord] together cover a smaller range than the one [at the top of the tetrachord], for in all *πυκνά* there is perceived the sound of something compressed [*πυκνόν*], even though they are unequal ...' (48.15–31).

³² See, for instance, *Elementa harmonica* 22.24–23.12 (*GMW*, II, p. 141).

³³ These issues are further discussed in my 'Aristoxenus's Theorems and the Foundations of Harmonic Science', *Ancient Philosophy*, 4 (1984), pp. 26–64.

What then are we to make of the claim that while hearing judges the sizes of intervals, it is reasoning that enables us to understand δυνάμεις? The question can perhaps be settled without too much difficulty. The context in which the problematic statement occurs is not concerned with the way we apprehend melodies in the ordinary course of listening to music. There, as the sequel plainly shows, it is the dynamic and qualitative features of the progressions that strike the musically attentive ear; and while perception of those features is a necessary condition of our hearing something as a melody, perception of the sizes of the intervals between notes is not. Aristoxenus's point at 33.6–9 is concerned exclusively with the procedures and resources of harmonic science. One of its tasks is to distinguish clearly the dynamic features of notes, intervals, tetrachordal structures and so on which give them the varieties of melodic character and impetus on which our unscientific perception has focussed. This is done by what Aristoxenus here calls 'reasoning' (διάνοια), which centrally involves the isolation of each type of δυνάμις presented to our ears by instances of melody, through a process of intellectual abstraction or 'induction': they can then be described, classified, and related to one another. The second task is to discover the sizes of the intervals in which each δυνάμις is capable of being instantiated. In many cases, as we have seen, a given δυνάμις (for instance, that of the structure known as πυκνόν) can be embodied in intervals of any of several sizes within a certain range, and our task is then to discover the limits of that range. But whether the intervals that support a given δυνάμις are of one size only or variable within a range, the sizes of the relevant intervals and ranges cannot be inferred by reason alone from an intellectual understanding of the nature of the δυνάμις in question. To discover them we must again enlist our hearing (the point is made forcefully at 33.9–26). It must be trained to accuracy in the assessment of the sizes of intervals, an accuracy that is by no means required in the ordinary perceptual recognition of melodic forms. But this quantitative perception has no work to do unless we have first discriminated the δυνάμεις which are the objects of ordinary perceptual recognition. By itself, the quantitative analysis of a series of intervals tells us nothing about its melodic character or credentials, since it gives us no way of deciding which quantitative differences between sequences correspond to aesthetically significant differences of melodic form, and in what way, and which do not.

There is no reason to suppose, as Plato and the Pythagoreans had done, that the boundaries between melodic forms in which musical perception finds important differences of character fall in the same places as distinctions which look interesting and significant from a mathematical point of view. There is, for example, no mathematical reason why an interval of a quartertone, placed at the bottom of a tetrachord, should belong to a structure that is aesthetically and perceptually quite different from one in which the interval of a third of a tone holds that position, whereas the difference between a third of a tone and a semitone marks no such distinction. Yet the quartertone implies the enharmonic genus, while the third and the half belong to the chromatic; and from the point of view of melodic perception, the progressions proper to these genera are radically

different in character.³⁴ The harmonic scientist must therefore begin from the identification of the qualitative, dynamic, categories that musical perception implicitly distinguishes, and only then proceed to the quantitative analysis of each type, relying at this stage on an ear that has been trained to scientific accuracy and is no longer working just within the modes of apprehension that are routinely and necessarily involved in hearing melody as melody.

This is undeniably a subtle account of the relations between musical hearing and harmonic science, but it introduces an important difficulty. When, as careful and sensitive listeners, we attend to a tune and recognize the melodic relations it involves for what they are, it is by no means implied that we must simultaneously be identifying the sizes of its intervals. On Aristoxenus's view the business of grasping melodic relations can apparently be completed without our having to make use of this 'quantitative awareness' at all. Yet it can hardly be a mere accident that there is, as he agrees, a quite determinate range of intervals in which each kind of melodic relation can actually be embodied, and that some such relations—that between the notes bounding a tetrachord, for example—can be achieved in intervals of one invariable size only (or perhaps within a range of variation so slight as to be imperceptible, as is suggested at 55.3–7). Then if the connection between a specific δυνάμις and the size of the intervals instantiating it is not accidental, what status can we assign to it?

The problem is serious and vexing, but it is not entirely of Aristoxenus's own making. It is precisely analogous to certain puzzles that arise in the treatment, by Aristoxenus's mentor Aristotle, of the relations between form and matter in natural substances. Logically speaking, it is not implied in the definition of a natural thing's form that it must be instantiated in just the sort of matter in which it does occur, though of course the character of the form imposes restrictions on the kinds of matter that can serve the purpose. And yet, once again, it can hardly be just an accidental truth that frogs and buttercups are made of the stuff they are made of and are never made of anything else. Aristotle is at pains to insist that the natural scientist must bring his investigations to bear on both the form and the matter of the things falling into his domain; and their 'natures' cannot be completely specified without reference to both.³⁵ Similarly, Aristoxenus's harmonic scientist must understand fully the patterns of 'dynamic' relations that define melodic form and must also—unlike the merely appreciative listener—be able to identify quantitatively the range of intervals available as 'matter' for the instantiation of each melodic type. Aristoxenus lays emphasis on the fact that this identification must be done by ear and by an ear trained to scientific precision (33.22–6): it cannot be done demonstratively, by inference from the definitions of the dynamic 'essences'.

It must be confessed that the nature of the relation between the δυνάμεις, as Aristoxenus conceives them, and the quantitatively specifiable 'matter' that is

³⁴ Aristoxenus takes a similar view of the relation between a mathematical analysis of rhythmic patterns and the forms that are recognized as aesthetically distinct and acceptable: see *Elementa rhythmica* II.8 (GMW, II, p. 186).

³⁵ See especially *Metaphysics* VII.10–11 on problems of definition and *Physics* II.1–2 on the scope of the natural scientist's concerns. In the biological works Aristotle seems to waver between a position that excludes 'matter' from the definition of a natural kind and one that incorporates apparent references to matter, but in a way that threatens to collapse the distinction between matter and form.

somehow necessary for their instantiation, remains in some respects obscure. But it is at least clear that the relevant sort of quantitative assessment introduces an aural capacity that is extrinsic to our hearing of melodies as such: it finds its role in harmonic science and presumably also in the technical procedures of performing musicians, but not in the kinds of hearing constitutive of aesthetically sensitive musical experience.

The Project of Reconciliation

It might be tempting to suppose that the eradication of a few entrenched prejudices on each side would be enough to allow the Aristoxenian and Platonist approaches to be fruitfully combined. They deal, after all, with different aspects of the subject and might not really be at loggerheads in the fairly restricted areas where they meet. Plato and his followers found little to say about the character and structure of melody, in the guise in which perception grasps it, but much about the mathematical patterns formed by the elements of its physical and psychological conditions, and much, too, about the nature of the formal, metaphysical perfection of which music, at its best, is a sonorous instantiation. Aristoxenus has a great deal to offer where Plato is lacking and says nothing about the issues to which Platonists devoted their greatest efforts. It is true that if we accepted his view that perceived melody has a nature independent of any material or mathematical underpinnings, this would effectively demolish the Platonist attempt at reduction. But might not this thesis be abandoned without serious loss? Is it possible, that is, to accept an Aristoxenian analysis of the content of melodic experience while finding a grounding for its categories, its perceived qualities and dynamic implications, in the principles of perfection governing the mathematical forms of physical and psychological processes?

The suggestion seems plausible; and yet the aesthetic distinctions that Aristoxenus makes, and whose significance was admitted on all sides, seem stubbornly to have resisted all Greek attempts at reduction to schemes falling under elegant mathematical laws. Certainly there were writers in later antiquity who attempted a rapprochement between the two programmes: something of the sort even predates Aristoxenus himself, in the important work of Archytas.³⁶ Of the later theorists, some merely draw on Aristoxenus for a small repertoire of distinctions that can be represented without much difficulty in the Platonist mode and ignore the rest: this is broadly true, for example, of Adrastus, Thrasyllus, Theon and Nicomachus. The works of Ptolemy and Aristides Quintilianus are a good deal more impressive, but insofar as they attempt a unification of Platonist and Aristoxenian perspectives, neither can be reckoned an unqualified success. Aristides sets out from analyses that are wholly Aristoxenian in origin (though some have suffered distortion either in the process of their transmission to Aristides, or during the course of their progress through his mind). He attempts in his second book to relate harmonic structures to the passions, dispositions and moral training of the soul, and in the third to expound the mathematical principles that link modes of musical and psychological order to the structures of the cos-

mos and the formal perfection in which they are founded. But his methods are eclectic and impressionistic: elements of the rival approaches are placed side by side rather than being fused into a unified system, and no procedure emerges through which Aristoxenian intuitions could be converted into propositions of a Platonist mathematics.³⁷ In Ptolemy's work, by contrast, there is no lack of scientific rigour, and he has an outstanding grasp on sound method. His major task is to show how, when the physical determinants of pitch are organized according to intelligible mathematical principles, the resulting melodic structures are those which the ear will recognize as perfect, as ideal specimens of systems falling under the categories that it grasps as species of melodic form. By these means he will demonstrate that the perceptible beauty of sonorous melodic relations is grounded in formal modes of organization whose perfection can be recognized by mathematical reason; and he will also show how these same coherent mathematical relations underlie genuine beauty wherever it is found, most notably in the structures of the soul and of the heavens.³⁸

In practice, however, this programme has severe limitations: two are of special importance. First, Ptolemy is trying to derive the laws of melodic order from principles that belong to the mathematics of ratio and proportion. But though he is notably successful in finding and justifying rational principles of division that will generate the basic framework of melodic structures, he can find no such foundation for all the other rules of order and progression, and the other categories into which Aristoxenus divides melodic forms and their elements, many of which Ptolemy himself finds it necessary to invoke. Thus though the distinctions between genera of attunement, between what is and what is not a *πυκνόν*, and so forth, can be mathematically described, their boundaries do not lie in places for which mathematical principles give any reason or explanation. Again, there are rules of an Aristoxenian sort on which—as Ptolemy agrees—perception insists, governing the order in which intervals of certain relative sizes can be taken in a scalar progression, and other matters of a similar sort: these too have no mathematical credentials, and when Ptolemy draws on them he describes them frankly as 'principles adopted on the basis of agreed perception'.³⁹ There is a great deal, then, in the essential character of what we hear as melodic, and in the aesthetic distinctions on which melodic perception turns, which Ptolemy cannot explain as reflections of modes of mathematical order. Like all other theorists of a more or less Platonist or Pythagorean persuasion, his mathematical metaphysics can give him, in the end, only a part of the foundation required even for so restricted a project as the rational 'division of the *κῶνών*'.

³⁷ Accounts of Aristides's enterprise are given in the introduction to Mathiesen's translation and more briefly in *GMW*, II, pp. 392–9.

³⁸ For a general account of his enterprise see the first two chapters of the *Harmonics*. I have tried to explicate it further in *GMW*, II, pp. 270–5.

³⁹ Ptolemy *Harmonics* I.15. The phrase occurs at 33.22 (*GMW*, II, p. 307), introducing a group of harmonic 'rules' that are wholly independent of his mathematical principles, but are equally essential to the arguments by which he derives his 'correct' tetrachordal divisions. It should also be noticed that though Ptolemy insists that the credentials for his 'rational' constructions are to be tested for their conformity to what perception will accept as melodic, nevertheless, when he comes to describe systems of attunement that are used in real musical practice, they turn out to diverge in several significant ways from those that mathematical reason has excogitated; and for these divergences no 'rational' or mathematical explanations are offered. See especially *Harmonics* I.16; II.16 (*GMW*, II, pp. 311–14, 356–7).

³⁶ See the discussion in *GMW*, II, pp. 46–52.

Secondly, Platonist and Pythagorean theory rests, as we have seen, on the treatment of notes as quantities and of intervals as the ratios between them. The principles of order that they uncover are those governing the pattern of relations in which these elements can stand. Each note, then, is a distinct and separate item, which fits into a system with others if their relative quantities fall into an appropriate form of order: a melodic structure is assembled rather as if it were a mosaic or a jigsaw puzzle. For Aristoxenus, by contrast, melody is created by the movements of a single continuous traveller, the voice of a person or an instrument. Nothing is heard as melody unless it is perceived as the route taken by one, enduring, continuous mover: the nature of μέλος is revealed in principles governing the form of its movement from place to place. Further, as I have explained, its arrival at a certain place by a given route carries implications for the nature of its subsequent progress. We grasp what its presence at that location amounts to, as a melodic property, by being aware of its dynamic potential for continued movement.

This involves a frame of reference of which Platonist, Pythagorean and even Ptolemaic terminology can make no sense. Their notes have no dynamism: they are just themselves and fit into an orderly scheme of relations if they are of the right size. No note carries any impulse for change or movement in any direction, and there is no room in the system for a continuing traveller through musical space. No doubt there are good reasons for this. From the physicist's point of view, at the level of the scientific analysis of the causal determinants of sound and pitch, no such traveller and no such dynamism exist. If they exist at all, they do so only in the realm of the phenomena directly perceived by the musical ear: there is no other kind of reality of which these phenomena are merely the audible aspects or signs. But to say that is to agree with Aristoxenus, to accept that the character of what we hear as melody, and the laws of its behaviour, are there in what we hear and nowhere else. Melody remains an independent form of being, existing only in the audible realm. Its laws cannot be translated into principles governing the orderly behaviour of something at an allegedly deeper level, something which is not itself the melody that we hear.

Appendix

List of Ancient Authorities and Works Cited

The following abbreviations are used:

- DK H. Diels and W. Kranz, *Die Fragmente der Vorsokratiker*, eighth edition (Berlin, 1956–9)
 MSG C. Janus (K. von Jan), *Musici scriptores Graeci* (Leipzig, 1895)
 GMW, I A. Barker, *Greek Musical Writings* (Cambridge, 1984), I
 GMW, II A. Barker, *Greek Musical Writings* (Cambridge, 1989), II

Adrastus 'the Peripatetic', fragments. Texts scattered through Theon Smyrnaeus; English translation of some of them in *GMW*, II, chapter 9.

Archytas, fragments. Cited according to the arrangement of DK; translations of musicological passages in *GMW*, II, chapter 1 (For discussions see also the works of Burkert, Bowen and Huffman mentioned in notes 10 and 21 above).

Aristides Quintilianus, *De musica*. Greek text edited in R. P. Winnington-Ingram (Leipzig, 1963); English translation in *GMW*, II, chapter 12. Another translation is by T. J. Mathiesen: Aristides Quintilianus, *On Music in Three Books* (New Haven etc., 1983), but see my review in *Ancient Philosophy*, 4 (1984), pp. 255–62.

Aristotelian *Problemata*, books XI and XIX. Greek text and translation in the Loeb edition by W. S. Hett (Cambridge, Mass., 1961); translations of selected passages in *GMW*, I, chapter 14, and *GMW*, II, chapter 4.

Aristotle. The editions used are the Oxford Classical Texts; for reliable English versions see the Revised Oxford Translation edited by J. Barnes, 2 vols (Princeton, 1984). Some musicologically important passages are collected in *MSG*; there are translations in *GMW*, II, chapter 3, and excerpts from the *Politics* in *GMW*, I, chapter 11.

Aristoxenus, *Elementa harmonica*. The best edition is: Aristoxenus, *Elementa harmonica*, edited by R. Da Rios (Rome, 1954), containing the Greek text, a Latin introduction, an Italian translation and notes, and a collection of reports about Aristoxenus by ancient writers. See also H. Macran, *The Harmonics of Aristoxenus* (Oxford, 1902; reprinted Hildesheim, 1974), including text, translation, introduction and notes. An introduction, translation and notes are in *GMW*, II, chapter 7. An admirable modern discussion and a useful bibliography can be found in the work by Bélis cited at n. 28 above.

Aristoxenus, *Elementa rhythmica*. Texts of surviving passages, with German translations, are in R. Westphal, *Aristoxenus von Tarent: Melik und Rhythmik des klassischen Hellenenthums* (Leipzig, 1893; reprinted Hildesheim, 1965), II; a fuller collection of texts is in: Aristoxenus, *Rhythmica*, edited by R. Pighi (Bologna, 1969). An English translation of the remains of the *Elementa rhythmica*, book II is in the appendix to *GMW*, II, chapter 7. A new critical edition with translation, commentary and a substantial introduction has recently been published: Aristoxenus, *Elementa rhythmica*, edited by L. Pearson (Oxford, 1990).

Didymus 'the musician', fragments. Texts are in Porphyry, *Commentary* 26.6 ff., and an English translation in *GMW*, II, chapter 9. Didymus's work is also discussed in Ptolemy, *Harmonica* II.13–14.

Euclid, *Sectio canonis*. The Greek text is in *MSG*. There are English translations in T. J. Mathiesen, 'An Annotated Translation of Euclid's Division of the Monochord', *Journal of Music Theory*, 19 (1975), pp. 236–58, and in *GMW*, II, chapter 8.

Nicomachus, *Enchiridion*. The Greek text is in *MSG*, and a translation is in *GMW*, II, chapter 10. For discussion see also F. R. Levin, *The Harmonics of Nicomachus and the Pythagorean Tradition*, American Classical Studies, 1 (Philadelphia, 1975).

Panaetius, fragment. The text is in Porphyry, *Commentary* 65.21 ff., and a translation in *GMW*, II, chapter 9.

Philolaus, fragments. Cited according to the arrangement of DK; translations of those passages that are relevant and possibly genuine are in *GMW*, II, chapter 1. For discussion see also Burkert, *Lore and Science* (n. 10 above), pp. 387–400.

Plato. The editions used are the Oxford Classical Texts. There are innumerable translations; some of the musicologically important passages are translated in *GMW*, I, chapter 10 and *GMW*, II, chapter 2.

Porphyry, *Commentary on Ptolemy's Harmonics*. The text is in: Porphyrios, *Kommentar zur Harmonielehre des Ptolemaios*, edited by I. Düring (Göteborg, 1932; reprinted New York etc., 1980, together with Düring's edition of Ptolemy's *Harmonics*); discussion in I. Düring, *Ptolemaios und Porphyrios über die Musik* (Göteborg, 1934; reprinted New York etc., 1980); some excerpts quoting earlier sources are translated in *GMW*, II, chapter 9.

Ptolemaïos of Cyrene, fragments. Texts in Porphyry, *Commentary* 22.22 ff.; English translations in *GMW*, II, chapter 9.

Ptolemy, *Harmonics*. The text is in I. Düring, *Die Harmonielehre des Klaudios Ptolemaios* (Göteborg, 1930; reprinted New York etc., 1980); German translation and commentary in Düring's *Ptolemaios und Porphyrios* (cited above); English translation and notes in *GMW*, II, chapter 11.

Theon Smyrnaeus, *Expositio rerum mathematicarum ad legendum Platonem utilium*. Greek text edited by E. Hiller (Leipzig, 1878); excerpts translated in *GMW*, II, chapter 9.

Theophrastus, fragment 89. The text is in Porphyry, *Commentary* 61.22 ff.; English translation in *GMW*, II, chapter 6.

Thrasyllus, fragments. The relevant texts are scattered through Theon Smyrnaeus; translations in *GMW*, II, chapter 9.