

Theory, theorists.

Theory is now understood as principally the study of the structure of music. This can be divided into melody, rhythm, counterpoint, harmony and form, but these elements are difficult to distinguish from each other and to separate from their contexts. At a more fundamental level theory includes considerations of tonal systems, scales, tuning, intervals, consonance, dissonance, durational proportions and the acoustics of pitch systems. A body of theory exists also about other aspects of music, such as composition, performance, orchestration, ornamentation, improvisation and electronic sound production. (There are separate articles on most of these subjects, but for more detailed treatment of the most fundamental of them see in particular [Acoustics](#); [Analysis](#); [Counterpoint](#); [Harmony](#); [Improvisation](#); [Melody](#); [Mode](#); [Notation](#); [Rhythm](#).)

The Western art music tradition is remarkable for the quantity and scope of its theory. The Byzantine, Arabic, Hebrew, Chinese and Indian traditions are also notable in possessing significant bodies of theoretical literature. Recently there has also been some theoretical treatment of jazz and other genres of popular music. This article, however, will deal exclusively with the Western art music tradition. (For these other traditions see particularly [Arab music](#); [China, §II](#); [India, §III](#); [Iran, §II](#); [Japan, §I](#); [Jewish music, §III](#); see also Byzantine chant, §17; [Greece, §I](#); [Mode, §V](#); [Jazz](#); [Popular music](#).)

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1. Introduction.

Treatises as disparate as *De institutione musica* (c500) by Boethius, *L'arte del contraponto ridotta in tavole* (1586–9) by Giovanni Maria Artusi, *L'armonico pratico al cimbalo* (1708) by Francesco Gasparini, and *Der freie Satz* (1935) by Heinrich Schenker are all commonly subsumed under the category of thought called music theory. Yet these four books have little in common. That of Boethius was totally divorced from the music of his time and probably not intended to be read by musicians or composers. In it a student of the liberal arts sums up the speculations about music of a number of Greek authors, mainly from the 2nd century. Artusi's book was a text

for the training of musicians and composers in counterpoint as practised and taught by his, then older, generation. Gasparini's is a manual for harpsichordists on the art of accompanying from a thoroughbass. Schenker's expounds some fundamental hypotheses about masterpieces of 18th- and 19th-century music through an analysis of their tonal and harmonic content.

Even allowing for the span of time encompassing them – from about 500 to 1935 – and the changing practice of music, the absence of any significant overlap in these four books, whether of content, purpose or intended audience, demonstrates at once the diffuseness and richness of the concept of theory. The term can be given an inclusive or an exclusive definition; in the one case it will embrace all of these works, in the other only one or two of them. It is useful to begin with an attempt at an inclusive definition.

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2. Definitions.

The word 'theory' itself has broad implications. Its Greek root *theōria* is the noun form of the verb *theōreō*, meaning to inspect, look at, behold, observe, contemplate, consider. A *theōros* is a spectator, as at a festival or game. Etymologically, then, theory is an act of contemplation. It is observing and speculating upon as opposed to doing something.

Aristides Quintilianus, who understood the concept in this way, constructed a plan of musical knowledge about ce 300 that may be outlined as follows: Although Aristides separated the purely theoretical from the practical, the entire field that he ordered is theoretical in a broad sense, the division under 'Theoretical' being what might now be called precompositional theory, while the category 'Practical' deals with compositional theory and the theory of performance. He was not so much dividing music as what can be said about music, consequently musical knowledge and thought.

Not much needs to be added to this outline to embrace all modern musical knowledge. Certain of the categories need to be broadened; for example, the 'arithmetical' ought to include mathematics in general, communications theory and artificial intelligence; 'natural' theory should include psychological and physiological as well as physical acoustics. Under 'Theoretical' one would add history, aesthetics, psychology, anthropology and sociology of music. Among the 'Artificial' categories, the 'harmonic' as understood by Aristides applied to tonal relations in terms of successive pitches and would have to be extended to simultaneous relations. Another technical category that one would add is that of 'timbre', comprehending instrumentation, orchestration and electronic media. Similarly, under 'Practical', 'melodic' would be complemented by 'harmonic', while 'poetic' would, as in Aristides' day, embrace both written and improvised composition. A modern version of Aristides' plan might then look as follows:

This entire field has sometimes been called *Musikwissenschaft*, the science of music, or musicology. Although it is all 'theoretical' in the sense that its method is thoughtful observation, only a relatively small part of this scheme is acknowledged as the province of the modern working theorist, namely the Theoretical–Technical (I.B), the Theoretical–Critical–Analytical (I.C.1), the Practical–Creative (II.A) and the Practical–Pedagogical (II.B) categories, which may be assumed under the catchwords 'theoretical', 'analytical', 'creative' and 'practical'. Yet many of the books from earlier times that are commonly referred to as 'theoretical treatises' address themselves to the whole area represented by the above outline. In this survey it will be important,

therefore, to keep in mind three things: the conception of the theoretical function prevailing at a particular time, the audience for which a treatise was written, and the philosophical or practical goals of the author.

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3. Antiquity.

This article cannot be a complete historical survey; it aims only to illustrate the variety of music theory through the ages, particularly its changing scope and methodology, although the central problem of tonal systems will be given special attention.

The earliest theorist for whom a significant body of writing has survived is Aristoxenus (4th century bce; see also [Greece, §I, 6\(iii\)](#)); much of his *Harmonic Elements* and fragments of his *Rhythmics* are extant. The *Harmonic Elements* concerns pitches as audible phenomena and their relationships to each other in melody; consequently it is dominated by the theory – he used the word *theōria* – of scales (*systēmate*) and keys (*tonoi*). If one goes beyond the theory of scales and keys to their use in the service of composition (*poiētikē*), he contended, one passes outside the science of harmonics to the science of music. He who possesses this larger science is a musician. The theory of music contained a number of components that Aristoxenus did not specifically enumerate; so far as poetics or composition is concerned, it comprised melody and, one assumes, versification. His scheme of the science of music may be partly reconstructed as shown in [Table 1](#).

Among the topics considered by Aristoxenus are high and low pitch, intervals, scales, keys, species of motion – diastematic and continuous – the nature of diastematic melody, concords, species of consonances, tetrachords, the genera and the shades of tuning. These are studied through the hearing and intellect: by hearing one judges the magnitude of intervals, by intellect one contemplates the functions of notes.

Aristoxenus eschewed questions such as that which asks what makes a good melody, because he was concerned with describing exhaustively the medium – the materials from which melody is made. His motive was at least in part to counteract the theories of the Pythagoreans, who based their harmonic science on numerical ratios, and the ‘harmonists’, who dealt exclusively with the enharmonic scale. As a scientific tract the *Harmonic Elements* was unique in completely excluding mathematical speculation. It is unlikely that Aristoxenus reached musicians, though it would have pleased him; rather he was studied by those who aspired to be philosophers.

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4. Hellenic period.

The scope of music theory widened with the Hellenistic writers of the 2nd and 3rd centuries. Claudius Ptolemy, the most systematic of these writers, took theory from the narrow sphere of tonal relationships to the larger one of natural philosophy. Musical observations were for him only one facet of the total natural universe. As an astronomer he recognized parallels between the order of planetary measurements and that inherent in musical ratios. Cosmology, human and world harmony, and aesthetics were all manifestations of musical organization.

Ptolemy fundamentally revised the methodology of musical investigation. Whereas Aristoxenus began with sense-experience of musical sounds and built a theory on it through dialectical analysis, Ptolemy saw a further function of reason as an aid to sense-observation itself. It was not enough to experience two sounding strings as consonant; it was necessary to measure their length numerically. Particularly in dealing with the smaller intervals, the imperfection of the senses demanded the aid of

the intellect and of scientific instruments. For example, he was dissatisfied with the *kanōn* – i.e. the monochord – as a device for investigation. He recognized that Didymus made an improvement when he plucked and measured the string of the monochord from both left- and right-hand sides of the bridge, facilitating comparison of sounds. But this did not go far enough. Ptolemy constructed a 15-string ‘polychord’ that permitted comparison of like strings of different tension or length. While the first two books of Ptolemy’s *Harmonics* differ little in content from the treatise of Aristoxenus (they are mainly about scales and tunings) the third book goes beyond these considerations to the relationship between observed sounds and other natural facts, and to the relationship of music to human needs. Thus music involves judgment of good form, which does not reside in the natural material but in the artist’s choices; and it employs as tools or servants the highest and most wonderful of our senses, sight and hearing, which among all the leading parts of the soul perceive and judge an object not according to desire but rather according to beauty (*Harmonics* iii.3). The genera of music are analogous to the virtues, the tetrachords to the aspects of the planets, and the greater perfect system is a microcosm for the ecliptic – the great circle formed by the intersection of the plane of the earth’s orbit with the celestial sphere.

Aristides Quintilianus, who wrote *Peri mousikēs* (‘On music’) around 300 ce, continued the expansion of the subject of music theory. As is evident from the outline of his division of the field (given above), he was concerned not only with the purely theoretical or speculative, but also the practical. The science of music includes both. ‘Theory defines the principles and rules of the art as well as its parts, and beyond that goes back to the origins and natural causes of the concord of all things. Practice, by following the rules of the art, aims to realize a goal, namely an edifying one [*paideutikon*].’ Aristides’ first book was concerned with the classic triad: harmonics, rhythmic and metrics. In the second book he proceeded to the practice of music, which for him meant education through music, developing right feeling in children as a preparation for right thinking. In the third book music is treated as an art of numerical relationships allied with other numerical arts; there is much speculation, for example, on masculine and feminine principles, temperance and beauty. Thus practical theory came to include pedagogical, aesthetic and psychological aspects of music. Both Ptolemy’s and Aristides’ treatises seem to have been directed towards a learned audience, the same readers who would have studied the *Almagest*. Whereas Aristoxenus had a message for the musicians of his time, the two Hellenistic authors give the impression of being aloof from contemporary musical practice.

The tonal systems described by the post-classical Greek authors differ in details, as might be expected for theoretical constructions made over a period of seven centuries. Cleonides (2nd century) attributed to Aristoxenus 13 keys or *tonoi*, one on each semitone step of the octave, and to his followers 15 keys, thereby extending the range by two more semitones. Ptolemy accepted only seven keys, because only that number was needed to produce the seven possible varieties of diatonic octave species within the central octave of the male vocal range. He also considered the boundaries of the double-octave *systema teleion* or ‘perfect system’ to constitute an absolute pitch limit, so that transpositions of the ‘natural’ Dorian system to other keys would lose at the top the steps gained at the bottom ([Table 2](#)). Alypius (3rd or 4th century) adopted the system of 15 keys, each with 15 steps from dynamic *proslambanomenos* to *nētē hyperbolaiōn*. Each step is assigned two notational symbols, one vocal, the other instrumental. The total range exceeds the double octave by a 3rd below and a 9th above. All the systems, from Aristoxenus on, assume that three genres of melody are

possible in each key: diatonic, chromatic and enharmonic; and most of them also assume various 'shades' of tuning for each genre. It is believed that all the theoretical schemes represent ideals rather than the realities of practice, though the notation of Alypius is borne out by surviving examples of music. The neatest scheme and the only one propagated in western Europe by Boethius is that of Ptolemy represented in Table 2. See also [Greece, §I](#).

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5. Early Middle Ages.

Boethius (c480–c524) inherited the tradition of the learned musical treatise, and his theory was a watershed. He knew a number of the treatises of antiquity, but those who read him in succeeding centuries did not. As a transmitter of ancient authority he could not be challenged until the 15th century, when scholars began reading ancient Greek sources again. The *De institutione musica* (c500) was a youthful effort. Like his even earlier book on arithmetic it was based principally on the work of the 2nd-century Greek Nicomachus. The two manuals were originally accompanied, it is believed, by similar manuals on geometry and astronomy, the other sciences of the Quadrivium. It is possible that Boethius intended his book as a teaching text for the study of music within the Quadrivium as part of the liberal arts curriculum, for Augustine of Hippo had accepted this as a suitable foundation for the study of theology; but it may have had no pedagogical aim.

There were some elements in Boethius's doctrine that appear to be original, such as the classification of music into cosmic (*mundana*), human and instrumental, and the rather thorough treatment of the physical basis of sound (see [Music of the spheres](#)). But the first four of the five books were largely based on the work of Nicomachus, whom Boethius frequently acknowledged. The first book was based on the brief *Manual* of Nicomachus, while the second to the fourth books are probably reworkings of a lost major treatise by the same author; the fifth book is a compendium, so far as it goes, and not without some misreadings, of the first book of Ptolemy's *Harmonics*. At no point, not even in an aside, did Boethius reveal the slightest interest in the musical practice of his time, which in any case would have been irrelevant to his purpose. Book 1 is a brief outline of the science of harmonics; book 2 concentrates on the arithmetical theory of proportions and the exposition of the intervals; book 3 is on semitones and other small intervals, particularly the comma; book 4 describes the Greek notation, derives the scale through the division of the monochord and briefly describes the system of *tonoi*, which Boethius called 'modes' (*modi*); book 5 goes over the foundations of harmonics again, this time as seen through Ptolemy, with his polemics against such ancient authors as Archytas and Aristoxenus. Boethius's treatise, however unoriginal and limited, is a concise, studious and dedicated exposition of difficult matter. If there were better compendia of the best of Greek theory in Latin, they did not survive.

Boethius was not, of course, the only source of Greek music theory for the writers of the Middle Ages. Martianus Minneus Felix Capella (4th to 5th century; *De nuptiis Philologiae et Mercurii libri ix*), Cassiodorus (c485–c580; 'De musica', chap.5 of bk 2 *De artibus ac disciplinis liberalium artium* of his *Institutiones*) and Isidore of Seville (c559–636; *Etymologiarum sive originum libri xx*), among others, supplied topical, etymological and, occasionally, technical information from Greek sources; and John Scotus Erigena (c810–77), a translator and commentator on Dionysius the Areopagite, in his writings divided music into 'natural' (*naturalis*), music praising God in the eight modes, and 'artificial' (*artificialis*), or instrumental music. But Boethius, and he was not

unworthy of it, became the principal fount and methodological model of music theory in the Middle Ages.

Boethius could provide a model only for that part of theory which underlies but does not give rules for composition or performance. The first surviving strictly musical treatise of Carolingian times is directed towards musical practice, the *Musica disciplina* of Aurelian of Réôme (9th century), but it bolsters this practical theory with concepts, definitions and rationalizations drawn from Boethius, Cassiodorus and Isidore. Aurelian's aim was to make the *cantor* – the singer – more of a *musicus* – the literate connoisseur whom Boethius placed in the highest class of musicians, one who investigated reasons and could make judgments of quality. Aurelian's first seven chapters contain a miscellany of traditional doctrine: the definition and classification of music, basic terminology, an introduction to the consonances and their ratios, and an enumeration of the Greek *tonoi* (called *toni*), the last based not on Boethius but on Cassiodorus. Although these chapters are preparatory, they relate only distantly to what follows in chapters 8 to 17, concerning the eight modes of plainchant, in 19, on the psalm formulae, and in 20, on chants of the Office and Mass in general. As an attempt to arrive at guidelines for usage, the portion from the eighth chapter onwards is more truly theoretical than the previous chapters, which, though based on traditional speculations, add up to no theory at all. Thus Aurelian pioneered a new kind of theory concerning the performance of plainchant. But because he did not use a nomenclature for the notes of the gamut, whether letters or Greek string names, he was forced to make his points with the utmost circuitousness, straining his readers' memories for countless passages of chant in order to fix his meaning concretely.

Hucbald (c840–930), writing at the end of the same century, saw that it was essential to establish a gamut, a pitch notation and a nomenclature if any meaningful discourse were to be carried on regarding plainchant. His *Musica* has a cyclical form, proceeding three times through the elementary principles of music. First he explained melodic intervals and simultaneous consonances and the distinction between these without reference to pitch names or a gamut by recalling, as Aurelian did, segments of chant (*GerbertS*, i, 104a–109b). Then he developed the gamut through dasia-like interval notation and spatial diagrams supplemented by the Byzantine Noneane syllables (109b–114b) and organized in ascending tone–semitone–tone tetrachords (see fig.1). Finally he used the Greek string names to locate the system within a pitch framework, this time organized according to the Greek–Boethian descending tone–tone–semitone tetrachords. In the course of this, he introduced letter signs, i, m, p, c, f, for the descending series *mesē* to *lichanos hypatōn* (our *a* to *d*) in order to make the existing neumes more specific in their pitch reference while retaining the temporal and vocal subtleties communicated by neumes.

Thus Hucbald used Greek theoretical concepts as transmitted by Boethius to organize a gamut previously carried in the memory, registered only in the keys of hydraulic organs. In so doing he revealed a dichotomy between the Greek-based *A* to *aa* system and a 21-note keyboard system starting with *C*, although he never referred to these letters but only to tone–semitone complexes. Whereas Boethius used the letters *A* to *O* and in another place *A* to *P* as geometrical points in monochord measurement, Hucbald and certain other medieval writers (not to mention modern commentators) took these to be an alternative system for the Greek string names or even a letter notation. Indirectly the Boethian letters may have inspired the gamut *A* to *a* that must have predated that of Pseudo-Odo, Γ to *a* (see [Table 3](#)).

Hucbald's treatise is practical without being addressed to either performance or composition, and puts forward a system that made discourse about these possible.

Thus it is purely theoretical in the modern sense of being concerned with precompositional tonal systems; at the same time it does not give the impression of being a primer, because it assumes a wide acquaintance with chant. It is the essay of an author who had something significant and fundamental to communicate to his colleagues, and, having accomplished this, went no farther.

What relationship there may be between Hucbald's treatise and the two anonymous works once attributed to him, *Musica enchiridis* and *Scolica enchiridis*, is uncertain, but they appear together in four of the seven theoretical manuscript anthologies that contain the *enchiridis* texts (see [Musica enchiridis](#), [Scolica enchiridis](#)). Hucbald's treatise seems almost to prepare the way for the *enchiridis* tracts, but not altogether, because both their notation and their gamut depart from those of Hucbald, and they cover intervals, consonances and modes again. *Musica enchiridis* broke new ground in providing the earliest instruction in the improvisation of organum, using the intervallically precise if cumbersome dasian notation. Whereas *Musica enchiridis* is entirely practical in its thrust, the *Scolica*, a dialogue between master and disciple, proceeds from instruction in organum to definitions of mathematics (the Quadrivium) and a consideration of the ratios of intervals, classes of proportions, and the various types of mean. *Scolica enchiridis* is thus the first of a genre of treatise in which complementary practical and theoretical approaches are merged; the first approach was obviously intended to train singers, the second to invite them to become educated in the Quadrivium.

The real successors to Hucbald's treatise were not the *enchiridis* tracts but the *Dialogus* attributed to Odo and the *Micrologus* of Guido. Michel Huglo (C1971) showed that the *Dialogus* attributed to Odo is probably by an anonymous Italian from the Milan area, and that the Prologue attached to it in some manuscripts was written later by a different anonymous author as a preface to an antiphoner. The *Dialogus* tackles the same question that Hucbald confronted: how to help singers learn new chants quickly and correctly. Again a letter notation is part of the solution, with the letters Γ (*gamma*) followed by the double octave *A–a–a* (Table 3). To locate these letters in a diatonic system the author proposed a new method, which involved learning to sing the intervals by imitating the sounds of the monochord. The monochord was carefully divided according to a new set of rules, starting with two ninefold divisions to obtain the first two Pythagorean whole tones whose ratios are 9:8, namely Γ –*A* and *A*–*B*. Thanks to an easily accessible gamut, the author was able to give the clearest exposition so far of the determination of the modality of chant, including that of chants ending on the co-finals or transposed by *B* .

Guido of Arezzo's *Micrologus* deserves its fame, because its independence and originality of thought, breadth and clarity have rarely been equalled; it is also one of the few manuals whose context can be precisely established. It was written about 1026 to train a choir, probably that of Arezzo Cathedral, and includes some topics of traditional theory – intervals, scales, species of consonances, and the division of the monochord – but only in so far as they meet the needs of the choir singer. Guido explored several new areas: the emotional qualities of the various modes, the internal phrase structure of plainchant, the temporal meaning of the neumes, various types of repetition in chant composition, considerations underlying the composition of new chant, and a mechanical method of inventing melodies for a given text using the vowels *a, e, i, o, u* (see [Guido of Arezzo](#)). Two chapters on *diaphonia*, or organum, come closer to describing and illustrating real music than any previous account. In the last chapter, almost as an afterthought, Guido recounted the story of the hammers of Pythagoras and finally gave the numerical ratios of the consonances, using the values

12, 9, 8, 6.

The system of hexachords with which Guido is usually credited does not appear in any of his extant works. In the *Epistola ad Michaelem* he proposed the syllables *ut, re, mi, fa, sol, la*, derived from the hymn *Ut queant laxis*, as a mnemonic aid for locating the semitones in the central part of the gamut, *C–D–E–F–G–a* (see fig.2). He probably used the hand for the same reason, but neither the fully developed Guidonian hand nor the system of natural, hard and soft hexachords (see [Hexachord](#) and [Solmization](#), §I) can be securely attributed to him. Both systems, though, are true to this method, for his theorizing was eminently practical. And there is hardly a trace of Boethius, whose book, he said, was ‘not useful to singers, only to philosophers’ (*GerbertS*, ii, 50*b*).

To reconcile the exigencies of practice with the Boethian tradition was the tendency, on the other hand, of a group of theorists from the Rhineland, among them Berno of Reichenau (*d* 1048), Hermannus Contractus (1013–54), Wilhelm of Hirsau (*d* 1091), Aribo Scholasticus and [Johannes Cotto](#). Whereas Guido tended towards the octave and hexachord as tonally organizing structures, these men were fond of speculating with the antique species of 4ths, 5ths and octaves and of dividing their gamut into tetrachords. These they named in imitation of the Greeks; the two conjunct lower tetrachords were of the *graves* and *finales*, then after a tone of disjunction the upper two conjunct tetrachords were of the *superiores* and *excellentes*. But instead of starting from B, working upwards semitone–tone–tone, they started from A, working upwards tone–semitone–tone. This gamut is compared in a chart (Table 3) with the Greek system and other solutions before and after.

Berno in the *Prologus in tonarium* adopted the methodology of the ancient species of consonances but announced that modern authors counted the species differently, as shown in [Table 4](#). His seven modern octave species were combinations of the species of 4ths and 5ths (first four), then of 5ths and 4ths (next three). These species agreed with the formation of the modes. Hermannus developed more explicitly the rationale for this arrangement: the first species of 4th was formed from the first step of the tetrachord of the *graves* and the first of the *finales*; the first species of 5th from the first of the *finales* and the first of the *superiores*; the first species of octave from the first of the *graves* and the first of the *superiores*, etc. Similarly, the first authentic mode was built from the first of the *finales* to the first of the *excellentes*, and so on. Hermannus assigned the names Hypodorian, Hypophrygian etc. to the octaves *A–a*, *B–b* etc., this being in agreement with the anonymous author of the commentary to the first ‘Quidam’ in the *Alia musica* (ed. Chailley, 121ff). In explaining why there should be two modal octaves *d–d'*, one Dorian, the other Mixolydian, Hermannus pointed out several important characteristics of modes: the Dorian made frequent use of its final *d* and middle pitch *a* for colons, commas and conclusions and emphasized by melodic contour its species of 4th and 5th, *a–d'* and *d–a*, while the Hypermixolydian was marked by returns to *g* and *d'* and the species of 4th *d–g* and 5th *g–d'*.

The most scholastic author of the group is Aribo, who dedicated his *De musica* to Ellenhard, Bishop of Freising (*d* 1078), and probably wrote it in Freising between 1068 and 1078. He included much of Hermannus’s material in a more elaborately argued and minutely and didactically subdivided format, including many arresting and cogent diagrams. It clothed what previously was presented informally in an erudite and correct academic garb. Of particular significance is the great attention paid not only to the division of the monochord but to the measurement of organ pipes, a new topic for a general treatise. As a commentary and critique perhaps of Boethius’s famous threefold classification, of players of instruments, inventors of songs and the true musicians (those who can judge and reason about music), Aribo divided musicians into ‘natural’

(*naturalis*) and 'artful' (*artificialis*). The 'natural' were mere minstrels (*histriones*), while the 'artful' understood all the intervals, modes and steps, knew by heart the qualities of hexachords, and could distinguish worthy melodies and correct corrupt chants. His treatise ends with a series of glosses on difficult passages in Guido's *Micrologus*.

A more extensive gloss on Guido, with many original comments, is the *De musica* of Johannes Cotto. The manuscript tradition, the repertory of chants quoted, little-known notational devices described, the geographical distribution of the authors he used, and other circumstances suggest that it was produced about 1100 by a monk in the St Gallen region to educate the boys of a cathedral or choir school. Casually unsystematic about such matters as the gamut and prone to technical errors, Johannes displayed great competence in the plainchant repertory, and his views about the correction of the readings and performance of chants and the norms of the modes reveal more about the practice of composition, notation, transcription and performance in his time than any other book of its age.

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6. Early polyphony and mensural music.

With the 12th century, writing about music entered a new phase dominated by the problems of improvising and writing organum and discant. The consonances recognized by Greek theory – the unison, octave, 5th and 4th – remained the cornerstones of note-against-note concurrences, but with the preference for contrary motion. Other intervals, particularly 3rds and 6ths, were tolerated, as in the anonymous 13th-century *Quiconques veut deschanter* (F-Pn lat.15139). In melismatic organum, the instructions and examples of the Vatican organum treatise (*I-Rvat* Ottob. lat.3025; ed. Zaminer) showed that a framework of note-against-note organum existed as a middleground behind the improvised melismas; indeed each word of text in the examples ends on a unison, 4th, 5th or octave (see [Discant, §1, 2](#), and [Organum, §§6 and 7](#)).

It was only about the second quarter of the 13th century, with Johannes de Garlandia's treatise *De mensurabili musica*, that a new consonance theory appeared. Perfect consonances were now the unison and octave, imperfect were the major and minor 3rds, while the 4th and 5th were intermediate (*medie*), being partly perfect, partly imperfect. The dissonances were also classified; imperfect: major 6th, minor 7th; intermediate: whole tone, minor 6th; perfect: semitone, tritone, major 7th (the terms used are *diapason*, *ditonus*, *ditonus cum diapente* etc.). Intervals compounded with the octave were classed together with their corresponding simple intervals. Johannes de Garlandia's symmetrical classification of consonances and dissonances into perfect, intermediate and imperfect is one of many instances of his application of the scholastic method taught in the universities; indeed his book is believed to have been intended as a text for the University of Paris. Each genre of music is defined by dividing it into species, and each of the species is then defined by further division. For example, in his first chapter the genus mensural music (*musica mensurabilis*) or organum is divided into three species: discant, copula and organum. Discant is then divided into six *maneries* (the rhythmic modes), of which the first, second and sixth are measurable (*mensurabiles*), and the third, fourth and fifth are beyond measure (*ultra mensurabiles*). These are then identified more concretely with music examples. In subsequent chapters Johannes de Garlandia applied a similar method to the description of the notes and ligatures that underlie certain rhythmic modes. Thus the longa may be *recta*, *duplex* or *plicata* and the ligature may be *cum proprietate* or *sine proprietate*. By this method he realized a clear exposition of a potentially confusing

subject, even if many of its points now seem obscure because of his language. The result is a highly theoretical exposition, independent in great part of previous writing, and exhaustive beyond the possibilities of practical application.

Johannes de Garlandia's disciplined focus on enumeration, definition and classification is all the more striking when compared with the treatise of Anonymous IV (c1270–80; ed. Reckow), which is clearly prescriptive as well as descriptive, at once a guide to composition and a commentary on existing compositions, excerpts from some of which are actually quoted. It includes an elementary introduction to arithmetical proportions and to the rules of discant, and was perhaps meant for the training of singers at Bury St Edmunds, where the author worked. The *Ars cantus mensurabilis* (c1250) of Franco of Cologne, for all its insistence on innovation and the importance of his step to unequivocal rhythmic reading of ligatures, broke no new ground either in redefining the nature of theory or in methodology. This can be said also for the St Emmeram Anonymous (1279; ed. Yudkin).

Deserving closer attention as a new type of treatise is Jerome of Moravia's *Tractatus de musica*. Written in Paris shortly after 1272, possibly in the monastery of the rue St-Jacques, it sums up the contemporary state of music theory, or at least as much as the compiler thought relevant. It is made up largely of carefully extracted and identified passages, and a few entire treatises, by authors from Boethius right up to immediate contemporaries, such as the Aristotelian commentary by Thomas Aquinas, *De celo et mundo*, completed in 1272 (hence the earliest probable date for Jerome's compilation). The first chapter, for example, compares definitions of music and the musician by Boethius, al-Fārābī, Richard of St Victor, Isidore, Hugh of St Victor, Guido, Johannes Cotto and Johannes de Garlandia. Its theoretical topics include the etymology of 'music', its inventors, its parts, instruments (the latter two based on Isidore), the classification of music according to al-Fārābī (*activa* and *speculativa*), Boethius, Richard of St Victor and Aristotle, its effect and its subject. The technical aspects begin with the tenth chapter, surveying the gamut, solmization, mutation, the intervals, the consonances (Nicomachus, Philolaus and Ptolemy, whom he knew through Boethius), the species of arithmetical proportions and means, the ratios of intervals (Boethius), monochord division (Johannes Cotto), the Greek *tonoi* (Boethius), the modern modes (Johannes), the psalm tones, composition of new chants (Johannes, with apparently original commentary), the duration of notes and rests, voice quality and ornaments in the performance and notation of plainchant (original), discant (full text of four treatises: Anon., *Discantus positio vulgaris*, Johannes de Garlandia, *De musica mensurabili positio*, Johannes de Burgundia (or Franco), *Ars cantus mensurabilis* and Petrus de Picardia, *Musica mensurabilis*), Greek notation (Boethius), and finally the construction, tuning and technique of the fiddle and rebec (original). Jerome thus discussed almost all that in this article has been defined as theory: the precompositional, compositional, executive and critical.

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7. 14th century.

Jerome of Moravia's treatise must not lead to the conclusion that the 14th century inherited this broad curriculum. Only one manuscript is known of the treatise, left to the Sorbonne by Petrus of Limoges in 1304 (*F-Pn* lat.16663). It was not an isolated example of the musical summa or encyclopedic compilation of learning. Walter Odington's *Summa de speculatione musice* (again only one complete copy, two fragmentary; early 14th century) is another such work, with greater emphasis than Jerome's on the mathematical side, more summary and synthetic on the practical. The

most remarkable example of the summa is the *Speculum musicae* of Jacques, believed to have been written in Liège in his old age, not before 1330, after he had spent most of his life perhaps in Paris. It is the biggest and most complete theoretical work of the Middle Ages. The critical edition by Roger Bragard (1955–73) occupies eight volumes. Jacques de Liège divided music into *theorica*, whose subdivisions were heavenly (*celestis*), cosmic (*mundana*), human, and sonorous or instrumental; and *practica*, whose subspecies are *plana* and *mensurabilis*. He spent little time on the non-sonorous categories and devoted most of the first five books to the theory of the sonorous realm, the sixth book mainly to the modes – ancient, intermediate and modern – the seventh book to measured music. Jacques de Liège’s normal method was to cite one or more authorities and to make an extensive gloss on each. He displayed broad erudition; among the Greek sources he cited are Plato’s *Timaeus*, Aristotle’s *Physics*, *Nicomachean Ethics*, *Politics*, *De anima*, *Categories*, *De coelo*, Euclid’s *De arte geometria* in Boethius’s translation; among the Roman writers, Virgil, Lucan, Seneca, Persius, Priscianus; among medieval writers, Augustine, *De musica*, Simplicius, Macrobius, Boethius, Gregory the Great, Jordanus Nemorarius, Petrus Comestor, Robert Kilwardby, Ibn Rushd, al-Fārābī. Among the musical theorists he credited some by name; others he honoured only by quotation or paraphrase. They include Guido, Hermannus, Johannes Cotto, Franco, Pseudo-Aristotle, Philippe de Vitry and Prosdocimus de Beldemandis. Some of the questions he proposed yielded to his method; others, such as ‘Why does a diatessaron sound more consonant above a diapente than below?’ (vii.8), elude his dialectics. Jacques was not just a dispassionate scholar, however; perhaps the best-known chapters (vii.9ff) are his angry diatribes against the mensural practices of the ‘moderni’, the composers and theorists of the *Ars Nova*.

More characteristic of the 14th century than Jacques de Liège’s encyclopedic approach are the fundamental revisions of practical theory by Johannes de Muris, Johannes de Grocheo, Marchetto da Padova and Philippe de Vitry. Johannes de Muris, a *magister artium* of the University of Paris, left a *Musica speculativa secundum Boetium* (*GerbertS*, iii, 249–83; completed 1323), known to have been used in university curricula, for example at Kraków, Prague, Vienna, Leipzig and Erfurt. Johannes was not content with repeating the traditional numerical theory, but applied his mathematical skills to the observation of contemporary musical practices, as he also did to the observation of eclipses. His *Notitia artis musicae* (1321; ed. in CSM, xvii), a youthful work, takes an objective stance on the controversial question of the duple versus triple division of note values. ‘Time belongs to the genus of continuous things, therefore may be divided in any number of equal parts’ (*GerbertS*, iii, 300b = CSM, xvii, *Notitia artis musicae*, chap.13, p.104). He showed that the option between duple and triple operated at four levels or *gradus*: *maximodus*, *modus*, *tempus* and *prolatio* (see [Notation, §III, 3](#)). The relation of the shortest note, the *minima*, to the longest, the triplex long, was in the ratio of 1:3⁴ or 1:81. Johannes de Muris may have derived the concept of four levels of musical time from his friend Philippe de Vitry, although the treatise *Ars nova* attributed to him may be spurious. There the author implied a fifth level, at which the *minima* was divided into *semiminime*. Its principal innovation was the proposal of four signs whereby the singer could recognize immediately the way in which long and *brevis* were to be divided ([Table 5](#)).

Johannes de Grocheo in his untitled treatise of about 1300 rejected the Boethian classification of music into *mundana*, *humana* and *instrumentalis*, noting that Aristotle denied the existence of celestial music; he also rejected the dichotomy between the immeasurable and the measured, because all music and art depend on measurement.

Every region, linguistic culture and city should have its own classification; for Paris he proposed three genres: common (*vulgaris*) music of the city; measured (*mensurata*), composed, regular or regulated music; and ecclesiastical (*genus ecclesiasticum*), made up of the other two brought to their highest perfection for the praise of the Creator. Thus the study of music was the taxonomy of compositional genres. In the first category he distinguished between song (*cantus*) and melody (*cantilena*), the former including *cantus gestualis* (epic poems), *cantus coronatus*, monophonic conductus and *cantus versicularis* (popular songs), while within *cantilena* he cited the rondeau (*rotundellus*), *estampie* (*stantipes*), and *ductia*. For each type he discussed the function, versification, form and manner of composition, but his descriptions are subject to a variety of interpretations. Measured music includes the motet, organum and hocket. Among the genres of ecclesiastical music, which he admitted varied with local custom, he named hymns, responsories, versicles, antiphons and parts of the Ordinary and Proper of the Mass.

The growing interaction of folk, popular and other secular music with church music documented by Johannes de Grocheo was bound to arouse discussion of the conflicting musical systems that existed side by side; even within church polyphony the favourite cadence form, that of major 6th progressing to octave, made it necessary to recognize the alteration of the gamut of the Guidonian hand, or *musica vera*. Magister Lambertus (c1270) argued that the practice of *falsa musica* or *falsa mutacione* was 'necessary, because of the search for good consonance' (*CoussemaekerS*, i, 258a) and defined it as making a semitone out of a whole tone or vice versa. Odington recognized in his gamut E, F and C as well as B (ed. in CSM, xiv, 97–8). Johannes de Grocheo associated the need for *musica falsa* with the *estampie* and *ductia* and claimed that any tone could be made into a semitone through the rounded flat sign known as *b rotundum*, and any semitone into a tone through the square-shaped sign known as *b quadratum*.

In his *Lucidarium* (1326–7) Marchetto da Padova began to confront the theoretical implications of this usage by dividing the whole tone into five *dieses* (Tractatus II, chap.5; ed. Herlinger, 130–41) of which two, or on some occasions only one, would comprise the melodic semitone from *mi* to *fa*. He also implied, as indicated in [ex.1](#), that the ratio for a semitone comprising two *dieses* was 18:17. While these formulae are mathematically incompatible with each other and with Pythagorean calculations, they indicate clearly enough that Marchetto preferred a melodic semitone to amount to less than half of a whole tone. Marchetto's calculations aroused objections from his Paduan compatriot Prosdocimus de Beldemandis, who adhered to the ratios of [Pythagorean intonation](#) and applied them to two chromatic monochords: in one the minor semitone preceded the major, in the second the opposite. Then he merged the two to provide both a flat and a sharp between each note of the regular monochord (*Parvus tractatulus de modo monacordum dividendi*, 1413; ed. Herlinger, 72–118). In his *Contrapunctus* (1412; ed. Herlinger) he had shown that any note could become a *mi* by placing the *b quadratum* before it, or a *fa* by placing the *b rotundum* before it.

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8. 15th century.

The 15th century inherited several theoretical difficulties that had not been squarely faced; one was the definition of consonance. The 3rds and 6ths were accepted in counterpoint as imperfect consonances: the major 6th somewhat reluctantly by Anonymous IV and fully by the *Ars contrapuncti secundum Johannem de Muris* (*CoussemaekerS*, iii, 60), Anonymous II (late 13th century; *CoussemaekerS*, i, 312), and

Anonymous XIII (14th century; *Cousse-makerS*, iii, 496); the minor 6th was admitted by the anonymous *Ars contrapunctus secundum Phillippum de Vitriaco* (*Cousse-makerS*, iii, 27) and the anonymous *Ars discantus secundum Johannem de Muris* (*Cousse-makerS*, iii, 70); while the 4ths were rejected. Yet no theoretical justification had yet appeared. Walter Odington was on the verge of one when he called the 3rds and major 6th 'concordant discords' (*concordes discordiae*: ed. in CSM, xiv, 75), and recognized that since the 3rds are close to the sesquiquarta and sesquiquinta ratios (in which the difference is one) many considered them consonant; and, he added, 'if in numbers they are not found consonant, the voices of men with its subtlety leads them into a smooth mixture and full consonance' (CSM, xiv, 70–71).

Allied to the problem of consonance was that of tuning. The theoretically accepted tuning, even for Odington, was the Pythagorean, in which the ditone was 81:64 and the semitone 32:27, both harsh-sounding. Also associated with the use of imperfect consonances was the use of *musica ficta*, which demanded potentially a full chromatic octave. Boethius provided no model for the division of the octave into semitones, whether equal or unequal.

While the problems just mentioned all involved mathematics in one way or another, conflicts also arose between traditional pedagogy and the realities of musical practice. Polyphony had inherited from plainchant a system of modes; but composers, even when basing their work on chant melodies, could not reconcile the purity of the modes with the desire for sweet and full concordance and smooth linear flow. The primacy of the modal octave *d–d'*, inherited from Byzantine music, conflicted with the C orientation apparent in several keyboard gamuts as early as the 10th century. The mutations of the hexachord system defied the limits of the octave and destroyed modal consistency, often going beyond the single flat of the Guidonian gamut to as many as three flats and three sharps, requiring hexachords starting on B, E, D and A. Moreover the single species of hexachord, *ut–la*, rendered meaningless the traditional species of 4ths, 5ths and octaves, and it was not clear how the modular tetrachord fitted into the modern systems, which now descended below Γ (see also [Solmization](#), §1). The admission of the duple division of time into written art music in the 14th century opened the gates to combinations of duple and triple divisions at several levels and to questions of relation of duration to speed of performance. This subject was becoming so complex that it was tempting to subject it to mathematical analysis.

Ugolino of Orvieto, author of the *Declaratio musice discipline* (c1430; Seay, ed.: CSM, vii), was on the threshold of the recognition of these problems. He discarded the tetrachordal gamuts, extended the normal range down one step to *F*, and alternatively recognized a further extension down to *C*, a 4th below (ii, 34). He permitted hexachords to begin on D, E, A and B, as well as C, F and G. Appended to his treatise in several of the manuscripts was a *Tractatus monochordi* that developed, in an elaborate and musicianly fashion, the three monochords described by Prosdocimus – of which the third was, according to Ugolino, more useful for organs than for singing (see [Temperaments](#) and [Enharmonic keyboard](#)). A fourth monochord added notes midway between B and C and E and F respectively, which Ugolino said were not sung by the moderns but had been by the ancients; this was a reference to the enharmonic genre of classical Greece.

Ugolino was in step with his age also in reviving the Quadrivial aspect of music, for the Boethian curriculum of arithmetical proportions of intervals and the metaphysics and physics of music are thoroughly explained in the fourth and fifth books, with many new insights drawn from the works of Aristotle and an otherwise unknown author cited as

Petrus Hispanus (probably Petrus de Osma). Ugolino anticipated the early Renaissance also in separating *musica theorica* from *musica practica*. The first two books cover the Guidonian curriculum of the choir school brought up to date by Johannes Cotto and the discant and counterpoint tutors. The third book is a commentary on the mensural music treatise of Johannes de Muris. These three books constitute a summa of *musica practica*; the last two are a summa of *musica theorica*.

Reading the treatises of the 13th and 14th centuries leads one to question how much of Boethius was studied or understood during those years of swiftly changing musical practices or how relevant the book was considered. Only Jacques de Liège gave evidence of having studied all of it. Although he admitted that he came on it late in his studies, it must have been available in every major monastic library. For a practising musician there was no compelling incentive for studying it. Careful study of Boethius was a phenomenon of the Italian Renaissance, and led to a search for the texts and authors whom Boethius mentioned, sometimes with praise as he did Nicomachus and Ptolemy, often deprecatingly, as Aristoxenus and Archytas.

The revival of Boethius elicited two opposite reactions: it led to his adulation, as in the writings of John Hothby, Johannes Gallicus, Nicolaus Burtius, Giorgio Anselmi, and in his youth Franchinus Gaffurius; it also started an anti-theoretical movement. The latter was personified in Bartolomeo Ramos de Pareia, a Spanish mathematician who settled and lectured in Bologna. The title of his *Musica practica*, published there in 1482, is misleading, because the first of three parts is virtually all *musica theorica*, but conclusions are reached empirically rather than through citation and explanation of authorities. It is not lacking in citations, for the book gives evidence of wide reading, but more often than not Ramos cited other authors only to disagree with them. He discarded both tetrachordal gamut structure and hexachordal solmization, replacing them with an octave system of eight syllables, *psal-li-tur per vo-ces is-tas*, based on C, from where his gamut started, a 5th below Γ, to accommodate the range of contemporary organs and 'polichorda'. Mutation was accomplished by substituting *psal* for any of the other syllables.

Ramos revised Boethius's monochord division, which in any case he found too laborious and subtle for young musicians, to yield most of the imperfect consonances of diatonic music in their simple ratios: 5:4 (major 3rd), 6:5 (minor 3rd), 5:3 (major 6th) and 8:5 (minor 6th), and he constructed out of this division a new chromatic monochord (see [Temperaments, §2](#), and [Just intonation](#)), which, like his other innovations, caused him to be attacked by his fellow-theorists Hothby, Burtius and Gaffurius. Although only Giovanni Spataro took up his defence at that time, many echoes of his theories, tempered in the forge of debate, found acceptance in the 16th century.

Johannes Tinctoris, in a series of 12 treatises (c1472–84) that exhausted current knowledge of musical practice, continued the empirical trend. His scepticism of the wisdom of the past was not confined to such mirages as *musica mundana* but to the entire repertory and foundation of older music, which he found inept and unworthy of performance. If he was fond of quoting the ancient Greek theorists and philosophers and even Boethius, the citations were more rhetorical ornaments than underpinning for his theories, which were founded squarely on the realities of everyday performance, composition and improvisation. Thus his citation of authorities is rendered pointless, as when he preferred Ptolemy's opinion reported by Boethius, that the 11th is a consonance, to that of Boethius himself, who considered it a dissonance, but finally rejected it from counterpoint as 'intolerably harsh' (*Liber de arte contrapuncti*, 1477; ed. in CSM, xxii/2, bk 1, chap.5, p.26). Tinctoris's great merit was not erudition but

acute observation and analytical description. Thus his penetrating dissection of how the dissonant suspension, for which he had no word, works on various levels of time value and in different proportions and prolations, and his recommendations for when to use or avoid it, represents theorizing of the highest order (ibid., chaps.23–9, pp.121–38). His important distinction between the standards of consonance and dissonance treatment in improvisation, *super librum cantare*, and written composition, *res facta*, was an important step in removing the art of counterpoint from trial and error. The *Proportionale musices* (c1473–4) was an exhaustive statement of the system of temporal relationships and their notation that reached the ultimate point of exploitation about that time. But the *Liber de natura et proprietate tonorum* (1476) said little that was new and did not come to terms with the nature of modality in polyphonic music.

It was Tinctoris who inspired Gaffurius to deepen his theoretical studies. From 1480 for 20 years Gaffurius was engaged in a constant search for the best truths of the past and tried to reconcile these with the most advanced knowledge and practices of his time. From almost complete dependence on Boethius in his *Theoricum opus*, he progressed in the *Theorica musice* of 1492 to the use of several previously unknown Greek treatises in Latin translation. He profited most from Francesco Burana's Latin version of the musical treatise of Bacchius, Ficino's Latin translation of Plato, Ermolao Barbaro's Latin translation of Themistius's *Paraphrases* on the *De anima* of Aristotle, and Pietro d'Abano's translation and commentaries on Aristotle's *Problems*. Added to his careful and critical reading of Boethius, they informed his work with a freshness of thought that merits our calling him the first real humanist in music. In preparation for his final speculative work, *De harmonia musicorum instrumentorum opus* (1518), he had translated for him the *Harmonics* of Ptolemy and the musical treatises of Aristides Quintilianus, Manuel Bryennius and the author now known as Bellermann's Anonymous. He also used Giorgio Valla's translation of Cleonides and Valguglio's of Plutarch. To cite only a few examples of the fruits of his studies, Gaffurius was able to communicate to Western musical readers for the first time Themistius's sophisticated theory of sound, the shades of tuning described by Ptolemy, including the syntonic diatonic soon to be championed by Spataro (see fig.5), and a glimmer of how the Greek tonal system differed from that of the medieval modes. The dynasty of Boethius was finally broken.

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9. 16th century.

Hardly an author on music in Italy after 1500 escaped the powerful tides of the revival of ancient learning. The first half of the century was particularly swayed by Ptolemy's argument that, since sound is sensation, judgments concerning sounds should be made by the sense of hearing with the assistance of the reasoning faculty. The Pythagorean view, which had dominated earlier speculative theory, was that only the reason could make a final judgment, because the senses are easily corrupted. This principle had a particularly profound effect in the investigation of tuning. Even Gaffurius, who never departed from his advocacy of the Pythagorean tuning, recognized that keyboards were tempered by flattening the 5ths (*Practica musice*, 1496, bk 2, chap.3). Spataro, a disciple of Ramos, upbraided Gaffurius for saying that the major and minor 3rds in the ratios 81:64 and 32:27 were inaudibly different from 5:4 and 6:5 (*Errori de Franchino Gafurio*, 1521). He maintained that singers used only the latter, because they were 'softer' (Error 19, f.20v; Error 23, f.22v). Indeed Spataro identified the syntonic diatonic tuning of Ptolemy as 'that which is applied in musical practice today' (Error 16, f.21v).

Lodovico Fogliani, without citing either Ptolemy or Spataro, defended a similar tuning on the grounds that the ear is the natural judge of consonance and dissonance and esteems the 3rds and 6ths as consonances no less than octaves and 5ths; therefore it demanded that these intervals be in their best intonation (*Musica theorica*, 1529).

Giuseffo Zarlino too advocated the syntonic diatonic tuning (*Le istituzioni harmoniche*, 1558), but Giovanni Battista Benedetti soon proved that it was impossible to sing polyphonically with this intonation without the pitch slipping, and that therefore the tuning had no practical application in modern music (letter to Cipriano de Rore, c1563; *Diversarum speculationum*, 1585). Vincenzo Galilei raised other objections and, convinced that equal temperament was the only solution for instrumental music, proposed a uniform semitone of 18:17 for placing the frets on a lute (*Dialogo della musica antica et della moderna*, 1581, p.49); voices, he admitted, strove for a juster intonation that, however, could not be defined. Giovanni Maria Artusi, although a disciple of Zarlino, later came to a similar conclusion (*L'Artusi*, i, 1600, f.34r). Both Galilei and Artusi supported their theories with the authority of Aristoxenus, whose *Harmonics*, translated in 1562 by Antonius Hermannus Gogava, implied an octave divided into equal semitones.

However much they believed in equal division, one of the practical problems that defied theorists schooled in Boethius was that no integer could be found between the terms of a superparticular ratio that would divide it equally. So the Pythagorean whole tone, 9:8, could only be split into a lesser and greater but not two equal semitones. Euclid's *Elements*, printed in 1482 in a 13th-century Latin translation by Johannes Campanus, offered geometrical constructions to make this division, and these were applied to this musical problem by Jacobus Faber Stapulensis (*Musica libris demonstrata quatuor*, 1496), Erasmus Horicius (*Musica, I-Rvat* reg.lat.1245, c1504–8) and Henricus Grammateus in *Ayn new kunstlich Buech* (1518).

At the moment when *musica ficta* hexachords became accepted on almost every step (Pietro Aaron in *Lucidario in musica*, 1545, recognized them on A, B, D and E), the nature of modality in polyphonic music began to be clarified, first by Aaron (*Trattato della natura e cognitione di tutti gli tuoni di canto figurato*, 1525), then by Heinrich Glarean (*Dodecachordon*, 1547). Leaning on the tradition that in ancient times there had been as many as 13 or 15 'modes', Glarean finally faced the problem of the finals on A and C. Although he claimed to understand it, he misrepresented the Greek tonal system. This did not prevent him from constructing a well-ordered array of 12 practicable modes, and showing how the great composer Josquin could endow them with every variety of emotion and musical fantasy.

Only when Girolamo Mei circulated his treatise *De modis musicis* (completed 1573) among a small circle in Florence did the truth, that the plainchant modes and those of Glarean bore no resemblance to the Greek 'modes' or *tonoi*, begin to penetrate musical, literary and scientific circles. Mei had studied in Greek every surviving ancient piece of writing on music and had concluded that the Greek *tonoi* were transpositions of one system higher or lower than the normal or 'Dorian' range. Francisco de Salinas (*De musica libri vii*, 1577), who also read Ptolemy in the original Greek, clearly showed that the *tonoi* were not modes, but reproductions of the same system at different levels of pitch, although he attributed to the octave species a modal function.

Zarlino first accepted the 12 modes of Glarean (*Le istituzioni harmoniche*, 1558); later he renumbered them (*Dimostrazioni harmoniche*, 1571) so that the series started on C. But the removal of an antique precedent tended to discredit the modes towards the end of the 16th century. Galilei (*Il primo libro della prattica del contrapunto intorno*

all'uso delle consonanze, 1588–91, *I-Fn Gal.1*, ff.99–100; ed. Rempp, 70–72) with rare candour proclaimed that the plainchant modes were meaningless in modern polyphonic composition.

If 16th-century humanism deprived the modes of one of their main props, it gave legitimacy to the technique that helped destroy them – chromaticism. The medieval tradition was that the chromatic and enharmonic were abandoned by the ancients because they were difficult and ungratifying to the ear. But anyone reading Plutarch's *De musica* would have gathered the opposite. The enharmonic, he said, was the most beautiful of the genera, practised by the ancients because of its nobility but later undeservedly neglected (ed. Lasserre, chap.38). Gaffurius, taking his cue from this source, said it was the most artful of the genera, favoured by the most distinguished musicians but unknown to the common class of them, who could not discern the small intervals (*De harmonia*, ii, 8, f.xiv). The principal champion of the chromatic and enharmonic was Nicola Vicentino (*L'antica musica ridotta alla moderna prattica*, 1555), who modernized the two 'dense' genres by dividing the entire octave, not merely the dense segments or *pycna* of the tetrachords as the ancients did, into semitones and microtones. Salinas followed a similar procedure. The special instruments that Vicentino built and that were used by several distinguished musicians, notably Luzzasco Luzzaschi and Carlo Gesualdo, translated the exotic genres from antique theory into modern practice.

As has been seen, 3rds and 6ths and their compounds were considered consonances in the practical handbooks for some time. But in *musica theorica* the 3rds and 6ths were still in a limbo, because they were outside the accepted Pythagorean ratios, those whose terms were made up of the numbers 1 to 4. Gaffurius, for example, although he admitted that the 3rds and 6ths were excellent in sound, attributed to them no perfection of ratio, indeed no determinable ratio, and, therefore, they were irrational (*De harmonia*, i, 3, f.5r). Fogliani was able to surmount the difficulty by proving that sound had no material existence but was an 'accident' of violent motion and therefore not subject to mathematical, only to aural, judgment (*Musica theorica*, 1529, ii, 1–3, ff.12ff). What the community of musicians and composers considered consonant was indeed so.

Zarlino took a step backwards, however, by reinstating the dominance of *ratio* over *sensus*, rationalizing a new numerical limit for consonance: the *senario*, or numbers 1 to 6, which took in the 3rds and the major 6th. This required that he hypothesize a 'natural' tuning, Ptolemy's syntonic diatonic, in which these imperfect consonances were 'just' or 5:4, 6:5 and 5:3. When this was shown to be impractical, the *senario* theory too had to fall. Galilei opposed any limits, arguing that all musical intervals, whether within or outside the *senario*, were natural. He contended that there was theoretically an infinity of consonances (*Discorso intorno all'opere di Messer G. Zarlino*, 1589, pp.92–3). Zarlino's practical theory of counterpoint, based on the premise of the *senario*, severely limited the introduction of dissonances to suspensions and passing notes; Galilei was much more pragmatic about them, opening the way to the free uses of the *seconda prattica* (*Discorso intorno all'uso delle dissonanze*, 1588–91). Thus Zarlino's heroic effort to bring *musica practica* and *musica theorica* together again was a failure because he bent theory to suit practice and misrepresented practice to fit the theory.

The aspect of the theory of music that was most affected by humanism was concerned with the goals and effects of music. Hardly a book on music failed to recount some of the stories that the ancient philosophers told about its miraculous therapeutic, moral or corrupting effects. The late 15th and early 16th centuries were dominated by the

Platonically inspired judgment that only music that strengthened moral character was desirable. But those who followed Aristotle, and particularly commentators on the *Poetics* after 1550, emphasized the positive value of all kinds of music, particularly that which could induce the catharsis of the passions and could move listeners to feel the affections of a poem or a dramatic character. Mei condemned polyphonic music as impotent for this, because the different vocal parts pulled in opposing directions; only monodic music could have the power that Greek music possessed. Galilei, who espoused Mei's ideas, wrote a vehement critique of polyphonic music (*Dialogo della musica antica et della moderna*, 1581) but was rather vague about what should take its place. More than at any time in the past, practical theory became prescriptive, the cutting edge of innovation.

[Theory, theorists](#)

10. The Baroque period.

In the first half of the 17th century musical practice caught up with the aesthetic ideals proclaimed in the second half of the previous century and practical theory caught up with improvised practice. The ideal of moving the affections was realized in the *seconda pratica*. Claudio Monteverdi (Preface, *Quinto libro de madrigali*, 1605) used this term to distinguish his own freer approach to contrapuntal writing, particularly dissonance treatment, from the practice taught in Zarlino's *Istitutioni* in which dissonances were very strictly controlled (see [Prima pratica](#)). His brother, Giulio Cesare Monteverdi, in commenting on this statement ('Dichiaratione', *Scherzi musicali*, 1607), explained that in the *seconda pratica* harmony is a servant of the text, while in the *prima pratica* the harmony is mistress over the text. The two prefaces were written in response to the criticisms of Giovanni Maria Artusi (*L'Artusi*, 1600), who enumerated some of the new style's characteristics more explicitly than its defenders: unprepared or improperly prepared suspensions, unprepared diminished 5ths and 7ths, false relations, difficult melodic intervals, incorrect part-writing after a flat or sharp, abuse of note-against-note chordal style, and other departures from the learned manner of writing counterpoint. Although Artusi described the style in negative terms, he made the astute observation in his dialogue that a number of these departures were characteristic of improvised music or improvised elaborations of written music. Thus some of the freely introduced dissonances were *accenti* and other grace notes normally added by the singer. Several singing teachers had written tutors for embellishing written music, for example Girolamo Dalla Casa (*Il vero modo di diminuir*, 1584). Other dissonances resulted from following the rules of counterpoint *a mente* or *supra librum* rather than the rules of *res facta*, or from imitating the free clashes allowed in instrumental figurations and runs. Thus many of the innovations of Monteverdi had been frequently heard before, but seldom written. In this sense the theory of written counterpoint was simply adjusting to the realities of performing practice.

In due time a theory developed to account for the new licences, but the *prima pratica* remained a viable option. Thus Girolamo Diruta (*Seconda parte del Transilvano*, 1609) considered *contrapunto osservato* (strict counterpoint) and *contrapunto commune* (the free modern style) as alternatives for the modern composer. Adriano Banchieri (*Cartella musicale*, 1614) and Marco Scacchi (*Epistola* to Werner, c1648; *Breve discorso sopra la musica moderna*, 1649) specified some of the norms by which these two co-existent styles were to be distinguished. Scacchi, his pupil Angelo Berardi, and Christoph Bernhard, who also came under Scacchi's influence, developed a system of stylistic classification that represents the first efforts at a theory of musical style. Bernhard was the most assiduous of these in detailing the licences of the various

styles, the freest of which was the recitative. Since the devices, like the figures of rhetoric, were at once a form of embellishment and of forceful expression, he gave them names derived from rhetorical theory, as Joachim Burmeister had done earlier in arriving at a terminology for the technical and expressive devices of polyphonic writing (*Musica autoschediastike*, 1601; *Musica poetica*, 1606).

Although the *prima pratica* continued to be applied in composition, particularly of sacred music, it became mainly a pedagogical style known as *stile antico* in which the pupil was expected to become proficient before attempting the modern style. Diruta taught five species of 'observed' or strict counterpoint, types that were later adopted, with modifications by Banchieri, Lodovico Zacconi (*Pratica di musica, seconda parte*, 1622), Berardi (*Ragionamenti musicali*, 1681, *Miscellanea musicale*, 1689) and Johann Joseph Fux (*Gradus ad Parnassum*, 1725). The *prima pratica* is thus the first example of a historical style that became the basis of a pedagogical theory, a phenomenon that was to mark the teaching of theory throughout the 19th and 20th centuries.

Another improvisatory practice that was annexed by written theory is that of florid elaboration, embellishment and variation on a written line or harmonic scheme. Throughout the 16th century musicians were taking melodic schemes or *arie* for singing poetry, and performing impromptu arrangements and variations on them, whether in reciting strophic poems or in playing variations or dances on a lute or other instrument. When performing the top line of frottolas and madrigals written in simple chordal style, singers would supply runs and other embellishments, especially in approaching the cadence. Some handbooks were published in the 16th century to guide the improviser, for example *Trattado de glosas sobre clausulas y otros generos de puntos en la musica de violones* (1553) by Diego Ortiz, and *Libro llamado Arte de tañer fantasia* (1565) by Tomás de Santa María. Singing tutors, such as that of Dalla Casa mentioned above or of Giovanni Battista Bovicelli (*Regole, passaggi di musica*, 1594), provided sample runs, figurations and models for the embellishment of both sacred and secular polyphonic music. A more tasteful, expressive and dynamically nuanced kind of ornamentation was developed in Giulio Caccini's *Le nuove musiche* (1601/2), which became a model for French treatises, such as Marin Mersenne's 'L'art de bien chanter', the fifth book of *Harmonie universelle* (1636–7). (Mersenne's contributions to music theory are not discussed in detail in this article since they pertain to acoustics and organology rather than theory proper.)

Accompanying from a bass was also probably an unwritten practice for many years before a basso continuo with figures was first printed in the score of Emilio de' Cavalieri's *Rappresentazione di Anima, et di Corpo* (1600). The earliest rules for playing from a bass appeared in prefaces, such as that to Cavalieri's score or to Lodovico Viadana's *Cento concerti ecclesiastici* (1602). Soon it became the subject of short tracts, the most notable of which is Agostino Agazzari's *Del sonare sopra 'l basso con tutti li stromenti e dell'uso loro nel conserto* (1607). The usage and theorizing about it spread quickly to Germany (Michael Praetorius, *Syntagma musicum*, chap.6, 'De basso generali seu continuo', 1618), quite late to England (Matthew Locke, *Melothesia, or Certain General Rules for Playing upon a Continued-Bass*, 1673) and France (Saint Lambert's *Nouveau traité de l'accompagnement du clavecin, de l'orgue et des autres instruments*, 1707; first edition, 1680, lost).

The first phase of thoroughbass theory is best summed up by Lorenzo Penna's *Li primi albori musicali* (1672). Although this consisted largely of instructions for accompanying, its detailed rules, prescribing part-movement, interval content of

chords, cadence formulae, rhythmic figures, and ornaments, make it by implication a book on composition; one section, indeed, showed how to supply a bass for an otherwise finished piece. The connection of thoroughbass with composition was made explicit in Johann David Heinichen's *Der General-Bass in der Composition* (1728). Though focussed on accompaniment, the book was invaluable for composers. One of its important contributions was that Heinichen clarified and expurgated the use of dissonances in the theatrical style in keeping with the renewed desire for correctness.

The chordal structure of Baroque music was obviously intuitively conceived and empirically understood by the thoroughbass theorists. But no theory had evolved that related the chords to a single goal or limited collection of pitches. The modes, through commonly used transpositions and accidentals, had been reduced in practice to just a few distinct octave species. Zarlino had already noted that the modes could be divided into two classes, those that began by rising a major 3rd, and those beginning with a minor 3rd. In England it became common to speak of 'sharp song' and 'flat song' for what in practice were the modes reduced to two (Christopher Simpson, *The Division-Violist*, 1659). In 1683 Jean Rousseau took the radical step of proclaiming that there were only two modes, major and minor, although he still clung to the concept of 'natural' and 'transposed' keys (*Méthode claire, certaine et facile pour apprendre à chanter*). Charles Masson went a step further and discarded the natural and transposed categories, accepting eight major and minor keys, omitting only the major keys on G, A, D and E and minor keys on G, A, B and D (*Nouveau traité des règles pour la composition de la musique*, 2/1699). He recognized in each key a 'final', a 'mediant' and a 'dominant', which he called the 'essential notes'.

These developments prepared the way for Rameau's conception of the notes and chords of a key as emanating from a single source pitch. Rameau acknowledged that the inspiration for this breakthrough came from Descartes' method, which was to build a system of natural law on a self-evident principle. In his *Traité de l'harmonie reduite à ses principes naturels* (1722) Rameau identified this first principle as the first six divisions of the string; these could be shown to generate all the consonant and dissonant intervals and chords as well as the rules for their interconnection. But it was first necessary to recognize as an *a priori* fact that a note and its octave-replicas were identical. From this ensued the principle of inversion (see fig.6). Through inversion it was possible to incorporate the major 6th, 8:5, into the consonances of the *senario*, because it could now be explained as the inversion of the minor 3rd, 6:5. Thus Rameau marked a return to naturalism and rationalism after the pragmatic theory of the thoroughbass.

By arithmetic manipulation of the ratios representing the primary division of the string, $\frac{1}{2}$ (octave), $\frac{1}{3}$ (octave-plus-5th, reducible to a 5th by the rule of octave equivalence), $\frac{1}{5}$ (double-octave-plus-3rd, reducible to a 3rd), he was able to generate the primary major triad. A triad, although it had three possible bass notes, had only one 'fundamental bass' note. A progression of chords could now be viewed as the movement of a fundamental bass line that might or might not actually be sounded. The leaps or steps of the fundamental bass were controlled by a system of cadences having closing, evasive or interruptive functions, and all harmony could be viewed as an 'imitation of cadences'. Numerical ratios were used also to rationalize the elementary relationships of chords to the tonic and to each other. The triple proportion 1–3–9 represented the polarity of the subdominant (1) and the dominant (9) and their attraction to the tonic (3). This dominant he called the 'tonic dominant' (*dominante tonique*) to distinguish it from dominants on other than the fifth degree, which were simply 'dominants' (*dominantes*). The dominant chords normally carried a 7th, while

the subdominant was normally accompanied by an added 6th, but this chord could also be interpreted as a 7th chord on the second degree, leading to the concept of 'double employment'. The diminished triads, diminished 7th chords and chords of the 9th, 11th and so on demanded a different explanation. For these Rameau invented the notion of assuming (*par supposition*) a fundamental bass note a 3rd or 5th above the actual lowest note of the chord.

While these general lines of his theory remained stable, many details, such as the derivation of the minor triad and the minor scale, experienced fluctuation in the course of a lifetime of publications. The most important change was his shift of the burden of the first principle from string division to the phenomenon of overtones in the *Nouveau système de musique théorique* (1726). Although Descartes had adumbrated the idea and Mersenne reported observing the overtones as early as 1623 (*Quaestiones celeberrimae in Genesim*), and John Wallis had explained their physical origin (*Philosophical Transactions*, xii, 1677, pp.839–42), it was through the work of Joseph Sauveur ('Système général des intervalles des sons', 1701) that Rameau became aware of the phenomenon. Sauveur had there given a detailed experimental and theoretical account of the partials that are heard in most vocal and instrumental sounds. This provided Rameau with an even more fundamental and natural first principle than string division, for the 3rd and 5th were actually generated by the fundamental pitch.

Rameau, while he clarified many aspects of harmonic practice, also left a legacy of unsolved problems – many of them in reality false issues – that occupied theorists long after him. The notion that the generation of each chord had to be explained led to a multitude of theories about the generation of the minor chord, the diminished triad, the diminished 7th chord, the augmented triad, and 7th chords on steps other than the dominant. The search to derive the minor and chromatic scales from some natural phenomenon exercised Rameau and many of his successors. How the fundamental bass should be permitted to move and how these movements were related to modulation raised other questions. Which was the primary dissonance, which dissonances could be attacked unprepared, and which had to be prepared were other problems seeking solution. There is hardly a theorist in the 18th or 19th centuries who did not engage in a dialogue across the years with Rameau on some of these and other issues first raised by him.

Rameau's most faithful interpreter, if also a severe critic, was Jean le Rond d'Alembert. While appreciating the great contribution he made to simplifying musical syntax, as a mathematician d'Alembert was shocked by Rameau's misuse of geometry and by his errors of method. He managed to distil the essence of Rameau's musical syntax in a little manual, *Eléments de musique théorique et pratique suivant les principes de M. Rameau* (1752). Among other critics, Leonhard Euler (*Tentamen novae theoriae*, 1739) challenged the assumption that a pitch and its octave were identical and contested the validity of the principle of inversion.

Another attempt at a natural theory of music was Giuseppe Tartini's application of the difference tone or 'the third sound' that he had observed as being heard when two notes are sounded simultaneously (*Trattato di musica secondo la vera scienza dell'armonia*, 1754). Although Georg Andreas Sorge (*Vorgemach der musicalischen Composition*, 1745–7) and Jean-Baptiste Romieu (*Nouvelle découverte des sons harmoniques graves*, 1751) had previously discovered the phenomenon, it was Tartini who showed that it corroborated six other fundamental observations previously made: string division; the notes of the trumpet marine, the trumpet, the hunting horn, and of organ mixtures; and notes derived by attaching weights to strings. All these produced

the same series of notes, which added up to the diatonic system and supported the concept of the fundamental bass and the primacy of the triad. Tartini was not content with this deduction, but indulged in daring mathematical and geometric speculations, which two mathematicians soberly refuted: Benjamin Stillingfleet in *Principles and Power of Harmony* (1771) and Antonio Eximeno in *Dell'origine e delle regole della musica* (1774).

[Theory, theorists](#)

11. The Classical–Romantic period.

Rameau's theory spread to Germany through the efforts of Friedrich Wilhelm Marpurg, whose *Systematische Einleitung in die musikalische Setzkunst nach den Lehrsätzen des Herrn Rameau* is in great part a translation of d'Alembert's handbook. Johann Philip Kirnberger (*Die Kunst des reinen Satzes in der Musick*, 1774–9) accepted many of Rameau's ideas, such as inversion, but he gave more importance to melodic functions. Thus he recognized two kinds of dissonance, the 'essential', as found in the 7th chord, and the 'incidental', as found in the suspension, which requires preparation. He united the study of counterpoint with harmony, counterpoint being given the subordinate role of arpeggiating the chordal harmony and colouring it through passing notes.

D'Alembert's handbook may have influenced two German writers who examined the capacity of a given chord or note to have different harmonic meanings in different contexts. Abbé Georg Vogler was the first to give this capacity a name, 'multiple meaning' (*Mehrdeutigkeit*), in two treatises ('Summe der Harmonik', 1780, in the *Betrachtungen der Mannheimer Tonschule*, and the *Handbuch zur Harmonielehre*, 1802). Through multiple meaning, Vogler developed an advanced theory of modulation to remote as well as nearby keys. He seems to have been the first to use Roman numerals to denote the degrees of the scale on which chords reside in a given key: the F major triad is thus 'I' in the key of F major, 'IV' in C major and 'V' in B major etc. With Gottfried Weber (*Versuch einer geordneten Theorie der Tonsetzkunst*, 1817, 3/1830–32) this nomenclature evolved into a fully-fledged system using large and small Roman numerals (for major and minor scale-degrees respectively, often preceded by an upper- or lower-case Roman letter to indicate the prevailing key) and upper- and lower-case gothic letters to identify root and chord-quality directly. Numerals and letters were qualified by symbols such as the superscript circle indicating diminished quality, superscript 7 indicating a minor 7th and dashed '7' for a major 7th. This system was adopted by subsequent theorists, and essentially remains in use to the present day for simple chordal analysis. Weber also expanded Vogler's multiple meaning greatly. With him it applied not only to notes and chords but also to interval, voice-crossing, composite melody, distance from the bass and many other categories. Into his discourse is woven a sense of the ear (*das Gehör*) as an agent actively perceiving, evaluating, remembering and understanding musical phenomena, a sense that gives Weber's theory a perceptual and cognitive character unprecedented for its time.

François-Joseph Fétis retained the main lines of Rameau's method, which he consecrated as 'the laws of tonality' (*Traité complet de la théorie et de la pratique de l'harmonie*, 1844). But he rejected mathematical and acoustical foundations for harmony, convinced by his study of history that the rules of composition were dictated not by nature but by feelings, needs and tastes of men in a given time and place. He identified four phases in the development of harmony: 'unitonic' (*unitonique*) or the unmodulating single tonality of plainchant; 'transitonic' (*transitonique*), in which through

dissonance a tonality tended to expand outwards but was still held in check by a single centre as in plainchant; 'pluritonic' (*pluritonique*), the post-16th-century system in which the urge to express the passions led to a multiplying of the relationships one tonality had to others, so that any one harmony could now resolve in several ways; 'omnitonic' (*omnitonique*), the music of the future, in which any sound in a harmonic combination could progress to any other by a generalized application of the device of alteration.

Another theorist who put aside natural explanations was Moritz Hauptmann in *Die Natur der Harmonik und Metrik* (1853). Disturbed by explanations founded on the harmonic series because of its potentially infinite and all-inclusive nature – containing as it does both dissonant and consonant members – he preferred to construct a purely autonomous musical system by means of Hegelian logic. The intervals directly understood, the octave, 5th and major 3rd, were the fundamental building-blocks of all harmony. Chord succession depended not only on the progression of roots, which he adopted from Rameau, but on the joining together of chords that possess notes in common. These make the connection intelligible as the other notes of the chord move on. Hauptmann applied the same logical principles to the unfolding of time: the dialectic process that activates the triad also activates metre as duple, triple or quadruple, and extends it to larger units of time.

A return to natural theory is marked by Hermann von Helmholtz in *Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik* (1863), which laid the foundation for modern physical and physiological acoustics. It is a book rich in new insights, among the most original being his explanation of dissonance through the intensity of beats, and of difference tones as subjective non-linear auditory responses to pitch. Helmholtz's forays into music theory were not productive of new theory so much as of authoritatively expressed syntheses, for example his definition of the principle of tonality (original italicized): 'the whole mass of tones and the connection of harmonies must stand in a close and always distinctly perceptible relationship to some arbitrarily selected tonic, and ... the mass of tone which forms the whole composition must be developed from this tonic, and must finally return to it' (pt.iii, chap.13; Eng. trans., 1875, p.249).

The physicist Arthur von Oettingen (*Harmoniesystem in dualer Entwicklung*, 1866), influenced by both Hauptmann and Helmholtz, sought a theoretical system in which the minor chord was granted the same status as the major chord rather than deriving from higher overtones or arising as a variant of the major chord or being explained in some other non-systematic way. His new system, relying on acoustics and mathematics, was founded on the opposition of 'being' and 'having'. The notes of the major triad 'are' all overtones of a common fundamental (c', e' and g' are the 4th, 5th and 6th overtones of C). The notes of the minor triad, on the other hand, are fundamentals that 'have' a common overtone (c', e' and g' have g''' as their 6th, 5th and 4th overtone respectively). The tones of the former (major) are in a relationship of 'tonicity' (*Tonicität*), their common element being called the 'tonic fundamental'. The tones of the latter (minor) are in a relationship of 'phonicity' (*Phonicität*), their common element being called the 'phonic overtone'. From this arises a symmetrical system. C major is spoken of as 'tonic C', while A minor is spoken of as 'phonic e'; and whereas the cadential 7th chord in the former is *g–b–d'–f'*, that of the latter is *a'–f'–d'–b* – the same intervals, but top-down. Major and minor thus become mirror worlds, and the hierarchies of keys to which they can modulate mirror universes. Such a system is called 'dual', and the approach is 'dualism'.

In appropriating Oettingen's dual system, Hugo Riemann revisited a notion briefly considered but rejected by Rameau (1737). In *Musikalische Syntaxis* (1877) he took the mirror worlds of tonic and phonic, which had been derived by different means from the one familiar harmonic series, a stage further by envisioning two harmonic series, mirror images of one another: overtones and undertones. Major was constructed from the overtone series, minor from the undertone series. Nomenclature now reflected this total inversion of worlds. The notes of the major triad were still called 'tonic' (c), 'third' (e) and 'fifth' (g), and represented by 1, 3 and 5, those of the minor triad were now read downwards as 'prime' (e), 'third' (c) and 'fifth' (a), and represented by I, III and V.

Whether Riemann truly believed in the undertone series is unclear, but he distanced himself from it, indeed from reliance on harmonic series altogether, in mid-career. What emerged was his theory of 'harmonic function', in which the primary relationships around a tonic were those of the perfect 5th above and below: tonic, overdominant and underdominant, or more simply tonic, dominant and subdominant (T, D and S). Long in gestation, the system was unveiled in a practical manual entitled *Vereinfachte Harmonielehre* ('Harmony simplified') (1893, Eng. trans., 1896), with the essential statement: 'There are only three kinds of tonal functions ... namely tonic, dominant and subdominant. In the change of these functions lies the essence of modulation' (p.9). Scale degrees no longer existed in their own right. However, since in C major the chord of D minor was the parallel (relative) minor of F major, D minor could be used as a 'substitute chord' (*Stellvertreter*) for the subdominant, designated 'Sp'; likewise E minor for the dominant ('Dp') and A minor for the tonic ('Tp') (pp.71–4). At the same time, E minor is the 'leading-note chord' of C major, thus E minor could also substitute for the tonic, as could A minor for the subdominant (pp.75–6). The reverse was true in the minor key. Riemann developed this system through later editions of his *Handbuch der Harmonielehre*.

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12. Theory of genres: 16th to 18th centuries.

The theory of genres and the norms for their composition received increasing attention. Its rather sketchy beginnings are to be seen in Pietro Pontio's *Ragionamento di musica* (1588), where the standards for composing motets, masses, madrigals, psalms and the like are discussed. Similar instructions occur in Pietro Cerone's *El melopeo y maestro* (1613) and in Michael Praetorius's *Syntagma musicum* (iii, 1618). Johann Mattheson's *Vollkommene Capellmeister* (1739) and Johann Adolph Scheibe's *Der critische Musicus* (1737–40) are virtually textbooks of musical genres and forms. These instructions are symptomatic of the way in which the distinctive affective, compositional and associative traits attached to specific genres, each with its proper style and level of artfulness, came to be recognized during the Baroque period. Mattheson (pt.ii, chap.13) took up 16 such vocal genres, including the recitative, cavata, arioso, cantata, serenata etc., and 22 instrumental types, including 11 of the most common dances, and the sinfonia, overture and concerto grosso. Johann Adolph Scheibe was perhaps more typical of his time when he paid greater attention to technical method and formal structure than to affective character in describing such types as the sonata, symphony and concerto. Still, the descriptions are impressionistic, and it was only with Heinrich Christoph Koch (*Versuch einer Anleitung zur Composition*, pt.iii, 1793) that detailed enough models were presented to serve a composer embarking on a sonata or concerto movement. With Koch, too, the instrumental forms and genres occupied the foreground for the first time. They were not abstract, however, for he conceived of instrumental music as still bound up with feelings and emotions, if in a non-specific way.

The more this group of theorists focussed on the purely musical logic of genres of composition, the more they resorted to literary and visual models for both concepts and vocabulary (see [Rhetoric and music](#)). Burmeister had described a motet as having, like an oration, an *exordium*, a *confirmatio* and a conclusion. Mattheson named six parts in a well-developed composition, the *exordium*, *narratio*, *propositio*, *confirmatio*, *confutatio* and *peroratio* – that is, introduction, report, proposal, corroboration, refutation and conclusion (pt.ii, chap.14). Although the example he used was an aria of Benedetto Marcello, the text is never considered, only the musical continuity. Moreover, musical punctuation is seen as breaking the structure down into paragraphs, sentences, phrases etc.

Koch borrowed from visual art, and specifically from J.G. Sulzer's *Allgemeine Theorie der schönen Künste* (1771–4), the concept of the *Anlage* or layout, a plan or sketch in which the most salient features of the final work are set down. Following this outline of the work, the artist proceeds to the *Ausführung* or execution, and finally the *Ausarbeitung* or elaboration of details. Koch realized that the parallel was imperfect and he was forced into literary analogies to convey his formal ideas. For music, though amenable to spatial imagery, was a temporal art like literature. Thus, the musical *Anlage* is a statement of the principal ideas and an exposition of how they relate to each other within the main periods. When he went on to speak of the articulation of sections, he called upon grammatical terms such as *Redetheile* (parts of speech), periods, commas, semicolons, caesuras, periods and even subject and predicate. Koch's preoccupation with explaining every detail of the anatomy of a piece led him to consider both minute and large-scale temporal units.

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13. Theory of rhythm: 17th to 19th centuries.

Interest in temporal problems was awakening after the long hiatus brought on by the simplification of rhythm in the 16th and 17th centuries. Most of the texts during these centuries continued to repeat, sometimes dutifully, often with a tinge of scorn, traditional discussions of prolations and proportions. One of the treatises most attuned with the times was Agostino Pisa's *Battuta della musica dichiarata* (1611), a tutor for 'conductors' on beating time. As was conventional in the 16th century, he divided all metres into two parts, the *positione* and *elevatione*, the lowering and raising of the hand; but with uneven metres the downbeat marked the larger part, for example two beats down against one up in triple. The proportional signatures, such as 3/2, lost their precise meaning before theorists took note of the new practice of indicating tempo by adjectives of mood and gait, such as *allegro* and *andante*. Michel de Saint-Lambert (*Principes du clavecin*, 1702) claimed that the proportions still held in some cases – for example C was twice as fast as C, though both were at a walking pace – but Thomas Morley (*Plaine and Easie Introduction*, 1597) a century earlier already found composers using the two indifferently.

A new approach to the organization of time is reflected in the dialogue by Joseph Riepel, *Anfangsgründe zur musicalischen Setzkunst* (1752–68). He was aware that the patterns of note values, their repetition in themes and their direction towards a cadence were subtly related to melodic and harmonic factors. In the first chapter, 'De rhythmopoeia oder Von der Tactordnung' (1752) the pupil is instructed to pay close attention to the length of phrases and the effect of adding them together. Although a preference is shown for four-bar modules, Riepel's preceptor shows that two-, three- and five-bar phrases (*Zweyer*, *Dreyer*, *Fünfer*) are also possible. Koch broke down temporal structure into even smaller units, which he called *Einschnitte* (incises), while

at the level of the phrase or *Absatz* he differentiated those that tended towards the fifth degree from those that closed on the tonic. *Absätze* cumulated into periods and these into full compositions.

Jérôme-Joseph de Momigny (*Cours complet de composition*, 1803–6) introduced the principle that musical units proceed prototypically from upbeat (*levé*) to downbeat (*frappé*), these two components being termed ‘antecedent’ and ‘consequent’, the two making a ‘cadence’. Antonín Reicha furthered the theory of phrase structure in his *Traité de mélodie* (1814), and evolved a theory of primary and subsidiary motives (*idées mères* and *idées accessoires*) and their ‘exposition’ and ‘development’ in his *Traité de haute composition* (1824–6). A.B. Marx developed a systematic theory of motif (*Motiv*) in the first volume of his *Die Lehre von der musikalischen Komposition* (1837–47). A motif here was a small unit, expansible by repetition and variation to form a phrase, passage, period and eventually whole piece. From this Marx created a taxonomy of musical forms, beginning with the simplest ‘song form’ (vol.ii) by way of theme and variation, simple and complex rondo forms, sonatina and sonata form, through to ‘mixed forms’ including multi-movement structures (vol.iii). Wagner adumbrated a theory of large-scale motivic structure, and while putting it into practice left to others, notably Hans von Wolzogen in his thematic guides (1874–82), the task of articulating it, using the terms *Motiv* and *Leitmotiv*.

In his *Katechismus der Phrasierung* (1890, with Carl Fuchs), Hugo Riemann revitalized the phrase-structure theory of Riepel, Koch and Reicha, particularly adopting Momigny’s upbeat–downbeat principle. Aimed at the general public, this work introduced a set of symbols denoting structural groupings, accentuation and articulation – symbols that Riemann was to use in many subsequent theoretical works, and also in his editions of classical keyboard music (called ‘phrase-structure editions’). Riemann had already deployed these symbols in a far from populist work, the *Musikalische Dynamik und Agogik* (1884), which systematizes all possible motif forms under all metrical conditions, and extends to dealing with polymetres. In this work, in which time and amplitude are treated as integral and reciprocal, the time-patterns being constantly dynamically ‘shaded’ with crescendos and decrescendos, Riemann sought completely to revise traditional theory of metre and rhythm. He was writing against the background of Hauptmann’s dialectic metric theory, and was considerably influenced by the work of Mathis Lussy (*Le rythme musical*, 1883).

[Theory, theorists](#)

14. 20th century.

The most crucial force in 20th-century theory was not Wagner’s chromaticism, Debussy’s non-functional harmony or Schoenberg’s 12-note system, but the historical perspective that made it inconceivable to try to explain music, past, present and future, by a single universal theory. Many 20th-century theories are deliberately limited in their applicability, such as Alfred Lorenz’s analyses of large-scale architecture in Wagner’s music dramas (*Das Geheimnis der Form bei Richard Wagner*, 1924–33, 2/1966), or Heinrich Schenker’s analytical system, which grew out of his studies of Beethoven.

Schenker’s is probably the most original and influential retrospective analytical theory of the century. Developed over a period of 40 years (*Neue musikalische Theorien und Phantasien*, 1906–35), it revealed a new breadth of logic in tonal music. Although in a difficult style and accompanied by novel graphic representations, much of his writing was destined for the performer. As such it is parallel to the thoroughbass methods, such as C.P.E. Bach’s *Versuch über die wahre Art das Clavier zu spielen* (1753), which Schenker greatly admired. It resembles them also in beginning with musical

practice – that is actual compositions rather than abstract principles – and evolving general principles by an inductive process. The most radical aspect of Schenker's approach is probably his view that discrete musical forms, such as single movements, are explicable in the 18th and 19th centuries as structures within a single key; sections conventionally interpreted as modulations are seen as 'prolongations' of a chordal or harmonic scale-step (*Stufe*) within the central key. To apprehend the basic structure of a piece as entirely in the tonic requires that it be reduced to its basic melodic and harmonic movements, that is to the 'background' level. This level, in turn, is derived by converting the written music first to a 'foreground' sketch containing the most cogent linear movement noticed by the ear, then to a 'middle-ground'. As in Kirnberger's method, harmony and counterpoint are united. The synthesis thus reveals the interaction of a skeletal melody with a distilled harmonic progression. Schenker's theory (see also Analysis, §II, 4–5) influenced a few German and Austrian theorists, notably Oswald Jonas (*Das Wesen des musikalischen Kunstwerks*, 1934). His impact was most pronounced among theorists and teachers in the USA, however. The Austrian Hans Weisse, a pupil of Schenker's, established Schenkerian studies at the Mannes School of Music in New York in 1931–32, and the Austrian Ernst Oster and the German Felix Salzer (*Structural Hearing*, 1952) taught at the Mannes School. The American-born scholar William J. Mitchell, with Salzer, founded the journal *Music Forum* (1967–), dedicated mainly to Schenkerian studies; Allen Forte, at Yale University, was the driving force behind the systemization of Schenkerian theory widely called 'Schenker(ian)ism' (*JMT*, iii, 1959), and in his *Introduction to Schenkerian Analysis* (with S.E. Gilbert, 1982) he furnished 'an unambiguous method to master the complexities of this useful analytical technique'. Carl Schachter at the Mannes School pioneered a method of rhythmic analysis in conjunction with tonal progression, based on Schenker's earlier rhythmic reductions (*Music Forum*, iv, 1976; v, 1980).

It was remarkable that a theory so authoritarian in tone, underpinned by nationalistic and monarchist beliefs, could eventually be embraced by the liberal, egalitarian world of American academia and rendered acceptably scholarly and 'scientific'. It became arguably the dominating music-theoretical paradigm of the second half of the 20th century (see Rothstein, 1990). So fully absorbed was it that it influenced basic textbooks of counterpoint (F. Salzer and C. Schachter: *Counterpoint in Composition: the Study of Voice Leading*, 1969) and harmony (E. Aldwell and C. Schachter: *Harmony and Voice Leading*, 1978–9). The period from 1979 saw the production of critical English translations of Schenker's major works (by Ernst Oster, John Rothgeb, Jürgen Thym, William Drabkin and others), such that by 2000 only the *Erläuterungsausgaben* (1913–20) and *Der Tonwille* (1921–4) remained unpublished, although translations of both were in progress. In the same period, Schenker's work became a focus for study within the context of cultural and intellectual history (Pastille, 1984–5; Blasius, 1996; Snarrenberg, 1997).

The search for a means of interpreting early 20th-century music led to a number of explanations based on the harmonic series. Schoenberg proposed that dissonances were not qualitatively distinguishable from consonances, since both could be found in the harmonic series (*Harmonielehre*, 1911, chap.2); he thus justified 'emancipating' dissonance from the restrictions of conventional counterpoint. Henry Cowell (*New Musical Resources*, 1930) applied the harmonics to rhythm by constructing a numerical series of durations analogous to the pitch numbers of the partials of a fundamental. Hindemith (*Unterweisung im Tonsatz*, 1937–9) used a synthesis of the harmonic series and the phenomenon of combination tones to classify chords according to the tension produced by their intervallic content. By this means he also

determined the roots of chords and consequently, the relationships among them. Harmony, grounded in root progression – a kind of fundamental bass – and progressing through a ‘fluctuation’ of tension, lent directional meaning to free flights of melody, which could be broken down into chordal and non-harmonic notes. Hindemith’s system was thus both analytical and compositionally prescriptive.

Other research proceeding from the harmonic series sought new tonal systems. Harry Partch (*Genesis of a Music*, 1949) used scales based on just intonation, including a 43-note scale, developed the theory for these scales, adapted and invented musical instruments, and wrote compositions. The Dutch physicist Adriaan Fokker (*Neue Musik mit 31 Tönen*, 1966) developed a 31-note scale that influenced a number of composers. Others developed theories of microtonal scales that relied on the equal-tempered scale. That of Alois Hába (*Neue Harmonielehre des diatonischen, chromatischen, Viertel-, Drittel-, Sechstel- und Zwölftel- Tonsystems*, 1927) was perhaps the most fully theorized, extending as far as the 12th-note scale. Hába wrote numerous compositions in his quarter-note, sixth-note and 12th note systems.

The roots of 12-note compositional theory lie in the 1910s; Hauer and Schoenberg arrived at independent methods around 1920. Hauer provided the theory of his method, which was based on hexachords (*Vom Melos zur Pauke*, 1925; *Zwölftontechnik: die Lehre von den Tropen*, 1926). Schoenberg’s earliest complete composition derived from a single row was his Piano Suite op.25 (1923); he never furnished a theory as such (see *Style and Idea*, 1975, pp.207–50), nor did Berg or Webern. The earliest formalizations of Schoenberg’s method were those by Krenek (*Studies in Counterpoint based on the Twelve-Tone Technique*, 1940), Rufer (*Die Komposition mit zwölf Tönen*, 1952, Eng. trans., 1954) and Jelinek (*Anleitung zur Zwölftonkomposition*, 1952–8), and early analytical-descriptive accounts of the method were given by Leibowitz (*Schoenberg et son école*, 1947; *Introduction à la musique de douze sons: les variations pour orchestre Op.31, d’Arnold Schoenberg*, 1949). 12-note theory was furthered by others, such as Eimert (*Grundlagen der musikalischen Reihentechnik*, 1963) and Perle (*Serial Composition and Atonality: an Introduction to the Music of Schoenberg, Berg, and Webern*, 1962, and many subsequent works). Perle suggested that it was not so much 12-note ordering in itself but individual concepts such as permutation, inversional symmetry and complementation, and invariance under transformation that were most fruitful for future composition.

At this point there was an essential bifurcation of theories. On the one hand, Boulez (*Penser la musique aujourd’hui*, 1964; Eng. trans., 1971) took Webern as the ‘bridge’ to the new music, and related Webern’s compositional practices to Messiaen’s use of ‘mode’ involving not only pitch but also duration, loudness and attack. From these he placed several parameters of musical sound under the governance of a single serial system, the result variously called ‘integral serialism’ and ‘total serialism’. On the other hand, Babbitt, working more from the later works of Schoenberg, treated 12-note compositional method as a system, characterizable entire by stating its elements, the relations among the elements and the operations (inversion, retrogression etc.) performable on those elements. In his hands the method became a branch of mathematical ordered set theory and group theory, the elements of a set being represented not by musical but by ‘integer’ notation: thus in 0,0; 1,9; 2,8; 3,2; 4,5 ..., the first of each number-pair representing the element’s order in the set, the second representing its pitch within the chromatic octave (irrespective of register, i.e. its pitch-class). Of particular interest for both composition and analysis are those characteristics that remain unchanged when particular operations are performed on the set, a phenomenon known as ‘invariance’. The first and second six elements of a

set are its 'hexachords'. These have been the subject of much study, certain hexachords possessing a special property known as 'combinatoriality' (as do certain trichords and tetrachords). Babbitt's exploration of the multifarious properties of musical sets are presented most notably in five key articles (*The Score*, no.12, 1955; *MQ*, xlvii, 1960; *JMT*, v, 1961; *PNM*, i/1, 1962–3; *College Music Symposium*, v, 1965). This work has been continued by many writers, including Lewin, Martino, Boretz, Forte, Clough and Morris.

Arising at an early stage out of this work was the study of the unordered set, for which the repertory of atonal but non-serial music written by Schoenberg between 1907 and 1923, and also by Berg and Webern, offered an unparalleled field of investigation. Lacking organization of either the tonal or the serial type, what gives music such as Webern's *Five Movements for string quartet* (1909), or Schoenberg's *Six Little Piano Pieces* op.19 (1911) their coherence? What enables listeners to make sense of and derive pleasure from hearing them? Forte (*The Structure of Atonal Music*, 1973) laid out a formal theory of unordered set operation dealing with sets of anything from two to 12 elements (i.e. pitch-classes). He established 'prime forms' for sets, each with a description of its total interval-content (an 'interval vector'), and a canonical list of the 220 set prime-forms containing three to nine elements. He further developed a theory of 'set complexes' and 'subcomplexes', formalizing relations among sets and facilitating descriptions of entire compositions. Schmalfeldt (*Berg's 'Wozzeck': Harmonic Language and Dramatic Design*, 1983) provided an analytical realization of that theory, and Forte himself (*The Harmonic Organization of 'The Rite of Spring'*, 1978) did likewise for atonal music outside the Second Viennese School. Baker (*The Music of Alexander Skryabin*, 1986) and others have since used Forte's theory in conjunction with that of Schenker to strive for comprehensive analytical descriptions of whole works of great length and complexity.

A new strand of music theory was begun in France in the 1970s. Ruwet (*Langage, musique, poésie*, 1972) and Nattiez (*Fondements d'une sémiologie de la musique*, 1975), building on the work of Saussure (*Cours de linguistique général*, 1916), C.S. Peirce, Eco (*La structure absente*, 1972), Lévi-Strauss (*Anthropologie structurale*, 1958; *Le cru et le cuit*, 1964) and others, sought to forge a semiology (or [Semiotics](#)) of music, i.e. a science of musical signs. Musical semiology sees music as a stream of sounding elements governed by rules of 'distribution'. Under analysis, a piece of music is placed on a grid of which the horizontal dimension marks the continuity of the musical stream (the syntagmatic plane) and the vertical dimension the identities and equivalences of segments of the music (the paradigmatic plane). The piece comes thus to be viewed all at once (i.e. synchronically), not in time, and consequently described in terms of 'units' (i.e. segments that cannot be further subdivided) and the laws that govern their distribution. Nattiez, based in Canada since the early 1970s, produced a classical model of such analysis (*Densité 21.5 de Varèse*, 1975), as did Morin (*Essai de stylistique comparée (Les variations de William Byrd et John Tomkins sur 'John Come Kiss Me Now')*, 1979) working with Nattiez at the University of Montreal. Nattiez produced a string of significant contributions to the field (*Tétralogies (Wagner, Boulez, Chéreau): essai sur l'infidélité*, 1983; *De la sémiologie de la musique*, 1987, Eng. trans., 1990; *Musicologie générale et sémiologie*, 1987; *Wagner androgyne*, 1990). Important contributions to the musical semiology have since been made by Hatten (*Musical Meaning in Beethoven: Markedness, Correlation, and Interpretation*, 1994), Tarasti (*A Theory of Musical Semiotics*, 1994) and Samuels (*Mahler's Sixth Symphony: a Study in Musical Semiotics*, 1995).

The most formidable challenge that music theory has had to confront is to explain

aleatory, electronic and colouristic music that exploits broad sound gestures rather than formal devices. It is apparent that informational, psychological, physiological, statistical, acoustical and even sociological approaches must figure prominently in theorizing concerning much new music. A growing reaction to some of the objective theories is also apparent; they are criticized for detecting micro-, macro- and hidden structures that are not apparent to the listener's hearing or related to his experience. This has led to an attempt to establish a phenomenological basis for analysis (Thomas Clifton, *JMT*, xiii, 1969; xix, 1975) and a critique of the use of verbal means to refer to non-verbal qualities (Benjamin Boretz, *PNM*, iv, 1966; viii, 1969).

A healthy trend is the recognition that music theory cannot be shielded from historical considerations, that analysis of structure divorced from stylistic, historical and sociological contexts falsifies the music it aims to describe. It is being recognized that only a multi-dimensional and pluralistic attack on the musical object can reveal its true nature and unique qualities.

[Theory, theorists](#)

15. New theoretical paradigms, 1980–2000.

In a series of articles from 1977, culminating in *A Generative Theory of Tonal Music* (1983), Lerdahl and Jackendoff developed an influential theory that formalized the listener's understanding (i.e. mental representation) of the common-practice tonal repertory – broadly, the music of the late Baroque, Classical and early Romantic periods. It sought to provide 'a principled account of what the experienced listener must know in order to sense the relative structural importance of events in a musical surface' (p.178). The theory drew from certain insights in Schenkerian theory, especially the general notion of unified hearing, and the complementary processes of reduction and prolongation; but its principal thrust was to 'model' the listening process according to the concepts of formal linguistics. Reflecting the generative-transformational linguistics of Noam Chomsky, it formulated musical procedures as a 'grammar' having verifiable 'rules'. However, rather than striving to conceive music as constructed in sentences made up of words and containing meaning, it addressed musical structure in its own terms, involving 'such factors as rhythmic and pitch organization, dynamic and timbral differentiation, and motivic-thematic processes' (p.6). From among these, it identified four focusses for modelling hierarchically: 'grouping structure', 'metrical structure', 'time-span reduction', and 'prolongational reduction', furnishing each with two sets of rules: 'well-formedness rules' (analogous to the rules of linguistics) and 'preference rules' (which acknowledge the nature of music as an art form). Much of what Lerdahl and Jackendoff investigate is, loosely speaking, psychological in nature. The formulation of their theory coincided with, while also providing a stimulus to, the growth in studies of what has since become an independent, mostly experimentally based discipline with its own professional international and national societies: music cognition (see [Psychology of music](#)). The new discipline maintains close links with parts of the field of music theory, with certain scholars active in both. Contributors at the intersection of the two disciplines include Epstein (1979, 1995), Gjerdingen (1988), Parncutt (1989), Roederer (1995), Narmour (1990, 1992), and Lerdahl himself, who has extended the original joint theory to apply to extended-tonal works of the late Romantic period and to atonal music. In the last of these, the organizing principle of stability in tonal music gives way to one of 'salience', which in turn forms the basis for prolongation, perceptual principles such as 'auditory streaming' being invoked in order to distinguish structural from ornamental levels.

A new theoretical paradigm of considerable power was developed by David Lewin in

the early 1980s and formalized in his *Generalized Musical Intervals and Transformations* (1987). The theory speaks of points in a conceptual musical 'space', and of distances between such points. These points are called 'elements', and the distances 'intervals'. 'Space' is conceived broadly to denote any of three musical dimensions: pitch, time, and timbre. Pitch space denotes any collection of pitches or pitch-classes arranged in scale order; Lewin's examples cite diatonic and chromatic scales, each either in just intonation (extending infinitely upwards and downwards, hence its elements are 'pitches') or in equal temperament (recycling with each octave, hence elements are pitch-classes mod-7 and mod-12); but any other kind of scale applies equally well – pentatonic, whole-tone, octatonic, or any of the church modes (mod-5, mod-6, mod-8, mod-7 respectively, in recycling). Temporal space is marked off by pulses called 'beats', or if time is considered as circular, 'beat-classes' (mod-4, mod-8, mod-16, etc.), or by 'durations' or 'duration-classes', by 'ratio-classes', even by 'tempo-classes'. Timbre space comprises a collection of steady-state timbres, defined by their harmonic spectra (i.e. absence or presence of individual harmonics, and strength of those harmonics present). In all of these cases, the elements in the spaces are conceived as having 'intervals' between any two – pitch-, rhythm-, or timbre-intervals – the intervals in each space having the properties of a mathematical 'group', and capable of being formalized as a single 'Generalized Interval System' (GIS), and giving rise to the operations of transposition, inversion and interval-preservation.

Lewin proceeds to generalize certain aspects of unordered set theory (including Forte's 'interval vector', 'complex' and 'subcomplex' – see above) so as to be invoked within the theory of GIS. He next moves to a higher music-organizational level. Instead of starting with elements in a space and examining the operations that occur between them, he starts with the *operations* themselves, and conceives them as forming GIS structures. This renders the theory more intuitive in that listeners, for cultural reasons, tend to hear in terms of such operations (transposition, modulation; we might add augmentation, diminution, change of tempo, etc.) rather than of individual notes, time-points, durations, etc. Lewin thus subsumes GIS theory within a broader transformation theory of musical relations. The latter, although cast in mathematical form, in turn connects interestingly with existing theories such as motivic transformation and tonal prolongation. In particular, Lewin invokes *tonal function theory*, as explicated by Hugo Riemann (1893 and later: see above §11), using 'Klang' for consonant triad, and treating 'dominant', 'subdominant', 'relative', 'parallel', etc. as transformational functions. Thus the form '(C,-)MED = (A ,+)' reads 'C minor become the mediant of A major', and so forth. Lewin incorporates also Riemann's 'leading-tone exchange' (Leittonwechsel) relations, thus '(E,-)LT = (C,+)', i.e. 'E minor becomes the leading-tone exchange chord of C major'. He develops a method of graphic analysis to present such transformations, and applies them analytically to passages from Wagner's *Ring* and *Parsifal*, while also formalizing them mathematically. In *Musical Form and Transformation: 4 Analytic Essays* (1993), Lewin applied his transformation theory to works by Debussy, Webern, Dallapiccola and Stockhausen.

The final part of this theory itself spawned a new line of enquiry known as 'Neo-Riemannian theory', which goes back to Lewin's first article on the topic (*JMT*, 1982). Dissertations by Hyer (1989) and Kopp (1995) made important contributions, another by Mooney (1996) explored further Riemann's *Tonnetz* (network of tonal relations), bringing Riemann's theoretical evolution and the theories of Hauptmann (1853) and Von Oettingen (1866) into the framework of the new theory, as also did Harrison's reinterpretation of dualism (1994). To these, Cohn (1996, 2000) has drawn

in the progressive harmonic theories of Weitzmann (1853). Elements of later 19th-century tonal theory have, in this way, been revalidated and formalized as tools for examining late 19th- and early 20th-century harmonic practice.

In 1985, *Music Theory Spectrum* gave over an entire issue to articles on 'Time and Rhythm in Music'. It recognized a growing body of work on temporality in music (by writers such as Ingmar Bengtsson, Diana Deutsch, Paul Fraise, Lewis Rowell, Carl Schachter and Karlheinz Stockhausen) that by no means cohered as a field of inquiry. It sought to foster a sense of common purpose, pointing beyond rhythm and metre to such issues as 'motion and stasis, continuity and discontinuity, progression, timelessness, pacing, proportion, duration, and tempo' (p.72). Since then, seminal studies have been Kramer's *The Time of Music* (1988), Epstein's *The Shaping of Music* (1995), and publications by Caroline Palmer, Justin London, Christopher Hasty, John Roederer, and many others. Indeed, this work, which has roots in music theory of ancient Greece, India, medieval Europe and elsewhere, operates across a broad front, connecting directly with philosophy, physics, psycho-acoustics, ethnomusicology and performance practice (see [Metre](#) and [Rhythm](#)).

Joseph Kerman's blast across the bows of musicology (1985), while hardly striking terror into the hearts of Schenkerians, set-theorists, and other practitioners, did give encouragement to several lines of investigation already underway and assisted their emergence and professional recognition. For some of these, see [Hermeneutics](#); [Gender](#); [Women in music](#); [Feminism](#); [Narratology, narrativity](#); [Postmodernism](#); [Reception](#). Music theory in 2000 is a far more diverse, more interdisciplinary, and less balkanized field the world over than it was in the 1970s. It is impossible to assess which of its recent efflorescences will take hold and change the nature of the discipline. The programme for the millennial joint meeting of the Society for Music Theory and 15 other American and Canadian music societies, at Toronto in 2000, showed Schenkerian and set-theoretical studies retaining their places in the world of English-language music theory, alongside transformational theory, cognition-based studies, and temporal theory, together with the history of music theory, which, already strong since the 1950s, experienced a rejuvenation in the 1980s and 1990s (see Bent, 1993).

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