THE HARVARD DICTIONARY OF MUSIC

Editorial Board

Edited by DON MICHAEL RANDEL

THE HARVARD DICTIONARY OF MUSIC

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Preface to the Fourth Edition

Whereas *The New Harvard Dictionary of Music* relied very little on the first two editions of *The Harvard Dictionary of Music,* this fourth edition does proceed rather directly from its predecessor. Numerous changes, including outright additions and deletions, have been incorporated, however. These reflect new developments in musical scholarship, especially the expanding range of subjects now being studied by scholars, as well as the fact that the world and its political boundaries have changed substantially since the last edition. Revised bibliographies point to recent literature but do not cite larger standard reference works.

I am very grateful to all of the contributors listed in the following pages—both those who contributed first to the previous edition and those whose work appears for the first time in the present edition. Members of the Editorial Board have been very helpful in suggesting revisions and in recruiting new contributors.

In the course of the preparation of this edition, the locus of activity changed from Cornell University to the University of Chicago. Thus, I must now thank assistants at both institutions. At the University of Chicago and new to this project are Peter Martens, Ryan Minor, and Pelarin Bacos. Those at Cornell University are listed in the Preface to the previous edition. The libraries of both institutions have of course provided essential support.

As always, the staff at Harvard University Press has been extraordinarily professional and helpful. I am especially grateful to Margaretta Fulton for her work on dictionary projects going back now over twenty-five years. Her labors on this edition have been more essential than ever.

Don Michael Randel
Chicago, Illinois

Preface to *The New Harvard Dictionary of Music*

The present dictionary carries on the tradition of the first and second editions of the *Harvard Dictionary of Music,* edited by Willi Apel. The greatly expanded scope of current musical scholarship and changes in the character of musical life in recent decades, however, have made it necessary to conceive the dictionary afresh. As a result, *The New Harvard Dictionary of Music* includes only a handful of articles based on the earlier dictionaries. The coverage of non-Western and popular music and of musical instruments of all cultures has been much enlarged. Within the tradition of Western art music, which remains its central concern, the dictionary reflects recent scholarship on all periods and the growing proportion of scholarship and criticism devoted to more recent music. On all of these topics, it aims, like its predecessors, to serve as a convenient reference work for laymen, students, performers, composers, scholars, and teachers.

The bibliographies that accompany many of the articles will serve as guides to further reading. These bibliographies do not in general cite other standard reference works, however. Both general and specialized reference works are listed in the article Dictionaries and encyclopedias.

In addition to the editorial board and the contributors who are listed on the following pages, numerous people helped to make this book possible. Principal among these were assistants in Ithaca, New York, who did research, verified bibliographies and other information, keyboarded material by contributors, and drafted or wrote many of the unsigned articles. These assistants (with the special areas, if any, in which they worked) included Matthew Brown (theory), Jennifer Brown (bibliography), William Cowdery, Charlotte Greenspan (opera, individual countries), Bettie Jean Harden, Christopher C. Hill (a broad range of medieval and other topics), Paul Horsley (individual countries), Barry Kernfeld (jazz and popular music), Mark S. Laporta (theory), Wayne Schneider (individual works), Robert Seletsky (performance

practice), John Spitzer (instruments used in non-Western and popular music), Shirlene Ward, and Patrick T. Will (popular music). Shirlene Ward was the chief assistant during the first years of the project, and Bettie Jean Harden was the chief assistant thereafter, playing a major role in the final typing, editing, bibliographical verification and updating, and proofreading. Dennis Libby, of South Paris, Maine, provided expert editorial assistance at several stages. Among those who gave valuable help on the use of computers were Tom Hughes, Dean Jacobs, and Ray Tim Teitelbaum. The project was housed in the Department of Music at Cornell University and could not have been carried out without the facilities and collection of the Cornell Music Library and the generous assistance of its staff, headed by Lenore Coral.

With the exception of the organ diagrams, which were drawn by Marcia Tucker, and the diagram of the modern piano action, for which thanks are due Steinway, the instrument drawings are by Carmela Ciampa and Laszlo Meszoly. Other line art was supplied by Deborah Schneck. Notation for *Concert for Piano and Orchestra* by John Cage, ©1960 by Henmar Press Inc., is reproduced by permission of the publisher. Notation from *in memoriam . . . CRAZY HORSE (symphony)* by Robert Ashley is reproduced by permission of the composer.

Don Michael Randel
Ithaca, New York

THE HARVARD DICTIONARY OF MUSIC

A

A. (1) See Pitch names, Letter notation, Hexachord, Pitch. (2) An abbreviation for *alto or *altus.* (3) *A* [It.], *à* [Fr.]. To, at, with, for; *a 2* [etc.] *voci,* for two [etc.] voices. Phrases beginning with this word should be sought under the word immediately following, e.g., *Battuta, Beneplacito, Cappella, Deux, Due, Peine entendu, Piacere, Tempo.*

Ab [Ger.]. Off, as for a mute or an organ stop.

Abandonné [Fr.], **abbandonatamente, con abbandono** [It.]. With abandon, unrestrained.

Abbassare [It.]. To lower, e.g., the pitch of a string.

Abbellimento [It.]. Ornament.

Abbreviations. For abbreviated or shorthand forms of musical notation, see Notation. Abbreviations of words, including performance directions, should be sought at the appropriate place in the alphabet.

Abdämpfen [Ger.]. To damp, to mute.

Abduction from the Seraglio. See *Entführung aus dem Serail, Die.*

Abegg Variations. Schumann's variations for piano op. 1 (1829–30), dedicated to his friend Meta Abegg, whose name is represented in the first five notes of the theme: a′, b♭′, e″, g″, g″.

Abendmusik [Ger.]. An evening concert in a church; specifically the performances at the Marienkirche in Lübeck, north Germany, begun in the 17th century and lasting until 1810. Paid for by local businessmen, the concerts came to prominence under Dietrich Buxtehude (organist at Lübeck from 1668 until 1707), who established them on five Sundays preceding Christmas. At first they included organ music and a variety of vocal music. Buxtehude and his successors, however, composed five-part oratorios to be performed over the course of the five Sundays.

Bibl.: Wilhelm Stahl, "Die Lübecker Abendmusiken im 17. und 18. Jahrhunderts," *Verein für lübeckische Geschichte und Altertumskunde* 29/1 (1937): 1–64. Georg Karstädt, *Die "extraordinairen" Abendmusiken Dietrich Buxtehudes* (Lübeck: M Schmidt-Römhild, 1962).

Abgesang [Ger.]. See Bar form.

Abgestossen [Ger.]. *Staccato.

Abnehmend [Ger.]. **Diminuendo.*

Absetzen [Ger.]. (1) To separate; to articulate. (2) To intabulate, i.e., to transcribe in *tablature.

Absolute music [fr. Ger. *absolute Musik, absolute Tonkunst*]. Instrumental music that is "free of" [Lat. *absolutus*] any explicit or implied connection with, or reference to, extramusical reality. The term, little-used today, long served as a polemical weapon in a debate, now largely resolved, about the validity of *program music; in this debate, the category of absolute music (sometimes also called "abstract music") was often defined as the antithesis of program music.

The term absolute music was used repeatedly by Wagner to condemn any music that was in his view deprived of the necessary solid basis in poetry or drama. He included in this category not only much instrumental music, but also the sections of *bel canto* operas in which tunefulness and vocal display often take precedence over dramatic truth. Subsequent writers have restricted the term to instrumental music. Eduard Hanslick praised absolute music (in this sense) as the only "pure" music and attacked the programmatic symphonic poems of Liszt and the operas of Wagner as attempts to subjugate music or to assign it tasks for which it is manifestly unfit.

The debate between the proponents of absolute and program music has continued for over a century, overlapping, but only in part, with a debate over the extent to which music is a form of *expression. In the 20th century, the proponents of absolute music have generally had the upper hand; the influence of the doctrine can be seen in many works of musical *aesthetics, in Schenkerian and other approaches to musical analysis, and not least in the relatively objective, intellectual, or formalistic character of much recent music. Nonetheless, the dichotomy between absolute and program music is essentially misleading, for it obscures the complex intertwining of extramusical associations and "purely" musical substance that can be found even in pieces that bear no verbal clues whatever.

Bibl.: Eduard Hanslick, *On the Musically Beautiful: A Contribution towards the Revision of the Aesthetics of Music,* 8th ed. (1891), trans. and ed. Geoffrey Payzant (Indianapolis: Hackett, 1986). Carl Dahlhaus, *The Idea of Absolute Music,* trans. Roger Lustig (Chicago: U of Chicago Pr, 1989). Leo Treitler, "Mozart and the Idea of Absolute Music," in his *Music and the Historical Imagination* (Cambridge, Mass.: Harvard U Pr, 1989), pp. 176–215. Lydia Goehr, *The Imaginary Museum of Musical Works: An Essay in the Philosophy of Music* (Oxford: Clarendon, 1992), pp. 211–218. Scott Burnham, "How Music Matters: Poetic Content Revisited," in *Rethinking Music,* ed. Nicholas Cook and Mark Everist (Oxford: Oxford U Pr, 1999), pp. 193–216. Daniel K. L. Chua, *Absolute Music and the Construction of Meaning* (Cambridge: Cambridge U Pr, 1999). R.P.L.

Absolute pitch. The ability to name a pitch (in reference to the musical scale, generally by letter name) or to produce a pitch designated by name without recourse to any external source or standard. The term perfect pitch is misleading because varying degrees of ability are observed. Most trained musicians have excellent *relative pitch; only some have absolute pitch, which has more limited practical value.

At the high end of the absolute pitch ability range, errors are rare and tend to differ from the correct response by a semitone, an octave, or an octave plus or minus a semitone. This suggests that there are two independent stages: locating the octave (pitch height) and determining the pitch name regardless of octave (pitch class, or chroma). Ability differences are attributed primarily to accuracy of pitch class. Octave errors may partially reflect the frequent use in these tests of complex tones, often piano tones, but errors are also found with pure tones (sine waves). Pure tones are generally more difficult to name, indicating that characteristics of musical instruments (overtones, inharmonic partials, timbre variations with pitch) may be used in identifying pitches. Recent research has found that pitches associated with white keys on the piano are identified by absolute pitch possessors faster and with greater accuracy than those associated with black keys.

Theories of absolute pitch assume that individuals with this ability possess an internal standard pitch in long-term memory. The ability appears to be most easily acquired in childhood. Some theories maintain that the ability is largely innate, but a few cases of apparently successful training have been reported. There is no general agreement as to whether absolute pitch is continuously distributed in the population or if there are distinct subgroups, although recent studies have found a higher incidence of absolute pitch among musicians than in the general population and a higher incidence among Asian music students than non-Asian music students. It is unclear whether this effect is due to genetics or to cultural differences in training. Underlying neurological mechanisms have not been identified.

Bibl.: Karl Stumpf, *Tonpsychologie* (Leipzig: S Hirzel, 1883–90). J. von Kries, "Über das absolut Gehör," *ZPP* 3 (1891–92): 257–79. Max Meyer, "Is the Memory of Absolute Pitch Capable of Development by Training?" *PR* 6 (1899): 514–16. Géza Révész, *Zur Grundlegung der Tonpsychologie* (Leipzig: Veit, 1913). Carl Emil Seashore, *The Psychology of Musical Talent* (Boston: Silver Burdett, 1919). Laurence A. Petran, "An Experimental Study of Pitch Recognition," *PsM* 42/6 (1932): 1–124. A. Bachem, "Various Types of Absolute Pitch," *JASA* 9 (1937–38): 146–51. D. Morgan Neu, "A Critical Review of the Literature on 'Absolute Pitch,'" *PB* 44 (1947): 249–66. A. Bachem, "Absolute Pitch," *JASA* 27 (1955): 1180–85. Paul T. Brady, "Fixed-Scale Mechanism of Absolute Pitch," *JASA* 48 (1970): 883–87. Jane A. Siegel and William Siegel, "Absolute Identification of Notes and Intervals by Musicians," *PP* 21 (1977): 143–52. Gregory R. Lockhead and Robert Byrd, "Practically Perfect Pitch," *JASA* 70 (1981): 387–89. W. Dixon Ward and Edward M. Burns, "Absolute Pitch," in *The Psychology of Music,* ed. Diana Deutsch (New York: Acad Pr, 1982), pp. 431–51. Ken'ichi Miyazaki, "Absolute Pitch Identification: Effects of Timbre and Pitch Region," *Music Perception* 7 (1989): 1–14. Ken'ichi Miyazaki, "The Speed of Musical Pitch Identification by Absolute-Pitch Possessors," *Music Perception* 8 (1990): 177–88. Annie H. Takeuchi and Stewart H. Hulse, "Absolute Pitch," *PB* 113 (1993): 345–61. Peter Gregersen et al., "Absolute Pitch: Prevalence, Ethnic Variation, and Estimation of the Genetic Component," *American Journal of Human Genetics* 65 (1999): 911–13. Elizabeth W. Marvin and Alexander R. Brinkman, "The Effect of Key Color and Timbre on Absolute Pitch Recognition in Musical Contexts," *Music Perception* 18 (2000): 111–37. C.K., J.B., rev. E.W.M.

Abstossen [Ger.]. (1) To detach; to play *staccato. (2) In organ playing, to take off a stop.

Abstract music. *Absolute music.

Abstrich [Ger.]. Down-bow. See Bowing (1).

Abwechseln [Ger.]. To alternate, as when a single player alternates in playing two instruments.

Abzug [Ger.]. (1) *Scordatura tuning, especially on the lute; by extension, in the writings of Praetorius, additional open bass strings. (2) The softening of an *appoggiatura as it tapers into its resolution; or, according to Löhlein, a **Schneller.* D.F.

Academic Festival Overture [Ger. *Akademische Festouvertüre*]. An orchestral composition by Brahms, op. 80 (1880), dedicated to the University of Breslau in recognition of the honorary doctorate awarded him in 1879. It makes free use of several German student songs, notably "Gaudeamus igitur."

Academy. A scholarly or artistic society. The term first referred to a grove in Athens sacred to the mythological hero Academus, where Plato established a school as early as 385 B.C.E. It gained new currency with the revival of Platonic and Neoplatonic thought in the Renaissance. Marsilio Ficino (1433–99), the central figure in this revival, created around 1470 a loosely structured "Platonic Academy" in Florence, whose members included the most illustrious poets and men of letters of that city. Many of these men were also accomplished musicians, including Ficino himself, Lorenzo de' Medici ("The Magnificent"), and Baccio Ugolini; and music, whose moral and curative effects played a large part in Ficino's thought, figured importantly in the meetings of the Academy.

By the mid-16th century more than 200 academies had sprung up in Italian towns in imitation of Ficino's group, most of them now formally organized with written statutes and statements of their scholarly goals. In literary and philosophical academies such as the Accademia fiorentina and Accademia della crusca of Florence (established, respectively, in 1540 and 1582), music was a frequent topic of discussion and

source of entertainment. And alongside these groups there arose academies in which musical composition and performance were the primary or even sole aims, such as the Accademia filarmonica of Verona (established 1543) and the Accademia degli elevati of Florence (established 1607). Finally, numerous informal groups of learned aristocrats gathered at private palaces in the 16th and 17th centuries. Many of these *camerate* or *ridotti,* such as those meeting in late 16th-century Florence at the palaces of Giovanni de' Bardi and Jacopo Corsi, featured musical discussion and experimentation.

France too participated in the Renaissance rebirth of academies, in conscious emulation of Italian developments. The first French academy officially instituted by royal decree gave pride of place to music: the Académie de poésie et de musique, established in 1570 by the poet Jean-Antoine de Baïf and the musician Joachim Thibault de Courville. The Académie aimed to rediscover the legendary effects of ancient music through a new style of quantitative poetry and music—*vers mesuré et *musique mesurée à l'antique.*

The French academic tradition languished during the period of religious wars, but was rejuvenated, now with the express aim of authoritarian cultural uniformity, by Cardinal Richelieu in the mid-17th century. After the institution in 1635 of the Académie française, whose purview was purely linguistic, numerous other similar groups followed, devoted to such subjects as painting and sculpture, dance, and the sciences. In 1669 the Académie Royale de Musique was founded, with letters patent granted to the poet Pierre Perrin and composer Robert Cambert (the patent passing to Jean-Baptiste Lully in 1672). It was not a learned society for musical experimentation and discussion like Baïf's, but rather an opera company with royal sponsorship. This survives as the Paris Opéra, the official title of which through most of its history has included the term *académie.* Such use of the term grew more prevalent throughout the 18th century, until by 1800 almost any concert with aristocratic support might be termed an academy. Musical academies since that time have assumed various forms, from schools of music, to groups promoting musical performance, to learned associations devoted to studies of music theory and history.

Bibl.: Michele Maylender, *Storia delle accademie d'Italia,* 5 vols. (Bologna: L Cappelli, 1926–30). Giuseppe Turrini, *L'Accademia filarmonica di Verona dalla fondazione (Maggio 1543) al 1600* (Verona: Tip Veronese, 1941). Frances A. Yates, *The French Academies of the Sixteenth Century* (London: Warburg Institute, 1947). Claude V. Palisca, "The Alterati of Florence, Pioneers in the Theory of Dramatic Music," *Grout,* 1968, pp. 9–38. Edmond Strainchamps, "New Light on the Accademia degli Elevati of Florence," *MQ* 62 (1976): 507–35. David S. Chambers and François Quiviger, eds., *Italian Academies of the Sixteenth Century* (London: Warburg Institute, 1995). G.A.T.

A cappella [It.]. See *Cappella.*

Accelerando, accelerato [It., abbr. *accel.*]. Becoming faster; faster.

Accent. (1) Emphasis on one pitch or chord. An accent is dynamic if the pitch or chord is louder than its surroundings, tonic if it is higher in pitch, and agogic if it is of longer duration. In measured music [see Meter], the first beat of each measure is the strong beat and thus carries a metrical accent. The creation of regularly recurring metrical accents depends on the manipulation of groups of pitches or chords (e.g., according to the principles of tonality) and not solely on the placement of dynamic, tonic, or agogic accents. Thus, the strong beat in a measure need not be louder, higher, or longer than the remaining weak beats in order to retain its quality of strength with respect to its surroundings. When the regular recurrence of metrical accents is contradicted by means of loudness, pitch, or duration, *syncopation results. In vocal music, the coordination of musical accent with the various sonorous characteristics (including accent) of a text is termed *declamation. For the role of tonic accent in Gregorian chant, see Cursive and tonic, Gregorian chant V.

A dynamic accent on a single pitch or chord may be specified with the symbols > and ^, the second calling for greater loudness and sharper attack than the first. See also *Sforzando, sforzato;* Dynamic marks; Notation.

(2) [Fr., Ger.; It. *accento*] From the late 16th through the 18th century, any of various ornaments such as the *springer, *appoggiatura, **Schneller* (according to Printz), and small groups of notes (see *NeuO,* pp. 577–78 for a list). The most common French meaning was springer (an *échappée*), and *accent* was J. S. Bach's term for an appoggiatura. Diruta (1593) used *accento* for the springer.

(3) [Fr.] In the 17th and 18th centuries, a type of **Nachschlag* in which the upper neighbor is added to the very end of the main note. The following note most often lies below the main note or is a return to the pitch of the main note. It is also called an *aspiration* and sometimes a *plainte.* See Ornamentation.

(4) For the signs associated with Greek prosodic accents and with cantillation of Semitic texts, see Ecphonetic notation. (2) D.F.

Accentuation. The placement of *accents. For the musical treatment of text accent, see also Declamation.

Accentus, concentus [Lat.]. Two broad classifications of liturgical chant, *accentus* referring to recitation tones of various types, and *concentus* referring to more elaborate melodies such as antiphons, responsories, and hymns. Andreas Ornithoparchus (*Musicae activae micrologus,* 1517) is among the first

to make this distinction. It is not found in the works of medieval writers.

Accessist [Ger.]. See *Akzessist.*

Acciaccatura [It., perhaps from *acciaccare,* to crush]. An ornament of 17th- and 18th-century keyboard playing, particularly in the Italian style of accompanying recitatives, consisting of a nonharmonic tone that is sounded simultaneously with a harmonic tone or tones but that is neither prepared nor resolved; sometimes referred to as a *Zusammenschlag* and by extension as a simultaneous appoggiatura. Francesco Gasparini (1708) and Francesco Geminiani (1749) seem to distinguish between striking and immediately releasing the semitone below the main note, termed *mordente* by Gasparini and *tatto* by Geminiani, and striking and sustaining a whole tone below one or more main notes, termed *acciaccatura.* Non-Italian writers of the 18th century and modern writers after them have often used the term *acciaccatura* for both the semitone and the whole-tone dissonance and have prescribed the very nearly immediate release of both. Although the 18th-century Italian practice was improvisatory and not indicated by any sign, the term *acciaccatura* has sometimes been applied to extremely dissonant chords occurring in keyboard compositions by Domenico Scarlatti and others. This has led, probably inappropriately and because of the confusion surrounding the term, to the suggestion that the dissonant pitches in such chords are not to be sustained for the full duration of the chord.

C. P. E. Bach and Friedrich W. Marpurg give the term *acciaccatura* as the equivalent of the *arpégé figuré* or figurate *arpeggio, i.e., an arpeggio into which are introduced one or more nonharmonic tones that are not sustained. Some modern writers have termed such a tone a passing *acciaccatura.* Both Bach and Marpurg, however, treat the simultaneously sounded but immediately released dissonance as a type of *mordent. In 1762, Marpurg terms this ornament a *Zusammenschlag* and equates it with the Italian term *acciaccatura* and, probably incorrectly, with the French **pincé étouffé.* See Ornamentation.

Accidental. In musical notation, any of the symbols used to raise or lower a pitch by one or two semitones or to cancel a previous sign or part of a *key signature. The five symbols used for this purpose are given in the table with their names in English, French, German, Italian, and Spanish. A sharp raises and a flat lowers a pitch by one semitone. A double sharp raises and a double flat lowers a pitch by two semitones. A natural cancels any preceding sign, including an element of the prevailing key signature. The combinations ♮♯ and ♮♭ are sometimes used to cancel one element of the double sharp and double flat, respectively, and ♮♮ is sometimes used to cancel the double sharp or double flat altogether. The simple forms ♯, ♭, and ♮ suffice for these purposes, however. An accidental is placed on a line or space of the staff immediately to the left of the note to which it applies. According to modern notational practice, an accidental remains in force for all notes occurring on the same line or space in the remainder of the measure in which it appears. This practice is not well established until the 19th century.

	♯	♭	𝄪
Eng.	sharp	flat	double sharp
Fr.	dièse	bémol	double dièse
Ger.	Kreuz	Be	Doppelkreuz
It.	diesis	bemolle	doppio diesis
Sp.	sostenido	bemol	doble sostenido

	♭♭	♮
Eng.	double flat	natural
Fr.	double bémol	bécarre
Ger.	Doppel-Be	Auflösungszeichen, Quadrat
It.	doppio bemolle	bequadro
Sp.	doble bemol	becuadro

In tonal music, certain conventions govern the choice between enharmonically equivalent sharps and flats, e.g., between F-sharp and G-flat. In general, if the note to be altered is followed immediately by a higher pitch it is altered by means of a sharp; if followed by a lower pitch, a flat is used. Alterations to the pure minor *scale result from "raising" the sixth and seventh scale degrees, with the result that a natural note is used to substitute for a prevailing flat and a sharped note to substitute for a prevailing natural. In some atonal music, in order to avoid ambiguity, accidentals are applied to every note and thus apply only to the note immediately following.

The sharp, flat, and natural derive from the two forms of the letter b employed to represent B-natural and B-flat in the medieval *Gamut. For B-natural, a square-shaped b, called *b quadratum* (square b) or *b durum* (hard b), was used. For B-flat a rounded b, called *b rotundum* (round b) or *b molle* (soft b), was used. This terminology is reflected in the terminology still in use for flats and naturals in German and the Romance languages as well as in the German *Dur* for major and *Moll* for minor. Since, according to the principles of *solmization and the use of the *hexachord, B-flat was to be sung with the syllable *fa* and B-natural with the syllable *mi,* the round b or ♭ meant principally that a note before which it appeared should be sung as *fa.* This did not necessarily entail lowering the pitch by a semitone, for when ♭ appeared before an F there was no need to alter the pitch in order to use the syllable *fa* appropriately. Only with the extension of the system to include all chromatic pitches did the ♭ come to mean universally that the pitch in question should be lowered by a semitone. Similar considerations governed the use of the square b, except that here several different forms developed: ♮, ♮, ♯, and 𝄪. Until the latter part of the 15th century, these signs, especially the last three, were used without distinction to specify the syllable *mi* and thus were in some cases (as on F) the equivalent of the modern sharp and in some

cases (as on E) the equivalent of the modern natural. Only beginning in the later 15th century is there theoretical support for the notion that all notes could be sharp, flat, or natural, a notion essential to the modern understanding of accidentals. The first of these four forms sometimes resembled an h in German practice of the 15th and 16th centuries, and as a result, German pitch nomenclature still refers to B-flat as B and to B-natural as H. The last of these forms was the preferred form in the 16th century and remained in use as the equivalent of the modern sharp into the 18th century. For the use of unnotated accidentals in some early music, see *Musica ficta.*

Acclamation. An elaborate musical salutation addressed to the Byzantine emperor, his family, the Patriarch, and other dignitaries of church or state. Known also as *Euphymia* ("song of praise") and *Polychronion,* it wished the personage "many years." Musical documents preserving acclamations date only from the 14th century, but according to written tradition (*De ceremoniis,* ii, 19) the practice is much older. Acclamations may have been used as models for the Carolingian *Laudes regiae* of the late 8th century. Apparently the performance was antiphonal, with two groups of singers: *kraktai* at secular ceremonies (sometimes accompanied by instruments) and *psaltai* on religious occasions. Each group was led by a *praipositos* or precentor, respectively. D.E.C.

Accolade [Fr.]. *Brace.

Accompagnato [It.]. Accompanied. See Recitative.

Accompanied (keyboard) sonata. A sonata for harpsichord or piano with one or more accompanying melodic instruments such as violin or flute, the keyboard part being written out in full rather than realized from a thoroughbass part. A product of the middle third of the 18th century with both French and German antecedents, it was a widely cultivated and very prominent form through the 1770s, and its influence was felt into the 19th century in the standard repertory of solo sonatas, trios, and the like. It was not an outgrowth of the sonata with thoroughbass accompaniment, but rather coexisted with it for several decades, some composers writing both types. By the 1770s, the accompanying instrumental parts were often distinctly subordinate (sometimes even marked as not obligatory) to the keyboard part, and this treatment of instruments was employed for types of music other than the sonata. Although the chamber music with keyboard by the masters of the Classical period often exhibits something approaching equality among participants and gives prominence to the nonkeyboard instruments, much of it shows very clear links to the tradition of the accompanied keyboard sonata. See also Sonata II.

Bibl.: David Fuller, "Accompanied Keyboard Music," *MQ* 60 (1974): 222–45. William S. Newman, *The Sonata in the Classic Era* (Chapel Hill: U of NC Pr, 1963; 3rd ed., New York: Norton, 1983).

Accompaniment. The musical background for a principal part or parts. This term is used in two somewhat different ways, one referring to manner of performance, the other to texture. The first is appropriate when the performers of a musical work are divided into two components of contrasting and complementary function: a principal part in which musical interest and the listener's attention are mainly centered, and the accompaniment, subordinate to it, whose main purpose is in some sense supportive. The principal part may be one or more solo performers, vocal or instrumental, or a group of performers, such as a chorus. The accompaniment is usually instrumental, either a single instrument (usually one capable of chords), an ensemble, or an orchestra. The relation between accompaniment and principal part can vary from a completely and unobtrusively subordinate role for the accompaniment, like that of guitar chords strummed with a song or that of the church organist in congregational singing, to what is usually called *obbligato accompaniment, found in more complex music, where the accompaniment is an essential part of the texture. Obbligato parts can remain in a subordinate relation to the principal part, as in much Baroque music, or can interact with it to varying degrees, as in much music from the Classical period onward. It is in such music that accompaniment makes its greatest artistic demands on performers.

This is the usual and original meaning of accompaniment. By extension the term has also been applied to musical textures, as in the phrase "melody and accompaniment," when one or more primary melodic parts are supported by other material subordinate in musical interest, often of a primarily harmonic rather than melodic character, commonly chords or chordal figuration, e.g., the *Alberti bass and similar formulas. Melody and accompaniment may be performed on a single instrument or by different performers in an ensemble. In many cases these two uses of the term are both applicable at the same time.

Instruments and voices were frequently used together in the Middle Ages and Renaissance, as documentary evidence shows, but the reconstruction of accompanimental practice is difficult because the written music lacks precise indications of when instruments were used, and which ones. Very likely this lack reflects a degree of flexibility on both points. The monophonic songs of the troubadours and trouvères were probably often accompanied in some way, but modern attempts to reproduce this practice are highly speculative. (The organ accompaniment of Gregorian chant often heard in Catholic churches in later centuries was not based on historical considerations but on a distaste for monophony.) Polyphonic chansons of the 14th and 15th centuries frequently have lines that appear to be more instrumental than vocal, but scholars are not in complete agreement on their implications. In the equal-voice polyphony of the 16th century, instruments were sometimes used to replace or

reinforce some of the singers [see Performance practice].

Accompaniment takes on a new and more essential role in the Baroque, because of the development of new kinds of texture in which vocal and instrumental parts of different functions and styles are clearly distinguished and because of the stronger differentiation of harmony and melody that arises with the tonal system. In Baroque music, accompaniment is often present on more than one level at once. The *thoroughbass pervades the background of most music for more than one performer, while obbligato accompaniment is often present in the foreground of many late Baroque vocal works and concertos. In much Baroque vocal music, the accompaniment has also a symbolic function, forming a tissue of musical elements representative of aspects of the text, in keeping with the principles of musical *rhetoric and the doctrine of *affections.

In the Classical period, the relation between principal part and accompaniment tends to become more varied and dynamically interactive. Mozart represents a peak of achievement in this regard, especially in his operas (where his accompaniments to the voices often convey a sense of gesture and movement very important to the dramatic effect) and concertos (where the dialectic of soloist and accompanying orchestra involves almost every possible relation between the two). In chamber music, the breakdown of the distinction between principal part and accompaniment becomes clear in, for example, Haydn's String Quartets op. 33 and later works. See also Accompanied keyboard sonata.

In the Romantic period, the growth of the orchestra, an increasing complexity of harmony and its growing importance as an element of expression, and the Romantic aesthetic position that music had more expressive potential by itself than with words (a reversal of earlier opinion) all tended to shift more importance to the accompaniment, especially in vocal music. These trends were more evident in German music than elsewhere, as in the climactic moments of Wagner's operas, where the orchestra sometimes challenges the primacy of the voice, or as in the contribution of the piano part to the musical design and expressive effect of many lieder [see Lied]. This continues a general difference between German and other national styles of accompaniment already apparent in the 18th century and persisting into the 20th. Schoenberg and associated composers sometimes explicitly distinguish between a leading part (**Hauptstimme*) and subordinate parts, though Boulez and others have sought to abolish the distinction.

Until the decline of the thoroughbass, improvisation played a prominent role in accompaniment. Since that time, it has been restricted within art music to a few domains, notably organ accompaniment of congregational singing, where improvisation is sometimes quite elaborate. In folk and popular music, accompaniment is often improvised, though ensembles may rely on written *arrangements for the purpose. There is a centuries-long tradition of providing composed accompaniments for folk songs that includes not only works by composers such as Haydn and Ives, but also what are now regarded as the misguided efforts of some 19th- and 20th-century collectors. In some non-Western musics, *heterophony is a prominent feature of accompaniment. See also Additional accompaniment.

Bibl.: Gerald Moore, *Singer and Accompanist* (London: Methuen, 1953). Kurt Adler, *The Art of Accompanying and Coaching* (Minneapolis: U of Minn Pr, 1965; corr. ed., New York: Da Capo, 1971). Gerhard Krapf, *Organ Improvisation: A Practical Approach to Chorale Elaborations for the Service* (Minneapolis: Augsburg, 1967). Philip Cranmer, *The Technique of Accompaniment* (London: Dobson, 1970).

Accoppiare [It.]. In organ playing, to couple.

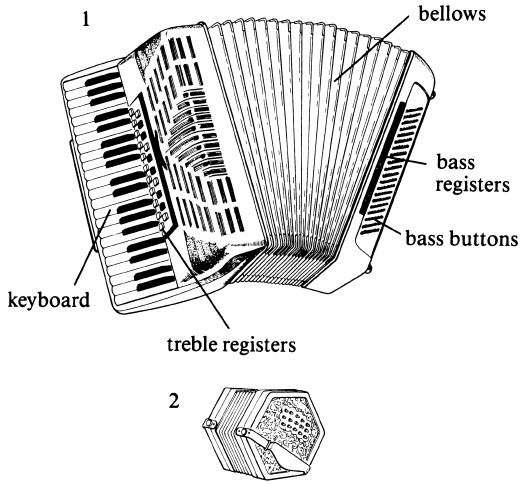
Accord [Fr.]. (1) Chord; *accord parfait,* triad. (2) The set of pitches to which an instrument such as the lute is tuned. Various tunings have been used for a single instrument. See also *Accords nouveaux,* Scordatura.

Accordare [It.]. To tune.

Accordatura [It.]. The set of pitches to which an instrument, especially a stringed instrument, is tuned; in stringed instruments, often the usual as opposed to some less common set. See also Scordatura.

Accorder [Fr.]. To tune.

Accordion. A bellows-operated, hand-held wind instrument sounded by free reeds. It consists in effect of two reed organs, each with its own keyboard, joined by a rectangular bellows. The organ in the player's right hand is the higher pitched, and in the prevalent design, its reeds are sounded by means of a piano keyboard. The left-hand organ, designed for accompani-



1. Accordion. 2. Concertina.

ment, is played on rows of buttons, some sounding single bass notes, others producing major, minor, diminished, and seventh chords. In standard double-action models, the steel reeds are arranged in pairs, one reed sounded by pressure (pushing), the other by suction (pulling). Supplementary sets of reeds in the right-hand organ are activated by register switches above the keyboard and provide a variety of tone colors.

Related instruments like the *concertina and *mouth organ were developed in the early 19th century, inspired by the Chinese *sheng. The first instrument of this type to incorporate bellows and a button keyboard was patented as the Handäoline in 1821 by Friedrich Buschmann of Berlin. The first instrument with the name accordion was patented in 1829 by Cyrillus Demian in Vienna and included a button keyboard and chords for accompaniment. The piano keyboard and steel reeds were introduced in the 1850s.

Accordo [It.]. Chord.

Accords nouveaux [Fr., new tunings]. The various 17th-century tunings for the lute and related instruments. To facilitate playing in diverse keys, at least 25 tunings appear in manuscript and printed sources of lute music, particularly in the French repertory of the Gaultier circle. These tunings, which stabilized into the standard "D-minor" tuning around 1640, stress intervals of thirds rather than the fourths used in the Renaissance tuning (**vieil ton*). Among the most common are the following (for others, see Radke, 1963): G c f′ a c′ f′ *(ton de la harpe par b dur);* G c f a♭ c′ f′ ("harpe way, flat"; *ton de la harpe par b mol*); A d g b d′ f♯′ ("tuning Gaultier"); A d g b♭ d′ f′ ("flat French"); B♭ d f a d′ f′ *(accord Mercure);* B♭ d f b♭ d′ f′ ("trumpet tuning"); A d f♯ a d′ f♯′ ("English tuning"; *Accord dur*); and A d f a d′ f′ ("D-minor"; *ton enrhumé*).

Bibl.: Hans Radke, "Beiträge zur Erforschung der Lautentabulaturen des 16.–18. Jahrhunderts," *Mf* 16 (1963): 34–51.

A.J.N.

Accoupler [Fr.]. In organ playing, to couple.

Accusé [Fr.]. Marked, emphasized.

Achtel, Achtelnote; Achtelpause [Ger.]. Eighth note; eighth rest. See Note.

Achtfuss [Ger.]. Eight-foot stop.

Acid rock. A genre of American *rock music often meant to evoke or to accompany an experience on psychedelic drugs such as LSD (termed acid). Performances were sometimes combined with light shows to enhance this effect. Most songs combined blues-derived song forms with heavy amplification and distortion. The genre emerged in San Francisco in the late 1960s; its originators include Jimi Hendrix, the Jefferson Airplane, and the Grateful Dead. The term lost currency in the early 1970s.

Bibl.: Ralph J. Gleason, *The Jefferson Airplane and the San Francisco Sound* (New York: Ballantine, 1969). P.T.W.

Acis and Galatea. Handel's two-act dramatic work, variously described as a *masque, *pastorale, or *serenata, to a libretto by John Gay with additions by Pope and Dryden, composed and first performed in 1718 at Cannons, the estate of the future Duke of Chandos. It was revived in London in 1732 with additions from his cantata *Aci, Galatea e Polifemo,* completed in Naples in 1708. The work makes significant use of the chorus and was evidently intended to be staged (elaborately so in the London performances), but without action.

Acoustic. (1) Not electric, especially with reference to the guitar or double bass (acoustic guitar, acoustic bass). (2) The acoustical character of a space.

Acoustic bass. An effect comparable in pitch to that of a 32-foot stop on an organ, obtained by playing a 16-foot stop with a stop pitched a fifth above. Also termed resultant bass or harmonic bass, the effect is produced by the acoustical phenomenon of *combination or resultant tones. See also Acoustic (1).

Acoustics. The science of the production, propagation, and perception of sound. Sound will be taken here in the physical sense and will refer to mechanical vibrations or pressure oscillations of various sorts. The production of musical sound entails mechanical vibrations such as those of stretched strings (violin or piano), wooden or metal plates (violin body, piano soundboard, or cymbal), stretched membranes (head of a drum or tambourine), wooden or metal bars (marimba or celesta), and the oscillatory motion of air columns (the vocal tract, trumpet, clarinet, or organ). The propagation of sound involves pressure oscillations and associated vibrational motion of a medium, usually air but sometimes a liquid or solid material, that carries the vibrational energy, or sound, from source to listener. The perception of sound requires the transmission of sound energy, again as mechanical vibrations, by the eardrum via the small bones of the middle ear to the fluid of the inner ear and finally to the hair cells of the inner ear where the information contained in the details of the vibrational motion is encoded into patterns of nerve impulses. The brain interprets these impulses, with extremely subtle discrimination, as the psychological sound of which we are consciously aware [see Psychology of music].

It is convenient to represent the physical sound as a graph that records the variation with time of the vibration, perhaps the displacement from its resting position of a particular point on a violin string or the air pressure at a particular position within a trumpet. Fig. 1a represents such an oscillatory motion for a string vibrating in a particularly simple way; the associated sound is called a pure tone, and its graph is a sine wave. The frequency, f, of this pure tone is the number of full oscillations that occur each second. For exam-

ple, since there are 4 full oscillations occurring in the duration .0091 second of the graph, the frequency is (4 cycles/.0091 second) = 440 cycles per second (cps or Hertz, abbrev. Hz). The approximate range of frequencies to which the human ear is sensitive, 20 to 20,000 cps, defines the frequencies of interest in musical acoustics. As is discussed more fully below, the frequency of a pure tone determines its *pitch, higher frequencies corresponding to higher pitches. The frequency 440 cps corresponds to the "concert A" produced when the tines of the tuning fork vibrate back and forth 440 times each second. Doubling frequency raises the pitch by one octave. The maximum displacement or pressure of the vibration, as recorded on the vertical axis of the graph, is the amplitude of the vibration, which is related to the amount of energy in the vibrating system and available to be transmitted to the surrounding medium. The amount of energy reaching any point in the surrounding medium is the intensity of the sound at that point. An increase in the intensity of a sound is heard as an increase in loudness. The relationship between intensity and perceived loudness is rather more complex than that between frequency and pitch.

I. *The representation of complex sounds and its relation to pitch.* Almost all musical sounds have a much more complex graph than Fig. 1a. Figs. 1b and 1d represent two examples of more complicated forms. An important mathematical theorem (Fourier's theorem) states that any such graph may be represented as the superposition or sum of sine waves, such as 1a, 1c, and 1d, with different frequencies and amplitudes. For example, 1b is obtained by adding together 1a and 1c. The vertical displacement B at the time 0.0047 second is the sum of the displacements A and C at that same time. Similarly, the displacement D, in the complex waveform 1d, is the sum of A and E. Quite generally, any complex musical tone may be represented as the sum of a number of pure tones of different frequencies and different amplitudes. If one strikes a metallic lampshade or pan lid and listens carefully, one can hear at least a couple of the distinct frequencies that make up the full complex tone. These different components, which together make up the sound produced by the flute, violin, or cymbal, are called partials, and their individual frequencies are called partial frequencies. For many practical purposes, the complete specification of a continuously sounding musical tone, and to a fair approximation decaying tones as well, requires only the enumeration of the frequencies and amplitudes (strengths) of the different partials. The partial frequencies are typically listed in order, the lowest first, as a series of numbers f_1, f_2, f_3, ... The sound represented by graph 1b has partial frequencies $f_1 = 440$ and $f_2 = 880$ cps; 1d reflects partials with frequencies $f_1 = 440$ and $f_2 = 1{,}000$ cps.

For many musical sounds, specifically those that are continuously produced by a single source such as the bowed violin, trumpet, oboe, or voice, a special relationship exists among the partial frequencies: they are all equal to an integer times a single frequency, called the fundamental. The partial frequencies f_1, f_2, f_3, . . . of the A played by the oboist will be 440, 880, 1320, 1760, . . . cps, or $1f_1$, $2f_1$, $3f_1$, $4f_1$, . . . , where $f_1 = 440$ cps. A convenient statement of the relationship, assuming none of the partial frequencies in the simple sequence happens to be missing, is that the frequency of the nth partial is n times the frequency of the fundamental. A set of frequencies related to one another in this way is called a harmonic set. Continuously produced musical tones are characterized by a harmonic set of partial frequencies.

The pitch of such a musical tone is well defined (identifiable without difficulty by a musician) and is related to the frequency of the fundamental of the harmonic set making up that tone. Although the frequencies making up the complex oboe tone when it is playing a "concert A" are 440, 880, 1320, . . . cps, the pitch is unambiguously concert A or 440 cps. Equally important in the composition of the tone nevertheless are the 880 cps partial (pitch an octave higher), the 1320 cps partial (pitch an octave and a fifth higher), etc. The tone is heard as a single entity, not as a chord corresponding to the various individual partials. So important is the psychological identification of the pitch of a tone with the fundamental of the harmonic set of partials making up that tone that the pitch remains identified with the fundamental even if the partial at the fundamental happens to be completely absent from the tone.

Musical sounds that are percussively produced, such as the tones of the bell, piano, cymbal, guitar, marimba, pizzicato violin, and drum, will have partial frequencies that are not harmonic sets. In some instances, for example the middle range of the piano or the guitar, the partial frequencies so nearly approximate a harmonic set that they may be considered harmonic, and the remarks of the preceding paragraphs are relevant; in particular, the pitch of such sounds is well defined. At the other extreme are the tones of the cymbal, gong, and many drums, in which there is a rich set of partials with no simple relationship among the partial frequencies and for which there is no defined pitch. Intermediate are some of the instruments of the percussion section, e.g., marimba, timpani, and some bells, which are constructed so that several of the lowest partial frequencies are harmonically related. The harmonically related partials establish a well-defined pitch, while additional partials, which are not harmonically related to the pitch, contribute importantly to the tone quality of the instrument. There are also examples such as the bass strings on small pianos, from which one hopes to hear a defined pitch but for which the partial frequencies are so far from harmonic that no meaningful pitch is established.

Figs. 1b and 1d illustrate the contrast between the wave forms characteristic of continuously produced

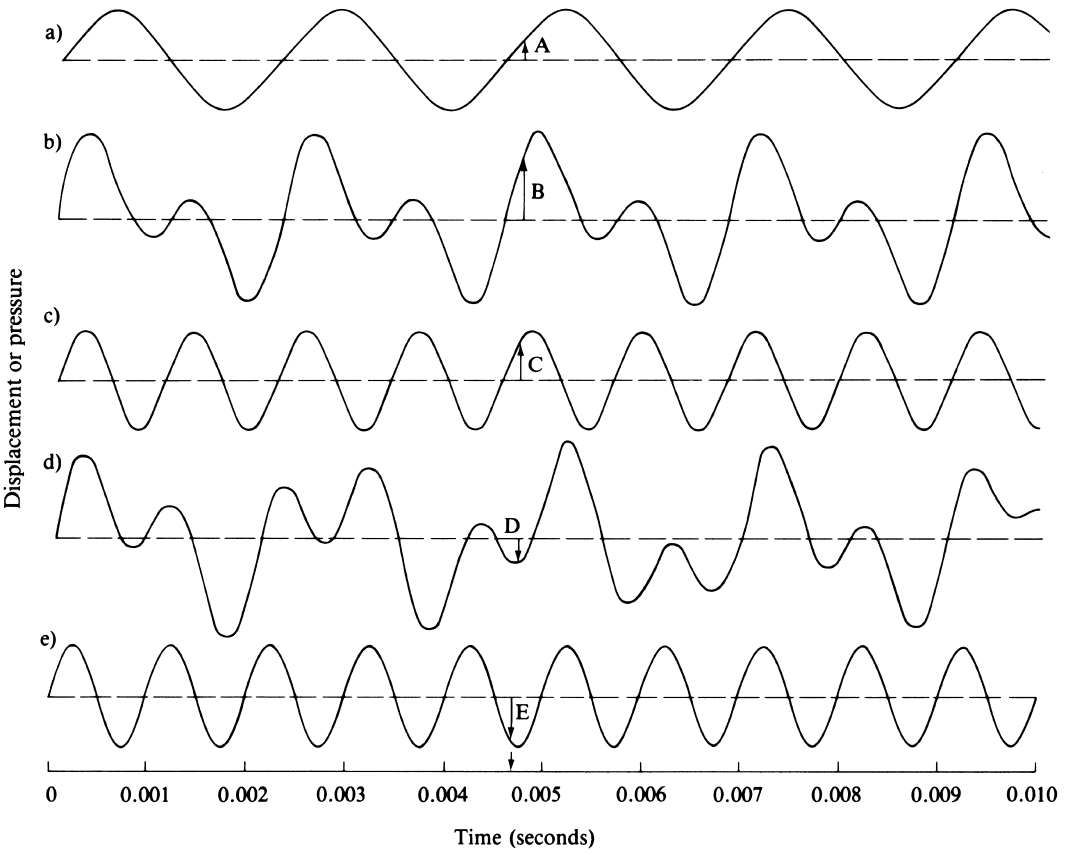


Fig. 1. a) pure sine wave at 440 cps; b) superposition of 1a and 1c; c) pure sine wave at 880 cps; d) superposition of 1a and 1e; e) pure sine wave at 1000 cps.

sound and those of percussively produced sound. The continuously produced sound, Fig. 1b, is the sum of two pure tones, or partials, of frequency 440 and 880 cps (Fig. 1a plus Fig. 1c), which are the first two members of a harmonic set; the wave form shows a clear pattern that repeats at the fundamental frequency of the partials that combine to make the full tone. The percussively produced sound of Fig. 1d is the sum of two partials (Figs. 1a and 1e) with frequencies 440 and 1,000 cps, frequencies not harmonically related to one another. The wave form now does not show a repeating pattern, a consequence of the anharmonic relation between the two partials.

II. *Sound production.* The first essential in the sound production by a musical instrument is the vibration of some part of the instrument. The simplest mechanisms to excite such motion are those used in the percussion instruments, plucking or hammering, for which the excitation is of short duration. The subsequent motion of the vibrating part is usually quite complex, but may be represented as the superposition or sum of many simple motions all taking place concurrently. Figs. 2a, b, and c represent some of the simple kinds of motion, or normal modes of motion, possible for a stretched string. The solid and dotted lines are meant to represent the extremes of the motion. Any point on the string oscillates back and forth between the extremes in a fashion similar to the graph of Fig. 1a. Each normal mode of motion, i.e., each pattern of Fig. 2, has associated with it a characteristic frequency. For the "ideal" stretched string, these frequencies happen to form a harmonic set. For modes other than the first, such a string vibrates in segments of equal length termed loops; the stationary points between loops are termed nodes. A drumhead, a straight wooden bar, or a cymbal also has a series of normal modes of vibration, or "ways in which it can vibrate," but in these examples the frequencies of the normal modes are not harmonically related. When an instrument is percussively excited, many normal modes of the instrument are set into vibration, and the partial frequencies of the tone produced by the instrument are just the frequencies characteristic of the normal modes of motion of the instrument.

The excitation of vibrations in instruments such as the winds and the bowed strings is a continuous rather

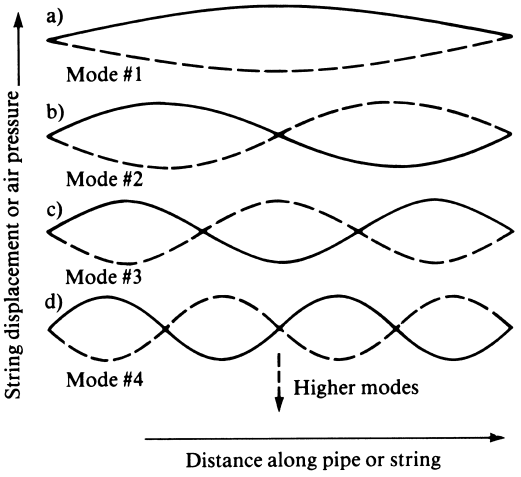


Fig. 2. Displacement patterns for the first four normal modes of the stretched string.

than an instantaneous process and is more complicated to describe. Essential is some device to convert continuous motion, such as airflow from the lungs or the movement of a bow, into the oscillatory motion of an air column or a string. As noted already, the partial frequencies of the sound produced by such an instrument will be a harmonic set of frequencies, and although the partials are often approximately equal to the normal mode frequencies of the instrument, that relationship is less direct than in the case of the percussively produced sound.

Understanding the determining factors in the pitch produced by an instrument requires a knowledge of the natural or normal-mode frequencies of the pitch-determining element, often a stretched string or an air column. As noted above, the natural modes of vibration of an ideal stretched string, represented schematically in Fig. 2, have frequencies that are a harmonic set, $f_n = nf_1$, with a fundamental frequency given by the following equation:

$$f_1 = \sqrt{(\text{tension})/(\text{mass per unit length})}\,/\,2(\text{length})$$

This equation is used intuitively by all string players, who tune their instruments by increasing the tension in the strings to raise the frequency f_1 and hence the pitch. The strings intended to sound at higher pitch are thinner and hence have smaller mass per unit length. The effective length of a string is shortened, and the pitch raised, by stopping the string against the fingerboard. The equation gives quantitative expression to these principles.

In a wind instrument, the vibration is an oscillatory motion of the air along the instrument pipe. For the lowest mode of oscillation in the flute, for example, the air flows alternately from both ends toward the middle of the instrument and back toward the ends. At the middle, the air is not moving, but the pressure rises as the air flows in from both ends, then falls as the air flows away. There are large pressure oscillations at the center of the instrument. Fig. 2a may in fact be interpreted schematically as representing the pressure variation along the flute, the solid line corresponding to the time when the pressure at the center is maximum, the dotted line to a half cycle later when some of the air has moved out of the ends, leaving decreased pressure at the center. Similarly, Figs. 2b and c may be interpreted as the pressure variations for the second and third modes of oscillation of the air column of the flute. It is the natural frequencies of these modes that define the pitches in the higher registers of the flute. Again, as in the case of the string, a formula something like the one above is appropriate to describe the dependence of the fundamental-mode frequency upon the physical parameters of the instrument; and again the higher mode frequencies are (approximately) members of the harmonic set based upon the fundamental, although for certain instruments only the odd-numbered harmonics are present. The proportionality of the fundamental frequency to the inverse of the effective length of the instrument is again essential to the idea of controlling the sounding pitch by varying, in one way or another, the effective length of the air column.

For most percussion instruments, stretched membranes, metal plates or bars, bells, etc., the formulas giving the natural frequencies are more complicated than those for strings or air columns. These formulas show, however, that stiff objects of small mass and small size produce sounds of high pitch; objects that are heavy, large, and flexible have low fundamental frequencies. The complicated formulas also show that the natural frequencies do not typically form a harmonic set, though some instruments are specifically constructed and tuned so that a few of the frequencies are harmonically related; and to the extent that the frequency set is strongly anharmonic, the pitch is ill defined.

A second essential feature of musical instruments is a mechanism to transfer the energy of the vibrations within the instrument to the surrounding air. This occurs naturally with an instrument such as a drum, in which the vibrations are set up in the drumhead, which provides a large moving area that is relatively efficient in forcing vibrational motion into the surrounding air. By contrast, a vibrating string, rigidly fixed at each end, is extremely inefficient in transferring the energy to the surrounding air. The purpose of the bridge and soundboard of the piano, or of the bridge and thin wooden body of the violin or guitar, is to provide the needed transfer. The bridge of the violin transfers the vibrational energy to the belly and via the sound post to the back; the motion of these front and back plates transfers the sound to the surrounding air. The efficiency of energy transfer and its variation with the frequency of vibration depend critically upon the

thickness and shape of the walls of the stringed instrument or the construction of the piano or harpsichord soundboard. These parts of the instrument are important in determining such properties of the instrument as tone quality, ease of playing, and carrying power.

III. *Tone quality.* The timbre or tone quality of an instrument is determined by many properties of the sound. Probably the most important properties—certainly the ones the scientist can most easily measure, characterize, and discuss—are the number, frequencies, and amplitudes of the various partials. One important characteristic of timbre is the number of partials that make up the tone. The tone of the flute, for example, has very few partials, while that of the violin has many.

The harmonicity of the partials of the piano tone contrasts dramatically with the anharmonicity of the sound of the chime or gong. The importance of the harmonicity of the set of partial frequencies is easily heard in an experiment with a guitar string or piano string (with the pedal holding the damper up). Compare the tone quality of the plucked (or hammered) bare string with the sound heard when a paper clip is clipped (not hung) onto the string. The variations in timbre are principally the consequence of the large deviations from harmonicity when the string is made "nonideal" by adding the weight of the paper clip.

The characteristic sound of some instruments results from the relative intensities of the partials. The clarinet, played in the low register, has strong odd-numbered partials and weak even ones. In the electronic synthesis of instrumental sounds, the first step in imitating a clarinet is to assure this alternation in the relative amplitudes of successive partials.

A special quality may also be provided by one or several relatively narrow ranges of frequency in which the coupling from the instrument to the surrounding air is stronger than at other frequencies. These ranges in frequency are referred to as formants. In the human voice, the several formant frequencies are varied by adjusting the shape of the vocal tract, and in speaking, the distinction among the various vowel sounds is made by appropriate subconscious adjustment or tuning of the various formant frequencies. In the singing voice these same adjustments are heard not only as differences among vowel sounds but also as changes in vocal timbre or tone quality.

Nevertheless, the specification of frequencies and relative amplitudes, though easy to measure, is by no means the only clue used by the ear and brain in identifying instrumental sounds. Just as, in a spoken language, the consonants that begin and end syllables are crucial in conveying the meaning of the syllable, so in the musical context the way in which tones start and end in different instruments is characteristic of, and important in the identification of, those instruments. If a tape recording of a piano piece is played backward, the sound is most likely to be identified as a strange-sounding organ, not as a piano. The way in which a tone starts and reaches a steady state is its attack. The way in which a tone ends or dies away is its decay. The combination of characteristics defining the attack, steady state, and decay of a tone taken together constitute its envelope. The envelope, attack, and decay controls on an electronic synthesizer regulate these essential transient characteristics of the synthesized tones.

IV. *Architectural acoustics.* The mechanisms and characteristics of tone production are not, of course, the sole determinants of the quality of sound heard by the auditor. One must consider as well how the sound is transferred from source to listener and how it is modified in that process. The two most important and relevant physical phenomena are the reflection of sound and the finite speed of propagation of sound. The phenomenon of reflection implies that in the concert hall the sound is heard both as it comes directly, by line of sight so to speak, from the performer and in addition as it propagates to a side wall or ceiling and is reflected to the listener from those surfaces. There are many paths, a direct one and ones involving one, two, or more reflections from walls and ceilings, by which any feature of the musical performance reaches the ear. Because of the finite speed of sound, about 350 meters per second, and because the various paths by which the sound reaches the ear involve different distances, each feature of the music in fact reaches the ear many times in close succession. This multiplicity has a number of consequences.

If the reflected sound is too long delayed with respect to the direct sound, as can be the case in a very large auditorium or sports arena, the reflected sound will be heard as a distinct echo, and the effect will be most objectionable. More usually, the reflected sound is not heard in this obtrusive fashion, but rather fuses, psychologically at least, with the directly received sound and is heard as richer, fuller sound. A "live" room is one in which the reflected sound is very apparent, though not as a series of discrete echoes, and contributes in a major way to the total sound heard. A "dead" room is one in which most of the sound reaching the surfaces of the room is absorbed, perhaps by carpeting, drapes, or sound-absorbing ceiling tiles, and the reflected sound is only a minor contributor, compared with the direct sound, to the perceived sound.

Both audiences and performers consider a substantial contribution of reflected sound, or reverberation, desirable in a concert hall. The reverberation increases the loudness of the sound heard by the listener and, perhaps more important, it creates a certain degree of overlap of one note in a melodic line with the next. Excessive reverberation, however, even when it is not heard as distinct echoes, is undesirable. Extensive overlap of successive sounds resulting from a too live room, though perhaps pleasing to the amateur singer in the shower, can destroy the intelligibility of both speech and music.

Controlling the amount of reverberation is only one concern, perhaps the most important and probably the easiest to quantify, in the acoustic design of a concert hall. Other considerations include freedom from extraneous noise, even distribution of sound throughout the hall, good balance between high and low frequencies, and a sense of acoustic intimacy.

V. *Beats and intervals.* An acoustical effect particularly relevant in music is the phenomenon of beats. Suppose that in a complex sound reaching the ear, two of the partials, perhaps from two different instruments, are comparable in loudness and very nearly equal in frequency, say within a few cycles per second of one another. Over time, the two partials alternately reinforce and tend to cancel each other [see Fig. 3]. The subjective impression is of a single partial varying in amplitude at a "beat frequency" equal to the difference in frequencies of the two original partials. If the source of one of the two partials is tuned to reduce the beat frequency to zero, the frequencies of the two partials become identical, a convenient method for tuning unisons. In general, beats will occur for two complex tones of different pitch whenever the frequency of one or more of the partials in one tone matches very nearly the frequency of partials in the second.

It is interesting to examine the relation between the pitches of two complex tones for which a partial from one matches in frequency, or nearly matches, one from the other. These matching partials will beat with one another if the tones are slightly mistuned. Suppose the fundamental of one tone is f_1, with the associated set of partials f_1, $2f_1$, $3f_1$, . . . nf_1, and the harmonic set composing the other tone is f_2, $2f_2$, $3f_2$, . . . mf_2. Beats will occur whenever a partial from one set nearly matches a partial from the other set, or when $nf_1 \approx mf_2$, where n and m are integers. The beats disappear when the approximate relation (denoted by $\approx$) becomes exact, that is, when $nf_1 = mf_2$.

There is thus a special relationship between pitch pairs whose corresponding fundamental frequencies are in the ratio of integers: small variations in the pitch of one tone or the other will change or eliminate the beats between some of the higher partials of each. The effect will be strong and obvious if the integers are small, say 1, 2, 3, and 4, becoming less obvious for larger m and n and becoming finally weak and unlikely to be evident for integers in the ratio larger than 7 or 8. The musical intervals with these special beatless relationships are the intervals of *just intonation; the just intervals of octave, fifth, fourth, major third, minor third, etc., correspond to ratios between the fundamentals of the harmonic sets of the two tones of 2/1, 3/2, 4/3, 5/4, 6/5, etc. In contrast, the frequency ratios of intervals in the system of equal *temperament only approximately satisfy these relationships, and these intervals will have beating upper partials. The frequency of this beating is used by piano tuners to adjust the tuning to the "imperfect" intervals characteristic of equal temperament.

VI. *Resonance.* The phenomenon of resonance plays an important role in a number of musical contexts. Resonance refers to the large oscillatory response of a system to a weak driving force whose frequency matches precisely one of the natural frequencies of the driven system. A swing can be set into a large amplitude of motion by a number of successive small pushes if the pushes are given at a frequency

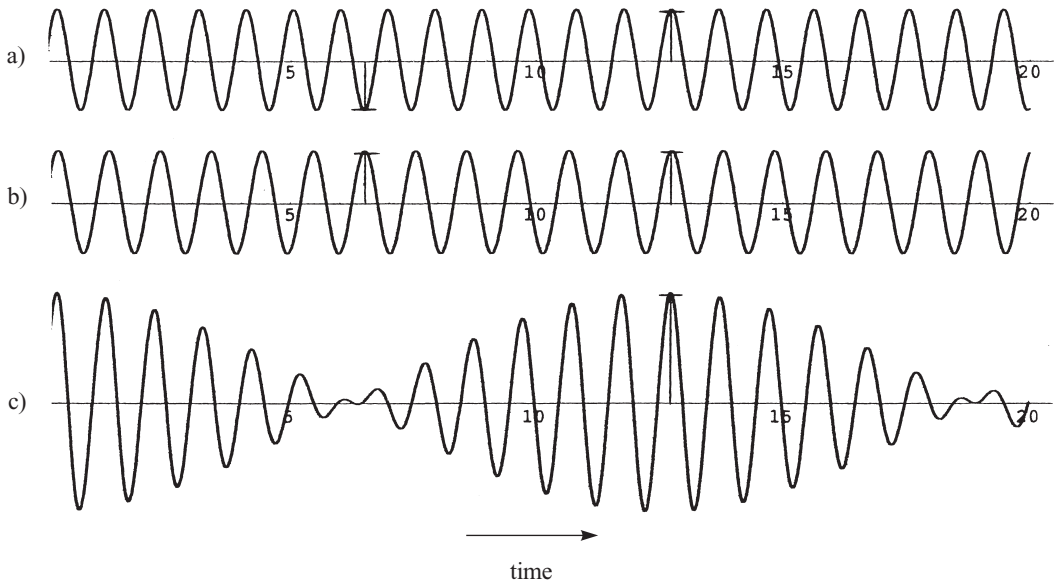


Fig. 3. Beats produced by the superposition of two sine waves of nearly the same frequency.

that matches the swing's natural, or freely swinging, frequency.

A soprano can make her voice "carry" better by shaping her vocal tract so that one or several of its resonances, or formants, have the same frequency as that of some partials of the note being sung; this more effectively transfers to the surrounding room the acoustic energy generated by the vocal cords. The lowest tones on a violin would be nearly inaudible were it not for several resonances of the front and back plates of the instrument and of the air chamber within the box that promote the efficient coupling of energy from the strings to the surrounding air. The judicious tuning of the frequencies of these resonances is an essential part of the art of violin making. The excitation of sympathetic strings in the viola d'amore and the change in quality of the sound of a piano when the damper pedal is depressed are the results of resonance. A wind instrument is the more easily played the more nearly the resonant frequencies of the higher normal modes match the frequencies of the harmonic set corresponding to the desired pitch.

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Action. (1) In keyboard instruments, the mechanism that causes a string or pipe to sound when a key is depressed [see Piano, Organ, Harpsichord, Clavichord]. (2) In the *harp, the mechanism that alters the pitch of strings when a pedal is depressed.

Act tune. A composition played between acts of an opera or play. See also *Entr'acte.*

Actus musicus [Lat.]. In German Protestant music of the late 17th and early 18th centuries, a dramatic vocal work on a Biblical subject. Like the less elaborate *historia,* it is an antecedent of the German Protestant *oratorio.

Actus tragicus. Bach's Cantata no. 106, *Gottes Zeit ist die allerbeste Zeit* (God's Time Is Best), perhaps composed in Mühlhausen in 1707 and performed at the funeral of his mother's uncle.

Adagietto [It., diminutive of *adagio*]. (1) A tempo slightly faster than **adagio.* (2) A movement in a slow tempo, but shorter or less somber in character than the typical **adagio.*

Adagio [It.]. (1) A slow tempo, often said to be slower than *andante* but not as slow as *largo.* Some writers of the 18th and 19th centuries, however, regarded the term as designating the slowest of all tempos, though the term itself could be modified to call for still slower tempos, e.g., *adagissimo.* In the 18th century, the term sometimes implied the need for ornamentation. See also Tempo marks. (2) A composition with a slow tempo (perhaps, but not necessarily, specified by the term *adagio* itself), especially the slow movement of a sonata, symphony, or similar multimovement work.

Adagissimo [It.]. Extremely slow. See also *Adagio* (1).

Added sixth. A sixth added above the root of a triad, or the chord thus produced; thus, f–a–c′–d′. The traditional theory of chord *inversion derived from Rameau requires such a structure to be viewed as the first inversion of a *seventh chord (the root in this example being d, making the chord a ii^7 in the context of C major and implying a resolution to the dominant). But Rameau himself observed that the chord can also function as an embellished triad (usually, as in this example in C major, the subdominant) and thus resolve in different ways. Such chords are often used in jazz and popular music as embellished triads and are specified by the letter indicating the root of the triad followed by the arabic numeral 6 (e.g., F6), as distinct

from what is termed the minor seventh chord (specified, in the example above, Dm7).

Additional accompaniment. The reworking of the accompaniments of older vocal works to fit them to later concepts of sonority and orchestration. The practice began with the continued performance of works by Handel in the changed musical conditions of the late 18th century. Mozart rescored, sometimes radically altering, *Messiah, Alexander's Feast, Acis and Galatea,* and the *Ode for St. Cecilia's Day.* His *Messiah* became the basis for several 19th-century versions. With the revival of Bach's music, similar treatment was applied to it, most notably by Robert Franz, whose reworkings of the *St. Matthew Passion,* Magnificat, and several cantatas were considered models of good taste. He filled out accompanying textures that were too thin by later standards, adjusted scoring to balance choruses much larger than intended, and rescored to compensate for changes in makeup of the orchestra and the disappearance of Baroque instruments. Mendelssohn also indulged in the practice, but is said to have later regretted it. Similar tendencies were also manifested in other genres, such as the reinforcing of the orchestration of Mozart's operas or Grieg's composition of a second piano part to accompany some of Mozart's sonatas.

The stronger historical awareness of the 20th century worked against the practice, although the continued existence of large choral societies has been an obstacle to its complete disappearance, particularly with Handel oratorios. More recently it has reappeared in the newly resurrected genre of 17th-century Venetian opera, the thinness of whose accompaniment has similarly been thought by some to require such treatment in order to appeal to modern audiences. See also Performance practice.

Addolorato [It.]. Pained, afflicted.

Adelaide. A song by Beethoven, op. 46 (1794–95), to a poem by Friedrich von Matthisson.

Adélaïde Concerto. A Concerto in D major for violin and orchestra attributed to Mozart, K. Anhang 294a. The work exists in a simple two-stave sketch, supposedly written in 1766, and dedicated to the French Princess Adélaïde. Although a letter exists in which Mozart dedicates such a work to the Princess, it is almost certainly not this concerto. The sketch was completed and published by Marius Casadesus in 1933.

Adeste fideles [Lat.]. A hymn often sung in the English translation beginning "O come, all ye faithful" by Frederick Oakeley (1802–80). The Latin text and the well-known tune have been dated ca. 1740 and attributed to John Francis Wade (d. 1786). It was published in 1751 and used thereafter in the Portuguese Embassy Chapel in London, whence the title "Portuguese Hymn" by which it is also known.

Adieux, Les [Fr.]. Beethoven's Piano Sonata no. 26 in E♭ *major op. 81a (1809–10), titled Das Lebewohl, Abwesenheit und Wiedersehn* and subtitled *Les adieux, l'absence, et le retour* (The Farewell, Absence, and Return). It was inspired by the departure from Vienna of Beethoven's patron the Archduke Rudolph, to whom the work is dedicated.

Ad libitum [Lat.]. At the pleasure of the performer. The phrase may indicate that a part for voice or an instrument may be omitted (in contrast to **obbligato*); that the performer is to improvise either ornaments or altogether new material such as a *cadenza; or that the tempo may be varied.

Adriana Lecouvreur. Opera in four acts by Francesco Cilea (libretto by Arturo Colautti after Eugène Scribe and Ernest Legouvé), produced in Milan in 1902. Setting: Paris, 1730, the year of the death of the celebrated French actress of this name.

A due [It.]. See *Due.*

Aeolian, aeolian mode. See Mode.

Aeolian harp. A zither whose strings are set in motion by the wind. A variable number of strings of varying thickness but equal length are stretched over a sound box (usually rectangular and as much as a meter or more in length) and tuned to the same fundamental pitch. The wind generates different harmonics in each string, producing a chord whose texture changes as the wind rises and falls. Instruments of this type were known in antiquity. It was popular in late 18th- and early 19th-century Europe and was a frequent subject of Romantic literature. See also Anémocorde.

Bibl.: Stephen Bonner, ed., *Aeolian Harp,* 3 vols. (Cambridge: Bois de Boulogne, 1968–70).

Aeoline. (1) A free-reed keyboard instrument invented by Bernhard Eschenbach ca. 1810. An antecedent of the *harmonium, it incorporated knee-operated bellows and permitted variations in loudness. (2) A soft string-tone organ stop.

Aeolodicon. Any of several free-reed keyboard instruments developed from the *aeoline.

Aeolo melodicon. A reed organ patented in Warsaw in 1824 with tubes attached to the reeds and permitting variations in loudness.

Aeolopantalon. An instrument combining the *aeolo melodicon and the piano, patented in Warsaw in 1824, and on which Chopin performed in 1825.

Aequal [Lat.], **Aequalstimmen** [Ger.]. See *Equale;* Equal voices.

Aerophon. See Aerophor.

Aerophone. An instrument in which a column of air is the primary vibrating system. In most cases the player sets the air in motion by blowing. There are three main categories of aerophone: *flutes, in which the turbulence produced by blowing across a sharp

edge sets the air column in motion; lip-vibrated aerophones (primarily *brass instruments), in which the air is set in motion by the vibration of the player's lips; *reedpipes (most *woodwinds), in which air is set in motion by a vibrating *reed. In addition there are free aerophones, in which the vibrating air is not confined to a column (e.g., the *accordion, *bull-roarer, *mouth organ, *harmonium) or in which the column serves merely as a *resonator (e.g., the *sheng). See also Instrument.

Aerophor. A device permitting the player of a wind instrument to sustain a tone indefinitely. A foot-operated bellows pumps air to the player's mouth through a tube, thus maintaining air pressure to the instrument while allowing breathing through the nose. Invented ca. 1912 by Bernhard Samuel, it was prescribed by Richard Strauss (incorrectly as an "aerophon") in his *Alpensinfonie.*

Aesthetics. First coined as a technical term in 1735 by Alexander Baumgarten, now denoting almost exclusively the constellation of philosophical problems raised in our thinking about the fine arts. Hence, music aesthetics is taken here to comprise those issues of a philosophical character surrounding the art of music since antiquity, excluding, insofar as such distinctions can be uncontroversially made, issues that belong more properly to music theory, musicology, the psychology of music, and normative compositional doctrine.

By far the most pervasive question of music aesthetics, if historical longevity and sheer quantity are any measures, is the question of whether music possesses a "content" beyond its purely musical "syntax" and structure: whether, that is, it denotes, conveys, or is even describable in terms of anything but what Kant felicitously called "the beautiful play of sensations." But in recent years another question has surfaced, of a logical or ontological kind, as to the exact nature of the musical work itself. These two questions, if not the alpha and omega of music aesthetics, are at least the major part of its alphabet.

I. *Musical content.* Theories of musical content can best be divided into the emotive and the nonemotive, emotive theories being the most numerous by far in modern times, and with us since Plato and Aristotle. In general, all such theories state that music is describable in emotive terms. They diverge sharply as to the construction to be put on such descriptions.

Historically, and perhaps currently as well, if "the man on the street," rather than the philosopher, is consulted, the most ubiquitous form that the emotive content theory takes is the "arousal" variety. On this view, to say that "the music is sad" is to say that, one way or another, the music arouses sadness in the listener: that is to say, literally makes the listener sad. Both Plato and Aristotle speak of music as "imitating" or "representing" the characters and passionate tones of men, but seem to suggest that the end for which this imitation or representation exists is the arousal of such passions in the listener, for good (Aristotle) and often for ill (Plato). And in the 17th and 18th centuries, the arousal theory gains almost absolute dominance, to the extent that Descartes actually *defines* music in terms of emotive arousal, thus: "Its medium is sound. Its end is to please and to move the various affections in us."

An important historical appendage to the arousal theory, deserving separate mention, is the "speech" theory of musical emotion, which amounts to the claim that "sad" music arouses sadness in the listener, by a kind of "sympathy," because of its resemblance to the passionate tones of human speech when the speaker is under the influence of that particular emotion. The theory flourished among the theorists and composers of the Florentine Camerata and functioned not only as a philosophical account of musical emotion, but as a basis for a compositional practice as well. It survived well into the 18th century.

With the rise of the Romantic movement—although not owing to that historical event alone—another emotive theory took form. The "self-expression" theory, as many have called it, concentrates on the composer rather than the listener and avers that sad music is, first and foremost, the "expression" of the composer's emotion, and this, somehow, perhaps by arousal, gives us an insight into or lets us share the emotion of the composer, which, it is supposed, if the composer is a great artist, must be a very special and great emotion, beyond the ordinary run of such things. Perhaps the leading proponent of this view in our own century was J. W. N. Sullivan, scientist and biographer of Beethoven, for whom the theory served the purpose of explaining the greatness of Beethoven's music in terms of the greatness of his "soul" (as opposed, in Sullivan's view, to the mean-spiritedness of Wagner's). But it has outlived its specific purpose and become an example of its kind in the writings of philosophers of music.

By far the most interesting and fruitful direction that emotive theories have taken since the 18th century has been *away* both from arousal and self-expression. Schopenhauer characterized music as a "direct copy" of the will and the emotions, meaning not the individual human psyche but the "metaphysical" will, which he saw as the basis of reality. Earlier, the 18th-century composer, critic, and musical theorist Johann Mattheson presented a theory of musical expression (the final flowering of the Baroque *Affektenlehre* [see Affections, Doctrine of]) that, at least on a charitable interpretation, can be taken for an attempt to see music not as an emotive stimulus but rather as a kind of musical "icon" or "copy" of specific human emotional states, *recognized* by the listener *in* the music, not experienced or felt. This notion, that emotions are apprehended in music rather than stimulated by it, has taken two distinct forms in recent years. The "semantic" approach, adumbrated by Carroll Pratt and made famous