DON MICHAEL RANDEL

# HARVARD CONCISE ICTIONARY OF MUSIC AND MUSICIANS



EDITED BY

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# THE HARVARD CONCISE DICTIONARY OF MUSIC AND MUSICIANS



This book, like its predecessor, the *Harvard Concise Dictionary of Music* (1978), is intended to serve the needs of a variety of readers, including students of music history, theory, and performance; amateur musicians; and those who simply listen to music and occasionally read about it. Its coverage, however, is somewhat expanded. It remains primarily a book devoted to concert music in the Western tradition from the earliest times, but it treats many of the terms and the people in this domain in greater detail. And, unlike its predecessor, it includes entries for performers of Western concert music, jazz, and popular music. In addition, there are entries for a number of terms and instruments (some of which are illustrated under the heading Instrument) belonging to non-Western musical traditions and to Western popular music.

In all of this, conciseness continues to be prized. I have avoided evaluative and emotive language that, in this context, is likely to be either misleading or merely superfluous. For every music lover, listening ought to come before taking anyone else's word about how to feel or what to like. That said, this book inevitably reflects in considerable degree what serious students of music have found valuable over the years. Especially with biographical entries, however, the relative lengths of entries should not be taken as an index of the relative importance of their subjects. It simply takes less space to say that Domenico Scarlatti wrote 555 sonatas than to list even a few of the works of a less well-known composer who wrote for unusual combinations of instruments and employed fanciful titles.

Readers in search of greater detail and guidance to the larger literature on music should turn first to *The New Harvard Dictionary of Music* (1986) and *The Harvard Biographical Dictionary of Music* (1996), on which the present book is based. It is to the many collaborators on these books that I owe my thanks in the first instance for the present one. Of particular importance in the production of this book, however, were Ronald Rabin and Julia Randel. Special thanks are also due the staff of the Harvard University Press, most notably Jennifer Snodgrass and Margaretta Fulton.

Don Michael Randel Ithaca, New York

# **Abbreviations**

### General

An asterisk (\*) before a term indicates a separate article on that subject.

Middle C is designated c', the C's below that c, C,  $C_1$ , etc. The C's above middle C are designated c'', c''', etc. See Pitch names.

Α	alto	ill.	illustration
abbr.	abbreviated, abbreviation	incl.	inclusive, including
anon.	anonymous	movt.	movement
В	bass	no.	number
b.	born	N.S.	New Style
bapt.	baptized	op.	opus (plural opp.)
B.C.E.	before the common era	O.S.	Old Style
bk.	book	p.	page (plural pp.)
ca.	circa	perf.	performance, performed
C.E.	of the common era	pl.	plural
cent.	century	Ps.	Psalm
d.	died	publ.	published by
ex.	example (plural exx.)	R;	reprint
f.	and following (plural ff.)	rev.	revised, revised by
fig.	figure	S	soprano
fl.	flourished	T	tenor
fr.	from	Univ.	University

# THE HARVARD CONCISE DICTIONARY OF MUSIC AND MUSICIANS

A. (1) See Pitch names, Letter notation, Hexachord, Pitch. (2) An abbreviation for \*alto or altus. (3) A [It.],  $\dot{a}$  [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.

Abaco, Evaristo Felice dall'. See Dall'Abaco, Evaristo Felice.

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

Abbado, Claudio (b. Milan, 26 June 1933). Conductor. Studied piano at the Milan Conservatory and with Gulda in Salzburg; conducting with Swarowsky at the Vienna Academy. Principal conductor (from 1968) and artistic director (1976–86) of La Scala; principal conductor of the Vienna Philharmonic from 1971; of the London Symphony, 1979–86; music director of the Vienna State Opera, 1986–91; chief conductor of the Berlin Philharmonic from 1990.

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

Abbatini, Antonio Maria (b. Città di Castello, 1609 or 1610; d. there, ca. 1679). Composer, teacher, and theorist. *Maestro di cappella* at St. John Lateran in Rome, 1626–28; at the cathedral in Orvieto in 1633; and at S. Maria Maggiore in Rome (1640–46, 1649–57, 1672–77). Cesti was among his pupils. His *Dal male il bene* (Rome, 1653; libretto by Giulio Rospigliosi; act 2 by Marco Marazzoli) is an important early example of comic opera. Also composed Latin church music.

Abbellimento [It.]. Ornament.

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', bb', e'', g'', g''.

**Abel, Carl Friedrich** (b. Cöthen, 22 Dec. 1723; d. London, 20 June 1787). Composer and viola da gamba player for whose use J. S. Bach's three gamba

sonatas may have been composed. Probably joined Bach's Collegium musicum in 1737. Settled in London, giving his first concert there in 1759. In 1764 gave his first joint concert with J. C. Bach, both serving as chamber musicians to Queen Charlotte from about this time. Together they established the Bach-Abel concerts, a series of 10 to 15 concerts given each year from 1765 until 1781. Works include symphonies, concertos, overtures; string quartets, string trios, sonatas; pieces for viola da gamba.

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. They came to prominence under Dietrich Buxtehude (organist at Lübeck from 1668 until 1707), who established them on five Sundays preceding Christmas.

Abgesang [Ger.]. See Bar form.

Abgestossen [Ger.]. \*Staccato.

Abnehmend [Ger.]. \*Diminuendo.

Abravanel, Maurice (de) (b. Thessaloniki, of Sephardic parents, 6 Jan. 1903; d. Salt Lake City, Utah, 22 Sept. 1993). Conductor. Studied composition with Weill in Berlin. Conducted in Germany; moved to Paris in 1933. On the staff of the Metropolitan Opera in New York, 1936–38; thereafter conducted Broadway shows (including Weill's Knickerbocker Holiday and Street Scene). Conductor of the Utah Symphony, 1947–79.

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

Absil, Jean (b. Bon-Secours, Hainaut, Belgium, 23 Oct. 1893; d. Brussels, 2 Feb. 1974). Composer. Studied organ and composition at the Brussels Conservatory beginning in 1913; studied composition with Gilson in 1920–22. Director of the Etterbeek Music School in 1922; faculty, Brussels Conservatory (from 1930), subsequently professor of fugue there (1939–59). The works of Schoenberg, Berg, Stravinsky, and Milhaud were important influences, as was his study of folk music from Romania and other countries. His *Postulats de la musique contemporaine* (1937) advocated his own brand of polytonality and pointed to its historical roots.

Absolute music [fr. Ger. absolute Musik, absolute Tonkunst]. Instrumental music that is "free of" [Lat. absolutus] any explicit connection with words beyond simple indications of tempo and genre. 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.

**Absolute pitch.** (1) \*Pitch as defined both by its name and by the specific frequency that produces it rather than by its name alone. (2) The ability to name a pitch or produce a pitch designated by name without recourse to any external source or standard, as distinct from \*relative pitch. Theories of absolute pitch assume that individuals with this ability possess an internal standard pitch in long-term memory, and some maintain that the ability is largely innate. There is no general agreement as to whether absolute pitch is continuously distributed in the population, and underlying neurological mechanisms have not been identified.

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).

Abt, Franz Wilhelm (b. Eilenburg, 22 Dec. 1819; d. Wiesbaden, 31 Mar. 1885). Composer. Studied in Leipzig; conducted in Zurich and at the court in Brunswick; traveled widely as a choral conductor and toured America very successfully in 1872. Composed over 3,000 works, including numerous choral works (many for male chorus) and many songs.

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; a \*Schneller.

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. In some academies 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). Numerous informal groups of learned aristocrats gathered at private palaces in the 16th and 17th centuries, and 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.

The first French academy officially instituted by royal decree was 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 [see \*musique mesurée à l'antique].

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). This was an opera company with royal sponsorship, and it survives as the Paris Opéra, the official title of which through most of its history has included the term académie. By 1800 almost any concert with aristocratic support might be termed an academy. Musical academies since that time have included schools of music, groups promoting musical performance, and learned associations devoted to studies of music theory and history.

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 \*declaration. For the role of tonic accent in Gregorian chant, see Cursive and tonic, Gregorian chant.

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, and small groups of notes.

(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.

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 (either a whole tone or a semitone below the main note) that is sounded simultaneously with a harmonic tone or tones but that is neither prepared nor resolved and usually released almost immediately; sometimes referred to as a Zusammenschlag and by extension as a simultaneous appoggiatura. 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 \ b are sometimes used to cancel one element of the double sharp and double flat, respectively, and h h is sometimes used to cancel the double sharp or double flat altogether. The simple forms #, b, 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.

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. Because of the early shapes of these signs, German pitch nomenclature still refers to B-flat as B and to B-natural as H. For the use of unnotated accidentals in some early music, see Musica ficta.

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 thorough-

	#	b	×	ЬЬ	<b>4</b>
Eng.	sharp	flat	double sharp	double flat	natural
Fr.	dièse	bémol	double dièse	double bémol	bécarre
Ger.	Kreuz	Be	Doppelkreutz	Doppel-Be	Auflösungszeichen, Quadrat
It.	diesis	bemolle	doppio diesis	doppio bemolle	bequadro
Sp.	sostenido	bemol	doble sostenido	doble bemol	becuadro

bass accompaniment, but rather coexisted with it for several decades.

**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.

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 [see Performance practice].

Until the decline of the \*thoroughbass at the end of the Baroque period, 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, accompani-

ment 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.

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

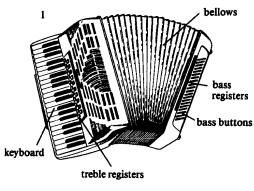
Accord [Fr.]. (1) Chord; accord parfait, triad. (2) The set of pitches to which an instrument such as the lute is tuned. Various tunings have been used for a single instrument. See also Accords nouveaux, Scordatura.

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





1. Accordion. 2. Concertina.

prevalent design, its reeds are sounded by means of a piano keyboard. The left-hand organ, designed for accompaniment, 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 Handaoline 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.

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

Accusé [Fr.]. Marked, emphasized.

Achron, Joseph (b. Lozdzieje, Poland, 13 May 1886; d. Hollywood, 29 Apr. 1943). Violinist and composer. In 1898 entered the St. Petersburg Conservatory, studying violin with Auer and composition with Lyadov. In 1911 joined with other Jewish musicians in the study of Jewish folklore, which played a continuing role in his compositions thereafter. Moved to Palestine (1924) and then the U.S. (1925), settling in Hollywood in 1934; played violin in film studio orchestras while continuing to compose and to perform as a soloist. His best-known work is Hebrew Melody for violin and orchestra (1911); later works employ principles related to those of the music of Schoenberg.

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 lightshows 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.

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.

**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.** (1) 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 (vocal cord or drumhead), 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.

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 example, since there are 4 full oscillations occurring in the duration .0091 second of the graph, the frequency is (4 cycles/.0091 second) = 440 cycles

Fig. I

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 and represents 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 important mathematical (Fourier's theorem) states that any such graph may be represented as the superposition or sum of sine waves such as 1a. In fact, 1b is obtained by adding together 1a and 1c. For example, the vertical displacement B at the time 0.0047 second is the algebraic sum of the displacements A and C at that same time. Similarly, the displacement D 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  $f_1, f_2, f_3, \ldots$  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  $f_2 = 573$  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  $f_1, f_2, f_3, \ldots$  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 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 573 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

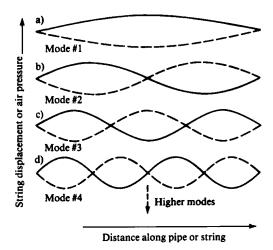


Fig. 2

as the winds and the bowed strings is a continuous rather 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 pitchdetermining 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:

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

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. 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.

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 characteristic sound of some instruments results from the relative intensities of the partials. The clarinet, played in the low register, has strong oddnumbered 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. The way in which tones start and end in different instruments is characteristic and important in the identification of those instruments. 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.

(2) The characteristics of a physical space affecting the perception of sound within it. 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. 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. Other considerations in architectural acoustics 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.

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.

Acuff, Roy (Claxton) (b. Maynardville, Tenn., 15 Sept. 1903; d. Nashville, 24 Nov. 1992). Countryand-western singer, fiddler, songwriter, and publisher. His performances of "The Wabash Cannon Ball" and "The Great Speckled Bird" were extremely popular, as was his own song "Precious Jewel."

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 Performance 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).

Adam, Adolphe (Charles) (b. Paris, 24 July 1803; d. there, 3 May 1856). Composer. Entered the Paris Conservatory and studied organ with Benoist, counterpoint with Reicha, and composition with Boieldieu, his principal mentor. Professor of composition there from 1849. Composed more than 50 operas and over a dozen ballets. Now best known for his ballets \*Giselle, ou Les Wilis and Le corsaire (1856) and the Christmas carol "Cantique de Noël" ("O Holy Night").

**Adam von Fulda** (b. Fulda, ca. 1445; d. Wittenberg, 1505). Composer and theorist. At first a Benedictine, he married and entered the service of Frederick the Wise of Saxony in 1490. Wrote a treatise titled *De musica* (1490). Composed a Mass, hymns, antiphons, and other sacred music, and 3 secular songs.

Adam de la Halle [Adan le Bossu, Adan le Boscu d'Arras] (b. Arras, 1245–50; d. Naples, 1285–88? or England, after 1306?). Trouvère poet and composer. In the late 1270s went to Italy in the service of Robert II, Count of Artois, and there entered the service of Robert's uncle Charles of Anjou (d. 1285). Works include monophonic chansons and *jeux-partis*; polyphonic *rondeaux* and motets; and 3 plays, of which one, a pastoral work titled *Le jeu de Robin et de Marion*, makes considerable use of music.

Ádám, Jenő (b. Szigetszentmiklós, 12 Dec. 1896; d. Budapest, 15 May 1982). Composer, conductor, and educator. Studied composition with Kodály in Budapest and conducting with Weingartner in Basel. Conductor and teacher at the Academy of Music in Budapest (1929–59). Collaborated with Kodály in the reform of music education in Hungary. Works include 2 operas, orchestral works, choral works (some with orchestra); 2 string quartets and other chamber music; numerous arrangements of folk songs.

Adam of St. Victor (d. St. Victor, Paris, late 1140s). Poet and composer. Probably identical with Adam Precentor, canon of the Cathedral of Notre Dame of Paris in the early 12th century; canon of and resident at the Abbey of St. Victor from 1133 or shortly thereafter. Wrote many \*sequences.

Adamis, Michael (b. Piraeus, Greece, 19 May 1929). Composer and musicologist. Studied Byzantine chant and composition (with Papaioannou) in Greece and then at Brandeis Univ. (1962–65). At Pierce College, Athens, from 1968. Early works employ twelve-tone techniques; more recent ones often draw on Byzantine chant and include a Byzantine Passion (1967); electronic works include music for classical Greek and other plays.

Adams, John (Coolidge) (b. Worcester, Mass., 15 Feb. 1947). Composer, clarinetist, and conductor. Studied composition at Harvard with Kirchner, Kim, and Sessions (1965-71). On the faculty of the San Francisco Conservatory and director of the New Music Ensemble there, 1972-82; composer in residence with the San Francisco Symphony, 1982–85. Winner of the 1995 Grawemeyer Award for his violin concerto (1993). Has employed a wide variety of media, including electronics and video, and often makes repetitive use of relatively simple tonal materials. Works include operas (Nixon in China, 1987; The Death of Klinghoffer, 1991); orchestral music (Shaker Loops, for 7 Strings, 1978; Harmonielehre, 1985; Fearful Symmetries, 1988; Short Ride in a Fast Machine, 1986); other instrumental (Light over Water [Symphony for Brass and Synthesizers], 1983); choral (Harmonium, 1981); songs; piano music.

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<sup>7</sup> 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).

Adderley, Cannonball [Julian Edwin] (b. Tampa, 15 Sept. 1928; d. Gary, Ind., 8 Aug. 1975). Jazz alto saxophonist and leader of small groups. In 1955 left a career as a high school music teacher to join Oscar Pettiford's bop group in New York. After leading a quintet (1956–57) with his brother Nat (b. 1931), a cornetist, he joined Miles Davis's sextet (1957–59). From 1959 to 1975 led groups with Nat.

Addinsell, Richard (Stewart) (b. London, 13 Jan. 1904; d. there, 14 Nov. 1977). Composer. Studied at the Royal College of Music and in Berlin and Vienna. Best known for his Warsaw Concerto, a work for piano and orchestra from the film Dangerous Moonlight (1941, released in the U.S. as Suicide Squadron). Other film scores include Goodbye, Mr. Chips (1939), Blithe Spirit (1945), A Tale of Two Cities (1958), The Roman Spring of Mrs. Stone (1961), and The Waltz of the Toreadors (1962).

Addison, John (b. Chobham, Surrey, 16 Mar. 1920). Composer. Studied at the Royal College of Music