International Encyclopedia of Communications, Erik Barnouw, ed. Oxford U. Press, 1989

SOUND

IV, pp. 101-107

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The term *sound* suggests a wide range of related communications phenomena in natural and human history. Although *sound communications* is often used specifically with regard to audio technologies, the auditory channel, or the perceptual mechanism involving the ear and brain, one might better use the phrase to refer to the overall study of articulation, production, interpretation, and value judgments that relate sounds—natural and human, face-to-face or mass-mediated—to their social meanings. In this sense sound communications parallels the study of visual communications; each of these areas of communications research addresses a variety of contexts, cultures, media, and codes, and each builds data and theory on disciplinary perspectives from the physical, natural, and social sciences, the humanities, and the fine arts.

Traditional approaches to sound focus on the intertwined yet analytically separable facets of acoustic production and aural reception. Production and the material properties of any natural or human sound are generally studied from the standpoint of acoustics, physics, and engineering. In this domain emphasis is placed on the determination and measurement of patterned pressure waves and on the delimitation of frequency, intensity, and quality. Reception and the processes of auditory sensation, perception, and COGNITION are studied from the perspectives of physiology, psychology, and psychoacoustics (*see* PERCEPTION—MUSIC). Here emphasis is placed on the delimitation and measurement of auditory sensations of pitch, loudness, and timbre; on the physical mechanism of the ear; on hearing and auditory theory; on phenomena such as masking, echo and reverberation, Doppler and binaural effects, and localization; as well as on SPEECH and music learning, memory, and general cognitive processing.

Although these areas involve primary scientific research of a very significant nature, their centerpiece has been neither the question of communication per se nor of sound and social MEANING. The production and perception of sound tend to be described in ahistorical and culture-free terms, independent of issues of interpretation. Yet when a sound is made, and when it is heard, more than a chain (object → channel → sense organ → neural impulse → brain state → perception) is set into operation. A pair of ears connected to a brain, subjected to and perceiving stimuli, is a necessary but not a total model of the production and reception of sound. It is merely a skeletal model of human sound communications, because the enormous variety of adaptive and learned overlays that we call CULTURE provides the concepts through which humans transform, experience, and interpret perceptions as situated, historically and socially meaningful symbols; hence the rationale for studying acoustic production and aural reception in a broader biosocial, communicational framework.

Animal sound communication. Another significant component of this biosocial, communicational framework is zoological and evolutionary. Here we attempt to distinguish innate from learned abilities, species-specific from pan-species sound patterning, and sound signals and channels from olfactory, visual, and tactile-gestural ones. Research in evolutionary biology and psychology has greatly expanded our understanding of the evolution of the ear from a simpler organ of balance to a more complex one for information processing. And more recent ethological research has clarified how sound plays a very significant role in animal interaction (*see* ANIMAL COMMUNICATION; ANIMAL SIGNALS—AUDIBLE SIGNALS).

Studies of coordinated exchanges in the avian world, for example, have led to an understanding of functional differences between nonvocal and vocal sounds. Although nonvocal sounds may be either incidental (as in feeding, flying, or swimming) or deliberate and communicative (as in the different rates of tapping beats per second distinguishing species of woodpeckers or wing beats per second distinguishing species

of hummingbirds), vocal sounds exhibit much more complex patterns. *See also* ANIMAL SONG.

Two delicate issues highlight potential differences between animal studies and similar behavioral-ethological approaches to human social interaction and communication. (1) The observer is an outsider to the system observed; researchers cannot ask questions of apes, birds, or other animals. It is therefore sometimes difficult to speak of animal communication at the level of intentional or meaningful articulation. (2) A related problem, anthropomorphism and the problem of "Clever Hans" effects (witting and unwitting cues and deceptions, expectation effects, and unconscious experimenter bias), may create other difficulties. Recent research with chimpanzee and ape vocalization and signing have produced cautionary tales about equating problem solving or task learning with "language" and operant conditioning with "communication."

Human sound communication. Human communication is transacted through modes of symbolic behavior, and these modes (visual, gestural, verbal, musical) provide culturally variable systems of codes and conventions through which objects and events can be perceived, conceived, and organized into forms that can be understood by others who possess knowledge of those codes and conventions (*see* CODE; MODE). The verbal and musical modes, both primary universal modeling systems, are each logically organized through symbols that pair sound and social meanings, and this factor suggests the fundamental importance of sonic-acoustic media, channels, and codes in human evolution.

In the case of languages, the general study of the variety of possible speech sounds is called phonetics. For any given LANGUAGE the subset of possible sounds that make up a regular inventory of systematically contrasting elements is called phonemes, and these are further analyzable in terms of their phonetic features. The branch of LINGUISTICS that describes the sounds of a language, their phonetic features, and the patterns governing their distribution and ordering is called PHONOLOGY. Those acoustic phenomena that accompany speech, such as voice set, quality, speed, rhythm, and intensity, are known as paralinguistic and prosodic features. In musical sound structure the general study of pitch inventories and tone systems is analogous to the realm of linguistic phonetics, and the relationship of tones, scales, modes, and tuning is more similar to the analysis of phonemes and phonetic features (*see* MUSIC THEORIES—TUNING SYSTEMS), whereas the analysis of timbre and texture has parallels with paralanguage and prosody.

Beyond this clear analogy in the realm of linguistic and musical sound organization is also an inevitable comparison of the variety of ways in which sonic media, channels, and codes are meaningfully interpreted. Both language and music can be approached along acoustic, psychoacoustic, and evolutionary lines, yet both clearly require a human-social, cross-cultural perspective, one that takes into account the forms and varieties of speaking and music making in human communities and the ways in which linguistic and musical means serve social ends, accomplishing real outcomes of personal and interpersonal meaning for participants.

The uniqueness of the verbal and musical modes goes beyond the notion that similar sensory apparatuses are involved or that production and reception of various stimuli characterize both. Although these two modes are unique and completely distinct from each other, they overlap considerably in communicative means and economies. Four dimensions of this overlap can be specified for acoustic and cultural comparison and contrast. (1) Throughout the world tunes are accompanied by texts, whether or not the society in question is characterized by adjacent or dominant traditions of instrumental music or verbal arts. Hence studies of *language in music* concern the fit between verbal artistry, musical melody and rhythm, and styles of sung vocalization, particularly as they contrast with other types of speech and oration. (2) In a complementary manner studies of *music in language* concern the melodic, metric, and timbral dimensions of speech varieties. Primary studies here concern dimensions of patterned sentence intonation, prosody, and vocal affect, as well as studies of how pitch and tonal patterns determine lexical meanings in some languages. All of this research on the overlaps between language and music contributes to our understanding of the boundaries of speech and SONG in acoustic, artistic, and cross-cultural perspective.

A parallel yet more abstract set of interrelations concerns cross-modal symbolization. (3) *Language about music* or, more generally, verbal discourse that prescribes or describes some dimension of musical experience points on the one hand to the systems and codifications of knowledge in culture-specific music theories (*see* MUSIC HISTORY) and on the other to the very fact that music is not linguistically translatable and that there are enormous cross-cultural and intracultural variations in discourse on musical experience and societal emphases on verbalization about music. Although both scientific and humanistic models of sound depend largely on visual recoding and notation systems for rational explication, they also depend on verbal descriptions of three types: (a) narrative of experience relating sound, source, and environment; (b) onomatopoeia/mimesis/imitative words; and (c) technicalized lexicon or metalanguage. The musicologist Charles Seeger wrote in detail about the "discretions" (overemphasis on space, underemphasis on time, overemphasis on event and

product over process and tradition) produced by discussing the musical mode in these varieties of the verbal; in remembrance of his zeal researchers often use the phrase "Seeger's dilemma" to refer to the problem of using language to discuss music.

It is often said—as an admitted oversimplification—that in music sounds stand for nothing but sounds, and in language sounds stand for ideas, but the case of (4) *music about language*, or perhaps more accurately language through music, provides an interesting exception. Speech surrogates substituting for vocalizations are most commonly found when variations in linguistic tone level are a significant part of speech communication. In surrogate systems instrumental (commonly drum, gong, xylophone, or flute) or organic (commonly whistling, humming, or falsetto) sounds correspond to natural language sounds. In other words, linguistic tonal contours are directly transposed to other media in such a way that the sound patterns reflect sound patterns in the language.

Theodore Stern identified the two major kinds of speech surrogates: abridgment systems, in which a limited number of phonemic elements of the base language are evoked or imitated by the surrogate; and logograph or ideograph systems, in which the surrogate sound symbolizes a concept, making no reference at all to the phonemic structure of the base language. Moreover, at least throughout Africa, where "talking drums" are widespread as instrumental speech surrogates, it is possible to distinguish a signal mode (stereotypic texts and formulas) from a speech mode (creative and novel linguistic messages); sometimes these modes alternate with each other, or additionally alternate, even quite rapidly, with the use of the same instrument for purely musical PERFORMANCE bearing no referential or connotative message.

Sounds and meaning. Turning now to the question of how sounds relate to meaning, there are varying ways to approach the communicative properties and potentials of both language and music. Some traditional perspectives view languages as basically referential and predicative, denoting or reflecting objects or events in a nonlinguistic real world. Other perspectives, generally anthropological in orientation, view speaking as a more active construction and implementation of realities, placing more emphasis on the creative investments and pragmatic concerns of speakers and societies than on the formal linguistic code. A perspective associated with the linguist ROMAN JAKOBSON, later elaborated by others, mapped the communicative relationship among factors in a speech event (addresser, addressee, CONTEXT, message, contact, code) and the multiplicity of functions and meanings (emotive, conative, contextual, referential, poetic, metalingual) that might be focused by shifts in emphasis or orientation to any one of those factors. This perspective has provided a sensible corrective to views of linguistic SEMANTICS more exclusively focused on the nature of denotation and reference.

Because musical sounds are not building blocks of word or sentence units, the patterns of musical sounds and rhythms are not interpreted as meaningful in reference to a nonmusical world. In various traditions composers express or depict emotions with materials that then come to have a conventional denotative character. Such is the case in the western European tradition with some of the devices of orchestral program music or with varieties of film music. At the same time, however, it is important to emphasize that such conventions are culturally grounded; they are not the result of an understanding by composers and listeners that a group of notes or chords or a rhythm in all cases and musical settings will represent a specific meaning or communicate a certain thought (*see* SOUND EFFECTS).

Some phenomena often labeled as musical reference or denotation are perhaps more like linguistic onomatopoeia, exploiting a variety of abstract principles of mimesis. The cuckoo calls of Ludwig van Beethoven's Sixth Symphony, the turtle dove of J. S. Bach's *Gott ist mein König*, the insects or water references by Béla Bartók and Maurice Ravel, or the birds of Olivier Messiaen's many works involve musical transformation to evoke the character of a natural sound. Such devices are transparent to listeners with knowledge of the natural sources but may be inaccessible or purely musical to other listeners. Similarly, the multiphonic growls and drones of an Aboriginal Australian didgeridoo may evoke the sounds and motions of animals such as a dingo, brolga, kookaburra, or emu to listeners with prepared ears; to others these sounds are perceived purely as structured pulsations of the music.

What, how, or whether music can communicate concepts or images is an old issue, often referred to as the absolutist/referentialist debate. The central problem here is whether, in addition to abstract intramusical meanings, music also refers to extramusical concepts or actions. Most contemporary treatments of musical meaning and communication build on this debate, tending to acknowledge that although referential meanings can and do exist, they are not strictly denotative, natural, or transparent. Moreover, as references can be apprehended only through a more thorough understanding of the historical and cultural contexts in which musical practices and ideas are situated, work on musical meaning at this level has fallen largely into the hands of anthropologists and ethnomusicologists, somewhat removed from formal musicological concerns with inherent musical structure (*see* ETHNOMUSICOLOGY).

No contemporary work on musical communication has more significantly extended this debate, or

stimulated more general discussion and reflection on it, than Leonard B. Meyer's *Emotion and Meaning in Music* (1956). This important work argues that meaning is not uniquely a property of things, located in a stimulus, or a property of what a stimulus refers to; rather meaning is to be understood as a relationship between the interaction of these two and the conscious observer. Putting aside designative meanings, those meanings relating to nonmusical domains, Meyer concentrates on what he calls embodied meaning, namely, the meaning of musical activities in terms of the unfolding structure of a work. The implications of a work's structural features and the listener's developing expectations about them based on immediately and remotely past musical experiences provide the basis for Meyer's theory. Grounded in Gestalt psychology and JOHN DEWEY's theory that emotion is a product of frustration, Meyer shows how the delay or fulfillment of structural tensions creates patterns of suggestion and resolution and argues that emotional values and meanings are a result of the drama experienced in listening.

Recent researchers in the anthropology and sociology of musical communications have attempted to expand and develop Meyer's position to address a greater variety of musical traditions, processes, and performance practices and the more explicitly sociocultural dimensions of listening experience. Their work moves the emphasis from the specific structural features of drama and tension that might arouse the listener to the range and variety of musical feelings that are socially constituted through musical experiences. Common concerns in this new work on musical communication include the importance of texture and timbre in relation to melodic-rhythmic syntax; distinguishing the meaning of one musical piece from another; addressing the meaning of specific pieces and performances rather than music in general; exploring musically meaningful evocations not directly linked to drama and tension; and probing the varied meanings of pieces to different listeners as well as to the same listener over time. The communications epistemology that results enlarges the description of the musical encounter from the text-processing-interaction level to one relating the intertwined experiences that are drawn on in the listening process.

Sound technology. Given the universal importance of language and music it is not surprising that the proliferation of mass-mediated technologies for the transmission and reproduction of sound have been major forces in twentieth-century history. The TELEPHONE, RADIO, phonograph, and tape recorder and the sound systems of film (*see* MOTION PICTURES) and television have proliferated to become features of the daily life experiences of peoples all over the globe. These technologies continually create new patterns of listening, new listening communities, and new challenges to the conventions of recording realism and fantasy. They are also intimately connected to a history of mechanical-electric-electronic musical technologies from music boxes to digital sampling keyboards (*see* MUSIC MACHINES). In the last hundred years sound technology has gradually evolved to a point at which the entire range of human hearing can be fully recorded and reproduced (*see* SOUND RECORDING). Indeed, recording and reproduction have moved into a surreal dimension, presenting the possibility of ultrarealistic listening experiences with special phasing equipment, headphones, and digital delays—listening whose realism is impossible to experience with as much clarity in live settings. And in the latter part of the twentieth century almost every musical style in the world is available on radio, tape, or record virtually everywhere in the world. This fact has, particularly in the last thirty years, tended to increase world musical homogenization and the appropriation of musics. It has also certainly changed the nature of many oral traditions and the fixity of regional folk and traditional repertoires (*see* MUSIC, FOLK AND TRADITIONAL). At the same time, it has promoted an extraordinary creative synthesis among world musical traditions and has brought increasing varieties of musical knowledge and experience to ever-growing numbers of people. In many musical traditions it is no longer possible to analyze stylistic stability and change without examining the local circulation and consumption of recordings. On a mass scale urban Afro-American and Afro-Latin musics have become increasingly African, and urban popular African styles have become increasingly Afro-American and Afro-Latin. The circulation of recordings and radio broadcasts is largely responsible for this extensive set of new influences.

Music was once defined—for example, by the nineteenth-century German physicist Hermann von Helmholtz—in contrast to noise; Helmholtz meant to distinguish regular vibrations with harmonics proportionate to the fundamental frequency from nonperiodic or irregular oscillations. Similarly, many discussions of sound started with a diagram of the range of human audibility, in hertz (Hz) and decibels (db), bounded by the thresholds of hearing and pain (see Figure 1). Within this range several smaller circles were drawn, indicating the range of noises, speech, vocal music, and orchestral music. Language, music, and noise were thus conceived as overlapping subsets within the range of audibility. With the proliferation of sound technologies, the ranges of noise, music, speech, and audibility are potentially identical and entirely within the control of musicians and audio engineers. See Figure 2.

Current research. In the 1970s there was an increasing awareness of the importance of sound in human affairs, stimulated no doubt by the worldwide

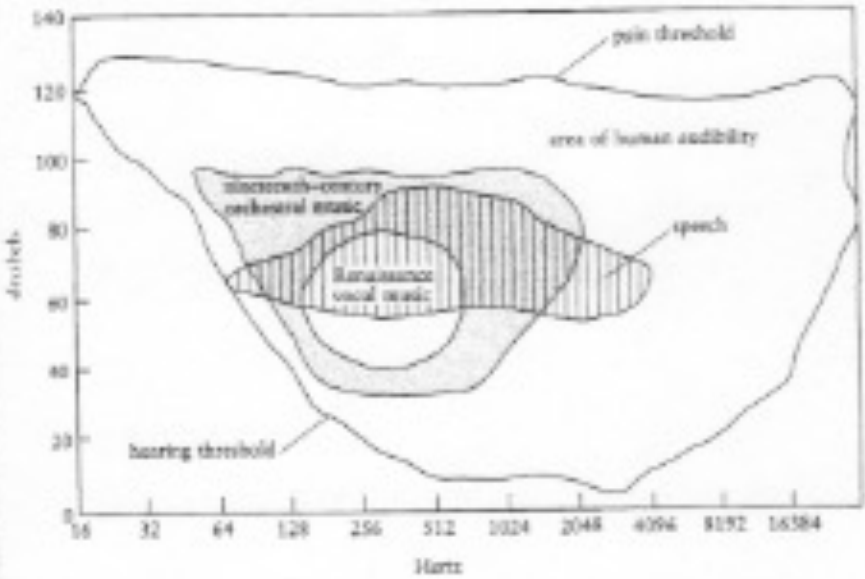

Figure 1. *(Sound)* Range of various sounds in relation to hearing.

Figure 2. *(Sound)* Decibel levels of some common sounds.

rise of popular musics and the rapid evolution of electronic technologies of music making and music reproduction. Two key synthetic books appeared and have since inspired a new generation of researchers: Peter F. Ostwald's *The Semiotics of Human Sound* (1973) and R. Murray Schafer's *The Tuning of the World* (1977).

Trained as both a psychiatrist and a musician, Ostwald studied a wide variety of noise, speech, and musical codes in terms of their communicative functions. For example, he developed diagnostic studies of speech for mood and personality assessment, studied schizophrenic speech pathologies, outlined the critical paralinguistic characteristics of the ways patients communicate with doctors, developed techniques for the analysis of newborn infant cries and sounds, enumerated the varieties and meanings of whistling, and investigated the relationship between physical and emotional disturbance and musical creativity, particularly in the case of the composer Robert Schumann. Major themes in Ostwald's work concern the uniqueness of sound as a resource in human emotional expression and the importance of a broadly biobehavioral approach to the physical and mental vicissitudes of sound making.

Schafer's writing builds on his background as educator and composer and as director of the World Soundscape Project, a research group devoted to community studies of soundscapes. Schafer coined the term *soundscape* to refer to the sound environment, and his work traces natural primitive, rural, town, city, industrial, and electric transformations in human history, showing how sounds and what he terms *schizophonia* (the splitting of an original sound from its source, brought about by electroacoustic reproduction) have played an important role in human invention. Some of his work in this area develops themes suggested by Edmund Carpenter and MARSHALL MCLUHAN, particularly concerning how electrically amplified sounds transform space to contain listeners. Schafer and his coworkers produced an elaborate series of notations, classifications, and measurements to describe the morphology and symbolism of sound environments. He also devoted particular attention to the study of noise; the nature of "hi-fi" and "lo-fi" soundscapes (environments with favorable and unfavorable signal-to-noise ratios); the problems of legislating the sound environment and devising creative approaches to what he terms *acoustic design*, namely, improvement of the aesthetic qualities of acoustic environments (*see* MUZAK); and acoustic ecology, that is, studies of the impact of soundscapes on the behaviors and outlooks of their inhabitants.

Another recent synthetic work about sound communications, integrating environmental, natural historical, linguistic, and musical concerns, is Steven Feld's *Sound and Sentiment* (1982). This anthropological study of sound as a symbolic system reports on the Kaluli, a remote rain-forest tribe in Papua New Guinea, and shows how patterns of adaptation to an environment in which sound is more important than vision permeates social and aesthetic communications. The Kaluli in good part encounter their world by sounds, reflected nowhere more importantly than in their classification of birds, which are believed to be their own spirit reflections. Bird sounds are transformed into the tonal materials of songs and weeping, two kinds of expression through which the Kaluli express sadness over death and loss. The texts of these are formed by special poetic codes called "bird sound words," and the songs are sung in a plaintive bird voice by a dancer costumed as a bird; the performance thereby moves an audience to cry, as if they had become birds as well. This symbolic circle linking birds, humans, death, life, nature, culture, language, and music is further rationalized in Kaluli mythology.

These works indicate that the study of sound communications in human social life increasingly integrates acoustic, psychological, cognitive, ecological, evolutionary, behavioral, historical, ethnographic, technological, institutional, humanistic, and artistic perspectives. That so many perspectives contribute to our understanding of sound communications is at once an indication of the extraordinary depth and complexity of sound phenomena in nature and culture and of the thoroughness with which they have captured human imagination.

Bibliography. Edmund Carpenter and Marshall McLuhan, "Acoustic Space," in *Explorations in Communication: An Anthology*, ed. by Edmund Carpenter and Marshall McLuhan, Boston, 1960; Robert Erickson, *Sound Structure in Music*, Berkeley, Calif., 1975; Steven Feld, "Communication, Music, and Speech about Music," *1984 Yearbook for Traditional Music* 16 (1984): 1–18; idem, *Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression*, Philadelphia, 1982; Hermann von Helmholtz, *On the Sensations of Tone as a Physiological Basis for the Theory of Music* (4th German ed., 1877), 2d ed., rev. and trans. by A. J. Ellis, New York, 1954; Roman Jakobson, "Linguistics and Poetics," in *Style in Language*, ed. by Thomas A. Sebeok, Cambridge, Mass., 1960; Charles M. Keil, "Motion and Feeling through Music," *Journal of Aesthetics and Art Criticism* 24 (1966): 337–349; Leonard B. Meyer, *Emotion and Meaning in Music*, Chicago, 1956; Peter F. Ostwald, *The Semiotics of Human Sound*, The Hague, 1973; idem, *Soundmaking: The Acoustic Communication of Emotion*, Springfield, Ill., 1963; R. Murray Schafer, *The Tuning of the World*, New York, 1977; idem, ed., *The Vancouver Soundscape*, Vancouver, B.C., 1973; Charles Seeger, *Studies in Musicology, 1935–1975*, Berkeley, Calif., 1977; John Shepherd, Phil Virden, Graham Vulliamy, and Trevor Wishart, *Whose Music? A Sociology of Musical Language*, New Brunswick, N.J., 1977; Theodore Stern, "Drum and Whistle 'Languages': An Analysis of Speech Surrogates," *American Anthropologist* 59 (1957): 487–506; Yoshihiko Tokumaru and Osamu Yamaguchi, eds., *The Oral and the Literate in Music*, Tokyo, 1986.

STEVEN FELD