sound mentioned above, this could be the same sound Peter Sellers might make as he gargles in a Blake Edwards comedy.

Here, the effect of the sound is so strong because it represents human speech felled at its physical core: what has been destroyed are a larynx and a tongue, which have just spoken.

TWO

THE THREE LISTENING MODES

. . .

CAUSAL LISTENING

When we ask someone to speak about what they have heard, their answers are striking for the heterogeneity of levels of hearing to which they refer. This is because there are at least three modes of listening, each of which addresses different objects.[1] We shall call them *causal listening*, *semantic listening*, and *reduced listening*.

Causal listening, the most common, consists of listening to a sound in order to gather information about its cause (or source). When the cause is visible, sound can provide supplementary information about it; for example, the sound produced by an enclosed container when you tap it indicates how full it is. When we cannot see the sound's cause, sound can constitute our principal source of information about it. An unseen cause might be identified by some knowledge or logical prognostication; causal listening (which rarely departs from zero) can elaborate on this knowledge.

We must take care not to overestimate the accuracy and potential of causal listening, its capacity to furnish sure, precise data solely on the basis of analyzing sound. In reality, causal listening is not only the most common but also the most easily influenced and deceptive mode of listening.

Identifying Causes: From the Unique to the General

Causal listening can take place on various levels. In some cases we can recognize the precise cause: a specific person's voice, the sound produced by a particular unique object. But we rarely recognize a unique source exclusively on the basis of sound we hear out of context. The human individual is probably the only cause that can produce a sound, the speaking voice, that characterizes that individual alone. Different dogs of the same species have the same bark. Or at least (and for most people it adds up to the same thing) we are not capable of distinguishing the barking of one bulldog from that of another bulldog or even a dog of a related breed. Even though dogs seem to be able to identify their master's voice from among hundreds of voices, it is quite doubtful that the master, with eyes closed and lacking further information, could similarly discern the voice of her or his own dog. What obscures this weakness in our causal listening is that when we're at home and hear barking in the back room, we can easily deduce that Fido or Rover is the responsible party.

At the same time, a source we might be closely acquainted with

can go unidentified and unnamed indefinitely. We can listen to a radio announcer every day without having any idea of her name or her physical attributes. Which by no means prevents us from opening a file on this announcer in our memory, where vocal and personal details are noted, and where her name and other traits (hair color, facial features—to which her voice gives us no clue) remain blank for the time being. For there is a considerable difference between taking note of the individual's vocal timbre—and *identifying* her, having a visual image of her and committing it to memory and assigning her a name.

In another kind of causal listening we do not recognize an individual, or a unique and particular item, but rather a category of human, mechanical, or animal cause: an adult man's voice, a motorbike engine, the song of a meadowlark. Moreover, in still more ambiguous cases far more numerous than one might think, what we recognize is only the *general nature* of the sound's cause. We may say, "That must be something mechanical" (identified by a certain rhythm, a regularity aptly called "mechanical"); or, "That must be some animal" or "a human sound." For lack of anything more specific, we identify *indices*, particularly temporal ones, that we try to draw upon to discern the nature of the cause.

Even without identifying the source in the sense of the nature of the causal object, we can still follow with precision the *causal history* of the sound itself. For example, we can trace the evolution of a scraping noise (accelerating, rapid, slowing down, etc.) and sense changes in pressure, speed, and amplitude without having any idea of *what* is scraping against *what*.

The Source as a Rocket in Stages

Remember that a sound often has not just one source but at least two, three, even more. Take the sound of the felt-tip pen with which I am writing this draft. The sound's two main sources are the pen and the paper. But there are also the hand gestures involved in writing and, further, I who am writing. If this sound is recorded and listened to on a tape recorder, sound sources will also include the loudspeaker, the audio tape onto which the sound was recorded, and so forth.

Let us note that in the cinema, causal listening is constantly manipulated by the audiovisual contract itself, especially through the phenomenon of synchresis. Most of the time we are dealing not with the real initial causes of the sounds, but causes that the film makes us believe in.

Semantic Listening

I call semantic listening that which refers to a code or a language to interpret a message: spoken language, of course, as well as Morse and other such codes. This mode of listening, which functions in an extremely complex way, has been the object of linguistic research and has been the most widely studied. One crucial finding is that it is purely differential. A phoneme is listened to not strictly for its acoustical properties but as part of an entire system of oppositions and differences. Thus semantic listening often ignores considerable differences in pronunciation (hence in sound) if they are not *pertinent* differences in the language in question. Linguistic listening in both French and English, for example, is not sensitive to some widely varying pronunciations of the phoneme *a*.

Obviously one can listen to a single sound sequence employing both the causal and semantic modes at once. We hear at once what someone says and how they say it. In a sense, causal listening to a voice is to listening to it semantically as perception of the handwriting of a written text is to reading it.[2]

Reduced Listening

Pierre Schaeffer gave the name *reduced listening* to the listening mode that focuses on the traits of the sound itself, independent of its cause and of its meaning.[3] Reduced listening takes the sound—verbal, played on an instrument, noises, or whatever—as itself the object to be observed instead of as a vehicle for something else.

A session of reduced listening is quite an instructive experience. Participants quickly realize that in speaking about sounds they shuttle constantly between a sound's actual content, its source, and its meaning. They find out that it is no mean task to speak about sounds in themselves, if the listener is forced to describe them independently of any cause, meaning, or effect. And language we employ as a matter of habit suddenly reveals all its ambiguity: "This is a squeaky sound," you say, but in what sense? Is "squeaking" an image only, or is it rather a word that refers to a *source* that squeaks, or to an unpleasant *effect*?

So when faced with this difficulty of paying attention to sounds in themselves, people have certain reactions—"laughing off" the project, or identifying trivial or harebrained causes—which are in fact so many defenses. Others might avoid description by claiming to objectify sound via the aids of spectral analysis or stopwatches, but of course these machines only apprehend physical data, they do not designate what we hear. A third form of retreat involves entrenchment in out-and-out subjective relativism. According to this school of thought, every individual hears something different, and the sound perceived remains forever unknowable. But perception is not a purely individual phenomenon, since it partakes in a particular kind of objectivity, that of shared perceptions. And it is in this objectivity-born-of-intersubjectivity that reduced listening, as Schaeffer defined it, should be situated.

In reduced listening the descriptive inventory of a sound cannot be compiled in a single hearing. One has to listen many times over, and because of this the sound must be fixed, recorded. For a singer or a musician playing an instrument before you is unable to produce exactly the same sound each time. She or he can only reproduce its general pitch and outline, not the fine details that particularize a sound event and render it unique. Thus reduced listening requires the fixing of sounds, which thereby acquire the status of veritable objects.

Requirements of Reduced Listening

Reduced listening is an enterprise that is new, fruitful, and hardly natural. It disrupts established lazy habits and opens up a world of previously unimagined questions for those who try it. Everybody practices at least rudimentary forms of reduced listening. When we identify the pitch of a tone or figure out an interval between two notes, we are doing reduced listening; for pitch is an inherent characteristic of sound, independent of the sound's cause or the comprehension of its meaning.

What complicates matters is that a sound is not defined solely by its pitch; it has many other perceptual characteristics. Many common sounds do not even have a precise or determinate pitch; if they did, reduced listening would consist of nothing but good old traditional solfeggio practice. Can a descriptive system for sounds be formulated, independent of any consideration of their cause? Schaeffer showed this to be possible, but he only managed to stake out the territory, proposing, in his *Traité des objets musicaux*, a system of classification. This system is certainly neither complete nor immune to criticism, but it has the great merit of existing.

Indeed, it is impossible to develop such a system any further unless we create new concepts and criteria. Present everyday language as well as specialized musical terminology are totally inadequate to describe the sonic traits that are revealed when we practice reduced listening on recorded sounds.

In this book I am not about to go into great detail on reduced listening and sound description. The reader is encouraged to consult other books on this subject, particularly my own digest of Pierre Schaeffer's work published under the title of *Guide des objets sonores*.

What Is Reduced Listening Good For?

"What ultimately is the usefulness of reduced listening?" wondered the film and video students whom we obliged to immerse themselves in it for four days straight. Indeed, it would seem that film and television use sounds solely for their figurative, semantic, or evocatory value, in reference to real or suggested causes, or to texts—but only rarely as formal raw materials in themselves.

However, reduced listening has the enormous advantage of opening up our ears and sharpening our power of listening. Film and video makers, scholars, and technicians can get to know their medium better as a result of this experience and gain mastery over it. The emotional, physical, and aesthetic value of a sound is linked not only to the causal explanation we attribute to it but also to its own qualities of timbre and texture, to its own personal vibration. So just as directors and cinematographers—even those who will never make abstract films—have everything to gain by refining their knowledge of visual materials and textures, we can similarly benefit from disciplined attention to the inherent qualities of sounds.

The Acousmatic Dimension and Reduced Listening

Reduced listening and the acousmatic situation share something in common, but in a more ambiguous way than Pierre Schaeffer (who first developed both notions) gave us to understand. Schaeffer emphasized how acousmatic listening, which we shall define further on as a situation wherein one hears the sound without seeing its cause, can modify our listening. Acousmatic sound draws our attention to sound traits normally hidden from us by the simultaneous sight of the causes—hidden because this sight reinforces the perception of certain elements of the sound and obscures others. The acousmatic truly allows sound to reveal itself in all its dimensions.

At the same time, Schaeffer thought the acousmatic situation could encourage reduced listening, in that it provokes one to separate oneself from causes or effects in favor of consciously attending to sonic textures, masses, and velocities. But, on the contrary, the opposite often occurs, at least at first, since the acousmatic situation intensifies causal listening in taking away the aid of sight. Confronted with a sound from a loudspeaker that is presenting itself without a visual calling card, the listener is led all the more intently to ask, "What's that?" (i.e., "What is causing this sound?") and to be attuned to the minutest clues (often interpreted wrong anyway) that might help to identify the cause.[4]

When we listen acousmatically to recorded sounds it takes repeated hearings of a single sound to allow us gradually to stop attending to its cause and to more accurately perceive its own inherent traits.

A seasoned auditor can exercise causal listening and reduced listening in tandem, especially when the two are correlated. Indeed, what leads us to deduce a sound's cause if not the characteristic form it takes? Knowing that this is "the sound of x" allows us to proceed without further interference to explore what the sound is like in and of itself.

Active and Passive Perception

It seemed important, in the context of this book on audio-vision, to draw clear distinctions among the three modes of listening. But we must also remember that these three listening modes overlap and combine in the complex and varied context of the film soundtrack.

The question of listening with the ear is inseparable from that of listening with the mind, just as looking is with seeing. In other words, in order to describe perceptual phenomena, we must take into account that conscious and active perception is only one part of a wider perceptual field in operation. In the cinema to look is to explore, at once spatially and temporally, in a "given-to-see" (field of vision) that has limits contained by the screen. But listening, for its part, explores in a field of audition that is given or even imposed on the ear; this aural field is much less limited or confined, its contours uncertain and changing.

Due to natural factors of which we are all aware—the absence of anything like eyelids for the ears, the omnidirectionality of hearing, and the physical nature of sound—but also owing to a lack of any real aural training in our culture, this "imposed-to-hear" makes it exceedingly difficult for us to select or cut things out. There is always something about sound that overwhelms and surprises us no matter what—especially when we refuse to lend it our conscious attention; and thus sound interferes with our perception, affects it. Surely, our conscious perception can valiantly work at submitting everything to its control, but, in the present cultural state of things, sound more than image has the ability to saturate and short-circuit our perception.

The consequence for film is that sound, much more than the image, can become an insidious means of affective and semantic manipulation. On one hand, sound works on us directly, physiologically (breathing noises in a film can directly affect our own respiration). On the other, sound has an influence on perception: through the phenomenon of added value, it interprets the meaning of the image, and makes us see in the image what we would not otherwise see, or would see differently. And so we see that sound is not at all invested and localized in the same way as the image.

parts of a city) and the more persistent or characteristic sounds would be conspicuously revealed. Material for the events map would have to be limited to a specific period of time and would be gathered by walking over or around the selected location. (In the case of a city block this might be a single excursion around the block.)

Another example of aerial sonography, which brings value judgment into play, is that used by Michael Southworth in his article "The Sonic Environment of Cities." Here, after walking about the given territory freely, numerous observers were asked to comment on the sounds they heard, and the results of their observations were gathered together for display. The resulting map for a section of the downtown area of Boston shows where the acoustic designer could profitably begin his work.

Such diagrams are hints only, but perhaps this is all one should expect of sound visualization—a few hints which the ear can then follow up in its own way. It is easier for the inexperienced to absorb the salient information from them than from other types of graphic presentation, and that is to their advantage. The temptation of bad habits is no doubt still implicit in them, and it is for this reason that I conclude this chapter with a warning that no silent projection of a soundscape can ever be adequate. The first rule must always be: if you can't hear it, be suspicious.

NINE

Classification

Why classify? We classify information to discover similarities, contrasts and patterns. Like all techniques of analysis, this can only be justified if it leads to the improvement of perception, judgment and invention.

Consider the dictionary—words slashed from their contexts and arbitrarily arranged according to their attack sounds. Yet, when used properly, the dictionary can contribute to the improvement of the language and can even provide us with inchoate thoughts and aesthetic moments.

Any classification system or taxonomy is surrealistic; for surrealistic art also depends on bringing together incongruous or anachronistic facts, which nevertheless somehow snap together to illuminate new relationships. The first such artists were the encyclopedists, who brought together strange groups of animals, vegetables and ideas for surrealistic family portraits.

Sounds may be classified in several ways: according to their physical characteristics (acoustics) or the way in which they are perceived (psychoacoustics); according to their function and meaning (semiotics and semantics); or according to their emotional or affective qualities (aesthetics). While it has been customary to treat these classifications separately, there are obvious limitations to isolated studies. My colleague Barry Truax puts the problem this way:

> Disintegrating a total sound impression into its component parameters appears to be a skill that must be learned; and while it is probably one that is necessary for acoustic design, a soundscape cannot be understood merely by a catalogue of such parameters, even if that were possible, but only through the representations formed mentally that function as a basis for memory, comparison, grouping, variation and intelligibility.

In this chapter I introduce some cataloguing systems for sounds—those systems which seem to be useful for dealing with various aspects of the soundscape—and the chapter will end with a discussion of the chief problems remaining to be solved. These have principally to do with the integration of classification systems. If soundscape study is to develop as an interdiscipline, it will have to discover the missing interfaces and unite hitherto isolated studies in a bold new synergy. This task will not be accomplished by any one individual or group. It will only be accomplished by a new generation of artist-scientists trained in acoustic ecology and acoustic design.

Classification According to Physical Characteristics

Let us consider first a physical classification for sound objects. Pierre Schaeffer has spent much effort in devising such a system. Schaeffer's concern is not really with acoustics but rather with psychoacoustics. He has tried to work out a paradigm by which it would be possible to classify all musical sound objects for the purpose of helping students to perceive their significant features clearly. He calls this a "solfège des objets musicaux." In his book he presents the paradigm in a table covering four pages. There are nearly eighty blocks in the table and many are further subdivided in a dazzling performance of French complexity. It would be useless to reproduce this table without Schaeffer's several-hundred-page explanation and rationale. The paradigm, it should be stressed, only deals with single musical sound objects. To cope with compound or more extended sound sequences, either the chart would have to be extended or the sounds would have to be broken up.

The system may be useful for the detailed analysis of isolated sound objects, but I would like to suggest a modification of it which might help to render it more immediately useful for soundscape field work. The idea would be to have a card on which the salient information of a sound heard could be quickly notated to be compared with other sounds. In line with our desire to comprehend sounds as events as well as objects (p. 131), it would be useful first to give some general information on setting: the distance of the sound from the observer, its strength, whether it rises clearly out of the ambiance or is barely perceptible, whether the sound under consideration is semantically isolable or is part of a larger context or message, whether the general texture of the ambiance is similar or dissimilar, and whether environmental conditions produce reverberation, echo or other effects such as drift or displacement.*

A chart could then be produced consisting of the answers to these questions plus a general physical description of the sound itself. For this purpose we might use a two-dimensional approach. On the horizontal

*Drift (fading) or displacement (ambiguous point of origin) often result from atmospheric disturbances such as wind or rain.

plane we will preserve the three components of the sound object discussed in the last chapter: *attack, body* and *decay.* On the vertical plane we will determine the relative *duration, frequency* and *dynamics* of the sound, to which we will add observations on any momentary *internal fluctuations* (technically called transients) and two new features, derived from Pierre Schaeffer: *mass* and *grain.*

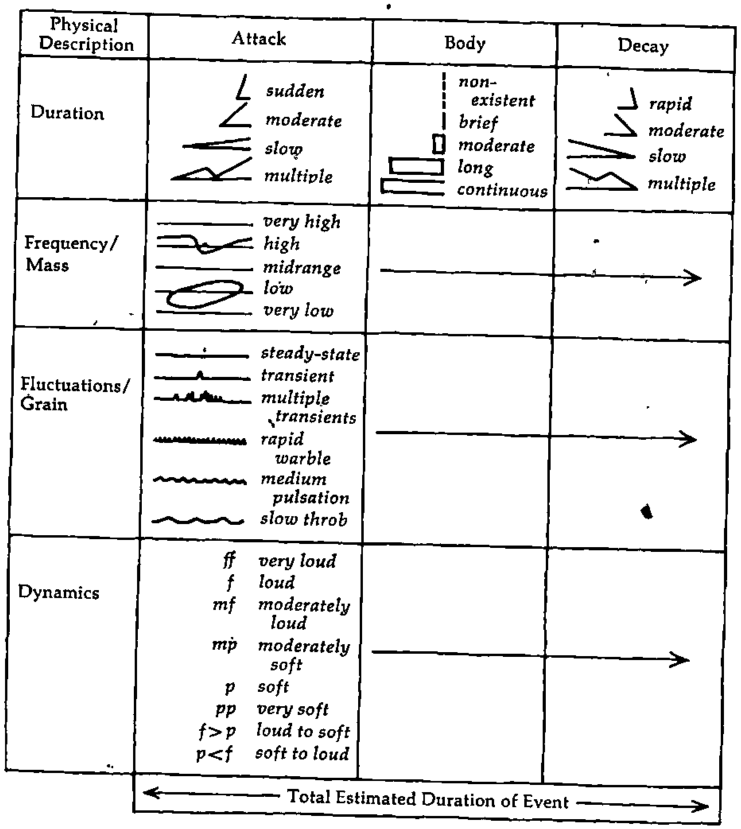
These last two need an explanation. Mass is related to frequency. While some sounds consist of clearly defined frequencies or pitches, others consist of inextricably entangled frequency clusters. Such may be the case with the broad-band noise of traffic, a flock of birds or the pounding of surf. Sometimes the sound will occupy a fairly narrow frequency band, sometimes it will be broad-band. The frequency spectrum of white noise will extend across the entire audio range (20 to 20,000 hertz), though it may also be filtered down to occupy a quite narrow range, at which point it may even appear "tuned," so that it could almost be hummed or whistled. The mass of a sound is where its bulk seems to lie. It is regarded as the predominant bandwidth of the sound. Indeed both mass and frequency are often present in environmental sounds and they may sometimes occupy quite independent positions in the spectrum, as would be the case with a sound consisting of a low throb and a high warble. As mass is composed of frequency clusters it can be indicated in the frequency block on our chart by drawing in its approximate shape.

Similarly, grain is a special type of internal fluctuation, one with a regular modulatory effect. It is accordingly contrasted with transients, which are isolated or irregular fluctuations. Grain gives texture; it roughens up the surface of the sound and its effects consist of tremolo (amplitude modulation) or vibrato (frequency modulation). The tempo of these modulations may vary from slow pulsing effects to rapid warbles of 16 to 20 impulses per second, at which time their grainy effect will be lost. Thus in grain, a tactile word, we again meet the convergence of the senses of touch and audition as individual impulses pass from their flicker state to smooth contours of pitched sound.

I have devised my own signs to indicate these various effects, as shown on the following chart.

SETTING

1. Estimated distance from observer:______meters.
2. Estimated intensity of original sound:______decibels.
3. Heard distinctly ( ), moderately distinctly ( ), or indistinctly ( ) over general ambiance.
4. Texture of ambiance: hi-fi ( ), lo-fi ( ), natural ( ), human ( ), technological ( ).
5. Isolated occurrence ( ), repeated ( ), or part of larger context or message ( ).
6. Environmental factors: no reverb. ( ), short reverb. ( ), long reverb. ( ), echo ( ), drift ( ), displacement ( ).



Description of a sound-event.

The symbols employed in the chart are not intended as exact graphic analogues, but rather as a handy index of devices for students to use in notating the significant physical features of sounds quickly during ear training exercises. Comparison of the chief characteristics of different sounds might also reveal useful distinctive features for the study of sound symbolism. The chart is, of course, useful only for isolated sound events, but despite its limitations it will serve to throw many of the most conspicuous features of isolated sounds into relief, as we can show in some simple classifications.

BARK OF A DOG

1 20 meters
2 85 dB
3 Heard distinctly
4 Hi-fi, human
5 Repeated, irregular
6 Short reverb.

SONG OF A BIRD

1 10 meters
2 60 dB
3 Heard distinctly
4 Hi-fi, natural
5 Part of extended song
6 No reverb.

FOG HORN

1 1,000 meters
2 130 dB
3 Heard distinctly
4 Hi-fi, natural
5 Periodic repetition
6 Long reverb., displacement

CHURCH BELL

1 500 meters
2 95 dB
3 Moderately distinctly
4 Lo-fi, technological
5 Periodic repetition
6 Med. reverb., drift

TELEPHONE

1 3 meters
2 75 dB
3 Heard distinctly
4 Hi-fi, human
5 Repeated
6 No reverb.

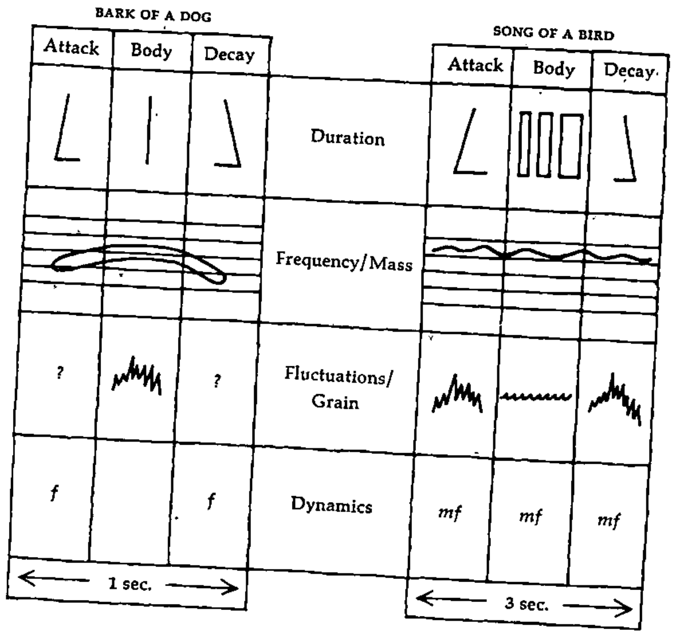
MOTORCYCLE
(passing on highway)

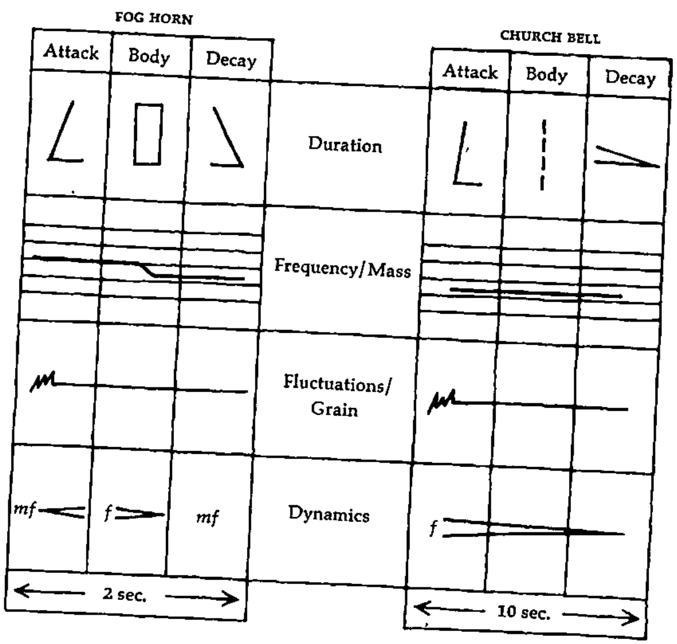
1 100 meters-pass-100 meters
2 90 dB
3 Indistinctly-distinctly-indistinctly
4 Lo-fi, technological
5 Isolated
6 No reverb.

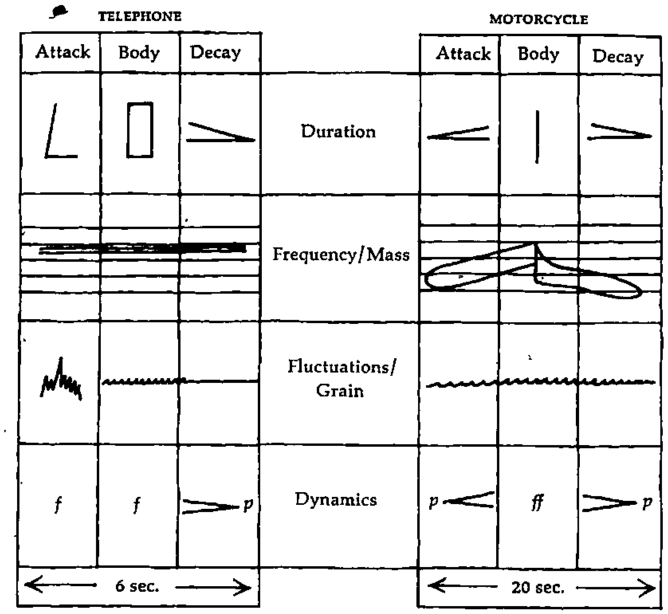
Classification According to Referential Aspects

We have next to consider a framework which will allow us to study the functions and meanings of sounds. Most sounds of the environment are produced by known objects and one of the most useful ways of cataloguing them is according to their referential aspects. But the system used to organize such a vast number of designations will be arbitrary, for no sound has objective meaning, and the observer will have specific cultural attitudes toward the subject. Even a library cataloguing system is stylized and reflects the interests and reading habits of librarians and library users. The only framework inclusive enough to embrace all man's undertakings with equal objectivity is the garbage dump.

The framework I present here is that which we have been using for one of the sub-projects of the World Soundscape Project, an extended card catalogue of descriptions of sound from literary, anthropological and historical documents. The only way we have of gathering information about the soundscapes of the past is through earwitness accounts by those who were there. From the first part of the book, the reader will know that I derived a great deal of information from this catalogue, which now numbers several thousand cards. The catalogue headings are arbitrary and have been built up empirically, but they do at least accommodate all descriptions we have encountered to date.







I. Natural Sounds

A. SOUNDS OF CREATION

B. SOUNDS OF APOCALYPSE

C. SOUNDS OF WATER
1. Oceans, Seas and Lakes
2. Rivers and Brooks
3. Rain
4. Ice and Snow
5. Steam
6. Fountains. Etc.

D. SOUNDS OF AIR
1. Wind
2. Storms and Hurricanes
3. Breezes
4. Thunder and Lightning. Etc.

E. SOUNDS OF EARTH
1. Earthquakes

2. Landslides and Avalanches
3. Mines
4. Caves and Tunnels
5. Rocks and Stones
6. Other Subterranean Vibrations
7. Trees
8. Other Vegetation

F. SOUNDS OF FIRE
1. Large Conflagrations
2. Volcanoes
3. Hearth and Camp Fires
4. Matches and Lighters
5. Candles
6. Gas Lamps
7. Oil Lamps
8. Torches
9. Festival or Ritual Fires

G. SOUNDS OF BIRDS
1. Sparrow
2. Pigeon
3. Killdeer
4. Hen
5. Owl
6. Lark. Etc.

H. SOUNDS OF ANIMALS
1. Horses
2. Cattle
3. Sheep
4. Dogs
5. Cats
6. Wolves
7. Gophers. Etc.

I. SOUNDS OF INSECTS
1. Flies
2. Mosquitoes
3. Bees
4. Crickets
5. Cicadas. Etc.

J. SOUNDS OF FISH AND SEA CREATURES
1. Whales
2. Porpoises
3. Turtles. Etc.

K. SOUNDS OF SEASONS
1. Spring

2. Summer
3. Fall
4. Winter

II. Human Sounds

A. SOUNDS OF THE VOICE
1. Speaking
2. Calling
3. Whispering
4. Crying
5. Screaming
6. Singing
7. Humming
8. Laughing
9. Coughing
10. Grunting
11. Groaning. Etc.

B. SOUNDS OF THE BODY
1. Heartbeat
2. Breathing
3. Footsteps
4. Hands (Clapping, Scratching, etc.)
5. Eating
6. Drinking
7. Evacuating
8. Lovemaking
9. Nervous System
10. Dream Sounds. Etc.

C. SOUNDS OF CLOTHING
1. Clothing
2. Pipe
3. Jewelry. Etc.

III. Sounds and Society

A. GENERAL DESCRIPTIONS OF RURAL SOUNDSCAPES
1. Britain and Europe
2. North America
3. Latin and South America
4. Middle East
5. Africa
6. Central Asia
7. Far East

B. TOWN SOUNDSCAPES
1. Britain and Europe. Etc.

C. CITY SOUNDSCAPES
1. Britain and Europe. Etc.

D. MARITIME SOUNDSCAPES
1. Ships
2. Boats
3. Ports
4. Shoreline. Etc.

E. DOMESTIC SOUNDSCAPES
1. Kitchen
2. Living Room and Hearth
3. Dining Room
4. Bedroom
5. Toilets
6. Doors
7. Windows and Shutters. Etc.

F. SOUNDS OF TRADES, PROFESSIONS AND LIVELIHOODS
1. Blacksmith
2. Miller
3. Carpenter
4. Tinsmith. Etc.

G. SOUNDS OF FACTORIES AND OFFICES
1. Shipyard
2. Sawmill
3. Bank
4. Newspaper

H. SOUNDS OF ENTERTAINMENTS
1. Sports Events
2. Radio and Television
3. Theater
4. Opera. Etc.

I. MUSIC
1. Musical Instruments
2. Street Music
3. House Music
4. Bands and Orchestras. Etc.

J. CEREMONIES AND FESTIVALS
1. Music
2. Fireworks
3. Parades. Etc.

K. PARKS AND GARDENS
1. Fountains
2. Concerts
3. Birds. Etc.

L. RELIGIOUS FESTIVALS
1. Ancient Greek
2. Byzantine
3. Roman Catholic
4. Tibetan. Etc.

IV. Mechanical Sounds

A. MACHINES (GENERAL DESCRIPTIONS)

B. INDUSTRIAL AND FACTORY EQUIPMENT (GENERAL DESCRIPTIONS)

C. TRANSPORTATION MACHINES (GENERAL DESCRIPTIONS)

D. WARFARE MACHINES (GENERAL DESCRIPTIONS)

E. TRAINS AND TROLLEYS
1. Steam Locomotives
2. Electric Locomotives
3. Diesel Locomotives
4. Shunting and Yard Sounds
5. Coach Sounds
6. Street Cars. Etc.

F. INTERNAL COMBUSTION ENGINES
1. Automobiles
2. Trucks
3. Motorcycles. Etc.

G. AIRCRAFT
1. Propeller Aircraft
2. Helicopters
3. Jets
4. Rockets. Etc.

H. CONSTRUCTION AND DEMOLITION EQUIPMENT
1. Compressors
2. Jackhammers
3. Drills
4. Bulldozers
5. Pile Drivers. Etc.

I. MECHANICAL TOOLS
1. Saws
2. Planes
3. Sanders. Etc.

J. VENTILATORS AND AIR-CONDITIONERS

K. INSTRUMENTS OF WAR AND DESTRUCTION

L. FARM MACHINERY
1. Threshing Machines
2. Binders

3. Tractors
4. Combines. Etc.

V. Quiet and Silence

VI. Sounds as Indicators

A. BELLS AND GONGS
1. Church
2. Clock
3. Animal. Etc.

B. HORNS AND WHISTLES
1. Traffic
2. Boats
3. Trains
4. Factory. Etc.

C. SOUNDS OF TIME
1. Clocks
2. Watches
3. Curfew
4. Watchmen. Etc.

D. TELEPHONES

E. (OTHER) WARNING SYSTEMS

F. (OTHER) SIGNALS OF PLEASURE

G. INDICATORS OF FUTURE OCCURRENCES

Other categories in this system include Mythological Sounds, the Sounds of Utopias and the Psychogenic Sounds of Dreams and Hallucinations. We also have categories for the last sounds heard before sleep, the first sounds heard on waking and acoustic experiences that connect with the other senses (synaesthesia). The final section of the catalogue indicates whether the reporter showed a particular attitude to the sound(s) described. Was it considered as a signal, as noise, as painful, pleasurable, etc.?

As sounds may function in a variety of contexts, all descriptive cards, indexed in this system, are cross-referenced generously. Thus any given sound may appear in several places, allowing us the opportunity to regard it from several angles or to compare it with others of a similar set.

Playing with this index is a splendid listening exercise. Let me pull out a few cards dealing with the sounds of footsteps and you will hear what I mean. I have already mentioned how the felt boots of *Doctor Zhivago*'s Russian winter seemed to "screech angrily" in the snow. Compare this with

- "the slap, slap of Gran's carpet slippers" (Emily Carr)
- "the clattering of the clogs" in Coketown (Dickens)
- "the loose tripping" feet of the Moroccans (Hans Ganz)

- "the violent clatter of . . . hobnailed wooden-soled shoes on the school flagstones" of a French provincial town (Alain-Fournier)
- "the flat, soft steps of the barefooted" (W. O. Mitchell)
- "the impish echoes of . . . footsteps" in the cloisters and quadrangles of Oxford (Thomas Hardy)
- or the way "the floor timbers boomed" under the strong rough feet of Beowulf.

By noting the date and place heard for every sound in the index, it is possible to measure historical changes in the world soundscape as well as social reactions to them. Then we can learn, for instance, that Virgil, Cicero and Lucretius did not like the sound of the saw, which was relatively new in their time (*c.* 70 B.C.), but that no one complained of factory noise until a hundred years after the outbreak of the Industrial Revolution (Dickens, Zola).

We can also note interesting proportional changes, for instance, between the number of descriptions of natural as against technological sounds. I am limiting the following observations to a period for which we have several hundred card samples. (It will be a long time before the index can be built up to a point where it may serve as a reliable indicator for all times and places.) Let us compare the nineteenth and twentieth centuries in Europe and America. We note that of all sound quotes from nineteeth-century Britain, 48 percent referred to natural sounds, while during the twentieth century, mentions of natural sounds had dropped to 28 percent. Among European authors the same decline is observed over the two centuries: 43 percent has dropped to 20 percent. Interestingly enough, this decline is not observed in North America (and our sample is very large here so that there can be little doubt about it); just over 50 percent of all quotes for both centuries refer to natural sounds. One might assume that North Americans are still closer to the natural environment, or at least have easier access to it than Europeans, for whom it definitely appears to be disappearing.

But the matter is not so simple. Our index does not show any corresponding increase in the perception of technological sounds throughout the same two centuries except for the period of the First World War, where the number increases sharply and then falls again. (The Second World War did not have a similar effect.) In fact, while the number of perceptions of technological sounds remains at the same level in Europe and Britain (about 35 percent of all observations), in America it actually declines!

But we also notice a decline in the number of times quiet and silence are evoked in literary descriptions. Of all descriptions in our file for the decades 1810–30, 19 percent mention quiet or silence; by 1870–90 mentions had dropped to 14 percent, and by 1940–60 to 9 percent. Thus it would appear that while writers are not consciously perceptive of the accumulation of technological sounds, at an unconscious level they are noticing the disappearance of quiet and silence. All this is perfectly consistent with the keynote character of technological noise as I have been describing it.

In going through the cards, I am struck by the negative way in which silence is described by modern writers. There are few felicitous descriptions. Here are some of the modifiers employed by the most recent generation of writers: solemn, oppressive, deathlike, numb, weird, awful, gloomy, brooding, eternal, painful, lonely, heavy, despairing, stark, suspenseful, aching, alarming. The silence evoked by these words is rarely positive. It is not the silence of contentment or fulfillment. It is not the silence toward which this book is modulating.

Classification According to Aesthetic Qualities Sorting sounds according to their aesthetic qualities is probably the hardest of all types of classification. Sounds affect individuals differently and a single sound will often stimulate such a wide assortment of reactions that the researcher can easily become confused or dispirited. As a result, study of this problem has been thought too subjective to yield meaningful results. Out in the real world, however, aesthetic decisions of great importance for the changing soundscape are constantly being made, often arbitrarily. The Moozak industry does not hesitate to make decisions about what kinds of music the public is most likely to tolerate, nor did the aviation industry consult the public before it entered on the development of the supersonic-boom-producing aircraft. Acoustic engineers have also succeeded in introducing increasing amounts of white noise into modern buildings and have invoked aesthetics in the process, by referring to the results as "acoustic perfume."*

When such stupid decisions are being made almost daily, can the systematic study of soundscape aesthetics continue to be ignored? If the soundscape researcher is to assist in developing improved acoustic environments for the future, some kinds of tests will have to be developed for the measurement of aesthetic reactions to sounds. At first they should be kept as simple as possible.

Reduced to its simplest form, aesthetics is concerned with the contrast between the beautiful and the ugly, so a good place to begin might be by simply asking people to list their most favorite and least favorite sounds. It would be good to know which sounds were especially pleasing or displeasing to people of different cultures, for such catalogues, which might be called sound romances and sound phobias, would not only be of inestimable value in a consideration of sound symbolism, but could obviously give valuable directives for future soundscape design. Read in conjunction with noise abatement legislation, sound phobias would also give a good impression of whether a given by-law fairly reflected contemporary public opinion concerning undesirable sounds.

*Acoustical engineering firms have also already taken over our term *soundscape* and speak of "soundscaping an office" to refer to the same white-noise mesmerism.

One of the sub-projects of the World Soundscape Project has been to offer such a test in as many different countries as possible. We have tried to run the test in two parts. First, the subjects, who were mostly high school or university students, were simply asked to list the five sounds they liked best and the five they disliked most. Next we had them take a short soundwalk around their environment, and when they returned they were asked to repeat the assignment with specific reference to the sounds they had heard during the walk. I wish we had space to print the complete results to some of the tests, for they make a fascinating exercise in imagination and perception. Reducing them to the extent necessary for inclusion here can only be excused on the grounds that the general patterns produced support the hypothesis that different cultural groups have varying attitudes to environmental sounds.*

A few general observations are in order. First, climate and geography obviously influence likes and dislikes to some considerable extent. We note, for instance, that while in countries which touch the sea, ocean waves are well liked, in an inland country like Switzerland, the sounds of brooks and waterfalls are a much greater favorite. Where tropical storms may blow in suddenly from the sea, strong winds are disliked (New Zealand, Jamaica). It is also clear that reactions to nature are affected by the degree of proximity to the elements. As people move away from open-air living into city environments, their attitudes toward natural sounds become benign. Compare Canada, New Zealand and Jamaica. In the two former countries, the sounds of animals were scarcely ever found to be displeasing. But every one of the Jamaicans interviewed disliked one or more animals or birds—particularly at night. Hooting owls, croaking frogs, toads and lizards were mentioned frequently. Barking dogs and grunting pigs were also strong dislikes. The animal sound most universally liked was the purring of a cat.

While the Jamaicans had no attitude concerning machine sounds, these were strongly disliked in Canada, Switzerland and New Zealand. Jamaicans also approved of aircraft while the other nationalities did not. For all nations except Jamaica traffic noise was especially objectionable. There can be little doubt about this. From the present as well as similar tests we have run with smaller groups of other nationalities, it appears clear that technological sounds are strongly disliked in technologically advanced countries, while they may indeed be liked in parts of the world where they are more novel. I stress this finding because in attempts to confront the contemporary noise pollution problem I have frequently heard politicians and other opponents argue that we represent a minority, citing the case of the mechanic who enjoys a good motor or the pilot who enjoys listening to aircraft. But there can be no doubt that such attitudes form a small minority, at least among young people.

Among other striking cultural differences is the intense fondness of the Swiss for bells, while in other countries they are scarcely mentioned.

*See Appendix II for International Sound Preference Survey.

On the phobia side, the dentist's drill elicits some mention in all countries except Jamaica (where it is less familar?). But the sound of fingernails or chalk on slate is mentioned as a sound phobia in all countries, a matter to which we will return presently.

This test needs to be followed by others, more detailed. We need to find out with greater precision how and why different groups of people react differently to sounds. To what extent are the differences cultural? To what extent individual? To what extent are sounds perceived at all? The field is open for some intelligent testing on an international scale.

Sound Contexts

Throughout this chapter sound has been considered in separate compartments. Acoustics and psychoacoustics have been dissociated from semantics and aesthetics. It is traditional to divide the study of sound in this way. The physicist and engineer study acoustics; the psychologist and physiologist study psychoacoustics; the linguist and communications specialist study semantics, while to the poet and composer is left the domain of aesthetics.

ACOUSTICS	PSYCHOACOUSTICS	SEMANTICS	AESTHETICS
What sounds are	How they are perceived	What they mean	If they appeal
Physicist Engineer	Physiologist Psychologist	Linguist Communicator	Poet Composer

But this will not do. Too many misunderstandings and distortions lie along the edges separating these compartments. Interfaces are missing. Let us follow through a few specimen sounds to understand the nature of the problem. Consider first the sample pair of sounds in the following table.

SAMPLE SOUND	ACOUSTICS	PSYCHOACOUSTICS	SEMANTICS	AESTHETICS
Alarm bell	Sharp attack; steady-state with rapid amplitude modulation; narrow band noise on center frequency of 6,000 hertz; 85 decibels	Sudden arousal; continuous warble; high pitch; loud; decreasing interest; subject to auditory fatigue; sensitive pitch area	Alarm signal	Frightening, unpleasant, ugly
Flute music	Interrupted modulations of shifting frequency; near pure tones with some presence of even harmonics; varying between 500 and 2,000 hertz; 60 decibels	Active patterned sound of shifting pitch; melodic contour; pure tones; highish register; moderately loud	Sonata by J. S. Bach; inducement to sit down and listen	Musical, pleasant, beautiful

There are apparently no problems here. The two sounds are physically quite different and they accordingly have different meanings and draw forth different aesthetic responses. But even here the context can produce divergent effects. Thus, without altering the physical parameters of the sound, the meaning of the alarm bell could change if, for instance, it was only being tested. Knowing this, the listener would not be impelled to drop everything and run. Or, without changing the physical character of Bach's flute sonata, the aesthetic effect could be quite different if the listener did not like the flute or did not care for the music of J. S. Bach.

When we get discrepancies such as these, our reliance on automatic across-the-board equations falters, and we become aware of the fallacy that a given sound will invariably produce a given effect. Let us consider some more discrepancies. Two sounds may be identical but have different meanings and aesthetic effects:

SAMPLE SOUND	ACOUSTICS	SEMANTICS	AESTHETICS
Car horn	Steady-state, reiterative; predominant frequency of 512 hertz; 90 decibels	Get out of my way!	Annoying, unpleasant
		I've just been married!	Festive, exciting

Or two sounds with quite different physical characteristics may have the same meaning and aesthetic effect:

SAMPLE SOUND	ACOUSTICS	SEMANTICS	AESTHETICS
I say, "Pierre, how are you?"	My crimpled baritone	Pierre is called.	Friendship
Margaret says, "Bonjour, Pierre."	Margaret's glorious contralto	Pierre is called.	Friendship

But supposing we are ringing up the Prime Minister of Canada, whose name is also Pierre. Margaret is his wife. I am not. Everything else remains the same, but the aesthetic effect is different:

SAMPLE SOUND	ACOUSTICS	SEMANTICS	AESTHETICS
Ditto	Ditto	Ditto	Annoyance
Ditto	Ditto	Ditto	Pleasure

Now consider the following pair of sounds:

SAMPLE SOUND	ACOUSTICS	PSYCHOACOUSTICS	SEMANTICS	AESTHETICS
Kettle boiling	Colored noise; narrow band (8,000+ hertz) steady-state; 60 decibels	High-pitched hissing sound	Tea is on.	Pleasing
Snake hissing	Colored noise; narrow band (7,500+ hertz); steady-state (occasionally intermittent); 55 decibels	High-pitched hissing sound	Snake preparing to attack	Frightening

Here two sounds with similar, but not identical, physical characteristics appear to be identical in perception, but nevertheless cause no confusion in meaning and accordingly have different aesthetic effects. Their contexts keep them clear. But when they are removed from their contexts in tape recordings, they may quickly lose their identities. Nor is the ear acute enough to be able to distinguish whatever differences may exist in their physical structure. Then the kettle may become the snake or either may become a green log on a fire.

It has always surprised me how even quite a common sound can be completely mistaken by listeners, dramatically affecting their attitudes toward it. For instance an electric coffee grinder was described as "hideous," "frightening," "menacing" by a group after listening to it on tape, though as soon as it was identified their attitudes immediately mollified.

There is one celebrated sound which seems to epitomize the interface dilemma which I have been describing: the sound of chalk or fingernails on slate. We have shown that it is an international sound phobia. Yet physical analysis fails to reveal why it should send cold shivers up the spine. It is not extraordinarily high or loud. It is not accompanied by any hurtful action. It does not even designate anything in particular. No single discipline then is capable of accounting for its remarkable effect. When sound enigmas like this are explained—and not until then—we will know that the missing interfaces are at last falling into place.

TEN

Perception

It is not surprising, noting the visual bias of modern Western culture, that the psychology of aural perception has been comparatively neglected. Much of the work done has been concerned with binaural hearing and sound localization—which also has largely to do with space. Quite a lot of work has been done on masking (covering one sound by another) and some has been done on auditory fatigue (the effect of prolonged exposure to the same sound); but taken as a whole such researches leave us a long way from our goal, which would be *to determine in what significant ways individuals and societies of various historical eras listen differently.*

Thus it is inconceivable that a music or soundscape historian should get quite the same thrill out of the preparatory work the laboratories have provided as that which has stimulated art historians such as Rudolph Arnheim and E. H. Gombrich, whose work owes such a heavy debt to research in the psychology of visual perception. In the work of men like these it has begun to be possible to comprehend the history of vision, at least in the Western world. The soundscape historian can only speculate tentatively on the nature and causes of perceptual changes in listening habits and hope that psychologist friends may respond to the need for more experimental study.

Figure and Ground

It is indeed possible that some terms employed in visual perception may have equivalents in aural perception. At least they are probably worth careful examination. For instance, a phenomenon like irradiation—by which a brightly illuminated area seems to spread—does seem to have an analogy in that a loud sound will appear to