
The Natural Soundscape

Voices of the Sea What was the first sound heard? It was the caress of the waters. Proust called the sea "the plaintive ancestress of the earth pursuing, as in the days when no living creature existed, its lunatic immemorial agitation." The Greek myths tell how man arose from the sea: "Some say that all gods and all living creatures originated in the stream of Oceanus which girdles the world, and that Tethys was the mother of all his children."

The ocean of our ancestors is reproduced in the watery womb of our mother and is chemically related to it. Ocean and Mother. In the dark liquid of ocean the relentless masses of water pushed past the first sonar ear. As the ear of the fetus turns in its amniotic fluid, it too is tuned to the lap and gurgle of water. At first it is the submarine resonance of the sea, not yet the splash of wave. But then

... the waters little by little began to move, and at the movement of the waters the great fish and the scaly creatures were disturbed, and the waves began to roll in double breakers, and the beings that dwell in the waters were seized with fear and as the breakers rushed together in pairs the roar of the ocean grew loud, and the spray was lashed into fury, and garlands of foam arose, and the great ocean opened to its depths, and the waters rushed hither and thither, the furious crests of their waves meeting this way and that.

Waves whipped into surf, pelting the first rocks as the amphibian ascends from the sea. And although he may occasionally turn his back on the waves, he will never escape their atavistic charm. "The wise man delights in water," says Lao-tzu. The roads of man all lead to water. It is the

fundamental of the original soundscape and the sound which above all others gives us the most delight in its myriad transformations.

At Oostende the strand is wide, with a scarcely perceptible rake across to the hotels, so that standing there one has the impression that the sea in the distance is higher than the beach and that sooner or later everything will be lifted away to oblivion by an enormous soft tidal wave. Totally otherwise is the Adriatic at Trieste, where the mountains leap into the ocean with an angular energy and the angry fists of the waves bounce noisily off rocks like India rubber balls. At Oostende the nexus of land is gentle in both vista and tone.

There are no rocks on which to sit at Oostende and so one walks along for miles, south with the waves in the right ear, and north with the waves in the left ear, filling an atavistic consciousness with the full-frequenced throb of water. All roads lead to water. Given the chance, probably all men would live at the edge of the element, within earshot of its moods night and day. We wander from it but the departure is temporary.

Day after day one walks along the strand, listening to the indolent splashing of the wavelets, gauging the gradual crescendo to the heavier treading and on to the organized warfare of the breakers. The mind must be slowed to catch the million transformations of the water, on sand, on shale, against driftwood, against the seawall. Each drop tinkles at a different pitch; each wave sets a different filtering on an inexhaustible supply of white noise. Some sounds are discrete, others continuous. In the sea the two fuse in primordial unity. The rhythms of the sea are many: infrabiological—for the water changes pitch and timbre faster than the ear's resolving power to catch its changes; biological—the waves rhyme with the patterns of heart and lung and the tides with night and day; and suprabiological—the eternal inextinguishable presence of water. "Observe measures," says Hesiod in *Works and Days*; "I will show you the measures of the much-thundering sea."

para thina polyphloisboio thalassēs

says Homer (*Iliad*, I:34), catching onomatopoeically the splendid armies of waves on the sea beach and their recession. *Canto II* of Ezra Pound begins,

And poor old Homer blind, blind, as a bat,
Ear, ear for the sea-surge . . .

The love of ocean has profound sources and they are recorded in a vast maritime literature of East and West. When water watches the history of the tribe, fingers of ocean grasp the epic. The prime material over which the *Odyssey* is strung is the ocean. The agrarian Hesiod, living in Boeotia, "far away from the sea and its tossing waters," cannot avoid the lure of the ocean.

For fifty days, after the turn
of the summer solstice,

when the wearisome season of the hot weather
goes to its conclusion
then is the timely season for men to voyage.

The Norsemen knew the ferocity of the ocean. When they sailed, "waves roared against the sides of the ship, it sounded just as if boulders were being clashed together." The alliterative verse of the Eddas is poetry for oarsmen. The repeated consonants of each half-line pin the accents of the verse to each stroke and return of the oar.

Splashing oars raced iron rattled
shield rang on shield as the Vikings rowed,
cutting the waves at the King's command,
farther and farther the fleet sped on.

When the crested waves of Kolga's sister
crashed on the keels the sound that came
was the boom of surf that breaks on rocks.

Across the world, in tropical northern Australia, the waves were more gentle.

Waves coming up: high waves coming up against the rocks,
Breaking, shi! shi!
When the moon is high with light upon the waters:
Spring tide; tide flowing to the grass,
Breaking, shi! shi!
In its rough waters, the young girls bathe.
Hear the sound they make with their hands as they play!

Any visitor to the seashore will find the recital of the waves remarkable, but only the maritime poet, with the ostinato of the sea in his ear from birth to grave, can measure precisely the systole and diastole of waves and tides. Ezra Pound spent much of his life moving from one coast of the Italian peninsula to the other—from Rapallo to Venice. His *Cantos* open on the sea, play out much of their dialectic at its edge, move away and then return. Where Scott Fitzgerald, a visitor to the Mediterranean, had heard merely "the small exhausted wa-waa of the waves," Pound gives us the fluctuations of the water with instinctive authority.

Lithe turning of water,
sinews of Poseidon,
Black azure and hyaline,
glass wave over Tyro,
Close cover, unstillness,
bright welter of wave-cords,
Then quiet water,
quiet in the buff sands,
Sea-fowl stretching wing-joints,
splashing in rock-hollows and sand-hollows

In the wave-runs by the half-dune;
 Glass-glint of wave in the tide-rips against sunlight,
 pallor of Hesperus,
 Grey peak of the wave,
 wave, colour of grape's pulp,
 Olive grey in the near,
 far, smoke grey of the rock-slide,
 Salmon-pink wings of the fish-hawk
 cast grey shadows in water,
 The tower like a one-eyed great goose
 cranes up out of the olive-grove,
 And we have heard the fauns chiding Proteus
 in the smell of hay under the olive-trees,
 And the frogs singing against the fauns
 in the half-light.
 And . . .

The sea is the keynote sound of all maritime civilizations. It is also a fertile sonic archetype. All roads lead back to water. We shall return to the sea.

The Transformations of Water Water never dies. It lives forever reincarnated as rain, as bubbling brooks, as waterfalls and fountains, as swirling rivers and deep sulking rivers.

A mountain stream is a chord of many notes strung out stereophonically across the path of the attentive listener. The continuous sound of water from Swiss mountain streams can be heard miles across a silent valley. When a stream leaps down a hundred-meter cascade in the Rocky Mountains, there is tense quietness, almost like fear, followed by noisy excitement when it strikes the rocks below. The water of the English moors has none of this virtuosity; its arrangements are more subtle.

The wanderer in this direction who should stand still for a few moments on a quiet night, might hear singular symphonies from these waters, as from a lampless orchestra, all playing in their sundry tones from near and far parts of the moor. At a hole in a rotten weir they executed a recitative; where a tributary brook fell over a stone breastwork they trilled cheerily; under an arch they performed a metallic cymballing; and at Durnover Hole they hissed.

The rivers of the world speak their own languages. The gentle murmur of the Merrimack River, "whirling and sucking, and lapsing downward, kissing the shore as it went," was a sleeping pill for Thoreau. For James Fenimore Cooper, the rivers of upstate New York often moved sluggishly into rocky caverns "producing a hollow sound, that resembled the concussions of a distant gun."

How different are the furious cataracts of the Nile at Atbara and Berber.

For the noise of battle cannot but arise when the river, among a thousand islands and rocks, forges its way onward in mile-long rapids. A Roman writer declared that the inhabitants emigrated because they lost their hearing, but the mighty voices of the Berbers prove to us today that necessity strengthens any organ, for their call carries over the rushing river from bank to bank, while white men can hardly hear each other at ten paces' distance.*

By contrast, on the still rivers of Siam, Somerset Maugham found a "sensation of exquisite peace," only occasionally broken by "the soft splash of a paddle as someone silently passed on his way home. When I awoke in the night I felt a faint motion as the houseboat rocked a little and heard a little gurgle of water, like the ghost of an Eastern music travelling not through space but through time." In Thomas Mann's *Death in Venice* the wasted and mournful waters of the canals form a tragic leitmotiv: "Water slapped gurgling against wood and stone. The gondolier's cry, half warning, half salute, was answered with singular accord from far within the silence of the labyrinth."

Water never dies and the wise man rejoices in it. No two raindrops sound alike, as the attentive ear will detect. Is then the sound of Persian rain like that of the Azores? In Fiji a summer rainstorm whips past in an enormous swirl taking less than sixty seconds, while in London it drones on as boring as a businessman's story. In parts of Australia it does not rain for two or more years. When it does, young children are sometimes frightened by the sound. On the Pacific coast of North America it rains gently but continuously on an average of 148 days each year. The Canadian painter Emily Carr describes it well:

The rain drops hit the roof with smacking little clicks, uneven and stabbing. Through the open windows the sound of the rain on the leaves is not like that. It is more like a continuous sigh, a breath always spending with no fresh intake. The roof rain rattles over our room's hollowness, strikes and is finished.

The tranquil timpani of West Coast rain is ambitionless, quite unlike the violent thunderstorms of the plains of Russia and central North America. In South Africa the rain is torrential: ". . . the thunder boomed out over-

*The Roman writer referred to is Pliny (*Natural History*, V. x. 54), who merely states that the cataracts were very noisy but does not claim that they caused deafness. A legend, nevertheless, seems to have grown up to this effect, for we find it mentioned in Bernardino Ramazzini's *Diseases of Workers (De Morbis Artificum)* of 1713, a work which is remarkable for being the first known study to mention industrial deafness.

head, and they could hear the rain rushing across the fields. In a moment it was drumming on the iron roof, with a deafening noise."

* Geography and climate provide vernacular keynotes to the soundscape. In the vast northern areas of the earth the sound of winter is that of frozen water—of ice and snow. During the winter 30 to 50 percent of the surface of the earth is covered by snow for some length of time, and 20 to 30 percent of the land surface is snow covered for more than six months annually. Ice and snow form the keynotes of the northern hinterland as surely as the sea is the keynote of maritime life.

Ice and snow are tuned by the temperature. Virginia Woolf at Blackfriars heard the snow "slither and flop to the ground." But in Scandinavia, when the giant Hymir of *The Elder Edda* returned from hunting:

Icicles clattered,
falling off his frozen beard.

In his poem *Orfano*, Giovanni Pascoli describes the slow flaking snow of Italy:

Lenta la neva fiocca, fiocca, fiocca.

The sound of snow in barely freezing Italy is very different from that at 30 degrees below zero in Manitoba or Siberia. As one moves to the interiors of the great northern continents the soft padded step begins to crunch, then to squeak—even painfully. Boris Pasternak in *Doctor Zhivago* tells how felt boots in the Russian winter make "the snow screech angrily at each step."

While seascapes have enriched the languages of maritime peoples, cold-climate civilizations have invented different expressions, of which the numerous Eskimo words for snow is the most celebrated though by no means the only instance. *The Illustrated Glossary of Snow and Ice* contains 154 terms for snow and ice in English and matches them with terms in Danish, Finnish, German, Icelandic, Norwegian, Russian, French-Canadian and Argentinian Spanish. Many of the expressions—for instance, *permafrost*, *icebound*, *pack ice*—are absent from the vocabularies of other languages.

Snow absorbs sound and northern literature is full of descriptions of the silence of winter.

In wintertime, the stillness, the absence of life or sound, is weird and oppressive. When the snow is on the ground, you may perceive indeed the footprints of animals, of birds, of deer, or occasionally of a bear, but you hear no sound, not a cry, not a whisper, not a rustle of a leaf. Sit down upon a fallen tree, and the silence becomes oppressive, almost painful. It is a relief even to hear at last the sough of the fall of the snow from the boughs of the cypress, the pine, or the yew, which stretch like dark horse-plumes high overhead.

When the snow is fresh and soft, even the traditional creaking of the runners of a sleigh are mute. ". . . we glided along over virgin snow which had come soft-footedly over night, in a motion, so smooth and silent as to suggest that wingless flight . . ." Even the cities were quiet.

Nor is anything quite like the silence of a northern city at dawn on a winter morning. Occasionally there was a hiss of whisper and a brushing against the windows and I knew it was snow, but generally there was nothing but a throbbing stillness until the street cars began running up Côte des Neiges and I heard them as though they were winds blowing through old drains.

* The destruction of the quiet northern winter by the jamming of snow-plows and snowmobiles is one of the greatest transmogrifications of the twentieth-century soundscape, for such instruments are destroying the "idea of North" that has shaped the temperament of all northern peoples and has germinated a substantial mythology for the world. The idea of North, at once austere, spacious and lonely, could easily throw fear into the heart (had not Dante refrigerated the center of his Hell?) but it could evoke intense awe, for it was pure, temptationless and silent. The technocrats of progress do not realize that by cracking into the North with their machinery, they are chopping up the integrity of their own minds, blacking the awe-inspiring mysteries with gas stations and reducing their legends to plastic dolls. As silence is chased from the world, powerful myths depart. That is to say, it becomes more difficult to appreciate the Eddas and sagas, and much that is at the center of Russian, Scandinavian and Eskimo literature and art.

The traditional winter of the North is remarkable for its stillness, but the spring is violent. At first there is a determined grinding of ice, then suddenly a whole river will rip down the center with a cannon shot and spring water will hurtle the ice downstream. When asked what he most loved about Russia, Stravinsky said, "The violent Russian spring that seemed to begin in an hour and was like the whole earth cracking."

Voices of the Wind Among the ancients, the wind, like the sea, was deified. In *Theogony*, Hesiod tells how Typhoeus, the god of the winds, fought with Zeus, lost, and was banished to Tartaros, in the bowels of the earth. Typhoeus was a devious god. He possessed a hundred snake heads,

and inside each one of these horrible heads
there were voices
that threw out every sort of horrible sound,
for sometimes
it was speech such as the gods
could understand, but at other
times, the sound of a bellowing bull,

proud-eyed and furious
beyond holding, or again like a lion
shameless in cruelty,
or again it was like the barking of dogs,
a wonder to listen to,
or again he would whistle
so the tall mountains re-echoed to it.

The story is remarkable because it touches on one of the most interesting aural illusions. The wind, like the sea, possesses an infinite number of vocal variations. Both are broad-band sounds and within the breadth of their frequencies other sounds seem to be heard. The deceptiveness of the wind is also the subject of a tempestuous description by Victor Hugo. You must read this aloud in the original to feel the pressure of the language.

Le vaste trouble des solitudes a une gamme; crescendo redoutable: le grain, la rafale, la bourrasque, l'orage, la tourmente, la tempête, la trombe: les sept cordes de la lyre des vents, les sept notes de l'abîme. . . . Les vents courent, volent, s'abattent, finissent, recommencent, planent, sifflent, mugissent, rient; frénétiques, lascifs, effrénés, prenant leurs aises sur la vague irascible. Ces hurleurs ont une harmonie. Ils font tout le ciel sonore. Ils soufflent dans la nuée comme dans un cuivre, ils embouchent l'espace, et ils chantent dans l'infini, avec toutes les voix amalgamées des clairons, des buccins, des oliphants, des bugles et des trompettes, une sorte de fanfare prométhéenne. Qui les entend écoute Pan.


The wind is an element that grasps the ears forcefully. The sensation is tactile as well as aural. How curious and almost supernatural it is to hear the wind in the distance without feeling it, as one does on a calm day in the Swiss Alps, where the faint, soft whistling of the wind over a glacier miles away can be heard across the intervening stillness of the valleys.

On the dry Saskatchewan prairie the wind is keen and steady.

The wind could be heard in a more persistent song now, and out along the road separating the town from the prairie it fluted gently along the wires that ran down the highway. . . . The night wind had two voices; one that keened along the pulsing wires, the prairie one that throated long and deep.

Treeless and open, the prairies are an enormous wind harp, vibrating incessantly with "the swarming hum of the telephone wires." In the more sheltered English countryside, the wind sets the leaves shimmering in diverse tonalities.

To dwellers in a wood almost every species of tree has its voice as well as its feature. At the passing of the breeze the fir-trees sob and moan no less distinctly than they rock; the holly whistles as it battles with



itself; the ash hisses amid its quiverings; the beech rustles while its flat boughs rise and fall. And winter, which modifies the note of such trees as shed their leaves, does not destroy its individuality.

Sometimes I ask students to identify moving sounds in the soundscape. "The wind," say some. "Trees," say others. But without objects in its path, the wind betrays no apparent movement. It hovers in the ears, energetic but directionless. Of all objects, trees give the best cues, shaking their leaves now on one side, now on the other as the wind brushes them.

Each type of forest produces its own keynote. Evergreen forest, in its mature phase, produces darkly vaulted aisles, through which sound reverberates with unusual clarity—a circumstance which, according to Oswald Spengler, drove the northern Europeans to try to duplicate the reverberation in the construction of Gothic cathedrals. When the wind blows in the forests of British Columbia, there is nothing of the rattling and rustling familiar with deciduous forests; rather there is a low, breathy whistle. In a strong wind the evergreen forest seethes and roars, for the needles twist and turn in turbine motion. The lack of undergrowth or openings into clearings keeps the British Columbia forests unusually free of animal, bird and insect life, a circumstance which produced an awesome, even sinister impression on the first white settlers. Emily Carr again:

The silence of our Western forests was so profound that our ears could scarcely comprehend it. If you spoke your voice came back to you as your face is thrown back to you in a mirror. It seemed as if the forest were so full of silence that there was no room for sounds. The birds who lived there were birds of prey—eagles, hawks, owls. Had a song bird loosed his throat the others would have pounced. Sober-coloured, silent little birds were the first to follow settlers into the West. Gulls there had always been; they began with the sea and had always cried over it. The vast sky spaces above, hungry for noise, steadily lapped up their cries. The forest was different—she brooded over silence and secrecy.

The uneasiness of the early settlers with the forest, and their desire for space and sunlight, soon produced another keynote sound: the noise of lumbering. At first it was the woodsman's axe that was heard just beyond the ever-widening clearing. Later it was the cross-saw, and today it is the snarl of the chainsaw that resounds throughout the diminishing forest communities of North America.

Once, much of the world was covered with forest. The great forest is foreign and appalling, quite inimical to intruding life. The few references to nature in the early epics, the sagas and Anglo-Saxon poetry testify to this fact; they are either brief or dwell on its horrors. Even as late as Carl Maria von Weber (1786–1826) the forest was a place of darkness and evil, and his opera *Der Freischütz* is a celebration of goodness over the forces of evil, whose home is the forest. The hunting horn, which Weber used so

brilliantly in his score, became the acoustic symbol by which the gloom of the forest was transpierced.

When man was fearful of the dangers of an unexplored environment, the whole body was an ear. In the virgin forests of North America, where vision was restricted to a few feet, hearing was the most important sense. The Leatherstocking Tales of Fenimore Cooper are full of beautiful and terrifying surprises.

... for, though the quiet deep of solitude reigned in that vast and nearly boundless forest, nature was speaking with her thousand tongues, in the eloquent language of night in a wilderness. The air sighed through ten thousand trees, the water rippled, and, at places, even roared along the shores; and now and then was heard the creaking of a branch, or a trunk, as it rubbed against some object similar to itself, under the vibrations of a nicely balanced body. . . . When he desired his companions, however, to cease talking, in the manner just mentioned, his vigilant ear had caught the peculiar sound that is made by the parting of a dried branch of a tree, and which, if his senses did not deceive him, came from the western shore. All who are accustomed to that particular sound will understand how readily the ear receives it, and how easy it is to distinguish the tread which breaks the branch from every other noise of the forest. . . . "Can the accursed Iroquois have crossed the river, already, with their arms, without a boat?"

The Miraculous Land "What is the sound of a tree falling in the woods with no one there to hear it?" asks a student who has studied philosophy. It would be unimaginative to reply that it sounds merely like a tree falling in the woods, or even that it makes no sound at all. As a matter of fact, when a tree crashes in a forest and knows that it is alone, it sounds like anything it wishes—a hurricane, a cuckoo, a wolf, the voice of Immanuel Kant or Charles Kingsley, the overture to *Don Giovanni* or a delicate air blown on a Maori nose-flute. Anything it wishes, from past or distant future. It is even free to produce those secret sounds which man will never hear because they belong to other worlds. . . .

The demystification of the elements, to which many modern sciences have contributed, has turned much poetry into prose. Before the birth of the earth sciences, man lived on an enchanted earth. From a third-century *Treatise on Rivers and Mountains*, perhaps by Plutarch, we learn of a stone in Lydia called argrophylax which looks like silver:

It is rather difficult to recognize it because it is intimately intermixed with the little spangles of gold which are found in the sands of the river. It has one very strange property. The rich Lydians place it under the threshold of their treasurehouses, and thus protect their stores of gold. For whenever any robbers come near the place, the stone gives

forth a sound like a trumpet and the would-be thieves, believing themselves to be pursued, flee and fall over precipices and thus come to a violent death.

In earlier times, all natural events were explained as miracles. An earthquake or a storm was a drama between the gods. When Sigurd killed the dragon Fafner, "the earth tremors were so violent that all the land round about shook." When the Giants stole Donner's thundering hammer

his hair stood upright, his beard shook with wrath,
wild for his weapon the god groped around.

There was bound to be a mighty storm. When Zeus led the Greek gods against the Titans

... the infinite great sea
moaned terribly
and the earth crashed aloud,
and the wide sky resounded. . . .
Now Zeus no longer held in his strength,
but here his heart filled
deep with fury, and now he showed
his violence entire
and indiscriminately. Out of the sky
and off Olympos
he moved flashing his fires incessantly,
and the thunderbolts,
the crashing of them and the blaze
together came flying, one after
another, from his ponderous hand,
and spinning whirls of inhuman
flame, and with it the earth,
the giver of life, cried out
aloud as she burned, and the vast forests
in the fire screamed. . . .

Donner and Zeus are still comprehensible gods even today. Thunder and lightning are among the most feared forces in nature. The sound is of great intensity and extreme frequency range, well outside the human scale of soundmaking. The gulf between men and the gods is great and often it has seemed as if a mighty noise was necessary to bridge it. Such a noise was that of the eruption of Vesuvius in A.D. 79 when, according to Dion Cassius's account, "the frightened people thought the Gyants were making war against heaven, and fancied they see the shapes and images of Gyants in the smoke, and heard the sound of their trumpets." The event was one of the soundmarks of Roman history.

Then the Earth began to tremble and quake, and the Concussions were so great that the ground seem'd to rise and boyl up in some places,

and in others the tops of the mountains sunk in or tumbled down. At the same time were great noises and sounds heard, some were subterranean, like thunder within the Earth; others above ground, like groans or bellowings. The Sea roar'd, The heavens rattled with a fearful noise, and then came a sudden and mighty crack, as if the frame of Nature had broke, or all the mountains of the Earth had faln down at once. . . .

Unique Tones Every natural soundscape has its own unique tones and often these are so original as to constitute soundmarks. The most striking geographical soundmark I have ever heard is in New Zealand. At Tikitere, Rotorua, great fields of boiling sulphur, spread over acres of ground, are accompanied by strange underground rumblings and gurglings. The place is a pustular sore on the skin of the earth with infernal sound effects boiling up through the vents.

The volcanoes of Iceland produce something of the same effect, but moving back from them one is surprised by the change of sound effects.

At the crater itself there are thunderous, explosive sounds and even near the crater you can feel the ground shaking. The fatal walls of lava (2-3 meters high) inch out killing everything in their path. They are almost silent, but not quite, for listening carefully you can hear delicate, brittle snaps in the crust—dry clicks, like the fracturing of glass, spread out over several miles. When it meets wet land the lava also hisses in a suffocating sort of way. Otherwise all is nearly silent.

Even where there is no life, there can be sound. The ice fields of the North, for instance, far from being silent, reverberate with spectacular sounds.

Within three or four miles of the glaciers you begin to hear the cracking of massive ice packs. It sounds like distant thunder and recurs every five or six minutes. As you get closer you can distinguish between the initial crack, like a huge pane of glass being cracked, followed by the rumble of falling ice, and then the whole is reverberated distantly in the mountains.

Rivers of glacier water form tunnels underneath the ice. The falling ice inside these tunnels, the running water and the movement of mud and rocks create a noise which is amplified many times by the hollow structure and hits the observer on the surface with great force.

Nor is it silent below the earth's surface as Heinrich Heine discovered when he visited the mines of the Harz Mountains in 1824.

I did not reach the deepest section . . . the point I reached seemed deep enough,—a constant rumbling and roaring, sinister groaning of machinery, bubbling of subterranean springs, water trickling down, ev-



When Krakatoa exploded on the night of August 26, 1883, the sound was reported heard over the area shaded here.

erywhere thick exhalations, and the miner's lamp flickering ever r
feebly in the lonesome night.

Apocalyptic Sounds Perhaps the universe was created sile
We do not know. The dynamics of the wonder which introduced
planet were without human ears to hear them. But the prophets exerc
their imagination over the event. "In the beginning was the Word,"
John; God's presence was first announced as a mighty vibration of co
sound. The prophets had a vision of the end also making a mighty n
References are especially plentiful in Judaic and Muslim prophecies

Howl ye; for the day of the Lord is at hand. . . . I will shake
heavens, and the earth shall remove out of her place, in the wra
the Lord of hosts, and in the day of his fierce anger.

By the din of the drums of resurrection they have pressed tight their two ears in terror.

They put their fingers in their ears against the thunderclaps, fearful of death.

In the imagination of the prophets the end of the world was to be signaled by a mighty din, a din more ferocious than the loudest sound they could imagine: more ferocious than any known storm, more outrageous than any thunder.

The loudest noise heard on this earth within living memory was the explosion of the caldera Krakatoa in Indonesia on August 26 and 27, 1883. The actual sounds were heard as far away as the island of Rodriguez, a distance of nearly 4,500 kilometers, where the chief of police reported: "Several times during the night . . . reports were heard coming from the eastward, like the distant roars of heavy guns. These reports continued at intervals of between three and four hours, until 3 p.m. on the 27th. . . ." On no other occasion have sounds been perceived at such great distances, and the area over which the sounds were heard on August 27 totaled slightly less than one-thirteenth of the entire surface of the globe.

It is as difficult for the human being to imagine an apocalyptic noise as it is for him to imagine a definitive silence. Both experiences exist in theory only for the living since they set limits to life itself, though they may become unconscious goals toward which the aspirations of different societies are drawn. Man has always tried to destroy his enemies with terrible noises. We shall encounter deliberate attempts to reproduce the apocalyptic noise throughout the history of warfare, from the clashing of shields and the beating of drums in ancient times right up to the Hiroshima and Nagasaki atom bombs of the Second World War. Since that time worldwide destruction has been lessened perhaps, but sonic destruction has not, and it is disconcerting to realize that the ferocious acoustical environment produced by modern civilian life derives from the same eschatological urge.

The Sounds of Life

Bird-Song One of the most beautiful miracles in all literature and mythology occurs in the midst of the brutalities of the *Saga of the Volsungs* when Sigurd, after slaying the dragon Fafner and tasting his blood, suddenly understands the language of the birds—a moment which Wagner used to great advantage in his opera *Siegfried*.

The language and song of the birds has been a subject of much study, though still today it is highly debatable whether the birds "sing" or "converse," in the customary sense of those terms. Nevertheless, no sound in nature has attached itself so affectionately to the human imagination as bird vocalizations. In tests in many countries we have asked listeners to identify the most pleasant sounds of their environment; bird-song appears repeatedly at or near the top of the list. And the history of effective bird imitations in music extends from Clément Janequin (d. c. 1560) to Olivier Messiaen (b. 1908).

Like birds themselves, bird vocalizations are of all types. A few are penetratingly loud. The call of the rufous scrubbird (*Atrichornis rufescens*) of Australia "is so intense that it leaves a sensation in one's ears." Other birds can at times dominate a soundscape because of their numbers. The bell minor bird (*Manorina melanophrys*) heard around Melbourne, with its persistent bell-like ring always sounding at approximately the same pitch (E₄–F₄–F₄), gives rise to a soundscape as dense as that created by cicadas, but different in that it maintains a certain spatial perspective; for the bird sounds issue from recognizable points, unlike the stridulations of the cicadas, which create a continual presence, seemingly without foreground or background.

In most parts of the world, bird-song is rich and varied, without being imperialistically dominating. Thus, St. Francis of Assisi adopted birds as

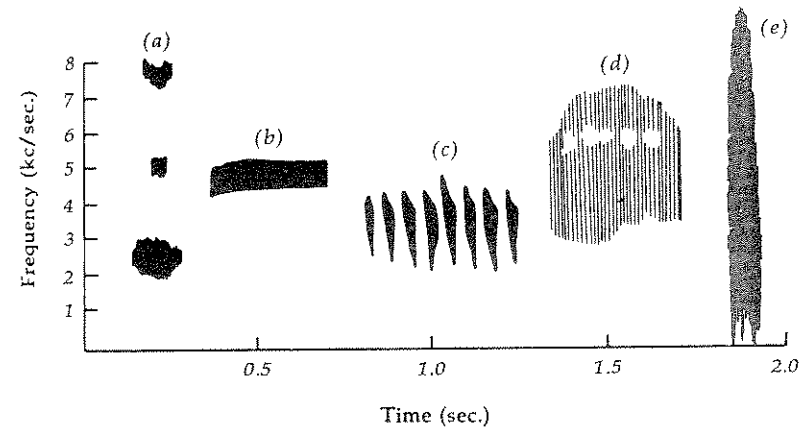
symbolic of gentleness in much the same manner as his Muslim contemporary Jalal-ud-din Rumi adopted the reed flute for his mystic sect as a symbol of humility and simplicity in opposition to the vulgarity and opulence of his time. The symbolic importance of bird-song for both music and the soundscape is a subject to be returned to later.

The vocalizations of birds have often been studied in musical terms. In the early days ornithologists constructed charming words in no man's language to describe their sounds.

Hawfinch	<i>Deak . . . waree-ree-ree Tchee . . . tchee . . . tur-wee-wee</i>
Greenfinch	<i>wah-wah-wah-wah-chow-chow-chow-chow-tu-we-we</i>
Crossbill	<i>jibb . . . chip-chip-chip-gee-gee-gee-gee</i>
Great Titmouse	<i>ze-too, ze-too, p'tsee-ée, tsoo-ée, tsoo-ée ching-see, ching-see, deeder-deeder-deeder, biple-be-wit-se-diddle</i>
Pied Flycatcher	<i>Tchéetle, tchéetle, tchéetle diddle-diddle-dée; tzit-tzit-tzit, trui, trui, trui</i>
Mistlethrush	<i>tre-wir-ri-o-ee; tre-wir-ri-o-ee-o; tre-we-o-wee-o-wee-o-wit</i>
Corncrake	<i>crex-crex, krek-krek, rerp-rerp</i>
Common Snipe	<i>tik-tik-tik-tuk-tik-tuk-tuk-chip-it; chick-chuck; yuk-yuk</i>

Musical notation was also used, and still is, by Olivier Messiaen, who has turned transcription into a complex art form. But despite the ingenuity of such work, bird vocalizations, with few exceptions, cannot be notated in musical terms. Many of the sounds uttered are not single tones but complex noises, and the high-frequency range and rapid tempo of many songs preclude their being transcribed in a notational system designed for the lower frequency ranges and slower tempi of human music. A more precise method of notation is that of the sound spectrograph and ornithologists are now using this method.

The structure of bird-song is often elaborate, for many birds are virtuoso performers. Some are also mimics. The Australian lyrebird is a superb mimic and its song often includes not only imitations of the songs of up to fifteen other species of birds, but also the neighing of horses, the sounds of cross-cut saws, car horns and factory whistles! The songs of many birds contain repetitive motifs, and though the function of the repetitions is often obscure, these melodic leitmotifs, variations and ex-



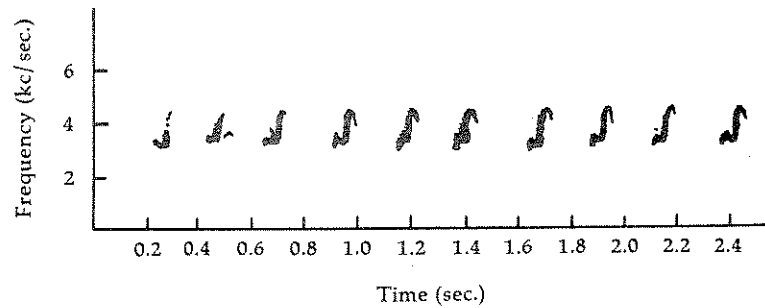
A sound spectrograph distinguishes clearly among bird notes having different tonal qualities: (a) nightingale note, very pure, with harmonics; (b) white-throated sparrow, clear whistle; (c) marsh warbler, musical trill; (d) clay-colored sparrow, toneless buzz; (e) budgerigar, noisy flight squawk.

pansions show certain similarities to melodic devices in music, such those employed by the troubadours, or by Haydn and Wagner. In so many details, the affective language of certain birds has been shown to bear relationship to the shapes of human vocal and musical expression. For instance, the distress notes of chicks are composed of descending frequencies only, while ascending frequencies predominate in pleasure calls. The same general contours are present in man's expressions of sadness and pleasure.

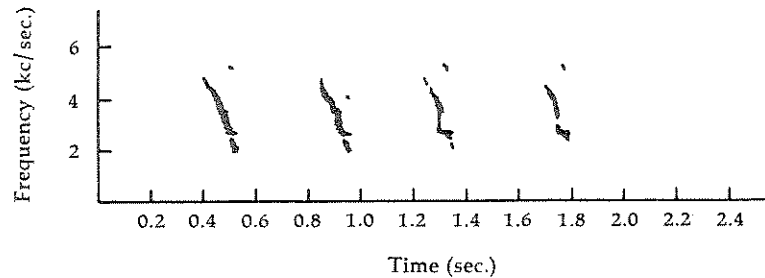
But despite these similarities, it is obvious that to whatever extent birds are deliberately communicating, it is for their own benefit rather than ours that their vocalizations are designed. Some men may puzzle over their codes, but most will be content merely to listen to the extravagant and astonishing symphony of their voices. Birds, like poems, should not merely be.

Bird Symphonies of the World Each territory of the earth will have its own bird symphony, providing a vernacular keynote as characteristic as the language of the men who live there. In Paris, Victor Hugo listened to the birds in the Luxembourg Gardens during May, the month of mating.

The quincunxes and flower-beds sent balm and dazzlement into the light, and the branches, wild in the brilliancy of midday, seem



A sound spectrograph of the pleasure notes (above) and distress call (below) of a three-day-old chick.



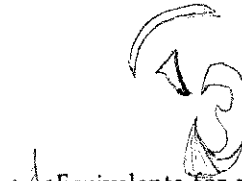
trying to embrace each other. There was in the sycamores a twittering of linnets, the sparrows were triumphal, and the woodpeckers crept along the chestnuts, gently tapping the holes in the bark. . . . This magnificence was free from stain, and the grand silence of happy nature filled the garden,—a heavenly silence, compatible with a thousand strains of music, the fondling tones from the nests, the buzzing of the swarms, and the palpitations of the wind.

Such rich polyphony is absent from the North American grasslands. On a plain near Pittsburgh a century ago, a German writer found "absolutely nothing. . . . Far and wide there was not a bird, nor a butterfly, nor the cry of an animal, not the hum of an insect." In the grasslands, sounds evaporated as if they had never been uttered. In the Russian Steppes, bird-song was also often isolated: "Everything might be dead; only above in the heavenly depths a lark is trilling and from the airy heights the silvery notes drop down upon adoring earth, and from time to time the cry of a gull or the ringing note of a quail sounds in the steppe." Occasionally only a single species is heard: "How enchanting this place was! Orioles kept making their clear three-note calls, stopping each time just long enough to let the countryside suck in the moist fluting sounds down to the last vibration." And in winter the birds blended with sleigh bells: "What could be more pleasant than to sit alone at the edge of a snowy field and listen to the chirping of the birds in the crystal silence of a winter's day, while somewhere far away in the distance sounded the bells of a passing troika—that melancholy lark of the Russian winter."

But in the jungles of Burma, such clarity was impossible to find, as Somerset Maugham discovered when he journeyed there. "The noise of the crickets and the frogs and the cries of the birds" produced a tremendous din, "so that till you become accustomed to it you may find it hard to sleep." "There is no silence in the East," Maugham concluded.

Ornithologists have not yet measured the statistical density of birds' singing in different parts of the world in sufficient detail for us to make objective comparisons—comparisons that would be helpful in mapping the complex rhythms of the natural soundscape. But ornithologists have done a lot of work on another subject of interest to soundscape researchers by classifying the types and functions of bird-song. Basically these are distinguished as follows:

- pleasure calls
- distress calls
- territorial-defense calls
- alarm calls
- flight calls
- flock calls
- nest calls
- feeding calls



★ Equivalents for many of these can be found in human soundmaking. To take some obvious examples: the territorial calls of birds are reproduced in automobile horn blowing, their alarm calls are reproduced in police sirens and their pleasure calls in the beach-side radio. In the territorial calls of birds we encounter the genesis of the idea of acoustic space, with which we will be much concerned later. The definition of space by acoustic means is much more ancient than the establishment of property lines and fences; and as private property becomes increasingly threatened in the modern world, it may be that principles regulating the complex network of overlapping and interpenetrating acoustic spaces as observed by birds and animals will again have greater significance for the human community also.

Birds may be distinguished by the sounds of their flight. The great slow clapping of the eagle's wing is different indeed from the tremulous shaking of the sparrow against the air. "In reality I did not see the birds, but I heard the fast whir of their wings," wrote Frederick Philip Grove after crossing the Canadian prairies at night. The startled exodus of a flock of geese on a northern Canadian lake—a brilliant slapping of wings on water—is a sound as firmly imprinted in the mind of those who have heard it as any moment in Beethoven.

Some birds have furtive wings: "The owl's flight is too silent, its wing is down-padded. You may hear its beautiful call, but you will not hear its flight, even though it circle right around your head in the dusk." Only those who live close to the land can distinguish birds by the sounds of their wings in flight. Urban man has retained this facility only for insects and aircraft.

One notes with sadness how modern man is losing even the names of the birds. "I heard a bird" is a frequent reply I receive following a listening walk in a city.

"What bird?"

"I don't know." Linguistic accuracy is not merely a matter of lexicography. We perceive only what we can name. In a man-dominated world, when the name of a thing dies, it is dismissed from society, and its very existence may be imperiled.

Insects The most easily recognized insect sounds for modern man are the most irritating. The mosquito, the fly and the wasp are easily distinguishable. The attentive listener can even tell the difference between male and female mosquitoes, the male usually sounding at a higher pitch. But only a specialist, such as a beekeeper, knows how to distinguish all the variants of the bee sound. Leo Tolstoy kept bees on his estate, and their sound is described in both *Anna Karenina* and *War and Peace*. "His ears were filled with the incessant hum in various notes, now the busy hum of the working bee flying quickly off, then the blaring of the lazy drone, and the excited buzz of the bees on guard protecting their property from the enemy and preparing to sting." When a queenless hive is dying, the beekeeper knows this too from the sound.

The flight of the bees is not as in living hives, the smell and the sound that meet the beekeeper are changed. When the beekeeper strikes the wall of the sick hive, instead of the instant, unanimous response, the buzzing of tens of thousands of bees menacingly arching their backs, and by the rapid stroke of their wings making that whirring, living sound, he is greeted by a disconnected, droning hum from different parts of the deserted hive. . . . Around the entrance there is now no

has been measured at up to 587 cycles per second would thus be the fundamentals of the resonance spectrum of harmonics is also often present, noise with little discernible sensation of pitch.

Another type of sound produced by so tapping the ground. Such is the case in several numbers of termites may hammer the ground warning device, at a rate of about ten times drumming noise. Julian Huxley writes: "I ran camp, near Lake Edward, in the Belgian Congo, clicking or ticking sound. A flashlight revealed from a column of termites which was crossing cover of darkness."

Still other insects, such as crickets and cicadas, produce their effects by drawing parts of the anatomy parts called files. The result of this filing action is in harmonics. The variety of these stridulatory sounds and by far the greatest number and variety of sounds are produced in this manner.

Among the loudest of insects are the cicadas. They means of ridged membranes or tymbals of the abdomen to the junction of the thorax and abdomen, a powerful muscle attached to the inner surface of the abdomen produces a series of clicks in the same manner as does the finger. The movement of the tymbals (about 4,500 c.p.s.) is greatly amplified by the bulk of the abdomen, so that the sound can be heard a mile away. In countries such as Australia an almost oppressive noise when in season (

preparing a corpse for burial, to assist the soul in disengaging itself from the body after death. The importance of the cicada in the soundscape of the South, as well as the symbolism it has provoked, has been overlooked since the comparatively recent northern drift of European and American civilization.

When they become part of the farmer's calendar, insects, like birds, arise out of the ambient soundscape to become signals for action: "May the fallows be worked for seed-time while the cicada overhead, watching the shepherds in the sun, makes music in the foliage of the trees."

The sounds of insects thus form rhythms, both circadian and seasonal, but entomologists have so far not measured these in sufficient detail for the soundscape researcher to be able to derive clear sound patterns from them. Difficulties have also been encountered in the analysis of the precise intensities and frequencies of insect sounds. This is because individual specimens are hard to isolate for recording purposes and also because the sounds insects make are generally complex frequency structures or broad-band noises, with harmonics often rising into the ultrasonic range. The locust *Schistocera gregaria* emits a sound of about 25 decibels when recorded very near the source, but the wing beat noise rises to 50 decibels when in flight. The flight noise of the desert locust has been measured as high as 67 decibels at a distance of 10 centimeters from the microphone. The sound output of many moths may be as little as 20 decibels quite near the source; while insects with hard wings and bodies, such as flies, bees and beetles, produce sounds up to 50 or 60 decibels. Since the human ear is more sensitive to sounds in the middle and upper frequency areas, insect sounds in the upper range (an average might be 400 to 1,000 c.p.s.) sound louder to the ear; but no human ear can hear the higher frequencies of the locust's call, which have been found to contain frequencies of 90,000 c.p.s.—that is, about two octaves higher than the human ear can detect.

For our purposes, however, one general feature of insect sounds is of interest. More perhaps than any other sound in nature, they give the impression of being steady-state or flat-line sounds. In part this may be an illusion, for many insect sounds are pulse modulated or varied in other subtle ways, but despite the "grainy" effect such modulations create, the impression with many insects is of a continuous, unvarying monotony. Like the straight line in space, the flat line in sound rarely occurs in nature, and we will not encounter it again until the Industrial Revolution introduces the modern engine.

The Sounds of Water Creatures The sounds of the living are uttered only within a thin shell around the earth's surface—much less than 1 percent of its radius in width. They are confined to the land surface, the sea a few score fathoms below the surface and the air immediately above. But within this relatively small area the diversity of sounds produced by living organisms is bewilderingly complex. It is not our purpose

here to survey all the sounds of nature and we will only touch on a few of the more unusual.

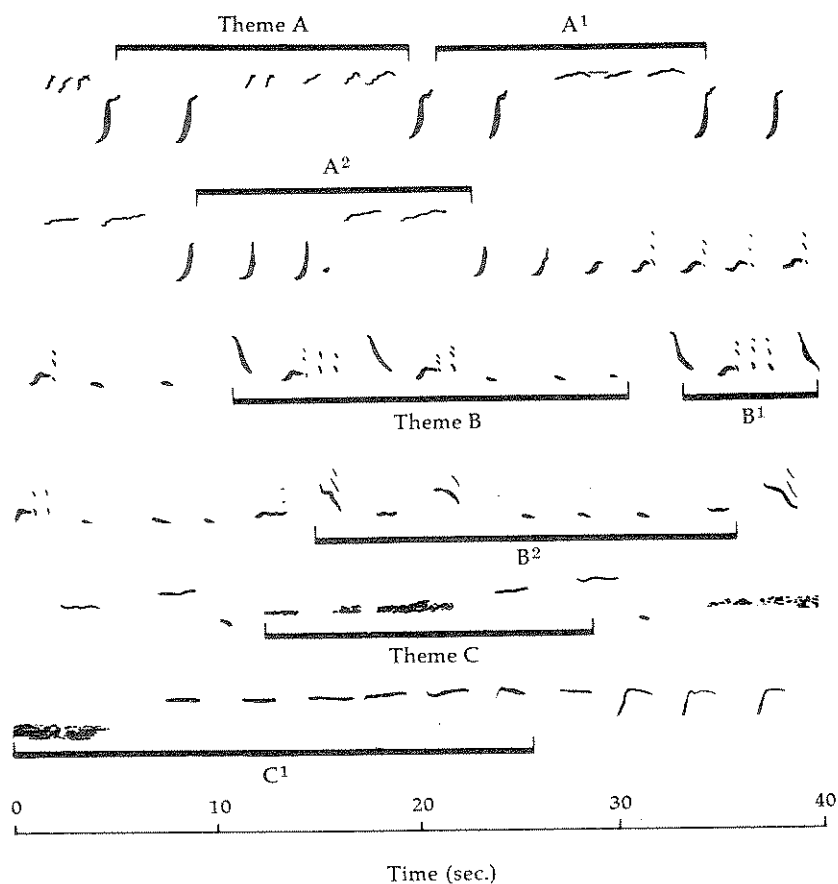
While many fish have no sound-producing mechanisms and no developed organs to hear sounds, many do produce unique sounds and some of these are very loud. Some fish, like sunfish or certain kinds of mackerel, make sounds by grinding or snapping their teeth. Others make sounds by expelling gas or by vibrating the gas bladder. One fish, the *Misgurnus*, makes a loudish noise by gulping air bubbles, and expelling them forcibly through its anus. At least thirty-four genera of fish produce sound by vibrating the gas bladder.

The songs of whales have been a subject of considerable recent study and some recordings of the humpback whale were produced commercially in 1970. The immediate and spectacular attention they received was partially attributable to the poignancy that the singers were an endangered species; but more than this, the songs were hauntingly beautiful. They also introduced many people, who had forgotten that the fish were their ancestors, to the echoing vaults of the ocean depths and united the feedback effects of popular electronic and guitar music with the multiple echoes of submarine acoustics—a subject to which we will return later. The songs of the humpback whale can be analyzed in musical terms. Each song seems to consist of a series of variations on constant themes or motifs, repeated differing numbers of times. Researchers are beginning to wonder if different herds or family groups of humpback whales may have different dialects.

Several of the crustaceans make sounds. The mantis shrimp (*Chloridella*) makes a loud noise by rubbing parts of its tail together, while the Florida spiny lobster makes a squeaking sound by rubbing a special flap on its antennae. Other crustaceans produce snapping, buzzing, hissing or even growling sounds which can often be heard on the seashore.

In the early spring, marshes in many parts of the world are filled with the sounds of frogs and toads. North America possesses a whole orchestra of performers: the narrow-mouthed toad bleats, the barking frog barks, the spring peeper chirps, the swamp cricket frog and the American toad trill, the least swamp cricket frog tinkles like an insect, the meadow frog rattles, the gopher frog snores, the green frog plays the banjo while the southern bullfrog belches.

When Julian Huxley visited America and heard the call of a bullfrog for the first time, he "refused to believe that it could proceed from a mere frog: it suggested a large and rather dangerous mammal, so loud it was and so low-pitched." Frogs are to North Americans what cicadas are to the Japanese or the Australians. The high resonant stridulations of some species such as the southern toad (*Bufo terrestris*) do indeed resemble cicadas, and sustained trills of the western toad (*Bufo cognatus*) have been recorded lasting as long as 33 seconds. But with the passing of the night, ardor wanes in the swamps; the voice of the bullfrog drops in pitch and the other instrumentalists gradually fade away.



The song of the humpback whale, consisting of distinct themes and variations.

The Sounds of Animals It is impossible to survey all the sounds produced by animals. I will mention only a few on our way to man himself. The carnivores produce the greatest range of individual sounds among animals, and many of these sounds, such as the roaring of lions, the howling of wolves or the laughing of hyenas, have such striking qualities that they impress themselves instantaneously on the human imagination. They present intense acoustic images. One hearing and they will never be mistaken or forgotten in a lifetime. They are among the great sounds that make history. Men who have heard tell of them only from the lips of the bard will still shudder at the thought of them.

Ludwig Koch recorded at least six distinct types of vocal expression in lions. Cubs yelp to obtain the attention of their parents and apparently yelp differently according to which parent they are soliciting. The maternal response is a rumbling sound with a certain grunting quality. There is a

"pleasure call," chiefly noticed among lions in captivity, which is initiated by the appearance of the keeper. The feeding sound, when the beast is alone and undisturbed, is a deep, gentle growl. Just when the prey is seized, lions produce a short and terrifying bark of ferocity. Finally there is the true roaring, usually heard at night, rarely heard during daylight. When roaring, lions will sometimes set their mouths close to the ground to assist the resonance and reverberation of their voices.

Lions do not purr. But leopards do and so do cheetahs, loudly. Aside from the hissing and spitting noises that most cats produce when angry, each cat has a repertoire of unique sounds. For instance, the puma has a loud wailing scream which Julian Huxley says could "be mistaken for that of a child," and the cubs produce a whistling note. Tigers are less noisy animals than lions but they do have a crazy love call, like that of ordinary cats, but greatly magnified.

The howling of wolves is haunting and isolating. Usually the leader of the pack will begin in solo; then the others will join in chorus, howling first, then descending to a ragged yelping bark. In the wolf call we encounter a vocal ritual which defines the territorial claim of the pack to an acoustic space—in just the same way as the hunter's horn lays claim to the forest or the church bell to the parish.

The sounds made by primates have always interested and amused man. They exist in great diversity, varying from whistling, screaming and chattering to grunting and roaring. Some are very loud. The howler monkey of South America has the strongest voice for its size of any mammal, and it is said to carry nearly five kilometers in open country and three kilometers in dense forest. The animal has a special bellows-like structure in its larynx to assist it in producing such a volume of sound. So far no exact measurements of these animals have been made. We measured Hoo-lack gibbons at a peak level of 110 dBA* outside their cages in the Vancouver Zoo. Julian Huxley tells of a friend having heard gibbons in the London Zoo from Oxford Circus, during quiet early morning hours. That would be a distance of nearly two kilometers.

The gorilla is the only primate to have discovered a nonvocal sound mechanism: it drums on its chest with its fist, producing a loud, hollow sound. This is done both when making vocal sounds and on its own. The gorilla has discovered the property of resonance, independent of the natural mechanism of the voice box. It seems forever on the verge of discovering the musical instrument without being able to make the transition from personal to artificial sound. So far as we know only man has done this.

*Decibels are more accurately designated by the addition of A, B or C to their abbreviation of dB. DBA indicates that the lower frequencies of the sound are discriminated against by a weighting network in the measuring instrument in a manner roughly equivalent to the human ear's discrimination against low-frequency sounds. DBB indicates less of such discrimination, while DBC represents nearly flat response to the sound being measured.

Man Echoes the Soundscape in Speech and Music

All the animal sounds mentioned in these pages fall into a few general categories. They may be either sounds of warning, mating calls, exchanges between mother and offspring, food sounds or social sounds. All of these are identifiable also in the vocal utterances of man, and the purpose of the remainder of this book will be to illustrate how they have been worked out in human communities throughout history.

To begin this we should draw attention to the fact that many of the signals communicated among animals—those of hunting, warning, fright, anger or mating—often correspond very closely in duration, intensity and inflection to many human expletives. Man also may growl, howl, whimper, grunt, roar and scream. This, together with the fact that man often shares the same geographic territories with the animals, obviously accounts for their frequent appearance in his folklore and rituals. In these rituals, such as the monkey dance of the Balinese, the voices of the animals are conjured by man in striking imitations. Marius Schneider writes:

One must have heard them to realize how extremely realistically aboriginals are able to imitate animal noises and the sounds of nature. They even hold "nature concerts" in which each singer imitates a particular sound (waves, wind, groaning trees, cries of frightened animals), "concerts" of surprising magnificence and beauty.

We are at that remote time in prehistory when the double miracle of speech and music occurred. How did these activities come about? It would be rash to insist that speech originated exclusively in the onomatopoeic mimicry of the natural soundscape. But that the tongue danced and still continues to dance with the soundscape, there can be no doubt. Poets and musicians have kept the memory alive, even if modern man has acquiesced into bespectacled muttering. Concerning the flattening out of human vocal style, the linguist Otto Jespersen has written:

Now, it is a consequence of advancing civilization that passion, or, at least, the expression of passion, is moderated, and we must therefore conclude that the speech of uncivilized and primitive man was more passionately agitated than ours, more like music or song. . . . Although we now regard the communication of thought as the main object of speaking. . . it is perfectly possible that speech has developed from something which had no other purpose than that of exercising the muscles of the mouth and throat and of amusing oneself and others by the production of pleasant or possibly only strange sounds.

Onomatopoeia mirrors the soundscape. Even with our advanced speech today we continue, in descriptive vocabulary, to cast back sounds

heard in the acoustic environment; and it may even be that the more sophisticated acoustic extensions of man—his tools and signaling devices—also continue, to some extent, to extend the same archetypal patternings. We have been discussing animals. Among the characters of his speech, man has numerous words to describe the animal sounds which are nearest to him. These are verbs, action words, and most of them are onomatopoeic still:

a dog *barks*
 a puppy *yelps*
 a cat *meows* and *purrs*
 a cow *moos*
 a lion *roars*
 a goat *bleats*
 a tiger *snarls*
 a wolf *howls*
 a mouse *squeaks*
 a donkey *brays*
 a pig *grunts* or *squeals*
 a horse *whinnies* or *neighs*

The English language reproduces only those animals with which English man, in his many migrations, has found himself in closest contact. But the English language knows no special words for those animals remote from English man: the galago, the mangabey, the llama or the tapir.

Some day a linguist ought to investigate those even more primeval human imitations, still found in folklore or children's rhymes, where we have a decisive attempt to duplicate the actual sounds of animals and birds. The differences between languages are interesting.

Dog: bow-wow (E), arf-arf (A), gnaf-gnaf (F), how-how (Ar), gaû-gaû (V), won-won (J), kwee-kwee (L).

Cat: purr-purr (E), ron-ron (F), schnurr-schnurr (G).

Sheep: baa-baa (E), méé-méé (Gr, J, M), maa'-maa' (Ar).

Bee: buzz (E), zûz-zûz (Ar), bun-bun (J), vû-vû (V).

Cockerel: cock-a-doodle-doo (E), cock-a-diddle-dow (Shakespeare), kikeriki (G), kokke-kokkō (J), kiokio (L).*

To this list one could add many other interesting words, for example, sneeze: kerchoo (A), atishoo (E), achum (Ar), cheenk (U), kakchun (J), ach-shi (V).

Such imitations are limited, of course, to the phonemes available for their reproduction in any given language; but such a study, if pursued

*Abbreviations for languages are: E—English, A—American, F—French, Ar—Arabic, V—Vietnamese, J—Japanese, G—German, Gr—Greek, M—Malay, U—Urdu, L—Lokéle tribe of the Congo.

diligently enough, might bring us closer to measuring how the critical features of natural sounds are perceived by different peoples.

In onomatopoeic vocabulary, man unites himself with the soundscape about him, echoing back its elements. The impression is taken in; the expression is thrown back in return. But the soundscape is far too complex for human speech to duplicate, and so it is in music alone that man finds that true harmony of the inner and outer world. It will be in music too that he will create his most perfect models of the ideal soundscape of the imagination.

THREE

The Rural Soundscape

The Hi-Fi Soundscape In discussing the transition from the rural to the urban soundscape, I will be using two terms: hi-fi and lo-fi. They need to be explained. A hi-fi system is one possessing a favorable signal-to-noise ratio. The hi-fi soundscape is one in which discrete sounds can be heard clearly because of the low ambient noise level. The country is generally more hi-fi than the city; night more than day; ancient times more than modern. In the hi-fi soundscape, sounds overlap less frequently; there is perspective—foreground and background: "... the sound of a pail on the lip of a well, and the crack of a whip in the distance"—the image is Alain-Fournier's to describe the economic acoustics of the French countryside.

The quiet ambiance of the hi-fi soundscape allows the listener to hear farther into the distance just as the countryside exercises long-range viewing. The city abbreviates this facility for distant hearing (and seeing) marking one of the more important changes in the history of perception.

In a lo-fi soundscape individual acoustic signals are obscured in an overdense population of sounds. The pellucid sound—a footstep in the snow, a church bell across the valley or an animal scurrying in the brush—is masked by broad-band noise. Perspective is lost. On a downtown street corner of the modern city there is no distance; there is only presence. There is cross-talk on all the channels, and in order for the most ordinary sounds to be heard they have to be increasingly amplified. The transition from the hi-fi to the lo-fi soundscape has taken place gradually over many centuries and it will be the purpose of several of the following chapters to measure how it has come about.

In the quiet ambiance of the hi-fi soundscape even the slightest disturbance can communicate vital or interesting information: "He was dis-

turbed in his meditation by a grating noise from the coachhouse. It was the vane on the roof turning round, and this change in the wind was the signal for a disastrous rain." The human ear is alert, like that of an animal. In the stillness of the night a paralyzed old lady in a story by Turgenev can hear the moles burrowing underground. "That's when it's good," she reflects; "no need to think." But poets do think about such sounds. Goethe, his ear pressed to the grass: "When I hear the humming of the little world among the stalks, and am near the countless indescribable forms of the worms and insects, then I feel the presence of the Almighty, Who created us in his own image. . . ."

From the nearest details to the most distant horizon, the ears operated with seismographic delicacy. When men lived mostly in isolation or in small communities, sounds were uncrowded, surrounded by pools of stillness, and the shepherd, the woodsman and the farmer knew how to read them as clues to changes in the environment.

Sounds of the Pasture The pasture was generally quieter than the farm. Virgil describes it well:

. . . Hyblaeon bees coax you with a gentle humming through the gates of sleep . . . you will have the vine-dresser singing to the breezes, while all the time your dear full-throated pigeons will be heard, and the turtle-dove high in the elm will never bring her cooing to an end.

Shepherds may, as Lucretius suggests, have got the hint of singing and whistling from the sound of the wind. Or it may have been from the birds. Virgil says that Pan taught the shepherd "how to join a set of reeds with wax" as a means of conversing with the landscape.

Sweet is the whispered music of yonder
pinetree by the springs,
goatherd, and sweet too thy piping. . . .
Sweeter, shepherd, falls thy song
than yonder stream that tumbles
plashing from the rocks.

Shepherds piped and sang to one another to while away the lonely hours, as the dialogue form of Theocritus's *Idylls* and Virgil's *Eclogues* shows us; and the delicate music of their songs forms perhaps the first and certainly the most persistent of the man-made sonic archetypes. Centuries of piping have produced a referential sound that still suggests the serenity of the pastoral landscape clearly, though many traditional literary images and devices are beginning to slip away. The solo woodwind always paints the pastorate, and this archetype is so suggestible that even such a grandiloquent orchestrator as Berlioz slims his orchestra to a duet between solo English horn and oboe to draw us gently into the country (*Symphonic Fantastique*, third movement).

In the still landscape of the country, the clear dulcet tones of the

shepherd's pipe took on miraculous powers. Nature listened, then responded sympathetically: "The music struck the valleys and the valleys tossed it to the stars—till the lads were warned to drive home and to count their sheep, by Vesper, as he trod unwelcome into the listening sky." Theocritus was the first poet to make the landscape echo the sentiments of the shepherd's pipes, and pastoral poets have been copying him ever since.

. . . Practice country songs on a light shepherd's pipe . . .
teaching the woods to echo back the charms of Amaryllis

says Virgil. For a recurrence of this miraculous power in music, we must wait until the nineteenth-century romanticists.

The pastoral soundscape our poets have been describing continued on into the nineteenth century. Alain-Fournier describes it in France: "Now and then the distant voice of a shepherdess, or of a boy calling to a companion from one clump of firs to another, had risen in the great calm of the frozen afternoon." The juncture between town and pasture is attractively captured in this description by Thomas Hardy:

The shepherd on the east hill could shout out lambing intelligence to the shepherd on the west hill, over the intervening town chimneys, without great inconvenience to his voice, so nearly did the steep pastures encroach upon the burghers' backyards. And at night it was possible to stand in the very midst of the town and hear from their native paddocks on the lower levels of greensward the mild lowing of the farmer's heifers, and the profound, warm blowings of breath in which those creatures indulge.

Sounds of the Hunt A quite different type of sonic archetype has come down to us from the hunt, for the horn transpierces the gloom of the forest wilderness with heroic and bellicose tones. Almost all cultures seem to have employed some type of horn in association with warfare and the hunt. The Romans used a hooped horn of conical tube as a signaling instrument for their armies and there are numerous references to it in Dion, Ovid and Juvenal; but when Rome declined, the art of smelting brass seems to have disappeared and with it went a special sound. When "Sigmund blew the horn that had been his father's, and urged on his men," it was an animal's horn that he blew. The same type appears in the pages of the *Chanson de Roland*. But by the fourteenth century, the skill of smelting brass had been recovered and brilliant metallic tones began to echo across Europe.

By the sixteenth century the *cor de chasse* had taken on something like a definitive character and it is this instrument that gained special significance in the European soundscape, a significance that has lasted until

recent times. In the days when hunting was popular, the countryside can scarcely have ever been free of horn calls, and the elaborate code of signals must have been widely known and understood.

As the *cor de chasse* was an open horn possessing only a few natural harmonics, its various signals possessed more distinctive rhythmic than melodic character. The various codes that have been preserved are of considerable complexity and, of course, vary greatly from country to country. They may be classified as follows:

1. brief calls intended to cheer on the hounds, to give warning, to call for aid or to indicate the circumstances of the hunt;
2. a special fanfare for each animal (several for the stag, depending on his size and antlers);
3. fancy tunes to begin or close a hunt, or sounded as special signs of joy.

Tolstoy has given us a good account of the festive nature of the hunt in Russia.

The hounds' cry was followed by the bass note of the hunting cry for a wolf sounded on Danilo's horn. The pack joined the first three dogs, and the voices of the hounds could be heard in full cry with the peculiar note which serves to betoken that they are after a wolf. The whippers-in were not now hallooing, but urging on the hounds with cries of "Loo! loo! loo!" and above all the voices rose the voice of Danilo, passing from a deep note to piercing shrillness. Danilo's voice seemed to fill the whole forest, to pierce beyond it, and echo far away in the open country.

A contemporary recollection by a young woman shows how strong the heritage of the hunt still is in northern Germany.

It was still quite dark when one of the hunters ceremonially opened the hunt with a fanfare on his horn. Unless the stretch of land to be hunted was an open field, the only method of communication between hunters and beaters was through horn signals. During the formation, in which the hunters enclosed the area on three sides and the beaters on one, everyone was very quiet so as not to disturb the animals. The silence was broken by a horn signal, which was answered by a terrible, shrill toot from a single-pitch trumpet (which looked like a toy trumpet) blown by one of the beaters. We started to attack the land in front of us with rattles, pots, pans, noisemakers of every sort and shouts in all modulations. Frightened by the noise, every living creature was stirred up and chased out of its shelter in the direction of the hunters. As children we just loved to make the loudest noises. . . .

At the end of the day, everybody gathered around and listened to the horn player blowing the fanfares for the dead animals. There

was a signal for every animal, and I remember that the one for the fox was the most beautiful, whereas the one for the rabbit was quite short and simple. At the end of the day, in the evening darkness, the hunt was ended by a cheerful, almost triumphant fanfare.

The hunting horn presents us with a sound of great semantic richness. On one level its signals provide a code which all participants understand. On another level it takes on a symbolical significance, suggesting free spaces and the natural life of the country. I also spoke of the hunting horn as an archetypal sound. Only sound symbols which are carried forward century after century qualify for this distinction, for they knit us with ancient ancestral heritages, providing continuity at the deepest levels of consciousness.

The Post Horn Another sound of similar character which was also ubiquitous on the European scene was the post horn. It too persisted for centuries, for it began in the sixteenth century when the administration of the post was taken over by the family of Thurn and Taxis, and as the postal routes extended from Norway to Spain so did the horn calls (Cervantes mentions them). In Germany the last post horns were heard in 1925. In England the post horn was still in use in 1914 when the London-to-Oxford mail was conveyed by road on Sundays. In Austria, horns were also heard until after the First World War, and even today no one is permitted to carry or sound a post horn, thereby enhancing the sentimental symbolism of the instrument (Article 24 of the Austrian Postal Regulations, 1957).

The post horn also employed a precise code of signals to indicate different types of mail (express, normal, local, packages) as well as calls for arrival, departure and distress, and indications for the number of carriages and horses—in order that the changing stations might receive advance warning. In Austria a recruit was given six months to learn the signals and if he failed, he was dismissed.

Through the narrow streets and across the country landscape the post horn was heard, in the villages and the alleys of cities, at the gates of castles above and by the monasteries below in the valleys—everywhere its echo was known, everywhere it was greeted joyfully. It touched all the strings of the human heart: hope, fear, longing and homesickness—it awakened all feelings with its magic.

Thus the symbolism of the post horn worked differently from that of the hunting horn. It did not draw the listener out into the landscape but, working in reverse, brought news from far away to home. It was centripetal rather than centrifugal in character and its tones were never more pleasant than when it approached the town and delivered its letters and parcels to the expectant.

Sounds of the Farm By comparison with the quiet life of the pasture and the shrill celebrations of the hunt, the soundscape of the farm provides a general turmoil of activities. Each of the animals has its own rhythm of sound and silence, of arousal and repose. The cock is the eternal alarm clock, and the dog's bark is the original telegraph—for one learns when acreage has been invaded by a stranger from the dog's barking, passed from farm to farm.

Many of the sounds of the farm are heavyweight, like the slow, tramping hooves of cattle and draft horses. The farmer's feet, too, move slowly. Virgil tells us of "ponderous-moving wagons," of threshers and "the immoderate weight of the harrow." He also gives us an interesting acoustic picture of the Italian farmhouse after dark.

One farmer stays awake and splits up wood
For torches with his knife. And all the while
His wife relieves her lengthy task with song,
And runs the squeaky shuttle through the warp,
Or boils down sweetened wine-must over flame,
And skims with leaves the bubbling cauldron's wave.

Context Some of the sounds of the farm have changed little over the centuries, particularly those suggesting the commotion of heavy work; and the voices of animals too have given a consistency of tone to the farm soundscape. But there are also vernaculars. From my own youth I recall a few. The first that comes to mind is the churning of butter. As the churn was pumped for half an hour or more, an almost imperceptible change in tone and texture occurred as the slopping cream gradually turned to butter. The hand-operated pump, also on the decline, now snaps into memory as a soundmark of my youth, though at the time I listened to it carelessly. There were others too, like the ubiquitous cackling of geese, or the swoosh and bang of the screen door. In the winter there was the heavy stamping of snow boots in the front hall, or the scream of sleigh runners over hard-packed country roads. In the silence of the winter night there might be a sudden crack as a nail sprang from a board in the intense cold. And there were the deep pedal tones that came again and again in the chimney flue during night winds. Then there were the regular rhythms like the gong which brought us in for dinner, or the whirring of the windmill, which the women put in motion at four o'clock each day to pump water for the returning cattle.

I have defined keynote as a regular sound underpinning other more fugitive or novel sound events. The keynotes of the farm were numerous, for farming is a life with little variation. Keynotes may influence the behavior of the people or set up rhythms that are carried over into other aspects of life. One example will have to suffice. In the Russia of Tolstoy, the peasants kept whetstones in little tin boxes strapped to their waists,

and the rhythmic rattling of these boxes formed a vernacular keynote during the haying months.

The grass cut with a juicy sound, and was at once laid in high, fragrant rows. The mowers from all sides, brought closer together in the short row, kept urging one another on to the sound of rattling tin boxes and clanging scythes, and the hiss of the whetstones sharpening them, and happy shouts.

Returning from the fields, the rhythms of the day's work were extended into song.

The peasant women, with their rakes on their shoulders, gay with bright flowers, and chattering with ringing, merry voices, walked behind the cart. One wild untrained female voice broke into a song, and sang it alone through a verse, and then the same verse was taken up and repeated by half a hundred strong, healthy voices of all sorts, coarse and fine, singing in unison . . . the whole meadow and distant fields all seemed to be shaking and singing to the measures of this wild, merry song with its shouts and whistles and clapping.

Russia is, of course, not the only place where the rhythms of work have been carved into folk song, but folk song suggested by work always carries a heavy stress. This becomes clear if we compare the music of the farm laborer with the levity of the shepherd's pipes. I do not think it would be going too far to suggest that man only discovers lilt and lyricism in music to the extent that he frees himself from physical labor.

Noise in the Rural Soundscape The rural soundscape was quiet, but it experienced two profound acoustic interruptions: the noise of war and the "noise" of religion.

Virgil, whose life was frequently interrupted by the Roman wars, laments these intrusions into the pastoral life.

Such was the life that golden Saturn
lived upon earth:
Mankind had not yet heard the bugle
bellow for war,
Nor yet heard the clank of the sword
on the hard anvil. . . .

To Virgil the sounds of war were brass and iron, and the acoustic image remains intact to this day, though to it must be added the explosions of gunpowder from the fourteenth century onward.

The world's literature is full of battles. Poets and chroniclers seem always to have been amazed at the noise they made. The Persian epic poet Ferdowsi is typical.

At the shouts of the Divs and the noise made by the black dust rising, the thunder of drums and the neighing of war-horses, the mountains were rent and the earth cleft asunder. So fierce a combat had been seen

by no man before. Loud was the clash of the battle-axes and the clatter of swords and of arrows; the warriors' blood turned the plain into marsh, the earth resembled a sea of pitch whose waves were formed of swords, axes and arrows.

Armies decorated for battle presented a visual spectacle, but the battle itself was acoustic. To the actual noise of clashing metal, each army added its battlecries and drumming in an attempt to frighten the enemy. Noise was a deliberate military stratagem; the ancient Greek generals advocated it: "One should send the army into battle shouting, and sometimes on the run, because their appearance and shouts and the clash of arms confound the hearts of the enemy." From Tacitus comes an interesting description of a German war chant called *baritus*:

By the rendering of this they not only kindle their courage, but, merely by listening to the sound, they can forecast the issue of an approaching engagement. For they either terrify their foes or themselves become frightened, according to the character of the noise they make upon the battlefield; and they regard it not merely as so many voices chanting together but as a unison of valour. What they particularly aim at is a harshly intermittent roar; and they hold their shields in front of their mouths, so that the sound is amplified into a deeper crescendo by the reverberation.

When the Moors attacked the Castilians in 1085, they employed African drummers who, according to the *Poema del Cid*, had never before been heard in Europe. The noise terrified the Christians but "the good Cid Campeador" pacified his army, promising to capture the drums and deliver them to the Church. The association of noise with both warfare and religion was not fortuitous, and we shall frequently find reason throughout this book for coupling them together. Both activities are eschatological, and undoubtedly an awareness of this fact lies behind the peculiar bending of the Latin word *bellum* (war) into the Low German and Old English *bell(e)* (meaning "to make a loud noise") before its final imprint on the instrument which gave Christianity its acoustic signal.

One further example will reinforce the relationship between religion, warfare and noise, for it is a description of a religious battle which seems to have been fought by sound alone.

It was at three o'clock on August 14th, 1431, that the crusaders, who were encamped in the plain between Domazlice and Horsuv Tyn, received the news that the Hussites, under the leadership of Prokop the Great, were approaching. Though the Bohemians were still four miles off, the rattle of their war-wagons and the song, "All ye warriors of God," which their whole host was chanting, could already be heard. The enthusiasm of the crusaders evaporated with astounding rapidity. . . . The German camp was in utter confusion. Horsemen were streaming off in every direction, and the clatter of empty wagons

being driven off almost drowned the sound of that terrible singing. . . . So ended the Bohemian crusade.

The point I am trying to make with the diverse descriptions of these pages is that while the original soundscape was generally quiet, it was deliberately punctuated by the aberrational noises of war. The other occasion for loud noise was religious celebration. It was then that the rattles and drums and sacred bones were brought out and sounded vigorously to produce what for elementary man was certainly the biggest acoustic event of civil life. There is no doubt that these activities were a direct imitation of the frightening sounds of nature already studied, for they too had divine origins. Thunder was created by Thor or Zeus, storms were divine combats, cataclysms were divine punishments. We recall that the word of God originally came to man through the ear, not the eye. By gathering his instruments and making an impressive noise, man hoped in his turn to catch the ear of God.

Sacred Noise and Secular Silence Throughout the several hundred pages of his *Mythologiques II*, the anthropologist Lévi-Strauss has developed an argument for placing noise in parallel with the sacred and silence in the same relationship with the profane.* The Lévi-Strauss argument, regarded from the vantage point of the modern noise-riddled world, may appear obscure; but soundscape studies help to clarify it. The profane world was, if not silent, quiet. And if we think of "noise" in its less pejorative sense as any big sound, the coupling of noise and sacred is easier to interpret.

Throughout this book we are going to discover that a certain type of noise, which we may now call Sacred Noise, was not only absent from the lists of proscribed sounds which societies from time to time drew up, but was, in fact, quite deliberately invoked as a break from the tedium of tranquility. Samuel Rosen confirmed this when he studied the acoustic climate of a quiet tribal village in the Sudan.

In general, the sound level in the villages is below 40 db on the C scale of the sound level meter except occasionally at sunrise or soon thereafter when a domestic animal such as a rooster, lamb, cow or dove makes itself heard. During six months of the year, heavy rains occur about three times a week with one or two loud claps of thunder. A few men engage in some productive activities such as beating palm fronds with a wooden club. But the absence of hard reverberating surfaces, such as walls, ceilings, floors and hard furniture, etc., in the

*I must warn the reader that Lévi-Strauss informs me that the Sacred Noise theory developed in this book bears "little relationship, if any" to what he has written. Nevertheless, I must give him credit for igniting my imagination.

vicinity apparently accounts for the low intensity levels measured on the sound level meter: 73–74 db at the worker's ear.

The loudest noises (over 100 decibels) were encountered when the villagers were singing and dancing, which occurred for the most part "over a two-month period celebrating the spring harvest" (i.e. a religious festival).

Throughout Christendom the divine was signaled by the church bell. It is a later development of the same clamorous urge, which had earlier been expressed in chanting and rattling. The interior of the church, too, reverberated with the most spectacular acoustic events, for to this place man brought not only his voice, raised in song, but also the loudest machine he had till then produced—the organ. And it was all designed to make the deity listen.

Aside from the spectacular celebrations of warfare and religion, rural and even town life was tranquil. There are many towns still, the world over, where life moves uneventfully, almost by stealth. Poor towns are quieter than prosperous towns. I have visited towns in Burgenland (Austria) where the only sound at midday is the flapping of storks in their chimney nests, or dusty towns in Iran where the only motion is the occasional swaying walk of a woman carrying water while the children sit mutely in the streets. Peasants and tribesmen the world over participate in a vast sharing of silence.



From Town to City

The two great turning points in human history were the change from nomadic to agrarian life, which occurred between ten and twelve thousand years ago, and the transition from rural to urban life, which has occupied the most recent centuries. As this later development has occurred, towns have grown into cities and cities have swollen out to cover much that was formerly rural land.

In terms of the soundscape, a practical division of developing urbanization is, as in so many other matters as well, the Industrial Revolution. In the present chapter I will consider only the pre-industrial period, leaving the sequel to be taken up in Part Two of the book. A proper consideration of pre-industrial town and city life would need a much more thorough treatment than it can be given here. Town and city life diverged greatly before the Industrial and Electric revolutions began to level it, but I can only hope to hint at some of the variations, while dealing particularly with the European scene. There is a practical reason for this limitation: the accessibility of documentation.

Looking at the profile of a medieval European city we at once note that the castle, the city wall and the church spire dominate the scene. In the modern city it is the high-rise apartment, the bank tower and the factory chimney which are the tallest structures. This tells us a good deal about the prominent social institutions of the two societies. In the soundscape also there are sounds that obtrude over the acoustic horizon: keynotes, signals and soundmarks; and these types of sounds must accordingly form the principal subject of our investigation.

Making God Listen The most salient sound signal in the Christian community is the church bell. In a very real sense it defines the

community, for the parish is an acoustic space, circumscribed by the range of the church bell. The church bell is a centripetal sound; it attracts and unifies the community in a social sense, just as it draws man and God together. At times in the past it took on a centrifugal force as well, when it served to frighten away evil spirits.

Church bells appear to have been widespread in Europe by the eighth century. In England they were mentioned by The Venerable Bede at the close of the seventh century. Of their gigantic presence, Johan Huizinga writes in *The Waning of the Middle Ages*:

One sound rose ceaselessly above the noises of busy life and lifted all things unto a sphere of order and serenity: the sound of bells. The bells were in daily life like good spirits, which by their familiar voices, now called upon the citizens to mourn and now to rejoice, now warned them of danger, now exhorted them to piety. They were known by their names: big Jacqueline, or the bell Roland. Every one knew the difference in meaning of the various ways of ringing. However continuous the ringing of the bells, people would seem not to have become blunted to the effect of their sound.

Throughout the famous judicial duel between two citizens of Valenciennes, in 1455, the big bell, "which is hideous to hear," says Chastellain, never stopped ringing. What intoxication the pealing of the bells of all the churches, and of all the monasteries of Paris, must have produced, sounding from morning till evening, and even during the night, when a peace was concluded or a pope elected.

Throngs of pitched bells or carillons were especially popular in the Netherlands, where they irritated Charles Burney on his European tours. "The great convenience of this kind of music," Burney wrote, "is that it entertains the inhabitants of a whole town, without giving them the trouble of going to any particular spot to hear it." At a suitable distance, however, church bells could be powerfully evocative, for the strident noises of the clappers are lost and they are given a legato phrasing which wind currents or water will modulate dynamically, so that even a few simple and not very good bells can provide hours of pleasant listening. Perhaps no sound benefits more from distance and atmosphere. Church bells form a sound complement to distant hills, wrapped in blue-gray mist. Traveling a similar route to that of Charles Burney, yet keeping to the rivers and canals and avoiding the cities, Robert Louis Stevenson experienced church bells transformed in this way.

On the other side of the valley a group of red roofs and a belfry showed among the foliage. Thence some inspired bell-ringer made the afternoon musical on a chime of bells. There was something very sweet and taking in the air he played; and we thought we had never heard bells speak so intelligibly, or sing so melodiously, as these. . .

There is so often a threatening note, something blatant and metallic, in the voice of bells, that I believe we have fully more pain than pleasure from hearing them; but these, as they sounded abroad, now high, now low, now with a plaintive cadence that caught the ear like the burthen of a popular song, were always moderate and tunable, and seemed to fall in with the spirit of still, rustic places, like the noise of a waterfall or the babble of a rookery in spring.

Wherever the missionaries took Christianity, the church bell was soon to follow, acoustically demarking the civilization of the parish from the wilderness beyond its earshot.* The bell was an acoustic calendar, announcing festivals, births, deaths, marriages, fires and revolts. In Salzburg, from a small ancient hotel room, I listened to the innumerable bells ring slowly, just a shade slower than what one would expect, producing little tensions in the mind as anticipation fell a fraction of a second short of reality. And at San Miguel de Allende in Mexico I remember watching the convicts in the belfry, putting the giant bells into motion by tugging at their rims with heavy, awkward movements.

The Sound of Time It was during the fourteenth century that the church bell was wedded to a technical invention of great significance for European civilization: the mechanical clock. Together they became the most inescapable signals of the soundscape, for like the church bell, and with even more merciless punctuality, the clock measures the passing of time audibly. In this way it differs from all previous means of telling time—water clocks, sand clocks and sundials—which were silent.

The church clock struck eleven. The air was so empty of other sounds that the whirr of the clock-work immediately before the strokes was distinct, and so was also the click of the same at their close. The notes flew forth with the usual blind obtuseness of inanimate things—flapping and rebounding among walls, undulating against the scattered clouds, spreading through their interstices into unexplored miles of space.

The clock bell had a great advantage over the clock dial, for to see the dial one must face it, while the bell sends the sounds of time rolling out uniformly in all directions. No European town was without its many clocks.

Other clocks struck eight from time to time—one gloomily from the gaol, another from the gable of an almshouse, with a preparative creak of machinery, more audible than the note of the bell; a row of tall,

*Typically, while both the Muslim and Christian faiths have important signaling devices, the Jewish faith, which is not missionizing, does not.

varnished case-clocks from the interior of a clock-maker's shop joined in one after another just as the shutters were enclosing them, like a row of actors delivering their final speeches before the fall of the curtain; then chimes were heard stammering out the Sicilian Mariners' Hymn; so that chronologists of the advanced school were appreciably on their way to the next hour before the whole business of the old one was satisfactorily wound up.

imposing conformity ★ Clocks regulated the movements of the town with militant imperiousness. Occasionally they rose to the status of soundmarks. (How well I remember the erratic pentatonic descent of the clock bell in the Kremlin wall—the only whimsey about the place.) Affectionately regarded by the inhabitants, some old clocks are even specifically exempted from anti-noise legislation, as is the case with the post office clock in Brantford (Ontario).

The historian Oswald Spengler believed that it was the mechanical clock that gave Europe (and particularly Germany) its sense of historical destiny.

Amongst the Western peoples, it was the Germans who discovered the mechanical *clock*, the dread symbol of the flow of time, and the chimes of countless clock towers that echo day and night over West Europe are perhaps the most wonderful expression of which a historical world-feeling is capable.

clock
time ★ The association of clocks and church bells was by no means fortuitous; for Christianity provided the rectilinear idea of the concept of time as progress, albeit spiritual progress, with a starting point (Creation), an indicator (Christ) and a fateful conclusion (the Apocalypse). Already in the seventh century it was decreed in a bull of Pope Sabinianus that the monastery bells should be rung seven times each day, and these punctuation points became known as the canonical hours. Time is always running out in the Christian system and the clock bell punctuates this fact. Its chimes are acoustic signals, but even at a subliminal level the incessant rhythm of its ticking forms a keynote of unavoidable significance in the life of Western Man. Clocks reach into the recesses of night to remind man of his mortality.

mill ★ *Other Focal Points* Clocks are centripetal sounds; they unify and regulate the community. But they are not the only centripetal sounds. From early times in agricultural territories, the mill was a prominent institution at the center of town life, and its sound was as familiar as the voices of the inhabitants themselves. In Ecclesiastes (12: 3-5) the author sketches a sinister soundscape when "the women grinding the meal cease to work . . . when the noise of the mill is low, when the chirping of the sparrow grows faint and the songbirds fall silent." Water wheels used for milling

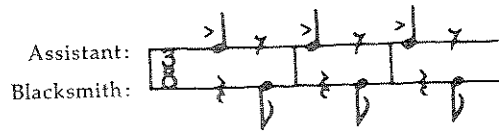
were recorded in Rome as far back as the first century B.C., and while many other Roman arts disappeared, only to be rediscovered in the late Middle Ages, the water mill survived, for there are frequent references to it throughout early medieval literature.

Grinding grain was not the only work done by the mills, for by the early fourteenth century there were also papermills and sawmills. By then mills also turned grinding machines for the armorers and later they ran the hammering and cutting machines of ironworks. This is why so many towns were founded on the banks of rivers or streams, where water power was available.

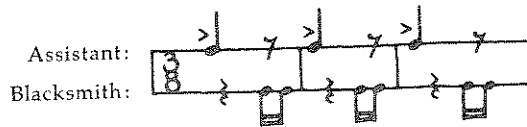
Where the lake became a brook, there were two or three mills. Their wheels seemed to run after each other, splashing water, like silly girls. I used to stay there long hours, watching them and throwing pebbles in the waterfalls to see them bounce and then fall again to disappear under the whirling round of the wheel. From the mills one could hear the noise of the millstones, the millers singing, children screaming, and always the squeaking of the chain over the hearth while the polenta was being stirred. I know this because the smoke coming out of the chimney always preceded the occurrence of this new, strident note in the universal concert. In front of the mills, there was a constant coming and going of sacks and flour-covered figures. Women from nearby villages came and chatted with the women of the mills while their grain was being ground. Meanwhile, the little donkeys, freed of their loads, greedily enjoyed the bran mash prepared as a treat for them on the occasion of the trips to the mills. When they finished, they started to bray, merrily stretching ears and legs. The miller's dog barked and ran around them with playful assaults and defenses. I tell you, it was indeed a very lively scene and I couldn't think of anything better.

To those living in the mill itself, life was never without the "patter" (Thomas Hardy's word) of the big wheel, to which the little ones mumbled responsively, producing "a remote resemblance to the stopped diapason in an organ." Later the mill, now equipped with a strident whistle, began to take on a more dominating aspect. We jump ahead momentarily to 1900, to a description of Dryomov, Russia, in the words of Maxim Gorky. "Awakening in the pearly gloom of an autumn dawn, Artamonov senior would hear the summoning blast of the mill whistle. Half an hour later would commence the indefatigable murmur and rustle, the accustomed, dull, but powerful din of labour." Another sound that continued all day within earshot of most of the residents of the early town was the blacksmith. ". . . the sounds could not have been more distinct if they had been dropped down a deep well. From the blacksmith shop . . . came a tang-tang. A bee doomed lazily. Annie sang in her kitchen . . . the halter shanks, made impatient, little clinking sounds. Tang-tang-ting-tang-tang, went Ab's hammer on the anvil."

It is impossible to realize how diversified were the sounds of the blacksmith without a visit to an active forge. No museum anvil can suggest the sound, for each type of work had its own meters and accents. While on a recording expedition in Europe, we were fortunate in persuading an old Swabian blacksmith and his assistant to fire up their abandoned forge and to demonstrate the techniques. Shaping scythes consisted of a rapid series of taps, followed by slight pauses for inspection. By comparison, the shaping of horseshoes called for the assistant to strike the metal with mighty sledgehammer beats while the smith, with a little hammer for shaping, struck the metal off the beat. The meter was in three, thus:



When the smith wanted more flattening he would tap the side of the anvil with two rapid flourishes.



One has to have experienced this to appreciate how deftly the smith would move in and out fashioning the metal between the powerful steady blows of the assistant. We measured the sound at over 100 decibels and residents on the outskirts of the village testified that they used to be able to hear the hammering, which began at dawn and would continue during the harvest season (when scythes had to be flattened regularly) late into the night.

Up to the time of the Industrial Revolution, the sound of the blacksmith's hammer was probably the loudest sound a solo human hand ever produced—a brilliant tintinnabulation.

In the Middle East it was the tinsmith's hammer that gave the most strident keynote. They may be heard there still, the happy tinsmiths, squatting in the bazaars, their backs straight as the letter alif, beckoning the visitor with their staccato hammering, which forms a strange counterpoint to the phlegmatic shuffling of feet over the uneven stones of the alleys. Today they fashion samovars for tourists; in the past they produced great gongs for the royal armies. In the Orient, the gong served in place of both drum and bell. "We started at break of day from the northern suburb of Ispahan, led by the *chaoushes* of the pilgrimage, who announced our departure by loud cries and the beating of their copper drums."

Keynote Sounds Many of the most unique keynote sounds are produced by the materials available in different geographical locales: bam-

boo, stone, metal or wood, and sources of energy such as water and coal. In older European cities the visitor from abroad is immediately struck by the preponderance of stone. Stone, and objects bumping it, chipping it or scraping it, form the first line of European keynotes. Scott Fitzgerald somewhere comments on "the substantial cobblestones of Zürich," and the way they echoed sound in the narrow streets at night.

In North America wood was a more important keynote, for many towns and cities were carved out of virgin forest. (Wood had, of course, been an original keynote of Europe also; but the forests were depleted when wood was required for the smelting and forging of metals.) The special keynote of British Columbia is still wood. In the early days of Vancouver, wooden planks were used in the construction of sidewalks and streets as well as buildings.

The first streets were planked and, where necessary, as with the old Water Street, supported on pilings. Photos of the time fail to convey the rumble and roar that quickened the pulse as carriages sped over the timbers. Vancouver had little cobblestone to represent its early paving, and thus the original surface has long since been composted. The sidewalks too were of plank, spaced to the detriment of women's shoe heels.

In those days (1870–1900) some of the Vancouver streets close to the seashore were also paved with clamshells. Wood, especially when elevated on pilings, is a musical surface, for each board gives its own pitch and resonance under boot heel or carriage wheel. Cobblestones possess this quality also, but the drudgery of asphalt and cement is uniform.

Wood meets stone in a combinatory keynote when casks are rolled over cobblestones, a sound which must have created a considerable disturbance in the old days. The city of Cape Town prohibits it (Police Offences Act, No. 27, 1882, para. 27), and it is also prohibited in the Australian city of Adelaide (By-law No. IX, 1934, para. 25a).

A subtle keynote is offered by the sounds of light. Between the soft sniffing of the candle and the stationary hum of electricity a whole chapter in human social history could be written, for the way men light their lives is equally as influential as the way they tell time or write down their languages. (In attributing dynamic social change to the appearance and decline of the printing press, Marshall McLuhan developed only one of several fertile themes.) The potent invention of the mechanical clock is more immediate to our study, but the effect of lighting cannot be ignored.

In the special darkness of the northern winter, where life was centered in small pools of candlelight, beyond which shadows draped and flickered mysteriously, the mind explored the dark side of nature. The underworld creatures of northern mythology are always nocturnal. By candlelight the powers of sight are sharply reduced; the ear is supersensitized and the air stands poised to beat with the subtle vibrations of a strange tale or of ethereal music. . . .

Romanticism begins at twilight—and ends with electricity. By the era of electricity, the last romanticists had folded their wings. Music dismissed the nocturne and the *Nachtstück*, and from the Impressionist salons of 1870 onward, painting emerged into twenty-four-hour daylight.

We will not expect to find striking confessions concerning the sounds of candles or torches among the ancients any more than we find elaborate descriptions among moderns of the 50- or 60-cycle hum; for although both sounds are inescapably there, they are keynotes; and, as I am taking repeated trouble to explain, keynotes are rarely listened to consciously by those who live among them, for they are the ground over which the figure of signals becomes conspicuous. Keynote sounds are, however, noticed when they change, and when they disappear altogether, they may even be remembered with affection. Thus I recall the vivid impression made on me when I first went to Vienna in 1956 and heard the whispering gas lights on the suburban streets; or, on another occasion, the huge hiss of the Coleman lamps in the unelectrified bazaars of the Middle East—which, in the late evening, quite overpowered the bubbling of the waterpipes. Similarly, in a reverse manner, when the heroine in *Doctor Zhivago* first arrived in Moscow after having spent her childhood in the Urals, she was “deafened by the gaudy window displays and glaring lights, as if they too emitted sounds of their own, like the bells and the wheels.” In the country, night had been accompanied by “the faint crackling of the wax candles” (Turgenev’s phrase), and she was immediately struck by the change. Another example: in his diary of 1919, amidst painterly thoughts, Paul Klee paused to listen when, in his Schwabing apartment, “the asthmatic gas lamp was replaced by a glaring, hissing and spitting carbide lamp.”

The Sounds of Night and Day When towns and cities were dark at night, the sounds of curfew and the voices of night watchmen were important acoustic signals. In London the curfew bell was decreed by William the Conqueror to be rung at eight o’clock. On the first stroke of the signal bell, St. Martin’s-le-Grand, all other churches took up the toll and the city gates were closed. Curfew bells were still rung in English towns up to the nineteenth century, as Thomas Hardy records.

The curfew was still rung in Casterbridge, and it was utilized by the inhabitants as a signal for shutting their shops. No sooner did the deep notes of the bell throb between the housefronts than a clatter of shutters arose through the whole length of the High Street. In a few minutes business at Casterbridge was ended for the day.

In Persian towns curfew was also announced, but the sounds were different.

I had in succession watched the distant din of the king’s band, the crash of the drums, and the swell of the trumpets, announcing sunset.

I had listened to the various tones of the muezzins, announcing the evening prayer; as well as to the small drum of the police, ordering the people to shut their shops, and retire to their homes. The cry of the sentinels on the watch-towers of the king’s palace was heard at distant intervals. . . .

After the town settled down for the night, the soundscape, even of a big city like Paris, became hi-fi.

Later that night—last night—when the children and women had quieted down in their back yards enough to let me sleep, I began hearing cabs roll by in the street. They passed only now and then, but after each one I waited for the next in spite of myself, listening for the jingling bell, the clatter of the horse’s hooves on the pavement.

Throughout the night, in towns the world over, night watchmen reassured the inhabitants with their punctual sounds.

Twelve o’clock,
Look well to your lock,
Your fire and your light,
And so good night.

Such was the London cry as recorded by Richard Dering in 1599. Milton records that in his day watchmen carried a bell and chanted a blessing (*Il Penseroso*, line 82 f.). Leigh Hunt has preserved descriptions of several London night watchmen in 1820.

One was a Dandy Watchman, who used to ply at the top of Oxford Street, next the park. We called him the dandy, on account of his utterance. He had a mincing way with it, pronouncing the *a* in the word “past” as it is in *hat*,—making a little preparatory hem before he spoke, and then bringing out his “Päst ten” in a style of genteel indifference, as if, upon the whole, he was of that opinion.

Another was the Metallic Watchman, who paced the same street towards Hanover Square, and had a clang in his voice like a trumpet. He was a voice and nothing else; but any difference is something in a watchman.

A third, who cried the hour in Bedford Square, was remarkable in his calling for being abrupt and loud. There was a fashion among his tribe just come up at that time, of omitting the words “Past” and “o’clock,” and crying only the number of the hour.

But by this time the cries of the watchman and the chimes of the town clock were clearly tautological and the watchman was on the wane. Virginia Woolf catches this situation well by placing the watchman sentimentally in the distance. The quote is from *Orlando*, set at about the same period. “There was the faint rattle of a coach on the cobbles. She heard the

far-away cry of the night watchman—"Just twelve o'clock on a frosty morning.' No sooner had the words left his lips than the first strike of midnight sounded." Sometimes the watchmen rang bells, sometimes rattles, as reported by Gorky in *The Artamonovs*. Sometimes they blew whistles, and I have heard them blow to one another every fifteen minutes throughout the night in Mexican towns today.

Such nocturnal interruptions were by no means always appreciated; they outraged Tobias Smollett in the eighteenth century.

... I go to bed after midnight, jaded and restless from the dissipations of the day—I start every hour from my sleep, at the horrid noise of the watchmen bawling the hour through every street, and thundering at every door; a set of useless fellows, who serve no other purpose but that of disturbing the repose of the inhabitants.

With the first rays of sunlight the watchman fell silent, and after the introduction of street lighting, he disappeared altogether.

With daybreak a different commotion began. Smollett continues: "... and by five o'clock I start out of bed, in consequence of the still more dreadful alarm made by the country carts, and noisy rustics bellowing green pease under my window."

The Keynotes of Horse and Wagon Smollett was by no means the only commentator to be irritated by the continuous and asymmetrical rattle of brass-bound wheels over cobblestones, and not only Europeans but people living in other parts of the world frequently complained of it. "The creaking of the wheels is indescribable. It is like no sound ever heard in all your life, and makes your blood run cold. To hear a thousand of these wheels all groaning and creaking at one time is a sound

From Town to City

only way the traveler knew he was passing was the sharpening of the hoofbeat. Returning to the circuit of the wheels, and the time-beating that hypnotize even the most wakeful passenger.

Surely I am not the only one to conclude that the influence of horses' hooves on poetical rhythm is also evident. How else would one care for the influence of the Alberti bass, which came into vogue with the coach travel throughout Europe became prominent. The same influence can be felt in the jigging riddle dance, which the southern Americans call "jig music." Perhaps these thoughts are merely coincidental. They come together again when I consider the influence of the horse and the automobile on contemporary music.

The Rhythms of Work Begin to
Industrial Revolution work was often wedded to the
labor were synchronized with the human body
habits of hands and feet. We will later discuss
the rhythms of men and machines got out
 to point out the tragedy. Before this, the rhythms
 of the fields and workshops set the rhythm. The
 flower girls imitated or counterpointed in a way
 as Gorky's novel *The Artamonovs* testifies, that

would speak in mocking tones of the fruitless building of the tower of Babel.

The industrial workshop killed singing. As Lewis Mumford put it in *Technics and Civilization*: "Labor was orchestrated by the number of revolutions per minute, rather than the rhythm of song or chant or tattoo."

Street Criers But this came later. Before the Industrial Revolution the streets and workshops were full of voices, and the farther south one went in Europe the more boisterous they appeared to become.

Turn your eyes upward, myriads of windows and balconies, curtains swinging in the sun, and leaves and flowers and among them, people, just to confirm your illusion. Cries, screams, whipcracks deafen you, the light blinds you, your brain begins to feel dizzy and you gulp air. You feel drawn into becoming part of the enthusiastic demonstration, to applaud, to cry "Evvive"—but for what? What is there before your eyes is nothing exceptional or extraordinary. All is perfectly calm; no deep political passion is stirring in these people. They all mind their business and talk about normal things; it is just a day like any other. It is Naples' life in its perfect normality, nothing more.

Why do the voices of South Europeans always seem louder than their northern neighbors? Is it because they spend more time outdoors where the ambient noise level is higher? We recall that the Berbers learned to shout because they had to shout over the cataracts of the Nile.

But the streets of all major European towns were seldom quiet in those days, for there were the constant voices of hawkers, street musicians and beggars. The beggars in particular plagued the composer Johann Friedrich Reichardt when he visited Paris in 1802–3. "Usually they are not violent as they fall on one, but they hamper one and touch the heart all the more with their continuous beseeching cries and their miserable behavior." The ubiquitous street cries were impossible to avoid. "The uproar of the street sounded violently and hideously cacophonous," reported Virginia Woolf in *Orlando*; but this is too general. Actually each hawker had an uncounterfeiting cry. More than the words, it was the musical motif and the inflection of the voice, passed in the trade from father to son, that gave the cue, blocks away, to the profession of the singer. In the days when shops moved on wheels, ads were vocal displays. Street cries attracted the attention of composers and were incorporated into numerous vocal compositions, by Janequin in sixteenth-century France and by Weelkes, Gibbons and Dering in the England of Shakespeare's time. The Fancies by the last three composers contain some one hundred fifty different cries and itinerant vendors' songs. A catalogue of some of these gives a good idea of the variety of goods and services which were available in the towns of Elizabethan England:

13 different kinds of fish,
18 different kinds of fruit,
6 kinds of liquors and herbs,
11 vegetables,
14 kinds of food,
14 kinds of household stuff,
13 articles of clothing,
9 tradesmen's cries,
19 tradesmen's songs,
4 begging songs for prisoners,
5 watchman's songs,
1 town crier.

The town crier preserved by Dering is clearly from before the days of the Puritan reforms. He begins with the traditional invocation "Oyez," from the Norman French verb *ouïr*, to hear.

Oyez, Oyez. If any man or woman, city or country, that can tell any tidings of a grey mare with a black tail, having three legs and both her eyes out, with a great hole in her arse, and there your snout, if there be any that can tell any tidings of this mare, let him bring word to the crier and he shall be well pleas'd for his labour.

The practice of maintaining town criers proceeded down to about 1880, or at least that is the time when their names disappear from the directories of cities like Leicester.

Public hawking was carried on also in the theaters and opera houses, as Johann Friedrich Reichardt reported from Paris.

Between the acts, hawkers enter bearing orangeade, lemonade, ice cream, fruit, and so forth, while others bring opera libretti, programs, evening newspapers and journals and still others advertise binoculars, all vying with one another and making such a commotion that one is driven to distraction. This is even worse on those days when the theatre, as is common in France, is so full that the musicians of the orchestra are forced out to accommodate extra spectators. Right after the last word of the tragedy, the hawkers push past the doors and bawl out "Orangeade, Lemonade, Glacés! marchand des lorgnettes!" and so forth, completely bereft of any music, lacerating the ears and feelings of all sensitive spectators.

Noise in the City It will be noticed, from several of the quotations of the last few pages, that street music was a continual subject of controversy. Intellectuals were irritated by it. Serious musicians were outraged—for frequently it appears that unmusical persons would engage in the practice, not at all to bring pleasure, but merely to have their silence

bought off. But resistance moved to the middle class as well, as soon as it contemplated an elevation of life style. After art music moved indoors, street music became an object of increasing scorn, and a study of European noise abatement legislation between the sixteenth and nineteenth centuries shows how increasing amounts of it were directed against this activity. In England, street music was suppressed by two Acts of Parliament during the reign of Elizabeth I, but it can hardly have been very effective. Hogarth's well-known eighteenth-century print, *The Enraged Musician*, shows the conflict between indoor and outdoor music in full view. By the nineteenth century, a by-law in Weimar had forbidden the making of music unless conducted behind closed doors. The bourgeoisie was gaining the upper hand, on paper at least. In England the brewer and Member of Parliament, Michael T. Bass, published a book in 1864 entitled *Street Music in the Metropolis*, together with a proposed Bill, designed to put an end to the abuse. Bass received a great many letters and petitions supporting his Bill, including one signed by two hundred "leading composers and professors of music of the metropolis," who complained vigorously of the way in which "our professional duties are seriously interrupted." Another letter, signed by Dickens, Carlyle, Tennyson, Wilkie Collins, and the Pre-Raphaelite painters John Everett Millais and Holman Hunt, stated:

Your correspondents are, all, professors and practitioners of one or other of the arts or sciences. In their devotion to their pursuits—tending to the peace and comfort of mankind—they are daily interrupted, harassed, worried, wearied, driven nearly mad, by street musicians. They are even made especial objects of persecution by brazen performers on brazen instruments, beaters of drums, grinders of organs, bangers of banjos, clashers of cymbals, worriers of fiddles, and bellowers of ballads; for, no sooner does it become known to those producers of horrible sounds that any of your correspondents have particular need of quiet in their own houses, than the said houses are beleaguered by discordant hosts seeking to be bought off.

A further communication received by Bass for his proposed bill was in the form of a detailed list of interruptions from Charles Babbage, the eminent mathematician and inventor of the calculating machine. Brass bands, organs and monkeys were the chief distractions, and Babbage came to the conclusion that "one-fourth part of my working power has been destroyed by the nuisance against which I have protested."

Selective Noise Abatement: The Street Crier Must Go
As a result of this agitation, the Metropolitan Police Act of 1864 was passed, though the problem cannot have been immediately solved, for street cries continued to be noted until the turn of the century and later. But by 1960, the only European city in which street cries could still regularly be heard was Istanbul. When at last the legislators of European towns

were able to conclude that the problem of street music had been solved, they failed to appreciate the correct reason for it. It was not the result of centuries of legislative refinement but the invention of the automobile that muffled the voices of the street cries. Then slow-witted administrations all over the world got down to designing by-laws to solve a problem that had already disappeared. "No hawker, huckster, peddler or petty chapman, news vendor or other person shall by his intermittent or reiterated cries disturb the peace, order, quiet or comfort of the public" (Vancouver, By-Law No. 2531, passed in 1938).

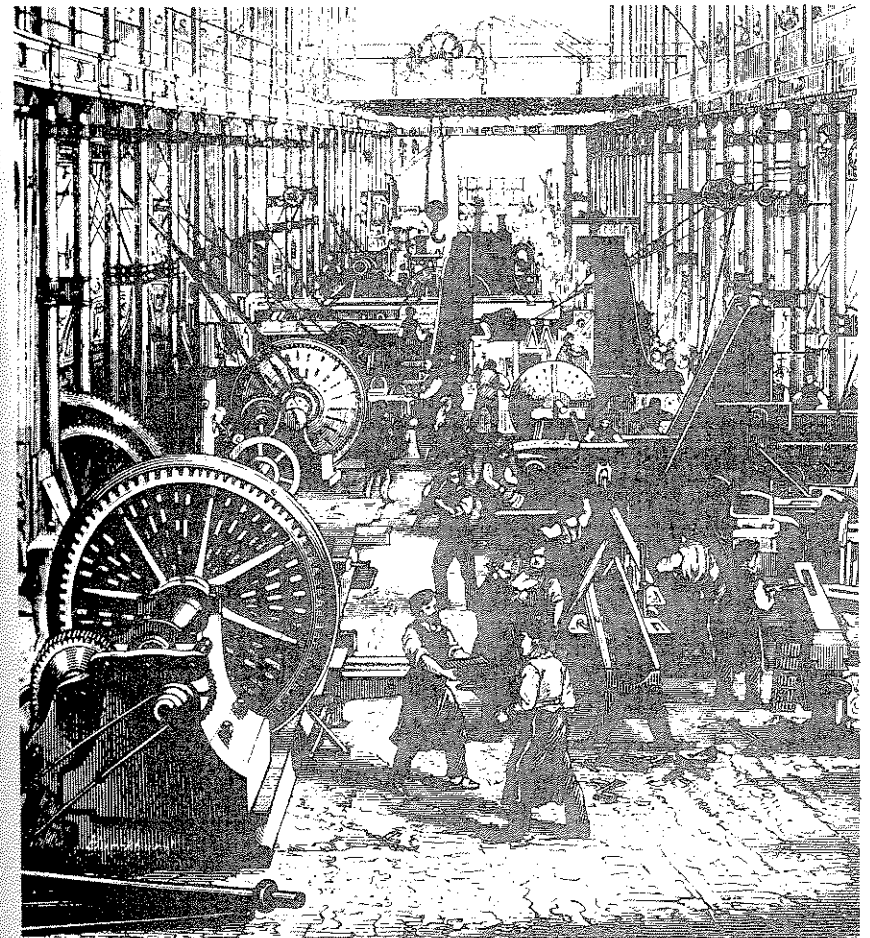
By the 1930s Parisian citizens were lamenting the disappearance of street criers—*si la chanson française ne doit pas mourir ce sont les chanteurs des rues qui doivent la perpétuer*; but Professor Beauty was by that time in his padded cell, which is to say that the disappearance of street music has been largely a matter of indifference to aesthetes and collectors.

The study of noise legislation is interesting, not because anything is ever really accomplished by it, rather because it provides us with a concrete register of acoustic phobias and nuisances. Changes in legislation give us clues to changing social attitudes and perceptions, and these are important for the accurate treatment of sound symbolism.

Early noise abatement legislation was selective and qualitative, contrasting with that of the modern era, which has begun to fix quantitative limits in decibels for all sounds. While most of the legislation of the past was directed against the human voice (or rather the rougher voices of the lower classes), no piece of European legislation was ever directed against the far larger sound—if objectively measured—of the church bell, nor against the equally loud machine which filled the church's inner vaults with music, sustaining the institution imperiously as the hub of community life—until its eventual displacement by the industrialized factory.

PART TWO

*The Post-Industrial
Soundscape*



The Industrial Revolution

The Lo-Fi Soundscape of the Industrial Revolution The lo-fi soundscape was introduced by the Industrial Revolution and was extended by the Electric Revolution which followed it. The lo-fi soundscape originates with sound congestion. The Industrial Revolution introduced a multitude of new sounds with unhappy consequences for many of the natural and human sounds which they tended to obscure; and this development was extended into a second phase when the Electric Revolution added new effects of its own and introduced devices for packaging sounds and transmitting them schizophonicly across time and space to live amplified or multiplied existences.

Today the world suffers from an overpopulation of sounds; there is so much acoustic information that little of it can emerge with clarity. In the ultimate lo-fi soundscape the signal-to-noise ratio is one-to-one and it is no longer possible to know what, if anything, is to be listened to. This, in summary, is the transformation of the soundscape which we will study in the next chapters.

The Industrial Revolution in England, the country which, for a variety of reasons, became the first to mechanize, took place approximately between 1760 and 1840. The principal technological changes which affected the soundscape included the use of new metals such as cast iron and steel as well as new energy sources such as coal and steam.

The textile industry was the first to undergo industrialization. John Kay's flying shuttle (1733), James Hargreaves's spinning jenny (1764-69) and Richard Arkwright's waterframe (1769) led to the development of the power loom by 1785. Increased production of finished cotton goods led to a greater demand for raw cotton, a problem which was solved in the U.S.A. by Eli Whitney's cotton gin (1793). Other industries quickly followed, for

as Alfred North Whitehead observed: "The greatest invention of the nineteenth century was the invention of the method of invention." A list of some of the more outstanding eighteenth-century inventions will allow the imaginative reader to overhear the changes in the soundscape which were worked by the new materials under the impress of new energy sources and the relentless precision of new machinery.

1711:	Sewing machine
1714:	Typewriter
1738:	Cast-iron rail tramway (at Whitehaven, England)
1740:	Cast steel
1755:	Iron wheels for coal cars
1756:	Cement manufacture
1761:	Air cylinders; piston worked by water wheel; more than tripled production of blast furnace
1765-69:	Improved steam pumping engine with separate condenser
1767:	Cast-iron rails (at Coalbrookdale)
1774:	Boring machine
1775:	Reciprocative engine with wheel
1776:	Reverberatory furnace
1781-86:	Steam engine as prime mover
1781:	Steamboat
1785:	First steam spinning mill (at Papplewick)
1785:	Power loom
1785:	Screw propeller
1787:	Iron steamship
1788:	Threshing machine
1790:	Sewing machine first patented
1791:	Gas engine
1793:	Signal telegraph
1795-1809:	Food canning
1796:	Hydraulic press
1797:	Screw-cutting lathe

The social concomitants to these changes were also profound. Agricultural workers were disfranchised and sent to the cities to seek work in the factories. Operated by steam engines, lighted by gas, the new factories could work nonstop day and night, and pauperized workers were forced to do the same. The working day was increased to sixteen hours or more, with a single hour off for dinner. Workers lived in squalid quarters near the factories, cut off from the countryside, with almost no recreational facilities except the public houses; and these, if we accept the evidence of numerous earwitnesses, became centers of much greater noise and rowdiness during the eighteenth century than before.

I have already mentioned how factories put an end to the unity of work and song. At a later date, after the reform work of men like Robert Owen, the urge for singing reappeared in the British choral societies, which flourished best in the factory towns of the North. Workmen who experienced the crucifixion of human culture then sang *Messiah* at Christmas in thousand-voice choirs.

The cacophonies of iron pushed out over the countryside first in the form of the railroad and the threshing machine. We can measure the phases of change as the new farming machinery moved out from England across Europe. While Tolstoy's Russian peasants still continued to sing over their sickles, the heroine of Hardy's *Tess of the d'Urbervilles* (contemporary of Anna Karenina) stands mutely over her work smothered by the concatenated roar of the threshing machine.

A hasty lunch was eaten as they stood, without leaving their positions, and then another couple of hours brought them near to dinner-time; the inexorable wheels continuing to spin, and the penetrating hum of the thresher to thrill to the very marrow all who were near the revolving wirecage.

The Sounds of Technology

Sweep Across Town and Country While the philosophy of utilitarianism was sufficient to condone the inhumanities of Coketown, the machine was immediately conspicuous when it was introduced into provincial life. It took time for the sounds of technology to rub their way across Europe. The following set of earwitness accounts by writers over several generations reveals how the new sounds were gradually accepted as inevitable.

French towns were upset at first by the new rhythms and aberrational noises of the machine, as Stendhal makes clear on one of the first pages of *The Red and the Black* (1830).

The little town of Verrières must be one of the prettiest in the Franche-Comté. Its white houses with their steep, red tile roofs spread across a hillside, the folds of which are outlined by clumps of thrifty chestnut trees. The Doubs flows a couple of hundred feet below the town's fortifications, built long ago by the Spaniards and now fallen into ruins. . . .

Scarcely inside the town, one is stunned by the racket of a roaring machine, frightful in its appearance. Twenty ponderous hammers, falling with a crash which makes the street shudder, are lifted for each new stroke by the power of a water wheel. Every one of these hammers makes, every day, I don't know how many thousand nails. Young, pretty, fresh-faced girls, slip little slivers of iron into place beneath the sledge hammers, which promptly transform them into nails.

By 1864 French towns were alive with factories, and were described with disdain by the Goncourts.

A vague, indeterminate smell of grease and sugar, mixed with the emanations from the water and the smell of tar, rose from the candle factories, the glue factories, the tanneries, the sugar refineries, which were scattered about on the quay amongst thin, dried-up grass. The noise of foundries and the screams of steamwhistles broke, at every moment, the silence of the river.

By the early twentieth century the sounds of technology became more acceptable to the urban ear, "blending" with the natural rhythms of antiquity. As Thomas Mann described it:

We are encompassed with a roaring like that of the sea; for we live almost directly on the swift-flowing river that foams over shallow ledges at no great distance from the poplar avenue. . . . There is a locomotive foundry a little way downstream. Its premises have been lately enlarged to meet increased demands, and light streams all night long from its lofty windows. Beautiful glittering new engines roll to and fro on trial runs; a steam whistle emits wailing head-tones from time to time; muffled thunderings of unspecified origin shatter the air. . . . Thus in our half-suburban, half-rural seclusion the voice of nature mingles with that of man, and over all lies the bright-eyed freshness of the new day.

Ultimately the throb of the machine began to intoxicate man everywhere with its incessant vibrations. D. H. Lawrence (1915): "As they worked in the fields, from beyond the now familiar embankment came the rhythmic run of the winding engines, startling at first, but afterwards a narcotic to the brain."

Eventually then the noises of modern industrial life swung the balance against those of nature, a fact which the futurist, Luigi Russolo, was the first to point out in his manifesto *The Art of Noises* (1913). Writing on the eve of the First World War, Russolo excitedly proclaimed that the new sensibility of man depended on his appetite for noises, which would achieve their grandest opportunity for expression in mechanized warfare.

Noise Equals Power We have gone far enough to show how the soundscape of both city and country was being transmogrified during the eighteenth and nineteenth centuries. We are now confronted by an enigma: despite the vast increase in noise that the new machines created, rarely do we find opposition to these noises.

In England, the first criticism of working conditions in factories was that of Sadler's Factory Investigating Committee of 1832. This pathetic seven-hundred-page document is filled with hideous descriptions of bru-

tality and human degradation—shifts extending to thirty-five hours, children sleeping in the mills in order not to be late for work, workers collapsing into the machines from sheer fatigue, alcoholism among children—but nowhere is noise mentioned as a factor contributing to the tragedy of these environments. Only once or twice does one encounter there a reference to the "rumbling noise" of the machinery. When sound is noticed it is usually the screams of the workers when they are beaten.

I happened to be at the other end of the room, talking; and I heard the blows, and I looked that way, and saw the spinner beating one of the girls severely with a large stick. Hearing the sound led me to look round, and to ask what was the matter, and they said it was "Nothing but — paying [beating] his ligger-on."

The only time the machines were ever stopped was to impress visitors, or during meal breaks, when the children had to clean them on their own time. Otherwise they rattled on undetected, and Sadler's interviewees even spoke of the "silence" of the mills, by which they meant the "rule of silence." "Is one part of the discipline of these mills profound silence?—Yes, they will not allow them to speak; if they chance to see two speaking, they are beaten with the strap."

The only people to criticize the "prodigious noise" of machinery were the writers, figures like Dickens and Zola. Dickens, in *Hard Times* (1854):

Stephen bent over his loom, quiet, watchful, and steady. A special contrast, as every man was in the forest of looms where Stephen worked, to the crashing, smashing, tearing piece of mechanism at which he laboured.

Zola, in *Germinal* (1885):

And now it had occurred to him to open the steam-cocks and let out the steam. The jets went off like gunshots and the five boilers blew off like hurricanes, with such a thunderous hissing that your ears seemed to be bleeding.

Despite these attacks, it was still to be a hundred years before noise criteria would be established and enforced as part of hygiene programs in industry. Neither unions nor social reformers nor the medical profession caught the theme. Noise was certainly known to cause deafness as early as 1831 when Fosbroke described deafness occurring among blacksmiths, but this remained an isolated study until 1890 when Barr surveyed one hundred boilermakers and discovered that not one of them had normal hearing.* Hammering and riveting steel plates together produced an intense noise, resulting in a form of hearing impairment in which there is

*The earliest study of industrial deafness that I have been able to discover was that of Bernardino Ramazzini, *Diseases of Workers (De Morbis Artificum)*, 1713.

deafness to high frequencies. The term "boilermaker's disease" came into use shortly afterward to refer to all kinds of industrial hearing loss, though its prevention only received serious consideration in most industrialized countries toward 1970.

The inability to recognize noise during the early phases of the Industrial Revolution as a factor contributing to the multiplicatory toxicity of the new working environments is one of the strangest facts in the history of aural perception. We must try to determine the reason. It may be partly explained as a result of the inability to measure sounds quantitatively. A sound might be recognized as unpleasantly loud, but until Lord Rayleigh built the first practical precision instrument for the measurement of acoustic intensity in 1882, there was no way of knowing for certain whether a subjective impression had an objective basis. The decibel, as a means of establishing definite sound pressure levels, did not come into extended use until 1928.

But I want to extend a thought which I had begun to develop in Part One. We have already noted how loud noises evoked fear and respect back to earliest times, and how they seemed to be the expression of divine power. We have also observed how this power was transferred from natural sounds (thunder, volcano, storm) to those of the church bell and pipe organ. I called this Sacred Noise to distinguish it from the other sort of noise (with a small letter), implying nuisance and requiring noise abatement legislation. This was always primarily the rowdy human voice. During the Industrial Revolution, Sacred Noise sprang across to the profane world. Now the industrialists held power and they were granted dispensation to make Noise by means of the steam engine and the blast furnace, just as previously the monks had been free to make Noise on the church bell or J. S. Bach to open out his preludes on the full organ.

The association of Noise and power has never really been broken in the human imagination. It descends from God, to the priest, to the industrialist, and more recently to the broadcaster and the aviator. The important thing to realize is this: to have the Sacred Noise is not merely to make the biggest noise; rather it is a matter of having the authority to make it without censure.

Wherever Noise is granted immunity from human intervention, there will be found a seat of power. The noisy clank of Watt's original engine was maintained as a sign of power and efficiency, against his own desire to eliminate it, thus enabling the railroads to establish themselves more emphatically as the "conquerers" that I will, in a moment, let Charles Dickens describe. A glance at the sound output of any representative selection of modern machines is enough to indicate where the centers of power lie in the modern world.

Steam engine	85 dBA
Printing works	87 dBA
Diesel-electric generator house	96 dBA

Screw-heading machine	101 dBA
Weaving shed	104 dBA
Sawmill chipper	105 dBA
Metalwork grinder	106 dBA
Wood-planing machine	108 dBA
Metal saw	110 dBA
Rock band	115 dBA
Boiler works, hammering	118 dBA
Jet taking off	120 dBA
Rocket launching	160 dBA

Sound Imperialism The historian Oswald Spengler distinguishes two phases in the development of a social movement: the cultural phase, during which the main ideas are still maturing; and the civilization phase, during which the main ideas, having matured, are legalized and transmitted abroad. Imperialism is the word used to refer to the extension of an empire or ideology to parts of the world remote from the source. It is Europe and North America which have, in recent centuries, masterminded various schemes designed to dominate other peoples and value systems, and subjugation by Noise has played no small part in these schemes. Expansion took place first on land and sea (train, tank, battleship) and then in the air (planes, rocketry, radio). The moon probes are the most recent expression of the same heroic confidence that made Western Man a world colonial power.

When sound power is sufficient to create a large acoustic profile, we may speak of it, too, as imperialistic. For instance, a man with a loudspeaker is more imperialistic than one without because he can dominate more acoustic space. A man with a shovel is not imperialistic, but a man with a jackhammer is because he has the power to interrupt and dominate other acoustic activities in the vicinity. (In this sense we note that outside workers were able to improve their position remarkably after they were in possession of tools to attract attention to themselves. No one listens to a ditchdigger.) Similarly, the growing importance of the international aviation industry can be easily assessed from the growth patterns of airport noise profiles. Western Man leaves his calling cards all over the world in the form of Western-made or Western-inspired machinery. As the factories and the airports of the world multiply, local culture is pulverized into the background. Everywhere one travels today one hears the evidence, though only in the more remote places is the incongruity immediately striking.

Increase in the intensity of sound output is the most striking characteristic of the industrialized soundscape. Industry must grow; therefore its sounds must grow with it. That is the fixed theme of the past two hundred years. In fact, noise is so important as an attention-getter that if quiet machinery could have been developed, the success of industrialization

might not have been so total. For emphasis let us put this more dramatically: if cannons had been silent, they would never have been used in warfare.

***The Flat Line in Sound

The Industrial Revolution introduced another effect into the soundscape: the flat line. When sounds are projected visually on a graphic level recorder, they may be analyzed in terms of what is called their envelope or signature. The principal characteristics of a sound envelope are the attack, the body, the transients (or internal changes) and the decay. When the body of the sound is prolonged and unchanging, it is reproduced by the graphic level recorder as an extended horizontal line.

Machines share this important feature, for they create low-information, high-redundancy sounds. They may be continuous drones (as in a generator); they may be rough-edged, possessing what Pierre Schaeffer calls a "grain" (as in mechanical sawing or filing); or they may be punctuated with rhythmic concatenations (as in weaving or threshing machines)—but in all cases it is the continuousness of the sound which is its predominating feature.

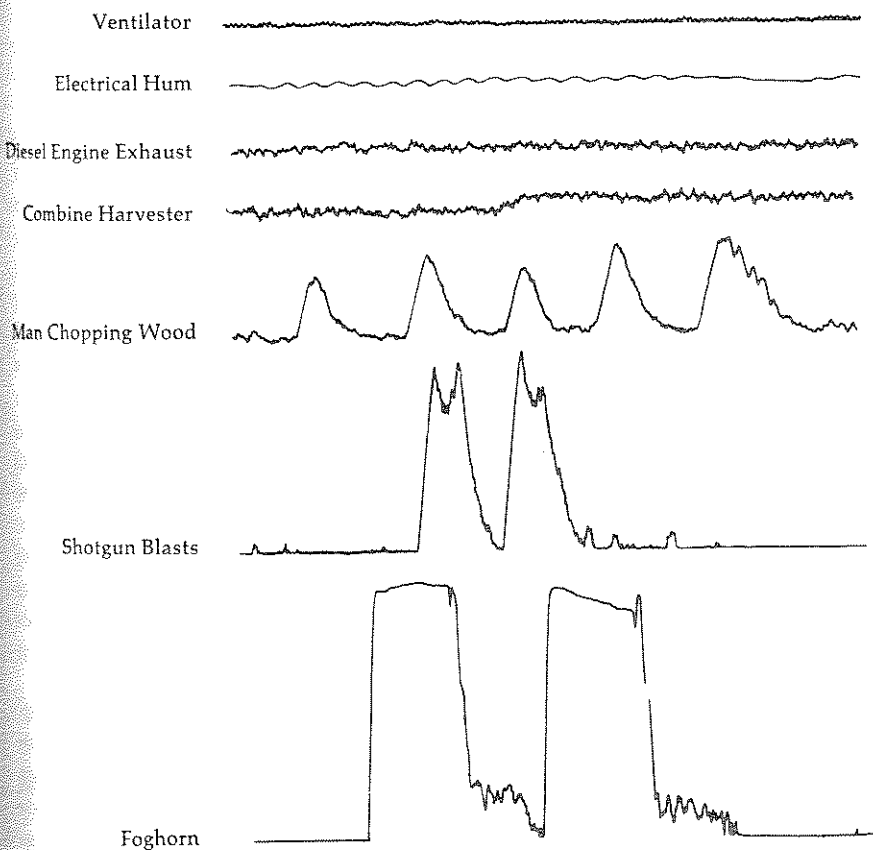
The flat continuous line in sound is an artificial construction. Like the flat line in space, it is rarely found in nature. (The continuous stridulation of certain insects like cicadas is an exception.) Just as the Industrial Revolution's sewing machine gave us back the long line in clothes, so the factories, which operated night and day nonstop, created the long line in sound. As roads and railroads and flat-surfaced buildings proliferated in space, so did their acoustic counterparts in time; and eventually flat lines in sound slipped out across the countryside also, as the whine of the transport truck and the airplane drone demonstrate.

A few years ago, while listening to the stonemasons' hammers on the Takht-e-Jamshid in Teheran, I suddenly realized that in all earlier societies the majority of sounds were discrete and interrupted, while today a large portion—perhaps the majority—are continuous. This new sound phenomenon, introduced by the Industrial Revolution and greatly extended by the Electric Revolution, today subjects us to permanent keynotes and swaths of broad-band noise, possessing little personality or sense of progression.

Just as there is no perspective in the lo-fi soundscape (everything is present at once), similarly there is no sense of duration with the flat line in sound. It is suprabiological. We may speak of natural sounds as having biological existences. They are born, they flourish and they die. But the generator or the air-conditioner do not die; they receive transplants and live forever.

The flat line in sound emerges as a result of an increased desire for speed. Rhythmic impulse plus speed equals pitch. Whenever impulses are speeded up beyond 20 occurrences or cycles per second, they are fused together and are perceived as a continuous contour. Increased efficiency in manufacturing, transportation and communication systems fused the im-

pulses of older sounds into new sound energies of flat-line pitched noise. Man's foot sped up to produce the automobile drone; horses' hooves sped up to produce the railway and aircraft whine; the quill pen sped up to produce the radio carrier wave, and the abacus sped up to produce the whirr of computer peripherals.



Graphic level recordings of typical flat-line and impact sounds.

Henri Bergson once asked how we should know about it if some agent suddenly doubled the speed of all events in the universe? Quite simply, he replied, we should discern a great loss in the richness of experience. Even as Bergson wrote, this was happening, for as discrete sounds gave way to flat lines, the noise of the machine became "a narcotic to the brain," and listlessness increased in modern life.

The function of the drone has long been known in music. It is an anti-intellectual narcotic. It is also a point of focus for meditation, particularly in the East. Man listens differently in the presence of drones, and the importance of this change in perception is becoming evident in the West.

The flat line in sound produces only one embellishment: the glissando—that is, as the revolutions increase the pitch gradually rises, and as they decrease the pitch descends. Then flat lines become curved lines. But they are still without sudden surprises. When flat lines become jerky or dotted or looping lines—the machinery is falling apart.

Another type of curve produced by the flat line is the Doppler effect, which results when a sound is in motion at sufficient velocity to cause a bunching up of the sound waves as the sound approaches an observer (resulting in a rise in pitch) and an elongation of the sound waves as the sound recedes (resulting in a lowering of pitch). There are certainly Doppler effects in nature (the flight of a bee, for instance, or the galloping of horses) but only after the new speeds of the Industrial Revolution did the effect become conspicuous enough to be “discovered.” Christian Johann Doppler (1803–53) formulated the explanation of the effect to which he has bequeathed his name in a work entitled *Über das Farbige Licht der Doppelsterne*, where he applied the principle to light waves. But Doppler acknowledged that he worked by analogy from sound to light.

Some sounds move in space, some do not; and we may move some sounds by carrying them with us. But which sound attracted Doppler's ear? It could only have been the railway. Although he does not mention this, we do know trains were used to verify the Doppler effect. About 1845 “musically trained observers were stationed along the tracks of the Rhine Railroad between Utrecht and Maarsen in Holland and listened to trumpets played in a railway car as it sped past. From the known pitch of the trumpet and the apparent pitch of the approaching and receding tones, the speed of the railway car was estimated with fairly good accuracy.”

The Lore of Trains The first railway was the Stockton and Darlington run in England (1825), designed to carry coal from the mines to the waterways. It proved so immediately successful that within a few years Britain was covered with a railway network. Dickens described the new sound in 1848:

Night and day the conquering engines rumbled at their distant work, or, advancing smoothly to their journey's end, and gliding like tame dragons into the allotted corners grooved out to the inch for their reception, stood bubbling and trembling there, making the walls quake, as if they were dilating with the secret knowledge of great powers yet unsuspected in them, and strong purposes not yet achieved.

From England the railway system fanned out quickly across Europe and the world. France had a railway by 1828 as did the U.S.A., Ireland by 1834, Germany by 1835, Canada by 1836, Russia by 1837, Italy by 1839, Spain by 1848, Norway and Australia by 1854, Sweden by 1856 and Japan by 1872.

The train conquered the world with a minimum of opposition. Dickens didn't like it: “Louder and louder yet, it shrieks and cries as it comes tearing on resistless to the goal.” Neither did Wagner, and although the Bavarian College of Medicine protested in 1838 that the speed with which trains traveled would undoubtedly cause brain damage, the trains remained and the tracks multiplied.

Of all the sounds of the Industrial Revolution, those of trains seem across time to have taken on the most attractive sentimental associations. J. M. W. Turner's celebrated painting *Rain, Steam and Speed* (1844), with its locomotive thrusting down diagonally on the spectator, was the first lyric inspired by the steam engine. It was a painter, too, who caught the next change in the epic of the railroads. By 1920 the main lines of Europe (though not of England and North America) were being electrified, and the change is recorded in de Chirico's wistful landscapes, where silent smoke-puffing trains pass out of sight in the extreme distance.

By comparison with the sounds of modern transportation, those of the trains were rich and characteristic: the whistle, the bell, the slow chuffing of the engine at the start, accelerating suddenly as the wheels slipped, then slowing again, the sudden explosions of escaping steam, the squeaking of the wheels, the rattling of the coaches, the clatter of the tracks, the thwack against the window as another train passed in the opposite direction—these were all memorable noises.

The sounds of travel have deep mysteries. Just as the post horn had once carried the imagination over the horizon, so also did its replacement, the train whistle. On European trains the whistle is high and piping: “Then the shrill whistle of the trains reechoed through the heart, with fearsome pleasure, announcing the far-off come near and imminent.”

In North America, on the other hand, the whistle is low and powerful, the utterance of a big engine with a heavy load. On the prairies—so flat that one can see the full train from engine to caboose, spread out like a stick across the horizon—the periodic whistlings resound like low, haunting moans. “The Canadian train whistle sounds like a dejected monster. It wails, and the pitch descends, unlike that of our British trains which rises in a chirpy and optimistic manner. The Canadian whistle sounds as if it has travelled far and still has a long way to go.” Farmers knew how to interpret these sounds. “When the train's whistle sounds hollow, the weather will turn colder,” runs an Ontario proverb. The train's whistle was the most important sound in the frontier town, the solo announcement of contact with the outside world. It was the stop clock of the elementary community, as predictable and reassuring as the church bell. In those days trains spoke to the heart of every man, and small boys came to greet the panting engine.

Trains speak to each other too. Each railroad employs a binary code of whistle signals by which quite precise messages can be communicated. But unlike the signals of the post horn, which we are given to understand everyone knew, the language of the trains is a mystery code, known to the

trainmen alone. Even without knowing the codes, those who listen attentively to the soundscape will notice the personality and style each engineer manages to bring to these elementary utterances. Some slur the signals, barely distinguishing the articulations; others separate each blast with lengthy pauses. With considerable artistry others manage to get the notes to slide in pitch by careful manipulation of the control valve. This last style of performance is atavistic, carrying us back to the old steam whistle which was naturally tapered at the edges. The original steam whistle was three-toned. Part of the fame of the legendary American engineer Casey Jones was acoustic, for Casey had a special five-tone whistle which he carried with him wherever he went.

Besides the variations in rhythm and articulation, the listener will also notice differences in sound quality and pitch. While the old steam whistles produced a cluster of frequencies, many modern whistles, especially on diesel engines, are single tones. Others are diads or triads, tuned in the factory, sometimes to the specifications of the customer. While American railroads have preferred the single pitch, Canadian railroads have withdrawn this type of whistle due to the number of level-crossing accidents attributed to it during the changeover period from steam to diesel engines. An attempt to reproduce the quality of the original steam whistle resulted in the adoption of specifically tuned air horns, one version of which, now used by the Canadian Pacific Railroad, is the E-flat minor triad in root position with the tonic pitched at 311 hertz. This deep and haunting whistle, sounded by every train, who knows how many thousands of times during the long haul from Atlantic to Pacific through spectacular and lonely countryside, provides the unifying soundmark of the nation. More than any other sound it is uncounterfeitingly Canadian.

The improvement in city conditions by the general adoption of the motorcar can hardly be overestimated. Streets—clean, dustless and odorless—with light rubber-tired vehicles moving swiftly and *noiselessly* over their smooth expanse would eliminate a greater part of the nervousness, distraction and strain of modern life.

Scientific American, July, 1899

The Internal Combustion Engine The internal combustion engine now provides the fundamental sound of contemporary civilization. It is the keynote, as surely as water was the keynote of thalassocratic civilization, and the wind is the keynote of the steppes.

In the external combustion engine a load of water is mixed with a load of coal to produce driving energy. Coal and water are bulky and heavy. The steam locomotive was accordingly confined to public enterprises. The internal combustion engine is light and easy to operate; it transferred power to the individual. In industrially advanced societies the average citizen may operate several internal combustion engines in the course of an average day

(car, motorcycle, truck, power lawnmower, tractor, generator, power tools, etc.) and the sound will be heard in his ear many hours each day.

★ By 1970, the United States was producing more automobiles annually than babies, but the Asian market still looked encouraging. An advertisement in *The New Yorker* magazine that year showed the globe with every available land mass covered with Hertz rent-a-cars. By that date classic cities of gems and germs like Istanbul and Isfahan had also become cities of incredible traffic jams. The reason for this was not merely the volume of traffic, but the way in which vehicles were driven. In order for a society to obey traffic codes it must have survived two important experiences: the Industrial Revolution and mechanized warfare. Americans can drive on the "belt" road (note the name) around Washington with great adroitness, but the Asian still drives his car as if it were a camel or a mule. Stoplights are ignored and the horn becomes a whip with which to cajole and punish the stubborn animal.

When two swaths of broad-band noise of the same intensity are superposed the result is an increase of approximately three decibels. Two cars, each producing a sound of 80 decibels, thus give a sound of 83 decibels. Assuming constant engine noise, each doubling of production in the automobile industry would give an elevation of three decibels of broad-band noise to the sonic environment. In fact, automobile engines are not uniformly constructed. The American manufacturers, for instance, produced their quietest automobiles around 1960. During the sixties they began to get louder again. By 1971 the Detroit manufacturers had begun to make the increased noise of their machines an advertised feature. The following is a magazine advertisement:

THE
1971
MUSCLE
CARS

This sleek, high-powered monster is
American Motors' 7 Javelin AMX.
Press the accelerator,
it roars.

That year General Motors informed us that

... the trend toward large displacement engines and higher compression ratios makes for increased engine noise, induction, and exhaust noise ... higher compression ratios ... result in larger deformations of the engine-block structure and, hence, higher radiated noise levels. ... We feel, on the basis of many cars, that muffler design and performance have nicely kept pace with requirements.

Today the value of the automobile is under serious scrutiny. As local noise abatement by-laws and practices seek to reduce its sound output by

setting increasingly tough noise standards, in the end perhaps only energy shortages will silence it. As the automobile becomes obsolete, its rattle becomes deathening.

Sheer volume aside, the human sound which most closely approximates that of the internal combustion engine is the fart. The analogies between the automobile and the anus are conspicuous. First of all the exhaust pipe is placed at the rear, at the same position as the rectum in animals. Cars are also stored in dirty and dark underground garages, beneath the haunches of the modern dwelling. Freud says there are anal types. There are probably also anal eras.

The Growth of Muscle Sounds Someone once observed—I think it was Aldous Huxley—that for contemporary urban man half the imagery of traditional poetry was lost. The same thing is happening to the soundscape, where the sounds of nature are being lost under the combined jamming of industrial and domestic machinery. More is less. A couple of illustrations from close to home will suffice to illustrate the equation.

In 1959 Canada manufactured \$8,596,000 worth of power chainsaws; by 1969 this had risen to \$26,860,000. The power chainsaw produces a sound of between 100 and 120 dBA, giving it a sweepout in a quiet forest of 8 to 10 square kilometers. It is possible to theorize that by 1974 the combined ripping of the 316,781 power chainsaws produced that year alone, if operated simultaneously, could cover about one-third of Canada's 9,222,977 square kilometers with their sound.

A West Coast Indian girl taught me how to listen to the voices of the trees through the bark of their trunks. "They tell the story of my people," she said. When the white men arrived in British Columbia, they could not teach the Indians to use the mechanical saw, or to fell trees in such a way that one tree could be made to knock down four others—the so-called domino technique. When the spirit of the deity inhabits the tree, one hesitates. Today, as the jabberware of the forest industry bevels down the woods, no one hears the frightened cries of the tree victims.

"If a tree might move by foot or wing it would not suffer the pain of the saw or the blows of the axe," wrote Rumi in the thirteenth century. As a matter of fact, we do know that trees and other vegetables tremble and send out electrical emergency charges before they are cut.

The snowmobile will serve as our other example of the devastating effect the careless introduction of technology can have on a society. The snowmobile, a Canadian discovery, is a recent invention but its ramming has already transmogrified the Canadian winter. Only in 1970, after millions of Canadians were being exposed to this new form of noise, was the National Research Council able to conduct research demonstrating that existing machines "present a definite hazard to hearing." Their report showed that machines then on the market frequently exceeded 110 dBA

at the drivers' ear. The NRC recommended reducing the noise to 85 dBA (thereby at least lessening the risk of hearing damage) and they showed how this could be done. But the federal government responded by limiting the noise level of new machines to 82 dBA at 50 feet (i.e., approximately 92 dBA at 15 feet).

The intrusion of snowmobiles has now made deafness and ear disease the largest public health problem in the Canadian Arctic, according to Dr. J. D. Baxter, head of McGill University's Otolaryngological Department. In his 1972 address to the Canadian Otolaryngological Society he pointed out that of 156 adult Eskimos examined in one area, 97 showed a significant hearing loss. The Canadian winter used to be noted for its purity and serenity. It was part of the Canadian mythology. The snowmobile has bitched the myth. Without a myth the nation dies.

... no sound issues from a cloudless quarter of the sky.

Lucretius, *On the Nature of Things*,
VI, 96

The Big Sound Sewer of the Sky It would be false to assume that man only became airborne in the twentieth century. In fact, man has always been airborne in his imagination, as the numerous magic carpets of folklore prove. The twentieth century has merely reduced the limitless spaces where the imagination soared to rare altitudes to specific air corridors of no intrinsic significance whatsoever. Listen to the sky. The whirring and scraping against the air is nothing but the wounds of a crippled imagination made audible. At one time it was only those unfortunate enough to live near airports who really suffered from aircraft noise. In those days a passing plane turned all heads upward. But since the Second World War all this has changed.

Sometimes I give a class of students the assignment: "You are facing south. You are to wait until a sound passes you by traveling from northeast to southwest." It may take two minutes. It may take two hours. Usually it takes two minutes. Usually it is a plane. "Air travel is doubling every five years, and air freight is growing still faster. . . . Thus . . . the noise goes up in the ratio of the horsepower used in the industry as a whole, that is, it doubles every five years in aviation."

This forecast refers only to the spread of noise energy in the sky. It assumes that we will continue to employ present-day aircraft but simply in greater numbers. To this we must add the very special problems of supersonic transport or any other aberrations that the international aviation industry may still be perpetrating on the drawing boards.

As every home and office is gradually being situated along the world runway, the aviation industry, perhaps more effectively than any other, is

destroying the words "peace and quiet" in every world language. For noise in the sky is distinguished radically from all other forms of noise in that it is not localized or contained. The plangent voice of the airplane motor beams down directly on the whole community, on roof, garden and window, on farm and suburb as well as city center.

In our research on the Vancouver soundscape we showed that the annual traffic of aircraft over a downtown park in 1970 was 23,000 per year and that this had grown by 1973 to 38,700—a trend well in line with the quotation above. We also showed that in 1973 the same park soundscape was filled with aircraft noise, from the time each flight was detected on the acoustic horizon until it disappeared, for an average of 27 minutes per hour; and from our research we are able to predict that if the trend continues the noise will be total and uninterrupted by 1981.

A great deal of research has taken place on aircraft noise and it is going forward today more strenuously than ever; but the problem continues to grow. While most of the research has concentrated on the superscreams of jets (and it has succeeded in making the jumbo jets slightly quieter than their predecessors), the insidious jamming of smaller aircraft—for instance, the bitter-batter of helicopters—has been given practically no attention.

The advent of supersonic transports has succeeded in focusing additional public attention on the problem of aircraft noise. Not only do such aircraft produce more noise on take-off and landing, resulting in "a growth in far afield noise accompanied by a serious worsening of the lateral noise spread in the vicinity of the airport," but the most critical feature of this aircraft is that by flying faster than the speed of sound it produces an additional thunderclap called a sonic boom. Unlike the sound of other aircraft, the bang-zone of the supersonic transport boom is about fifty miles wide and extends along the entire length of the aircraft flight path. Supersonic aircraft turn the whole world into an airport.

Let's use the German word *Überschallknall* instead of sonic boom; its ugly syllabification seems more suitable. In addition to its startling noise, the heavier vibrations of the *Überschallknall* can cause serious property damage, smash windows, crack walls and ceilings. On the basis of trial runs of supersonic aircraft in the U.S.A. (the small fighter variety only) and the resulting damage suits filed, it has been estimated that each supersonic flight across that country would startle up to forty million people. In Chicago, test flights over the city resulted in 6,116 complaints and 2,964 damage claims.

As a result of these forecasts, and because in order for supersonic aircraft to be economically viable they must be flown at supersonic speeds as frequently as possible, the Americans in 1972 abandoned their plans to develop such aircraft for commercial purposes. Many countries of the world have banned the flight of supersonic aircraft over their territories, and while the British and French as well as the Russians have such planes, they are now beginning to look like the biggest white elephants of all time.

The supersonic aircraft was an attempt to outmaneuver sound. It failed.

The Deaf Ear of the Aviator Rather than assist in finding solutions to the problems of aircraft noise, the commercial airlines have turned a deaf ear. They have preferred instead to spend enormous sums of money to pretend that the problem does not exist. If planes make any sound at all, the advertising implies, they are happy sounds. Witness:

- Eastern Airlines "Whisper Jet Service"
- "Fly the Friendly Skies of United."
- "Trident-Two is fast, smooth, quiet and reliable." (BEA)
- "Fly across the Atlantic on the Quiet." (BOAC)
- "We have smart new DC-9 jets with engines quietly at the rear." (Air Jamaica)
- "The DC-10 is a quiet plane that whispers its way through airports." (KLM)
- "More and more people-pleasing 747s are bringing more and more big-jet comfort to more and more cities and towns." (Boeing)

Big jets as people pleasers? Question: What obligation does an airline have to people outside or beneath its aircraft?

On the Acropolis in Athens there is a sign reading:

THIS IS A SACRED PLACE.
IT IS FORBIDDEN TO SING OR
MAKE LOUD NOISES OF ANY KIND.

When I was last there in 1969 the Acropolis was grazed by seventeen jets. Against this hypocrisy we offer the news that Christ and Buddha were also aviators, and wonder what kind of noise they made as they mounted up into the air.

Counter-Revolution Opposing the developments described in this chapter, there has been, over the past decade, a counter-revolution in many countries around the world. Technological noise is the target for increasing opposition and in a rapidly growing number of instances it is being met directly by noise abatement legislation. As the dangers of excessive noise have been known for at least one hundred fifty years, this sudden expression of interest in the subject, while welcome, raises the question: *Why only now?* Perhaps it is part of a general criticism of the direction in which reckless technology has been taking us. If this is so, the industrialist as God has fallen, and his divine license to make the Sacred Noises without prosecution has ended. I think, and I am merely testing an idea in this sentence, that what we are witnessing in the recent noise abatement campaigns is not so much an attempt to silence the world as an attempt to wrest Sacred Noise from industry as a prelude to the discovery of a more trustworthy proprietor to whom the power may be bequeathed.

The Electric Revolution

The Electric Revolution extended many of the themes of the Industrial Revolution and added some new effects of its own. Owing to the increased transmission speed of electricity, the flat-line effect was extended to give the pitched tone, thus harmonizing the world on center frequencies of 25 and 40, then 50 and 60 cycles per second. Other extensions of trends already noted were the multiplication of sound producers and their imperi-
alistic outswEEP by means of amplification.

Two new techniques were introduced: the discovery of packaging and storing techniques for sound and the splitting of sounds from their original contexts—which I call schizophonia. The benefits of the electroacoustic transmission and reproduction of sound are well enough celebrated, but they should not obscure the fact that precisely at the time hi-fi was being engineered, the world soundscape was slipping into an all-time lo-fi condition.

A good many of the fundamental discoveries of the Electric Revolution had already been made by 1850: the electric cell, the storage cell, the dynamo, the electric arc light. The detailed application of these inventions occupied the remainder of the nineteenth century. It was during this period that the electric power station, the telephone, the radio telegraph, the phonograph and the moving picture came into existence. At first their commercial applications were limited. It was not until the improvement of the dynamo by Werner Siemens (1856) and the alternator by Nikola Tesla (1887) that electrical power could become the generating force for the practical development of the discoveries.

One of the first products of the Electric Revolution, Morse's telegraph (1838), unintentionally dramatized the contradiction between discrete and contoured sound which, as I have said, separates slow from fast-paced

societies. Morse used the long line of the telegraph wire to transmit messages broken in binary code, which still relied on digital adroitness, thus maintaining in the telegrapher's trained finger a skill that related him to the pianist and the scribe. Because the finger cannot be wiggled fast enough to produce the fused contour of sound, the telegraph ticks and stutters in the same way as its two contemporary inventions, Thurber's typewriter and Gatling's machine gun. As increased mobility and speed in communication continued to be desired, it was inevitable that, together with the act of letter-scratching, the telegraph should give way to the telephone.

The three most revolutionary sound mechanisms of the Electric Revolution were the telephone, the phonograph and the radio. With the telephone and the radio, sound was no longer tied to its original point in space; with the phonograph it was released from its original point in time. The dazzling removal of these restrictions has given modern man an exciting new power which modern technology has continually sought to render more effective.

The soundscape researcher is concerned with changes in perception and behavior. Let us, for instance, point up a couple of observable changes effected by the telephone, the first of the new instruments to be extensively marketed.

The telephone extended intimate listening across wide distances. As it is basically unnatural to be intimate at a distance, it has taken some time for humans to accustom themselves to the idea. Today North Americans raise their voices only on transcontinental or transoceanic calls; Europeans, however, still raise their voices to talk to the next town, and Asians shout at the telephone when talking to someone in the next street.

The capacity of the telephone to interrupt thought is more important, for it has undoubtedly contributed a good share to the abbreviation of written prose and the choppy speech of modern times. For instance, when Schopenhauer writes at the beginning of *The World as Will and Idea* that he wishes us to consider his entire book as one thought, we realize that he is about to make severe demands on himself and his readers. The real depreciation of concentration began after the advent of the telephone. Had Schopenhauer written his book in my office, he would have completed the first sentence and the telephone would have rung. Two thoughts.

The telephone had already been dreamed of when Moses and Zo-roaster conversed with God, and the radio as an instrument for the transmission of divine messages was well imagined before that. The phonograph, too, has a long history in the imagination of man, for to catch and preserve the tissue of living sound was an ancient ambition. In Babylonian mythology there are hints of a specially constructed room in one of the ziggurats where whispers stayed forever. There is a similar room (still in existence) in the Ali Qapu in Isfahan, though in its present derelict state it is difficult to know how it was supposed to have worked. Presumably its highly polished walls and floor gave sounds an abnormal reverberation

time. In an ancient Chinese legend a king has a secret black box into which he speaks his orders, then sends them around his kingdom for his subjects to carry out, which I gloss to mean that there is *authority* in the magic of captured sound. With the invention of the telephone by Bell in 1876 and the phonograph by Charles Cros and Thomas Edison in 1877 the era of schizophonia was introduced.

Schizophonia The Greek prefix *schizo* means split, separated; and *phone* is Greek for voice. *Schizophonia* refers to the split between an original sound and its electroacoustical transmission or reproduction. It is another twentieth-century development.

Originally all sounds were originals. They occurred at one time in one place only. Sounds were then indissolubly tied to the mechanisms that produced them. The human voice traveled only as far as one could shout. Every sound was uncounterfeitable, unique. Sounds bore resemblances to one another, such as the phonemes which go to make up the repetition of a word, but they were not identical. Tests have shown that it is physically impossible for nature's most rational and calculating being to reproduce a single phoneme in his own name twice in exactly the same manner.

Since the invention of electroacoustical equipment for the transmission and storage of sound, any sound, no matter how tiny, can be blown up and shot around the world, or packaged on tape or record for the generations of the future. We have split the sound from the maker of the sound. Sounds have been torn from their natural sockets and given an amplified and independent existence. Vocal sound, for instance, is no longer tied to a hole in the head but is free to issue from anywhere in the landscape. In the same instant it may issue from millions of holes in millions of public and private places around the world, or it may be stored to be reproduced at a later date, perhaps eventually hundreds of years after it was originally uttered. A record or tape collection may contain items from widely diverse cultures and historical periods in what would seem to a person from any century but our own, a meaningless and surrealistic juxtaposition.

The desire to dislocate sounds in time and space had been evident for some time in the history of Western music, so that the recent technological developments were merely the consequences of aspirations that had already been effectively imagined. The secret *quomodo omnis generis instrumentorum Musica in remotissima spacia propagari possit* (whereby all forms of instrumental music could be transmitted to remote places) was a special preoccupation of the musician-inventor Athanasius Kircher, who discussed the matter in detail in his *Phonurgia Nova* of 1673. In the practical sphere, the introduction of dynamics, echo effects, the splitting of resources, the separation of soloist from the ensemble and the incorporation of instruments with specific referential qualities (horn, anvil, bells, etc.)

were all attempts to create virtual spaces which were larger or different from natural room acoustics; just as the search for exotic folk music and the breaking forward and backward to find new or renew old musical resources represents a desire to transcend the present tense.

When, following the Second World War, the tape recorder made incisions into recorded material possible, any sound object could be cut out and inserted into any new context desired. Most recently, the quadraphonic sound system has made possible a 360-degree soundscape of moving and stationary sound events which allows any sound environment to be simulated in time and space. This provides for the complete portability of acoustic space. Any sonic environment can now become any other sonic environment.

We know that the territorial expansion of post-industrial sounds complemented the imperialistic ambitions of the Western nations. The loudspeaker was also invented by an imperialist, for it responded to the desire to dominate others with one's own sound. As the cry broadcasts distress, the loudspeaker communicates anxiety. "We should not have conquered Germany without . . . the loudspeaker," wrote Hitler in 1938.

I coined the term schizophonia in *The New Soundscape* intending it to be a nervous word. Related to schizophrenia, I wanted it to convey the same sense of aberration and drama. Indeed, the overkill of hi-fi gadgetry not only contributes generously to the lo-fi problem, but it creates a synthetic soundscape in which natural sounds are becoming increasingly unnatural while machine-made substitutes are providing the operative signals directing modern life.

Radio: Extended Acoustic Space A character in one of Jorge Luis Borges's stories dreads mirrors because they multiply men. The same might be said of radios. By 1969, Americans were listening to 268,000,000 radios, that is, about one per citizen. Modern life has been ventriloquized. The domination of modern life by the radio did not take place unnoticed; but whereas opposition to the Industrial Revolution had come from the working classes, who feared the loss of their jobs, the principal opponents of the radio and the phonograph were the intellectuals. Emily Carr, who wrote and painted in the British Columbia wilderness, hated the radio when she first heard it in 1936.

When I go to houses where they are turned on full blast I feel as if I'd go mad. Inexplicable torment all over. I thought I ought to get used to them and one was put in my house on trial this morning. I feel as if bees had swarmed in my nervous system. Nerves all jangling. Such a feeling of angry resentment at that horrid metallic voice. After a second I have to clap it off. Can't stand it. Maybe it's my imperfect hearing? It's one of the wonders of the age, simply marvelous. I know that but I *hate* it.

Hermann Hesse, in *Der Steppenwolf* (1927), was disturbed by the poor fidelity of the new electroacoustical devices for the reproduction of music.

At once, to my indescribable astonishment and horror, the devilish metal funnel spat out, without more ado, its mixture of bronchial slime and chewed rubber; that noise that possessors of gramophones and radio sets are prevailed upon to call music. And behind the slime and the croaking there was, sure enough, like an old master beneath a layer of dirt, the noble outline of that divine music. I could distinguish the majestic structure and the deep wide breath and the full broad bowing of the strings.

But more than this, Hesse was revolted by the schizophrenic incongruities of broadcasting.

It takes hold of some music played where you please, without distinction or discretion, lamentably distorted, to boot, and chucks it into space to land where it has no business to be. . . . When you listen to radio you are a witness of the everlasting war between idea and appearance, between time and eternity, between the human and the divine . . . radio . . . projects the most lovely music without regard into the most impossible places, into snug drawing-rooms and attics and into the midst of chattering, guzzling, yawning and sleeping listeners, and exactly as it strips this music of its sensuous beauty, spoils and scratches and beslimes it and yet cannot altogether destroy its spirit.

Radio extended the outreach of sound to produce greatly expanded profiles, which were remarkable also because they formed interrupted acoustic spaces. Never before had sound disappeared across space to reappear again at a distance. The community, which had previously been defined by its bell or temple gong, was now defined by its local transmitter.

The Nazis were the first to use radio in the interests of totalitarianism, but they have not been the last; and little by little, in both East and West, radio has been employed more ruthlessly in culture-molding. Readers of Solzhenitsyn's novel *Cancer Ward* will recall the "constant yawping" of the radio which greeted Vadim when he went to the hospital and the way he detested it. I recall, twenty years ago, hearing the same loudspeakers blaring out their cacophonies of patriotism and spleen on station platforms and in public squares throughout Eastern Europe. But broadcasting has now gone public in the West as well. It may be hard for younger readers to appreciate what has happened but, up until about a decade ago, one of the most salient differences between cities like London or Paris and Bucharest or Mexico City was that in the former there were no radios or music in public places, restaurants or shops. In those days, particularly during the summer months, BBC announcers would regularly request listeners to keep their radios at a low volume in order not to disturb the neighborhood. In a dramatic reversal of style, British Railways recently began beaming the BBC regional service throughout railway stations (I have heard it over

loudspeakers in Brighton Railway Station, 1975). But they still have a long way to go to catch Australian Railways, which plays the ABC light program on trains from 7 a.m. to 11 p.m. during the three-day run from Sydney to Perth. In my compartment in 1973 it was impossible to shut it off.

In the early days one listened to the radio selectively by studying the program schedule, but today programs are overlooked and are merely overheard. This change of habit prepared modern society to tolerate the walls of sound with which human engineering now orchestrates the modern environment.

The radio was the first sound wall, enclosing the individual with the familiar and excluding the enemy. In this sense it is related to the castle garden of the Middle Ages which, with its birds and fountains, contradicted the hostile environment of forest and wilderness. The radio has actually become the bird-song of modern life, the "natural" soundscape, excluding the inimical forces from outside. To serve this function sound need not be elaborately presented, any more than wallpaper has to be painted by Michelangelo to render the drawing room attractive. Thus, the development of greater fidelity in sound reproduction, which occupied the first half of the present century—and in a way may be thought of as analogous to the development of oil paints, which also rendered possible greater veracity in art—is now canceled by a tendency to return to simpler forms of expression. For instance, while the transition from mechanical to electrical recording (Harrison and Maxfield) extended the available bandwidth from three to seven octaves, the transistor radio reduced it again to something like its former state. The habit of listening to transistor radios outdoors in the presence of additional ambient noise, often in circumstances which reduce the signal-to-noise ratio to approximately one to one, has in turn suggested the inclusion of additional noise which, in some popular music, is now engineered right onto the disc, often in the form of electroacoustical feedback. This, in turn, leads to new evaluations of what is signal and what is noise in the whole constantly changing field of aural perception.

The Shapes of Broadcasting Radio programming needs to be analyzed in as much detail as an epic poem or musical composition, for in its themes and rhythms will be found the pulse of life. But detailed studies of this kind appear never to have been undertaken. The structural principles of such an analytical undertaking will be developed in the Rhythm and Tempo chapter of Part Four, but it will not be out of place here to make a few general comments.

At first radio broadcasts were isolated presentations, surrounded by extended (silent) station breaks. This occasional approach to broadcasting, now absent from domestic radio, can still to some extent be experienced with shortwave broadcasts, where station breaks are often several minutes long and are accompanied by short musical phrases or signature tunes.

(This attractive practice is only slightly spoiled by the unlikely choice of instruments used on some stations: thus, the calls of Jordan and Kuwait are played on the clarinet, those of Jamaica and Iran on the vibraphone—that is, they are played on instruments so distinctly non-indigenous that one might suppose they were originally recorded in New York.)

During the 1930s and 1940s schedules were filled out until the whole day was looped together in unsettled connectivity. The modern radio schedule, a confection of material from various sources, joined in thoughtful, funny, ironic, absurd or provocative juxtapositions, has introduced many contradictions into modern life and has perhaps contributed more than anything else to the breakup of unified cultural systems and values. It is for this reason that the study of joins in broadcasting is of great importance. The montage was first employed in film because it was the first art form to be cut and spliced, but since the invention of magnetic tape and the compression of the schedule, the shapes of broadcasting have followed the editor's scissors also.

The function of the montage is to make one plus one equal three. The film producer Eisenstein—one of the first to experiment with montage—defines the effect as consisting "in the fact that two film pieces of any kind, placed together, inevitably combine into a new concept, a new quality, arising out of that juxtaposition." The non sequiturs of the montage may be incomprehensible to the innocent though they are easily accommodated by the initiated. I recall one night in Chicago, at the height of the Vietnam War, listening to an on-the-spot report of the grisly affair, sponsored by Wrigley's Chewing Gum, whose jingle at the time was "Chew your little cares away!" I mentioned the experience to a class of students at Northwestern University the next day. They were interested in my opposition to the war, but failed to see my point about the gum. For them the elements had been montaged as part of a way of life.

Since the advent of the singing commercial on North American radio, popular music and advertising have formed the main material of the radio montage, so that today, by means of quick cross-fades, direct cuts or "music under" techniques, songs and commercials follow one another in quick and smooth succession, producing a commercial life style that is entertaining ("buy baubles for your bippy") and musical entertainment that is profitable ("five million sold").

Radio introduced the surrealist soundscape, but other electroacoustical devices have had an influence in rendering it acceptable. The record collection, which one may observe in almost every house of the civilized world, is often equally eclectic and bizarre, containing stray items from different periods or countries, all of which may nevertheless be stacked on the same phonograph for successive replay.

I am trying to illustrate the irrationality of electroacoustic juxtapositioning in order that it might cease to be taken for granted. One last story. A friend was once on an aircraft that supplies a selection of recorded programs of different types for earphone listening. Choosing the program

singer. As the overture soared to a climax, the disturbed voice of the stewardess suddenly interrupted the music to announce: "Ladies and gentlemen, the toilets are plugged up and must be flushed with a glass of water."

As the format of radio tightened, its tempo increased, substituting superficiality for prolonged acts of concentration. Heavyweight fare like the famous BBC Third Programme was dismissed to be replaced by material with more twist and appeal. Each station and each country has its own tempo of broadcasting, but in general it has been speeded up over the years, and its tone is moving from the sedate toward the slaphappy. (I am speaking here only of Western-style broadcasting; I am not sufficiently familiar with the monolithic cultures of Russia or China.) In the West, material is being increasingly pushed together, overlapped. In a World Soundscape Project in 1973 we counted the number of separate items on four Vancouver radio stations over a typical eighteen-hour day. Each item (announcement, commercial, weather report, etc.) represented a change of focus. The results ran as follows:

STATION	TOTAL NUMBER	
	OF ITEMS	HOURLY AVERAGE
CBU	635	35.5
CHQM	745	41.0
CJOR	996	55.5
CKLG	1097	61.0

Stations broadcasting popular music are the fastest-paced. The duration of individual items of any kind rarely exceeds three minutes on North American pop stations. Here the recording industry discloses a secret. On the old ten-inch shellac disc, the recording duration was limited to slightly over three minutes. As this was the first vehicle for popular music, all pop songs were abbreviated to meet this technical limitation. But curiously, when the long-play disc was introduced in 1948, the length of the average pop song did not increase in proportion. This suggests that some mysterious law concerning average attention span may have been inadvertently discovered by the older technology.

One acoustic effect is rarely heard on North American radios: silence. Only occasionally, during broadcasts of theater or classical music, do quiet and silence achieve their full potentiality. A graphic level recording of a popular station will show how the program material is made to ride at the maximum permissible level, a technique known as compression because the available dynamic range is compressed into very narrow limits. Such broadcasting shows no dynamic shadings or phrasing. It does not rest. It does not breathe. It has become a sound wall.

Sound Walls Walls used to exist to delimit physical and acoustic space, to isolate private areas visually and to screen out acoustic interfer-

buildings. Confronted with this situation modern man has discovered what might be called audioanalgesia, that is, the use of sound as a painkiller, a distraction to dispel distractions. The use of audioanalgesia extends in modern life from its original use in the dental chair to wired background music in hotels, offices, restaurants and many other public and private places. Air-conditioners, which produce a continuous band of pink noise, are also instruments of audioanalgesia. It is important in this respect to realize that such masking sounds are not intended to be listened to consciously. Thus, the Moozak industry deliberately chooses music that is nobody's favorite and subjects it to unvenomed and innocuous orchestrations in order to produce a wraparound of "pretty," designed to mask unpleasant distractions in a manner that corresponds to the attractive packages of modern merchandising to disguise frequently cheesy contents.

Walls used to exist to isolate sounds. Today sound walls exist to isolate. In the same way the intense amplification of popular music does not stimulate sociability so much as it expresses the desire to experience individuation . . . aloneness . . . disengagement. For modern man, the sound wall has become as much a fact as the wall in space. The teenager lives in the continual presence of his radio, the housewife in the presence of her television set, the worker in the presence of engineered music systems designed to increase production. From Nova Scotia comes word of the continuous use of background music in school classrooms. The principal is pleased with the results and pronounces the experiment a success. From Sacramento, California, comes news of another unusual development: a library wired for rock music in which patrons are encouraged to talk. On the walls are signs stating NO SILENCE. The result: circulation, especially among the young, is up.

They never sup without music; and there is always fruit served up after the meat while they are at table, some burn perfumes and sprinkle about fragrant ointments and sweet waters: in short, they want nothing that may cheer their spirits

Sir Thomas More, *Utopia*

Moozak If the Christmas card angels offer any proof, utopian creatures are forever smiling. Thus Moozak, the sound wall of paradise, never weeps. It is the honeyed antidote to hell on earth. Moozak starts out with the high motive of orchestrating paradise (it is often present in writings about utopias) but it always ends up as the embalming fluid of earthly boredom. It is natural then that the testing-ground for the Moozak industry should have been the U.S.A., with its highly idealistic Constitution and the cruddy realities of its modern life styles. The service pages of the telephone directories beam out its advertisements to clients in every North American city.

MUZAK IS MORE THAN MUSIC—PSYCHOLOGICALLY PLANNED—FOR TIME AND PLACE—JUST FLIP THE SWITCH—NO MACHINES TO ATTEND/FRESH PROGRAMS EACH DAY—NO REPETITION—ADVISED BY BOARD OF SCIENTIFIC ADVISORS—OVER 30 YEARS OF RESEARCH—PAGING AND SOUND SERVICE—FAST ROUND-THE-CLOCK SERVICE—MUZAK BRAND EQUIPMENT—OFFICES—INDUSTRIAL PLANTS—BANKS—HOSPITALS—RETAIL STORES—HOTELS AND MOTELS—RESTAURANTS—PROFESSIONAL OFFICES—SPECIALISTS IN THE PSYCHOLOGICAL AND PHYSIOLOGICAL APPLICATIONS OF MUSIC.

Facts on Moozak program design are elementary. The programs are selected and put together in several American cities for mass distribution. "... program specialists . . . assign values to the elements in a musical recording, i.e., tempo (number of beats per minute); rhythm (waltz, fox trot, march); instrumentation (brass, woodwinds, strings), and orchestra size (5 piece combo, 30 piece symphony, etc.)." There are few solo vocalists or instrumentalists to distract the listener. The same programs are played to both people and cows, but despite the happy claim that production has in both cases been increased, neither animal seems yet to have been elevated into the Elysian Fields. While the programs are constructed to give what the advertising calls "a progression of time"—that is, the illusion that time is dynamically and significantly passing—the implicit malaise behind the claim is that for most people time continues to hang heavily. "Each 15-minute segment of MUZAK contains a rising stimulus which provides a logical sense of forward movement. This affects boredom or monotony and fatigue."

Although no precise growth statistics have ever been published, there can be no doubt that these bovine sound slicks are spreading. This does not perhaps so much indicate a lack of public interest in silence as it demonstrates that there is more profit to be made out of sound, for another claim of the Mooze industry is that it provides a "relaxed background to profit." When we interviewed 108 consumers and 25 employees in a Vancouver shopping mall, we discovered that while only 25 percent of the shoppers thought they spent more as a result of the background music, 60 percent of the employees thought they did.

Against the slop and spawn of Moozak and broadcast music in public places a wave of protest is now clearly discernible. Most notable is a resolution unanimously passed by the General Assembly of the International Music Council of UNESCO in Paris in October, 1969.

We denounce unanimously the intolerable infringement of individual freedom and of the right of everyone to silence, because of the abusive use, in private and public places, of recorded or broadcast music. We ask the Executive Committee of the International Music Council to initiate a study from all angles—medical, scientific and juridical—without overlooking its artistic and educational aspects, and with a view to proposing to UNESCO, and to the proper authorities everywhere, measures calculated to put an end to this abuse.

There is a parallel to this resolution: when, in 1864, Michael Bass proposed his Bill to prohibit the sounds of street singing in the city of London, he drew substantial support from the musical profession itself. With the 1969 UNESCO resolution sonic overkill was apprehended by the musicians of the world as a serious problem. For the first time in history an international organization involved primarily with the production of sounds suddenly turned its attention to their reduction. In *The New Soundscape* I had already warned music educators that they would now have to be as concerned about the prevention of sounds as about their creation, and I suggested that they should join noise abatement societies to familiarize themselves with this new theme for the music room.

In any historical study of the soundscape, the researcher will repeatedly be struck by shifts in the perceptual habits of a society, instances where the figure and the ground exchange roles. The case of Moozak is one such instance. Throughout history music has existed as figure—a desirable collection of sounds to which the listener gives special attention. Moozak reduces music to ground. It is a deliberate concession to lo-fi-ism. It multiplies sounds. It reduces a sacred art to a slobber. Moozak is music that is not to be listened to.

By creating a fuss about sounds we snap them back into focus as figures. The way to defeat Moozak is, therefore, quite simple: listen to it. Moozak resulted from the abuse of the radio. The abuse of Moozak has suggested another type of sound wall which is now rapidly becoming a fixture in all modern buildings: the screen of white noise, or as its proponents prefer to call it "acoustic perfume." The hiss of the air-conditioner and the roar of the furnace have been exploited by the acoustical engineering profession to mask distracting sound, and where they are in themselves not sufficiently loud, they have been augmented by the installation of white noise generators. A desideratum from America's most prominent firm of acoustical engineers to the head of a music department shows us that if music can be used to mask noise, noise can also be used to mask music. It ran: "Music Library: There should be enough mechanical noise to mask page turning and foot movement sounds." The mask hides the face. Sound walls hide characteristic soundscapes under fictions.

Prime Unity or Tonal Center In the Indian *anāhata* and in the Western Music of the Spheres man has constantly sought some prime unity, some central sound against which all other vibrations may be measured. In diatonic or modal music it is the fundamental or tonic of the mode or scale that binds all other sounds into relationship. In China an artificial center of gravity was created in 239 B.C. when the Bureau of Weights and Measures established the Yellow Bell or Huang Chung as the tone from which all others were measured.

It is, however, only in the electronic age that international tonal centers have been achieved; in countries operating on an alternating current

of 60 cycles, it is this sound which now provides the resonant frequency, for it will be heard (together with its harmonics) in the operation of all electrical devices from lights and amplifiers to generators. Where C is tuned to 256 cycles, this resonant frequency is B natural. In ear training exercises I have discovered that students find B natural much the easiest pitch to retain and to recall spontaneously. Also during meditation exercises, after the whole body has been relaxed and students are asked to sing the tone of "prime unity"—the tone which seems to arise naturally from the center of their being—B natural is more frequent than any other. I have also experimented with this in Europe where the resonant electrical frequency of 50 cycles is approximately G sharp. At the Stuttgart Music High School I led a group of students in a series of relaxation exercises and then asked them to hum the tone of "prime unity." They centered on G sharp.

Electrical equipment will often produce resonant harmonics and in a quiet city at night a whole series of steady pitches may be heard from street lighting, signs or generators. When we were studying the soundscape of the Swedish village of Skruv in 1975, we encountered a large number of these and plotted their profiles and pitches on a map. We were surprised to find that together they produced a G-sharp major triad, which the F-sharp whistles of passing trains turned into a dominant seventh chord. As we moved about the streets on quiet evenings, the town played melodies.

The Electric Revolution has thus given us new tonal centers of prime unity against which all other sounds are now balanced. Like mobiles, whose movements may be measured from the string on which they are suspended, the sound mobiles of the modern world are now interpretable by means of the thin line fixture of the operating electrical current.

To relate all sounds to one sound that is continuously sounding (i.e., a drone) is a special way of listening. In respect to this development there is an interesting feature of Indian music which might bear further investigation in terms of its relevance for young people growing up in the electronic culture of today. Alain Daniélou explains:

The modal group of musical systems, to which practically all Indian music belongs, is based on the establishment of relations between a permanent sound fixed and invariable . . . the [drone], and successive sounds, the notes. . . Indian music . . . is built on the independent relationship of each note to the tonic. The relationship to the tonic determines the meaning of any given sound. The tonic must therefore be constantly heard.

Could this account for the recent popularity of Indian music among the young of the West? One of the key words in the vocabulary of young Americans during the early seventies was "vibrations," i.e., a cosmic sound giving prime unity, a concentration or gathering point from which all other sounds are perceived tangentially.