

Urban noise batters the psyche along with the eardrums. It may make us less sociable, aggravate mental problems, increase aggressiveness. But how we perceive it depends on attitudes as well as decibels.

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BY SHELDON COHEN

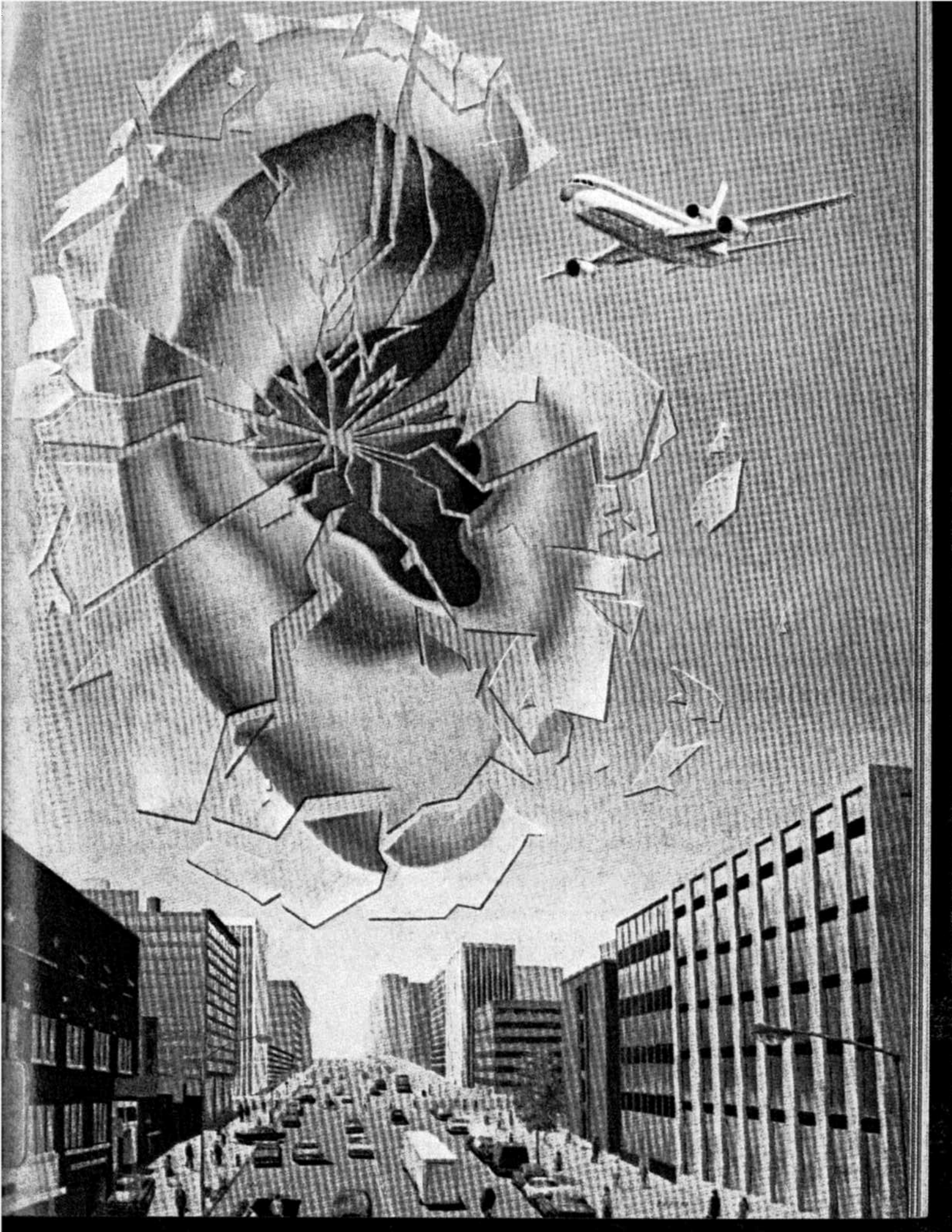
# SOUND EFFECTS ON BEHAVIOR

**I**t was summer, and the weather was sunny: a good day for householders in Seattle to mow their lawns—and for psychologists Kenneth E. Mathews and Lance Canon to conduct a field experiment. As people walked down the street, they encountered a confederate of the experimenters' as he "accidentally" dropped several volumes from an armload of books he was carrying. In half of the encounters, a lawn mower without a muffler was running at full throttle nearby; in half, it was turned off. When the lawn mower was off, 50 percent of the passersby picked up the books and handed them back; when it was going full tilt, only 12.5 percent came to the stranger's aid.

Those figures are part of the accumulating evidence that noise can affect human beings in unexpected ways. Studies of how noise affects hearing and other aspects of physical health have been going on for years, but it is only recently that investigators have turned their attention to the psychological effects of noise. Researchers want to know just how irritating noise is to people and just how much psychological harm noise actually causes. The degree of irritation people feel seems to vary greatly, depending in part on how necessary a

noise seems to be and how predictable it is. There *are* provocative hints that noise may have an adverse effect on emotional well-being. Recent research suggests that noise can reduce both sociability and sensitivity to the needs of others.

Questions about noise are of more than academic interest. Distracting, unwanted sound is part of our everyday experience. Our homes are full of noisy appliances: air conditioners, vacuum cleaners, dishwashers, refrigerators, exhaust fans. The streets blare with the sound of cars, trucks, motorcycles, and jackhammers. Even our neighbors, our children, and our spouses are sources of noise. There is reason to believe that noise levels in residential communities have increased substantially during the past 25 years; the Environmental Protection Agency (EPA) estimates that more than 70 million Americans now live in neighborhoods with noise levels high enough to interfere with communication and to cause annoyance and dissatisfaction. In a recent Census Bureau survey, street noise was the most-mentioned neighborhood problem; more than one-third of those surveyed complained about it. And not long ago, the U.S. National Research Council reported that more than 12



million people were thinking of moving because they found neighborhood noise exasperating.

The issue of noise is particularly timely because the Reagan administration's proposed budget provides no funds for the Office of Noise Abatement and Control after mid-1982. The office, a subdivision of the EPA, was created by Congress to coordinate national noise-control efforts, and Congress may refuse to let it die. If it is actually dissolved, however, that could mean relaxed federal regulation of noise sources such as trucks, buses, motorcycles, and railroads; reduced support for research on the effects of noise on health and well-being; and cutbacks in assistance to states and localities trying to develop and enforce noise-abatement legislation.

**B**efore discussing the research that has been done so far, it is important to understand what scientists mean by sound and noise. Sound results from changes in air pressure that are detected by the ear. Noise is a psychological term referring to unpleasant, unwanted, or intolerable sound. It follows that noise is in the ear of the beholder. Thus, even loud sounds may sometimes be judged desirable, while soft sounds may be considered noisy. Your neighbor may enjoy listening to a rock album at a sound level that shakes the foundation of your house, while you find the same sound infuriating. Likewise, the sound of a couple whispering endearments to each other during a theater performance may be barely audible, but other members of the audience may react to it as an intruding noise.

The problem for social scientists is how to measure the extent to which noise disturbs people. One obvious approach is to count formal complaints, which do, of course, reflect annoyance. The difficulty is that not everyone who is disturbed files a complaint. In general, better-educated, higher-income, higher social-status people complain most often. It is not that they are more annoyed than other peo-

ple but that they understand the complaint procedure better and more often expect someone to listen to them. Complaints are thus not an accurate measure of reaction to noise. Most community noise research—that is, studies done outside the laboratory—has therefore focused on the level of annoyance people report in interviews or on questionnaires.

The usual format for surveys is as follows: "To what degree are you annoyed because the noise [of planes, trucks, or some other specified source

that psychological factors—attitudes and beliefs about a noise and its source—are of equal or even greater importance than the intensity of a sound. Studies done near London's Heathrow Airport by sociologist Aubrey McKennell and similar studies in the vicinity of Kennedy Airport in New York by acoustic sociologist Paul Borsky showed that respondents were greatly influenced by what they imagined other people's attitudes to be. Subjects who assumed that pilots, airport personnel, and government of-

**Can noise cause mental illness? The evidence is mixed. But workers habitually exposed to high-intensity sound complain of instability, sexual impotence, and anxiety.**

of sound] interferes with sleep, rest, relaxation; hearing radio and television; hearing conversation; work, study?" Such questions are usually buried in a broad interview concerning satisfaction with neighborhood and community, which avoids making respondents feel that they are *supposed* to complain about noise.

Many interview studies have been done in neighborhoods near airports, highways, and factories. Responses show that the nature of a person's reaction to sound is affected by a wide range of influences, the least surprising of which is loudness. Annoyance mounts with the decibels. (A sound registering zero decibels is the weakest sound that can be heard by a person with good ears in quiet surroundings.) Background sounds up to 50 decibels, the level of an air conditioner, annoy only a few people. Seventy decibels (a vacuum cleaner, for example) irritates a high percentage of hearers, while 110 decibels (a riveting machine) is likely to grate on almost everyone. Complaints are most frequent when there is high-intensity sound (jet takeoff at 120 decibels).

But there is considerable evidence

officials couldn't care less about those who had to listen to planes were much more annoyed by airport sounds than were people who believed someone cared. Respondents were also more annoyed when they thought the noise was unnecessary, disliked other aspects of their environment, believed that noise was harmful to their health, or feared plane crashes.

Studies of annoyance with traffic noise similarly indicate the important role of psychological and sociological factors. German researchers have found that traffic annoyance increases with worry about accidents; a perception that it is difficult to reduce the noise level; and dissatisfaction with other aspects of the neighborhood. Respondents who believe noise is harmful to their health also report greater annoyance.

A survey by sociologists Craig Humphrey and John Krout at Pennsylvania State University has shown that concern about the economic impact of a noise source is an important predictor of noise annoyance. Respondents who believed that a nearby limited-access highway adversely affected the value of their property were

more annoyed with the noise than were the people who expected the highway to increase property values. That relationship held no matter how far people lived from the highway. The study also showed that people who believed the road made jobs, religious services, stores, and other services more accessible were less annoyed by the traffic noise than were those not holding that attitude. Both the American and the German researchers found that demographic factors such as age, income, and education were unrelated to annoyance.

A striking study was done by Swedish sociologists Rune Cederlöf, Erland Jonsson, and Stefan Sörensen, who tried to lessen irritation by changing community attitudes toward the source of noise. They sent a group of residents near a Swedish air force base a souvenir book that commemorated the 50th anniversary of the Royal Swedish Air Force and suggested that people living near the base believed the air force to be of vital importance to the country. Surveys conducted several weeks and even years later showed that this group was less annoyed by aircraft noise than was a control group from the same community that had not received the souvenir book. In short, redefining the importance of the noise source drastically reduced annoyance. Thus it appears that the meaning of a noise for a particular respondent is crucial to his or her perception of it.

Although there is no accepted theory of annoyance that explains such findings, many of the psychological factors associated with noise annoyance are understandable if annoyance is viewed as a mild form of anger. According to cognitive theories of emotion, anger occurs when people believe that they have been harmed and that the harm was both avoidable and undeserved. In noisy situations, harm may include threats to health and property values, blocking of valued goals, or simply exposure to an unpleasant stimulus.

If noise causes irritation and frustration, it seems plausible that prolonged exposure can cause or aggravate mental illness. So far, however, the evidence is mixed. Industrial surveys show that exposure to noise increases self-reported anxiety and emotional stress. Workers habitually exposed to very high intensity noise show increased incidence of nervous complaints, nausea, headaches, instability, argumentativeness, sexual impotence, mood changes, and anxiety. German physician Gerd Jansen reported that workers in the noisiest parts of a steel factory had more social conflicts both at home and in the plant. The results of this research are difficult to interpret, however, since the same workers were often subject to work stresses other than noise (for instance, difficult tasks to be done and risks to be

faced), which might have precipitated or contributed to the symptoms.

Although a number of studies of the impact of community noise on self-reported mental distress similarly indicate more symptoms among those exposed to noise, the questions in these studies were often worded in a way that seemed to invite people to blame their ailments on noise. For instance, a researcher might ask, "Does this traffic noise give you a headache?" When interviewers do not mention noise as a possible cause of symptoms ("What causes your headaches?" for example), results are inconsistent.

A final group of studies has examined the possible relationship between community noise and admission rates to community mental health centers near London's Heathrow Airport and Los Angeles International Airport. Although some of the studies showed differences between mental-hospital admission rates in quiet neighborhoods and in noisy ones, the differences were so small (between .001 percent and .003 percent) as to be trivial. Moreover, critics of the studies say the quiet neighborhoods chosen as controls were not comparable in socioeconomic status with the noisy areas.

A long-range project being conducted by psychiatrist Alex Tarnopolsky and his colleagues at the Institute of Psychiatry in London may help resolve questions about the relationship of community noise annoyance and

## GETTING CONTROL OF OUR EARS

Both laboratory and naturalistic studies on the effects of noise indicate that people who have some control over their acoustic environment are less affected by loud noise than are people who cannot control what they listen to. This is of course consistent with the definition of noise as unwanted sound—sound that we wouldn't listen to if we had the choice.

It appears that residents of a number of large cities are taking some action in an attempt to assert control over their acoustic environment—witness the boom in sales and use of stereo earphone headsets now being

worn by thousands of urban pedestrians. Instead of listening to the din that usually accompanies a walk through a busy city, these people select their own music and tune out the unwanted "music" of the city.

Some even use earphones to tune out other people's voices. Not long ago, the *New York Times* described a young couple who wore their headsets throughout a shared restaurant dinner. Most of the time, they didn't even look at each other. They did communicate once, though: *he* wrote his companion a note, and *she*, having read it, nodded briefly.

—S. C.

psychiatric disturbance. Initial reports suggest that respondents who express annoyance with aircraft noise are no more likely to have psychiatric disorders one year later than those who are not annoyed. However, respondents troubled by psychiatric problems at the time they are surveyed are more likely to report noise annoyance than are respondents without psychiatric problems. The implication is that noise does not increase the number of psychiatric cases but may aggravate existing psychological problems.

All of the studies discussed above involved adults only. It is possible that children are more susceptible to noise-induced psychological distress than are adults. David Krantz, Gary Evans, Dan Stokols, and I recently completed a large-scale study of 142 elementary school children living under the air corridor of Los Angeles International Airport. Compared with 120 similar children in quiet areas of Los Angeles, the children near the airport did not perform as well on a difficult task and were more likely to give up in discouragement. In the noisy area, 53 percent of the children were unable to put together a nine-piece jigsaw puzzle within the four minutes allotted to the task, and 31 percent of the children who failed stopped trying even before their time was up. In the quiet area, only 36 percent failed to finish the puzzle, and all but 7 percent of those kept doggedly working at the task as long as they were allowed to. Lack of persistence is characteristic of "learned helplessness," essentially a conviction that there is nothing one can do to remedy a situation or solve a problem. Learned helplessness sometimes develops after people have a traumatic experience in which they cannot control the environment; a sense of helplessness carries over to other situations and is thought to be one cause of depression. Our data suggest the possibility that youngsters living near the airport might have been more susceptible to depression. That is pure speculation, though, without further research.

**R**ecent studies both in laboratory and in community settings have examined the effects of loud noise on social and antisocial behavior in college students and other adults. Although firm conclusions are not yet possible, the research suggests that loud noise can change the way people normally behave toward one another,

a map he was studying with evident puzzlement, and 73 percent agreed to aid a researcher by granting an interview. Under noisy conditions, the figures went down to 1.1 percent and 62.5 percent, respectively.

William Sauser, Carlos Arauz, and Randall Chambers found a lack of sympathy for others when they asked 20 undergraduate subjects to work at a

**Assigned a difficult task, children living under an airport corridor were more likely to give up in discouragement than were children who lived in a quiet area.**

reducing willingness to help, to be neighborly, and to inhibit aggression.

The researchers mentioned at the beginning of this article—Mathews of Seattle City Light and Canon of the University of New Hampshire—found in a laboratory study that subjects exposed to loud noise were less likely to help people pick up books and papers that they had dropped than were subjects exposed to moderate noise or to none at all. In one part of the lawn-mower experiment, the researchers' book-dropping confederate wore a cast on his arm to see if it would make passersby take pity on him when the books slipped from his grasp. The cast did just that when the lawn mower was silent, but not when it was running. In the first case 80 percent of people picked up the books. In the second, the figure was only 15 percent—a further demonstration of the power of noise to inhibit Good Samaritan impulses.

Studying 2,567 people in the Netherlands, social psychologist Charles Korte and his colleagues similarly found that in both cities and towns, persons in quiet areas with little traffic and few pedestrians were more likely to be helpful than were persons in noisy, trafficked areas. Where it was quiet, 5.5 percent of passersby helped an apparently lost person read

simulated business-management task either in quiet surroundings or while hearing a recording of typical office noises: the sound of typing, ringing telephones, papers rustling, and people moving around. The students evaluated five simulated résumés from job applicants and set starting salaries for each. Subjects working where the noise level reached 70 to 80 decibels recommended a mean salary of \$8,989. Subjects in offices registering only 50 to 57 decibels suggested a mean salary of \$9,960, almost \$1,000 more. (Moral: choose a quiet spot when you ask the boss for a raise!)

It is interesting to speculate about the reasons for decreased helpfulness in a noisy environment. Four explanations come to mind. First, it is probably natural to exchange a few words with a person one is about to help, and people may have sensed that helping would be awkward if noise drowned out their voices. Second, people may have found the noise so unpleasant that their first priority was to get away from it. Third, the noise may have put people in a bad mood, which interfered with their motivation to help.

The fourth possible explanation is a complex one, based on an effect of loud noise that has been established in laboratory research on human performance. Studies by British psycholo-



gist Robert Hockey and others have demonstrated that when people are performing a complex task in a noisy environment, they focus their attention on the most important aspects of the task, ignoring everything that is going on around them unless it can help them get the job done. I believe that this attentional focusing is a strategy to cut down on the amount of information they have to process in a noisy situation. In other words, when too much is going on at once, people can't pay attention to everything. Loud noise may be "too much," so people's brains simply may not process—or even perceive—subtle social cues that might otherwise influence their behavior. The arm cast in the Mathews-Canon study was probably such a cue. Under ordinary circumstances, most passersby might have perceived it as a subtle expression of need and come to the rescue. The lawn-mower noise may have made ordinarily helpful people insensitive.

Like planned experiments, surveys of naturally noisy neighborhoods suggest that noise interferes with interpersonal behavior. Donald Appleyard, an urban planner, and Mark Lintell, an architect, investigated the effects of traffic noise on the residents of three streets in a middle-income San Francisco neighborhood. The streets differed in the amount of traffic—light, moderate, or heavy—and, consequently, in noise levels. Residents of the lightly trafficked street were found to have three times as many friends and twice as many acquaintances as residents of the heavily trafficked streets. There was substantially more casual social interaction on the lightly trafficked street than on the other two; on the street with heavy traffic, there was virtually no activity at all. People on the noisiest street reported that it was a rather lonely place to live, while those on the quietest one perceived it as a friendly and sociable area.

Lack of community as well as an unwillingness to use outdoor facilities shows up in other surveys of noisy neighborhoods. People living near a busy airport complain that their

friends and relatives refuse to visit them because of the noise. Suburbanites exposed to heavy traffic noise do not make use of decks, patios, outdoor grills, or picnic tables; urban apartment dwellers living adjacent to busy streets are less likely to keep their entryways looking attractive than are their counterparts in quiet neighborhoods. Decreased neighborliness in the midst of noise probably occurs for the same reason decreased helping does: communication difficulties caused by noise, desire to get away from the noise quickly, a bad mood,

not affect the intensity of the shocks given by the unprovoked group.

In real life, noise sometimes appears to lead to extreme violence. A middle-aged mother recently strangled her neighbor's four-year-old daughter and later told the police that she had done it because the girl made too much noise and disturbed her two teenage sons, who were studying for school examinations. The child's murder occurred only one month after a 47-year-old worker was convicted of stabbing his neighbor's wife and her two daughters to death because "they played the

**Noise inhibits the Good Samaritan impulse. In one study, more passersby helped an "injured" person pick up dropped books on a quiet street than on a noisy one.**

and a tendency to concentrate on one's own problems.

Evidence on the relationship between noise and aggression is sparse but consistent. Laboratory studies clearly indicate that while loud noise itself is not sufficient to cause aggression, noise intensifies a predisposition to behave aggressively. In a study by psychologists Edward Donnerstein and David Wilson, an experimental confederate intentionally angered half of the subjects by telling them they had done poorly on a laboratory task and by giving them a number of painful shocks. The confederate gave the remaining subjects a positive evaluation and only one shock. Subject and confederate then switched roles, with the subject now in the role of shock-giver. As we would expect from our knowledge of conditions that lead people to act aggressively, angry subjects administered more intense shocks to the confederate than did subjects who were not angry. Moreover, when a recording of loud noise was played during the shock session, angered subjects administered even more severe shocks. But the noise did

piano too loudly." Several months ago, my hometown newspaper reported the story of a man who was apparently angered by a gas company crew using a jackhammer in the street in front of his house. The man approached the workers, asked them to be quiet, and then went home. The workers told police that they had begun to work again when they heard a shotgun blast and saw the man standing on his porch with a gun aimed at them. Of course, these are not everyday occurrences; they exemplify extreme reactions to noise by people who must have serious psychological problems to begin with.

**T**he research up to now is far from complete concerning the effects of noise on human beings. There are data linking noise exposure to heart disease, but the evidence is not conclusive. Some studies suggest that noise can impair the ability to do certain tasks well, but the findings are inconsistent and open to different interpretations; as yet, we do not know how a specific noise will affect per-

formance in specific circumstances.

Despite the gaps in our knowledge, we do have enough information to formulate community noise policies. On the one hand, individual attitudes toward a noise and its source are probably as important as noise intensity in determining response to sounds. Thus it is reasonable to expect large individual differences in reaction to any noise source. Does that make laws limiting the intensity of noise beside the point? Not at all. We know that intensity remains an important factor, with increases in loudness almost always resulting in increases in the percentage of affected residents. Noise-elicited annoyance and disruption of interpersonal activities can be a serious threat to the quality of life; increases in intensity result in increased risk of psychological harm.

The role of noise research in setting public policy is only just beginning to be established. The fact that loud noise can damage hearing is widely accepted, but until recently, few if any public officials accepted as fact the idea that noise can do psychological harm. In a recent landmark court case, however, several residents of the area surrounding Los Angeles International Airport sued for compensation from the city of Los Angeles for loss of property value and for mental and emotional distress caused by airport din. Not only were they granted compensation for loss of property value, but the California Supreme Court also affirmed their contention that jet noise interferes with daily life and causes "a sense or feeling of annoyance, strain, worry, anger, frustration, nervousness, fear, and irritability." Moreover, the court didn't even demand medical proof that the residents had suffered impaired hearing or other physical injury. Thus, the court made it official: in the eyes of the law, as well as in the minds of psychologists, noise is a nuisance. □

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