

# *Silence, please*





## Psychologists are increasing awareness of the harmful effects noise has on cognition and health.

BY AMY NOVOTNEY

**W**e've all been annoyed by a neighbor's late-night partying or early-morning lawn mowing. But it turns out that living in a noisy neighborhood — particularly one plagued by train horns blaring or airplanes overhead — is more than exasperating. It might actually be deadly, according to a report released in April by the World Health Organization and the European Commission's Joint Research Centre.

A steady exposure to "noise pollution," the report concludes, may lead to higher blood pressure and fatal heart attacks. The report analyzed a large number of epidemiological studies, most of which were conducted in Europe.

The report also confirmed what several psychologists have known for decades: Chronic noise impairs a child's development and may have a lifelong effect on educational attainment and overall health. Numerous studies now show that children exposed to households or classrooms near airplane flight paths, railways or highways are slower in their development of cognitive and language skills and have lower reading scores.

"There is overwhelming evidence that exposure to environmental noise has adverse effects on the health of the population," the report concludes, citing children as particularly vulnerable to the effects of chronic urban and suburban racket.

As air traffic increases worldwide and politicians consider building noise-producing wind turbines in more residential neighborhoods (see sidebar), the negative effects of noise will only continue to grow unless more is done to abate

it, says environmental psychologist Arline Bronzaft, PhD, of the City University of New York. Her now-classic study from the 1970s was among the first to report the harmful effects of subway noise on children's learning, and she has advised four New York City mayors on noise policy. New noise research in the United State has been scarce, however, since nearly 30 years ago federal funding for noise pollution research was cut after the U.S. Environmental Protection Agency's Office of Noise Abatement and Control was eliminated during the Reagan administration.

Still, Bronzaft says, as a matter of public health, psychologists must continue to stay involved in efforts to reduce environmental noise.

"Noise is a psychological phenomenon," says Bronzaft, a contributor to the book "Why Noise Matters" (2011). "While the ear picks up the sound waves and sends it to the temporal lobe for interpretation, it's the higher senses of the brain that determine whether that sound is unwanted, unpleasant or disturbing, and that's why psychologists need to be heavily involved in this issue."

### Trains, planes and automobiles

It was her daily three-hour commute via New York City's transit system that first piqued Bronzaft's interest in the effects of transportation noise on children's learning. Passing homes along the elevated train trips to and from Lehman College, she couldn't help but wonder how residents, especially children, coped with the trains' noise. A student in one of her classes had a child in a school adjacent to an elevated train structure and



this provided the opportunity for Bronzaft to find out how students and teachers could cope with the sound of the elevated train passing by every four-and-a-half minutes. So she set out to study it in 1974, and found that reading scores of sixth-grade students whose classrooms faced the train were a year behind those on the quieter side of the building (*Environment and Behavior*, Vol. 7, No. 4).

"We even talked to the teachers who taught students in those classrooms at Public School 98 and they said they were

exhausted at the end of every day," Bronzaft says. "Eleven percent of class time was ultimately lost as teaching had to stop for the train. The kids hated the train noise."

After Bronzaft completed her study, the New York City transit system agreed to install noise reduction materials on the rails adjacent to the classrooms and the Board of Education installed sound-reducing materials in the ceilings of these classrooms. Noise abatements lowered the din in these classrooms significantly, and reading scores on both sides of

### Noise isn't always loud

Another spate of psychological research is exploring the psychological and health effects of quieter — albeit constant — noise from wind farms. While these turbines are typically many decibels lower than the noise emitted by busy city traffic, power lawn movers or leaf blowers, sounds don't have to be loud to be disturbing or to decrease quality of life, says Bronzaft.

"A dripping faucet may not measure that loud, but it sure can keep someone awake," says Bronzaft, who has testified on the hazards of noise to government and health organizations in the United States and Canada and served as an expert witness in court cases on wind turbine noise.

Since the technology is still relatively new, a strong link between wind turbine noise and impaired human behavior or performance has yet to be proven — and the lack of federal funding means that research is unlikely to remedy this anytime soon. Yet several small case studies and observational interviews have found an increase in sleep disturbance, psychological stress and headaches among those who live near the structures, according to New York pediatrician Nina Pierpont, MD, PhD. Pierpont documents the individual experiences of families in Canada, Europe and the United States who live within several miles of the windmills in "Wind Turbine Syndrome: A Report on a Natural Experiment" (2009), and advocates for more

research on the health effects before additional harm is done. Yet some experts, including Robert J. McCunney, MD, a staff physician at Massachusetts General Hospital, argue that to establish a better connection between wind turbines and health, an individual's health status must be studied before and after the windmills are installed, and the research should be peer reviewed. In

addition, in 2009, a panel of independent experts in public health, audiology and medicine commissioned by the American and Canadian Wind Energy Associations looked at peer-reviewed studies on the health effects of wind turbines and found that while some people might be annoyed by the "swish, swish" sound of the windmills, no medical basis existed for the health complaints that often arise near large wind-farm projects.

"The sounds emitted by wind turbines are not unique," panelists, including McCunney, contend in their review. "There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from

wind turbines could plausibly have direct adverse health consequences."

Still, Bronzaft's efforts — along with a continued focus by psychologists around the world on noise pollution research and on teaching psychology students about the potential negative effects of noise — can help to increase society's understanding of how to help abate chronic noise.

—A. NOVOTNEY



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the building among the two groups were equalized — further evidence that noise was to blame, Bronzaft says (*Journal of Environmental Psychology* Vol. 1, No. 3).

Trains aren't the only noisy culprits to affect children's learning. Several cross-sectional studies have linked aircraft noise to poor classroom performance. One of the most compelling studies in the field of noise pollution is a naturally occurring longitudinal experiment published in 2002 in *Psychological Science* (Vol. 13, No. 9) examining the effects of the relocation of Munich's airport on children's health and cognition. Six months before and 12 months and 18 months after the airport closed and moved to a distant location, researchers — led by psychologists Staffan Hygge, PhD, Gary W. Evans, PhD, and Monika Bullinger, PhD — administered tests of reading, memory, attention and hearing to third- and fourth-graders who lived and attended school near the two airport sites. They found that the reading comprehension skills and long-term memory of children near the old airport improved once air traffic moved to the new airport, while the performance of children near the new airport declined.

The study also suggested that noise-exposed children may be less sensitive to speech, even though their hearing was unimpaired. After the old airport closed, children living near its site showed marked improvements in reading and memory, but their speech perception remained impaired, says Evans, a professor of human ecology at Cornell University.

"We think one thing that might be going on is that children who are exposed to noise develop a stress response of ignoring the noise, but not only do they ignore noise, there's evidence that they also ignore speech," Evans says. "So not only are they ignoring the stimuli that are harmful, but they're also ignoring stimuli that they need to pay attention to."

Researchers also found that the Munich students near the working airports had significantly higher levels of the stress hormones adrenaline and cortisol and markedly higher blood pressure readings than children in quieter neighborhoods. Evidence suggests that elevated blood pressure in childhood predicts higher blood pressure later in life, and higher levels of stress hormones are linked to several life-threatening adult illnesses, including high blood pressure, elevated cholesterol and other lipids, and heart disease.

"This study is among the strongest, probably the most definitive proof that noise — even at levels that do not produce any hearing damage — causes stress and is harmful to humans," Evans says.

### Beep goes the ventilator

Noise experts are also exploring another place where noise may, ironically enough, impair health: hospitals. The din of motorized beds, ambulance sirens, human voices and 24/7 patient monitoring via alarm-based ventilators and other medical devices make hospitals noisier than ever these days. A 2005 study in the *Journal of the Acoustical Society of America*

(Vol. 118, No. 6) suggests that noise levels in hospitals have increased dramatically over the past 50 years. In the 1960s, daytime hospital sound levels around the world averaged 57 decibels; today the average is 72 decibels. Nighttime levels have jumped from 42 decibels to 60. The World Health Organization's hospital noise guidelines recommend that sound levels in patient rooms should not exceed 35 decibels.

The racket of modern medicine can have debilitating effects on patient health and healing by disrupting sleep, raising stress levels and triggering medical errors. In a 2004 unpublished white paper examining noise in neonatal intensive care units, for example, environmental psychologist Craig Zimring, PhD, found that higher noise levels elevated blood pressure, increased heart rates and disrupted patient sleep patterns, possibly enough to impede development and contribute to hearing loss in premature infants. And a set of 2010 auditory perception experiments published in *Social Science & Medicine* (Vol. 70, No. 1) conducted by University of Illinois, Chicago, researchers showed that hospital noise levels led clinicians to confuse similar-sounding drug names with one another.

"There's a lot of empirical evidence now that noise impacts patients, and anyone who has spent any time in a hospital can support that," says Zimring, of the Georgia Institute of Technology.

To help hospitals address the problem of noise, Zimring is serving as a member of the multidisciplinary Healthcare Acoustics Research Team, a team of experts in acoustics, engineering, architecture, psychology and medicine. The team is working with health-care officials to reduce sources of noise — from overhead paging systems or unnecessary alarms, for example — and redesign hospitals using building materials and furniture that can help absorb noise.

"Installing carpeting and acoustic ceilings in hospitals has always been difficult because they're not easily scrubbable, but recently people have discovered ways to develop panels that are both sound absorbent and that limit the possibility of infection," Zimring says. "These are pretty low-cost investments that can have a pretty high impact on patients." ■

Amy Novotney is a writer in Chicago.

### Further reading, resources

- Pierpont, N. (2009). *Wind Turbine Syndrome: A Report on a Natural Experiment*. Santa Fe, NM: K-Selected Books.
- Stewart, J. (2011). *Why Noise Matters*. Oxford, U.K.: Earthscan Publications.
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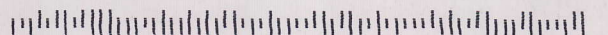
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