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ESSAY

Hearing Too Much in a Noisy World

Even ordinary levels of background din can drown out the meaning our brains seek from sound

ILLUSTRATION: DOMINIC BUGATTO

By Nina Kraus
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When the pandemic struck in March of 2020, the human world went quiet. During what some are now calling the anthropause, highways and byways emptied of cars while shops and services locked their doors for weeks and months. Using sensitive sound level analyzers, scientists from every continent confirmed a reduction in human-created sound levels, in some cities by as much as seven decibels, which translates to about one-fifth as loud as before.

We have all experienced not noticing a sound until it goes away. Often it is an air conditioner that cycles off or an idling truck whose ignition is cut. Suddenly we “hear” the silence and sigh in relief. We revel in the peace until the drone starts up again or is

replaced by the next aural annoyance. This kind of noise doesn't damage our ears, and we can mostly tune it out. And yet research tells us that it should concern us for the sake of our brains. Our ability to distinguish signal from noise is crucial to nearly everything we do, and the more noise surrounds us, the less we are able to call our brains to attention when attention is warranted.

Few people realize that there are two types of dangerous noise. Everyone knows about the danger of loud sounds. If you spend too much time in a noisy place, using power tools, or listening to loud music, your ears may be damaged. The National Institute for Occupational Safety and Health standards make very clear that sustained noises at a level of 85 decibels and up are damaging to the ears. There is no mistaking an ear-damaging noise when you hear it: It is LOUD.

The sounds of human activity generally don't reach that accepted threshold of "unsafe." Most people would consider the day-to-day sounds of urban life or a bustling workplace "background noise." We think we shrug it off and tune it out. But we are not really tuning it out so much as we are adapting our lives to a constant state of alarm.

> **Noise can have a pernicious effect not only on our hearing, but on all our senses.**

Our brains evolved to respond to changes in otherwise predictable sound patterns because our distant ancestors needed to be alerted to potential sources of danger— think of the sudden movement of a snake while crickets are chirping. Chronic exposure to meaningless noise requires our brains to sustain an exhausting state of alertness and ultimately dulls our perceptions. According to a 2010 study in the journal Hearing Research, such exposure can blunt an animal's ability to distinguish meaningful sounds.

If you live in a city or labor in a noisy workplace, you may ace the hearing-threshold test when your ears are tested, but you are less able than your peers who are accustomed to quiet environments to detect sounds in noise or to pick up on subtle timing cues in sounds. A 2004 study in Psychophysiology of noise-exposed workers with otherwise clinically "normal" hearing found that they showed diminished responses to subtle changes in otherwise predictable acoustic patterns. They also were excessively distracted by irrelevant sounds, which interfered with their ability to perform tasks. Such weakened aural processing is exactly the sort that we associate with old age.

What we hear, when and how often—and the value and importance we place on those sounds—cannot be separated from the functioning of the other systems in our bodies. Noise can have a pernicious effect not only on our hearing, but on all our senses. When there was background noise, subjects in the 2004 Psychophysiology study performed worse on visual-motor tasks, such as tracking a moving target on a computer screen with a mouse pointer. Road traffic noise has even been convincingly correlated with heart disease. Indeed, chronic noise exposure increases both the levels of stress people report and the measurable level of the stress hormone cortisol.

A constant low-level barrage of meaningless sound is demonstrably bad for any brain, but it is especially devastating for a developing brain. Some medical scientists have grown concerned that the lifesaving medical equipment in neonatal ICUs could have the unintended consequence of funneling a jumble of potentially damaging noise into the brains of fragile newborns during their developmentally critical first few days of life. That concern has spawned a fast-growing area of study among neuroscientists and other specialists, with some suggesting that "auditory trauma" may compromise the linguistic and cognitive development of infants.

Having our hearing always "on" is fatiguing for the brain, especially when the background noise is unimportant but unrelenting. A 1975 study furnished the stark example of an elementary school in New York City that on one end abutted a busy elevated subway track. Reading scores of children in classrooms on the noisy side of the school lagged behind those of their peers on the quiet side by up to 11 months. Mitigation efforts, including rubber rail padding and noise abatement materials in the affected classrooms, erased the learning gap.

When the noise level was tamped down, the children could tune their brains to extract the sounds that were important—those of their teachers' voices—a sophisticated process that our amazing hearing brains can automatically achieve, given the right aural environment.

But that environment is fragile. A 1994 U.S. housing survey found that residents of low-income neighborhoods were more than twice as likely as others to report bothersome levels of neighborhood noise. And according to a 2013 study in The Journal of

Neuroscience, children raised in such environments often have a high level of neural noise in their brains, meaning that their auditory neurons are active even when the external world is quiet.

The result is a noisy brain, processing sound less distinctly than it otherwise might. Imagine listening to a poorly-tuned radio, with static noise getting in the way of hearing what the radio announcer has to say. The noise on the outside becomes noise on the inside, obscuring the subtle, yet important distinctions in language—like the difference between 'bill' and 'pill,' for example. Another study, in 2005 in The Lancet, found that chronic exposure to aircraft noise negatively affected cognition and reading comprehension among children.

The hearing brain is vast. It engages how we think, feel, move, and interpret our other senses. Not only does it shape our health, but it is deeply involved in forming memories and contributes in no small way to making us who we are. No one wishes to endure another pandemic, but the silence of the anthropause and the lessons of auditory neuroscience should remind us of the importance of distinguishing what matters from the clamor of all that doesn't.

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