

'Safe' Noise Harms the Brain

By Nina Kraus, PhD, and Trent Nicol, BS

Helping clients navigate hearing in noise is a major chunk of an audiologist's purview and noise-induced hearing loss is one of the most prevalent causes of hearing complaints.

The National Institute for Occupational Safety & Health (NIOSH) spells out the duration of exposure one can endure at a given intensity before hearing loss becomes a real risk. Sustained noises at a level of 85 decibels and up are damaging to the ears. Spending too much time in a noisy place, using power tools, or listening to loud music likely results in hearing loss. Many of us treat our own ears with respect by wearing hearing protection at concerts, while mowing, at the shooting range, or when in other unavoidably noisy places.

THE COVID-19 PANDEMIC EFFECT ON NOISE

But noise does not have to be loud to do biological harm, as discussed considerably in my book, "Of Sound Mind".¹ When the human world temporarily became quiet in the early weeks of the coronavirus pandemic, people worldwide noticed a distinct, refreshing lack of noise. Measurements from every continent confirmed a reduction in human-created sound levels, in some cities by as much as seven decibels.

The kind of noise that the pandemic temporarily erased—the idling truck, the rumbling subway, the murmur of voices at the restaurant, the sound of quotidian human activity—doesn't damage our ears, and we can mostly tune it out. Yet it should concern us for the sake of our brains. Having our hearing always "on" is fatiguing for the brain, especially when the noise is that brutal combination of unimportant and unrelenting. 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.

INSIDE THE BRAIN

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. Separating the signal from the noise is evolutionarily important—think



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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; the signal becomes ever more elusive. If you live in a noisy city or work in a noisy place, you may ace your audiogram, but be less able to detect sounds in noise or to pick up on subtle timing cues in sounds than your peers who are accustomed to quieter environments. You may be excessively distracted by irrelevant sounds, compromising your effectiveness on the job, your psychological health, and your relationships.

A constant low-level barrage of meaningless sound is especially devastating for a developing brain. Some 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.² That concern has spawned a fast-growing area of study among neuroscientists and other specialists, suggesting that NICU auditory trauma may compromise the linguistic and cognitive development of infants.

Children raised in noisy neighborhoods 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.³ The result is a noisy brain, processing sound less distinctly than it otherwise might. Another study found that chronic exposure to aircraft noise negatively affected cognition and reading comprehension among children.⁴ Whatever the source of noise, it erodes our ability to home in on the signal with sometimes devastating consequences.



From left: At Northwestern University, **Dr. Kraus** is a professor of auditory neuroscience, investigating the neurobiology underlying speech and music perception and learning-associated brain plasticity (Learn more at www.brainvolts.northwestern.edu), and **Mr. Nicol** is a research associate in the Auditory Neuroscience Lab.

HUMANMADE NOISE'S IMPACT ON NATURE

Humanmade noise is damaging to our non-human compatriots as well. During the weeks of lockdown in March and April of 2020, many of us noticed a riot of birdsong. Birds increased the intricacy of their songs, realizing perhaps that the hard work they put into their compositions would not be wasted, buried under the usual humanmade din. Birds also shifted the pitch of their songs downward to fill the vacant pitch space once filled with traffic noise. But here is a little surprise about the birdsongs during the quiet period: birds actually reduced the loudness of their songs. Yet their pitch-shifted, sophisticated, and now-softer songs traveled double the distance and stood out in bold relief against the newly quiet backdrop of our pandemic-caused caesura of commotion.⁵

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Birdsong during a pandemic is but one example of human noise having an impact on animal life. Birds, frogs and even whales—like humans—increase the loudness of their voices as the environment gets noisier. Animals also change their call rates or pitches, or make other qualitative changes, just to make themselves heard over us.

But sometimes animals simply give up. Ship sonar can cause whales to go silent. It also interferes with the echolocation they rely on for navigation and is thought to be a cause of some beachings.⁶ Human-created noise has forced hundreds of species of animals around the world to alter their behaviors, which holds consequences for mating, migrating, and even their continued existence. As go these species, so may go humans if the delicate balance between human and animal worlds is upset further than it already has been.

Sound has interesting and unexpected roles in plant life as well. Sound can stimulate plant growth and promote their resistance to pests.⁷ Certain flowers release their pollen only when the preferred species of bee buzzes at its characteristic pitch. Evolution has “taught” tomatoes, peppers, eggplant, kiwis, and other plants that their blossoms’ pollen spreads best when borne on the bodies of bee species that buzz at some 200-400 hertz.⁸ Who knows how humanmade noise might affect our non-animal cohabitants of earth?

THE POWER OF SOUND

The power of sound, then, is pervasive but under-recognized. We rally around causes that reduce visual pollutants in our towns and cities or protest the loss of forests, which are easy to see. But there is little awareness of the acoustic network that helps many species thrive.

We heard a bit of what we were missing in spring of 2020. As humanmade noise attains its pre-pandemic roar, let's not forget the damage we are doing to our brains and to the other living things we share this world with. [UJ](#)

References for this article can be found at <http://bit.ly/HJcurrent>.