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The sound of screech

Experts decipher the blood-curdling nature of fingernails on a chalkboard

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In a study that borders on painful, people who listened to the sounds of nails and squeaky chalk dragged across a chalkboard have helped scientists pinpoint which frequencies cause people to cringe.

Two scientists who study icky sounds have figured out why fingernails dragged across a chalkboard make people's skin crawl. It's not the highest or lowest sounds in the squeak that are so annoying, but rather tones that lie in the range of a piano keyboard.

This makes sense because the human ear has evolved to be sensitive to these frequencies, says Christoph Reuter of the University of Vienna's Musicological Institute. His colleague, Michael Oehler of the Macromedia University for Media and Communication in Cologne, Germany, will present the findings in San Diego November 3 at a meeting of the Acoustical Society of America.

But sound waves alone can't account for the excruciating experience. Knowing that a screech comes from a chalkboard instead of a piece of contemporary music increases a listener's discomfort, the researchers found.

"I'm also convinced that watching somebody scrape their nails on a chalkboard will make the experience even more unpleasant," says Randolph Blake, a vision scientist at Vanderbilt University in Nashville. More than a quarter of a century ago, he and his colleagues first showed that filtering out the highest frequencies doesn't make the fingernail-scraping sound any less chilling.

To pinpoint which frequencies are to blame, Reuter and Oehler played six different chalkboard squeaks to 104 unfortunate people who rated their discomfort. The researchers measured changes in 24 listeners' vital signs and skin conductivity — indicators of stress — while replaying the two most annoying clips.

The shrill sounds contained frequencies ranging all the way to 12,000 hertz and beyond. Cutting out the lowest or highest frequencies didn't change the listeners' desire to gouge out their own eyes. But removing all tones between 2,000 and 4,000 hertz did make the experience a little more pleasant — or at least a little less hellish.

It may be that the ear canal naturally resonates with these frequencies, the researchers suggest. This amplifies many of the important sounds people pay attention to every day, including the human voice.

Josh McDermott, a hearing scientist at New York University who has studied other annoying noises like metal being dragged across glass, agrees with this explanation. He says this sensitivity is why people with noisy jobs tend to lose hearing in this frequency range first. McDermott himself has trouble hearing these frequencies — a fact he blames on his former career as a radio DJ.

"We're learning that's where some of these really annoying sounds pack most of their punch," he says.

SUGGESTED READING :

- Lay language paper summarizing Reuter and Oehler's research:
- Josh McDermott on annoying sounds:

CITATIONS & REFERENCES :

- C. Reuter and M. Oehler. Psychoacoustics of chalkboard squeaking. 162nd Meeting of the Acoustical Society of America, San Diego, November 3, 2011.