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## Science NOW UP TO THE MINUTE NEWS FROM SCIENCE

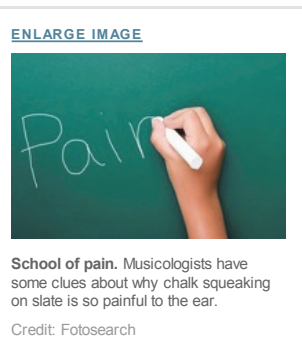
### Cover Your Ears!

by Kim Krieger on 28 October 2011, 12:35 PM | 13 Comments

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Some sounds are excruciating. Take fingernails squeaking on a chalkboard. The noise makes many people shudder, but researchers never knew exactly why. A new study finds that there are two factors at work: the knowledge of where the sound is coming from and the unfortunate design of our ear canals.



Previous research found that the painful parts of unpleasant sounds appear to be in the middle range of audible frequencies. But scientists didn't nail down exactly which frequencies or explain why the sounds were painful. So musicologists Michael Oehler of the Macromedia University for Media and Communication in Cologne, Germany, and Christoph Reuter of the University of Vienna asked listeners to rank sounds in a listening test. Fingernails raking against a chalkboard and chalk squeaking against slate were the most unpleasant sounds from a family of recordings, which also included sounds such as Styrofoam squeaks and scraping a plate with a fork.

The researchers then modified the recordings of fingernails and chalk, removing or attenuating various frequency ranges. They also modified the sounds by selectively extracting either the tonal, musical-pitch parts or the scraping, growling, noiselike parts of the sound. Some listeners were told the true source of the sounds, whereas others were told that the sounds were part of contemporary musical compositions. The same listeners then rated the pleasantness or unpleasantness of the sounds while the researchers measured physical indicators of distress: the listeners' heart rate, blood pressure, and the electrical conductivity of their skin.

As they will report next week at the Acoustical Society of America conference in San Diego, California, Oehler and Reuter found that a listener's skin conductivity changed significantly when the person heard a sound he or she later reported as unpleasant, showing that disturbing sounds do cause a measurable physical reaction. More surprisingly, they found that the frequencies responsible for making a sound unpleasant were commonly found in human speech, which ranges from 150 to 7000 hertz (Hz). The offending frequencies were in the range of 2000 to 4000 Hz. Removing those made the sounds much easier to listen to. Deleting the tonal parts of the sound entirely also made listeners perceive the sound as more pleasant, whereas removing other frequencies or the noisy, scraping parts of the sound made little difference.

The ratings also changed depending on what the listeners thought the sounds were. If they thought a sound came from a musical composition, they rated it as less unpleasant than if they knew it actually was fingernails on a chalkboard. But their skin conductivity changed consistently even when they thought the chalkboard sound was from music and rated it as less unpleasant.

The researchers suspect that the shape of the human ear canal may be to blame for the pain. Previous studies have shown that the ear canal amplifies certain frequencies, including those in the range of 2000 to 4000 Hz. A loud screech on a chalkboard could be amplified within our ears to painful effect, the researchers propose.

Combining physiological measurements of pain such as skin conductance with psychological ratings of uncomfortable sounds is new and makes an important point about perception, says Reinhard Kopiez, a musicologist at the Hanover University of Music, Drama and Media in Germany, who was not involved in the study. Kopiez says the research shows just how important context is in the enjoyment of music. "The audience enjoys the performance because of the knowledge about the [artistic] origins of a sound, although the physiological response remains the same as for uncomfortable sounds," Kopiez says.

Oehler and Reuter intend to explore the parameters of unpleasant noises further in the future. Knowing what makes certain sounds painful, they say, could help engineers know which frequencies to modify or mask in order to

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make annoying sounds, such as whining vacuum cleaners, screeching factory machinery, or grating construction equipment, more pleasing to the ears.

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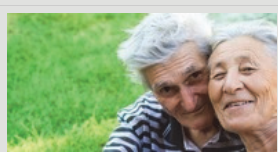
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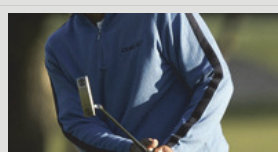
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**Bjorn Roche**

The A-weighted loudness scale, which has been around since 1936, was designed precisely for this reason. Sounds in this frequency range are well known to be annoying.

<http://blog.bjornroche.com/2011/11/annoying-sounds.html>

4vor Tagen, 22:35:30 – Markieren – Gefällt mir – Antworten



**DrNostoc**

In my old days at class... I used to squeak my fingernails on the chalkboard. Well, in fact I was not very popular...

5vor Tagen, 22:52:54 – Markieren – Gefällt mir – Antworten



**Gregory Earls**

So let me get this straight, none of these geniuses figured that the sound of fingernails on a chalk board annoy us because the FEELING of your nails scraping on a chalkboard is horrible. We associate the sound with the uncomfortable actual physical act of doing it.

And the high pitch isn't the problem, is the ugly way it falls in and out of pitch. I hear high pitched noises when I get my hearing checked. No problem. It's an even tone. The fork on the plate is uneven and grating. Come on!!!

Freitag, 4. November 2011, 04:03:33 – Markieren – Gefällt mir – Antworten



**cody bell**  
or implode

Montag, 31. Oktober 2011, 16:57:22 – Markieren – Gefällt mir – Antworten



**cody bell**

its interesting but im sure your head cant explode from it

Montag, 31. Oktober 2011, 16:57:05 – Markieren – Gefällt mir – Antworten



**Wouldn'tYouLikeToKnowMyName**

What was the importance in doing all this research? How does this even help us.

Montag, 31. Oktober 2011, 16:49:01 – Markieren – Gefällt mir – Antworten



**Article reader**

If one can determine what makes a sound unpleasant, one might engineer noisy machines to remove those unpleasant characteristics. This makes life better for everyone who is exposed to environmental noise. Conversely, deliberately created unbearable sounds might be used to make an area un-occupiable. How much would wall street pay for that?

Montag, 31. Oktober 2011, 21:53:12 – Markieren – Gefällt mir – Antworten

gefällt das Azrael



**John Adams**

The whole point of scientific research is to study the unknown and therefore by its nature we don't know whether a particular piece of research will be 'useful' or not. Take for example the study of those strange materials called semiconductors that was done in the early part of the 20th century. There was no perceived use for them at that point other than perhaps in crystal sets but no one knew how they worked or what they were. Thankfully some people decided to do some basic 'worthless' research on semiconductors. I'll let you find out what become of that research, you might be surprised.