

# Interaction between auditory cortex and amygdala responsible for our response to unpleasant sounds, research finds

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(Medical Xpress)—Heightened activity between the emotional and auditory parts of the brain explains why the sound of chalk on a blackboard or a knife on a bottle is so unpleasant.

In a study published today in the [Journal of Neuroscience](#) and funded by the Wellcome Trust, Newcastle University scientists reveal the interaction between the region of the brain that processes sound, the auditory cortex, and the [amygdala](#), which is active in the processing of [negative emotions](#) when we hear unpleasant sounds.

Brain imaging has shown that when we hear an unpleasant noise the amygdala modulates the response of the auditory cortex heightening activity and provoking our negative reaction.

"It appears there is something very primitive kicking in," says Dr Sukhbinder Kumar, the paper's author from Newcastle University. "It's a possible distress signal from the amygdala to the auditory cortex."

Researchers at the Wellcome Trust Centre for Neuroimaging at UCL and Newcastle University used functional [magnetic resonance imaging](#) (fMRI) to examine how the brains of 13 volunteers responded to a range of sounds. Listening to the noises inside the scanner they rated them from the most unpleasant - the sound of knife on a bottle – to pleasing - bubbling water. Researchers were then able to study the [brain response](#)

to each type of sound.

Researchers found that the activity of the amygdala and the auditory cortex varied in direct relation to the ratings of perceived unpleasantness given by the subjects. The emotional part of the brain, the amygdala, in effect takes charge and modulates the activity of the auditory part of the brain so that our perception of a highly unpleasant sound, such as a knife on a bottle, is heightened as compared to a soothing sound, such as bubbling water.

Analysis of the acoustic features of the sounds found that anything in the frequency range of around 2,000 to 5,000 Hz was found to be unpleasant. Dr Kumar explains: "This is the frequency range where our ears are most sensitive. Although there's still much debate as to why our ears are most sensitive in this range, it does include sounds of screams which we find intrinsically unpleasant."

Scientifically, a better understanding of the brain's reaction to noise could help our understanding of medical conditions where people have a decreased sound tolerance such as hyperacusis, misophonia (literally a "hatred of sound") and autism when there is sensitivity to noise.

Professor Tim Griffiths from Newcastle University, who led the study, says: "This work sheds new light on the interaction of the amygdala and the [auditory cortex](#). This might be a new inroad into emotional disorders and disorders like tinnitus and migraine in which there seems to be heightened perception of the unpleasant aspects of sounds."

## MOST UNPLEASANT SOUNDS

Rating 74 sounds, people found the most unpleasant noises to be:

1. [Knife on a bottle](#)
2. [Fork on a glass](#)
3. [Chalk on a blackboard](#)

4. [Ruler on a bottle](#)
5. [Nails on a blackboard](#)

Provided by Newcastle University

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