

# Scholar explores mystery of the 'music-evoked frisson'

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Why are opera singers' voices so distinctive and powerful? Why can we pick them out, without the help of amplification, against the sound of more than 100 accompanying instruments?

According to musicologist David Huron, we can do it because opera singers produce the bulk of their sound energy in the 3- to 4-kilohertz range. Humans are quite sensitive to this range, probably because it is also the range of a human scream.

"When something scares the wits out of you," Huron said, you involuntarily raise the ventricular folds sitting on your vocal cords. "A major aspect of opera training involves bringing the ventricular folds under voluntary control" to produce this distinctive pitch.

This finding is one of many pieces of evidence that Huron, a music professor at Ohio State University, has used to construct a theory of "music-evoked frisson"—the sensation of chills and gooseflesh that music sometimes provokes in listeners.

Huron was one of several speakers at the third annual International Symposium on Music and the Brain, which took place on campus May 16-17. The event featured more than a dozen scholars and musicians presenting research and performing music related to the symposium's theme of "exploring emotion." Other topics included how music triggers autobiographical memories, the ability of tone-deaf individuals to sense emotion in music and the effect of music on the repression of trauma.

To Huron, the "distinct feeling of shivers running up and down your spine" is "one of the most sublime feelings induced by music"—one reason why he has spent a great deal of time studying the phenomenon. He began his talk by describing the physiological sensations that compose a frisson. Noting that music is not alone in producing this sensation, he listed several pleasant and unpleasant analogues, including unexpectedly being touched by a potential romantic partner, climbing into a warm bath, riding a roller coaster, encountering a wild animal and hearing fingernails on a chalkboard.

Gooseflesh originally evolved to regulate body temperature: "When you feel cold, making your hair stand up on end is a good [compensatory] mechanism," he said. However, this physical reaction also is evoked by fear and used in displays of aggression.

Why, then, is this sensation involved in such a pleasurable feeling? Huron theorized that frisson, and other pleasurable feelings like it, are caused by "cortical inhibition of the amygdala," an area of the brain involved in fright, "following fear-inducing stimuli."

The data seem to fit this model. According to Huron, researchers have discovered that several of the frisson's acoustic correlates—things that seem to induce the sensation in listeners—are fear-related. These correlates include rapidly large increases in the loudness of music, abrupt changes in tempo and rhythm, a broadening of frequencies and an increase in the number of sound sources, among other factors.

These are all "low-probability musical events" that surprise and startle us, Huron said. The factors that evoke a frisson are, in his mind, "suspiciously similar" to those that evoke fear.

How does the mediation between fear and pleasure play out in the sensation of a frisson? The brain, Huron said, has two competing goals.

One, the unconscious "fast path," is to "react as fast as possible, especially to danger." The other, the "slow, conscious path," is to "react as accurately as possible." When a listener experiences a frisson, Huron believes that he first reacts with fear toward the stimulus, then comes to enjoy it by consciously recognizing that the stimulus is actually harmless.

This theory fits many of the other examples he cited, as well; for instance, being touched by a stranger who is not a potential romantic partner is unpleasant, according to Huron, because there is no cortical compensation for the fear response in that case. This also is likely why some people do not enjoy roller coasters—they really believe that they will die or be injured by the coaster and thus cannot effectively mediate their initial fright. Finally, this model might explain why some people dislike opera—the number one complaint about opera, Huron said, is that the singers sound like they are screaming.

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