Scientists uncover how our brains try to tell the difference between music- and speech-like noise

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Music and speech are among the most frequent types of sounds we hear. But how do we identify what we think are differences between the two?

An international team of researchers mapped out this process through a series of experiments—yielding insights that offer a potential means to optimize therapeutic programs that use music to regain the ability to speak in addressing aphasia. This language disorder afflicts more than one in 300 Americans each year, including Wendy Williams and Bruce Willis.

"Although music and speech are different in many ways, ranging from pitch to timbre to sound texture, our results show that the auditory system uses strikingly simple acoustic parameters to distinguish music and speech," explains Andrew Chang, a postdoctoral fellow in New York University's Department of Psychology and the lead author of the paper, which appears in the journal *PLOS Biology*. "Overall, slower and steady sound clips of mere noise sound more like music while the faster and irregular clips sound more like speech."

Scientists gauge the rate of signals by precise units of measurement: Hertz (Hz). A larger number of Hz means a greater number of occurrences (or cycles) per second than a lower number. For instance, people typically walk at a pace of 1.5 to 2 steps per second, which is 1.5–2 Hz. The beat of Stevie Wonder's 1972 hit "Superstition" is approximately 1.6 Hz, while Anna Karina's 1967 smash "Roller Girl" clocks in at 2 Hz. Speech, in contrast, is typically two to three times faster than that at 4–5 Hz.

It has been well documented that a song's volume, or loudness, over time—what's known as "amplitude modulation"—is relatively steady at 1–2 Hz. By contrast, the amplitude modulation of speech is typically 4–5 Hz, meaning its volume changes frequently.

Despite the ubiquity and familiarity of music and speech, scientists previously lacked clear understanding of how we effortlessly and automatically identify a sound as music or speech.

To better understand this process in their *PLOS Biology* study, Chang and colleagues conducted a series of four experiments in which more than 300 participants listened to a series of audio segments of synthesized music- and speech-like noise of various amplitude modulation speeds and regularity.

The audio noise clips allowed only the detection of volume and speed. The participants were asked to judge whether these ambiguous noise clips, which they were told were noise-masked music or speech, sounded like music or speech. Observing the pattern of participants sorting hundreds of noise clips as either music or speech revealed how much each speed and/or regularity feature affected their judgment between music and speech.

It is the auditory version of "seeing faces in the cloud," the scientists conclude: If there's a certain feature in the soundwave that matches listeners' idea of how music or speech should be, even a white noise clip can sound like music or speech. Examples of both music and speech may be downloaded from the research page.

The results showed that our auditory system uses surprisingly simple and basic acoustic parameters to distinguish music and speech: to participants, clips with slower rates (

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