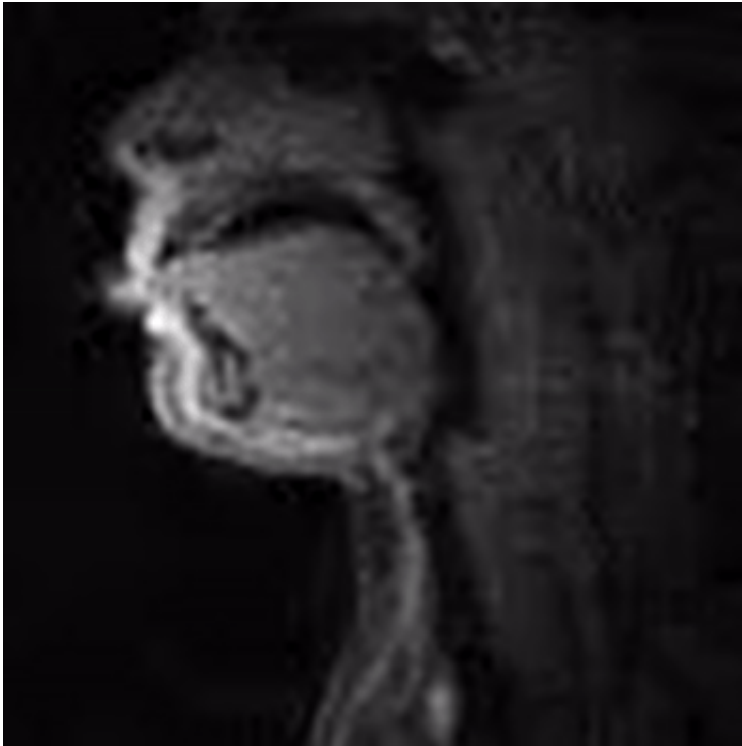


Unpacking the mysteries of beatboxing—linguists and engineers team up

April 11 2019, by Susan Bell



Video created from real-time MRI scans shows the inside of a beatboxer's mouth as she practices her art. [Click here to watch the video with sound.](#) Credit: Courtesy of SPAN

On the screen, a grainy MRI scan of a human mouth shows a tongue, leaping and curling as a sound like a snare drum rings out. This is a beatboxer in action—viewed from a new perspective: inside her mouth.

Once heard, never forgotten, beatboxing is a form of vocal percussion in which humans mimic drum machines, laying down beats using only their mouth, lips, tongue and voice. Linguists at USC Dornsife College of Letters, Arts and Sciences, including doctoral candidate Reed Blaylock, have teamed up with [electrical engineers](#) from USC Viterbi School of Engineering at the interdisciplinary research group SPAN (Speech Production and Articulation kNnowledge), to crack the mystery of how beatboxers make such a stunning range of sounds.

To do this, the researchers analyze real-time MRI videos they have created of the vocal tract in the process of producing beatboxing sounds using data from five beatboxers: two experts, two novices and award-winning beatboxer Nimisha Patil '17, who joined the project as an undergraduate.

"The project needed a linguist to analyze the videos, figure out what the beatboxers are doing, how they coordinate the movements of the lips and tongue with the soft palate to make all the different sounds," said Blaylock, who is writing his doctoral thesis on beatboxing. "As a linguist who studies the mouth, I was equipped to do that."

The first phase of the team's research is figuring out different sounds beatboxers make and how they make them. Beatboxers already have some knowledge of how they make their own sounds, but until the USC study, there hadn't been any real video evidence for what's actually happening inside their mouths. The research team is developing algorithms to study the live MRIs and provide feedback on exactly how the performers create the sounds.

The next phase looks at how beatboxers might change sounds, depending on what other sounds are around them. One of Blaylock's hypotheses is that when a certain beatboxing [sound](#)—the clickroll—is used, it changes how nearby sounds are produced.

Unheard of sounds

The clickroll is an example of a particular kind of airflow manipulation that hasn't been found in any language, Blaylock says.

So, if humans can make these sounds, why don't they appear in languages?

One theory is that because language only needs a handful of sounds to make an infinite number of words, we may as well use sounds that are relatively easy to produce.

By analyzing the movement patterns beatboxers use, we can better understand how the human body learns and produces coordinated actions.

"The whole point of all this research, from a linguistic or cognitive science perspective, is to figure out what's going on in the human mind," Blaylock says.

His research tries to answer such questions as: If someone is learning how to beatbox, how do they transition from speech to beatboxing sounds? Once they've learned beatboxing, does it affect the way they speak or how they unconsciously think about and manipulate sounds in their head?

"Beatboxing research is important," Blaylock says, "because it shows us what the limits of human vocal behavior are, and that helps us understand how we conceive of sound and movement in our minds."

"Boots and cats"

Blaylock knew very little about beatboxing before starting his research but immediately fell in love with the art form.

Learning to beatbox is like learning a new language, he says, except that there are no words, only sounds. By repeating the beginning beatboxing sounds of "boots and cats and boots and cats," then removing the vowels, anyone can achieve a reasonable sound, he maintains.

"Getting it to sound really crisp, clean and 'beatboxy,' though—that takes a while."

Blaylock is modest about his own beatboxing skills.

"It's nice, as with any motor skill, if you come into it as a kid. I'm 29, so I'm a little bit late to the party, but I'm trying. This morning I was working on my PF snare and the Inward K,"—a versatile snare sound that can be used in different beats.

"A big mystery when you first hear beatboxers is that they just keep making sound," Blaylock says. "When do they ever breathe?"

The trick, he reveals, is that some sounds—like the Inward K—are designed to help beatboxers breathe so they can keep going. "I'm trying to learn that one so I can beatbox all day long."

Provided by University of Southern California

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