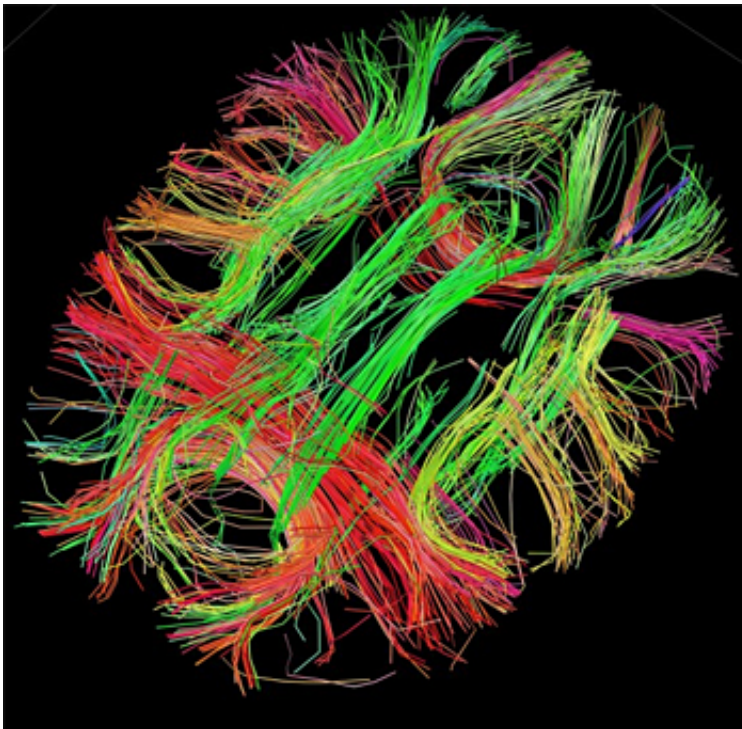


Research shows brain's predictive nature when listening to others

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White matter fiber architecture of the brain. Credit: Human Connectome Project.

Our brain activity is more similar to that of speakers we are listening to when we can predict what they are going to say, a team of neuroscientists has found. The study, which appears in the *Journal of Neuroscience*, provides fresh evidence on the brain's role in communication.

"Our findings show that the brains of both speakers and listeners take language predictability into account, resulting in more similar [brain activity patterns](#) between the two," says Suzanne Dikker, the study's lead author and a post-doctoral researcher in New York University's Department of Psychology and Utrecht University. "Crucially, this happens even before a sentence is spoken and heard."

"A lot of what we've learned about language and the brain has been from controlled laboratory tests that tend to look at language in the abstract—you get a string of words or you hear one word at a time," adds Jason Zevin, an associate professor of psychology and linguistics at the University of Southern California and one of the study's co-authors. "They're not so much about communication, but about the structure of language. The current experiment is really about how we use language to express common ground or share our understanding of an event with someone else."

The study's other authors were Lauren Silbert, a recent PhD graduate from Princeton University, and Uri Hasson, an assistant professor in Princeton's Department of Psychology.

Traditionally, it was thought that our brains always process the world around us from the "bottom up"—when we hear someone speak, our auditory cortex first processes the sounds, and then other areas in the brain put those sounds together into words and then sentences and larger discourse units. From here, we derive meaning and an understanding of the content of what is said to us.

However, in recent years, many neuroscientists have shifted to a "top-down" view of the brain, which they now see as a "prediction machine": We are constantly anticipating events in the world around us so that we can respond to them quickly and accurately. For example, we can predict words and sounds based on context—and our brain takes advantage of

this. For instance, when we hear "Grass is..." we can easily predict "green."

What's less understood is how this predictability might affect the speaker's brain, or even the interaction between speakers and listeners.

In the *Journal of Neuroscience* study, the researchers collected [brain responses](#) from a speaker while she described images that she had viewed. These images varied in terms of likely predictability for a specific description. For instance, one image showed a penguin hugging a star (a relatively easy image in which to predict a speaker's description). However, another image depicted a guitar stirring a bicycle tire submerged in a boiling pot of water—a picture that is much less likely to yield a predictable description: Is it "a guitar cooking a tire," "a guitar boiling a wheel," or "a guitar stirring a bike"?

Then, another group of subjects listened to those descriptions while viewing the same images. During this period, the researchers monitored the subjects' brain activity.

When comparing the speaker's brain responses directly to the listeners' brain responses, they found that activity patterns in brain areas where spoken words are processed were more similar between the listeners and the speaker when the listeners could predict what the speaker was going to say.

When listeners can predict what a speaker is going to say, the authors suggest, their brains take advantage of this by sending a signal to their [auditory cortex](#) that it can expect sound patterns corresponding to predicted words (e.g., "green" while hearing "grass is..."). Interestingly, they add, the speaker's brain is showing a similar effect as she is planning what she will say: [brain activity](#) in her auditory language areas is affected by how predictable her utterance will be for her [listeners](#).

"In addition to facilitating rapid and accurate processing of the world around us, the predictive power of our brains might play an important role in human communication," notes Dikker, who conducted some of the research as a post-doctoral fellow at Weill Cornell Medical College's Sackler Institute for Developmental Psychobiology. "During conversation, we adapt our speech rate and word choices to each other—for example, when explaining science to a child as opposed to a fellow scientist—and these processes are governed by our brains, which correspondingly align to each other."

Provided by New York University

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