How do musician's brains work while playing?

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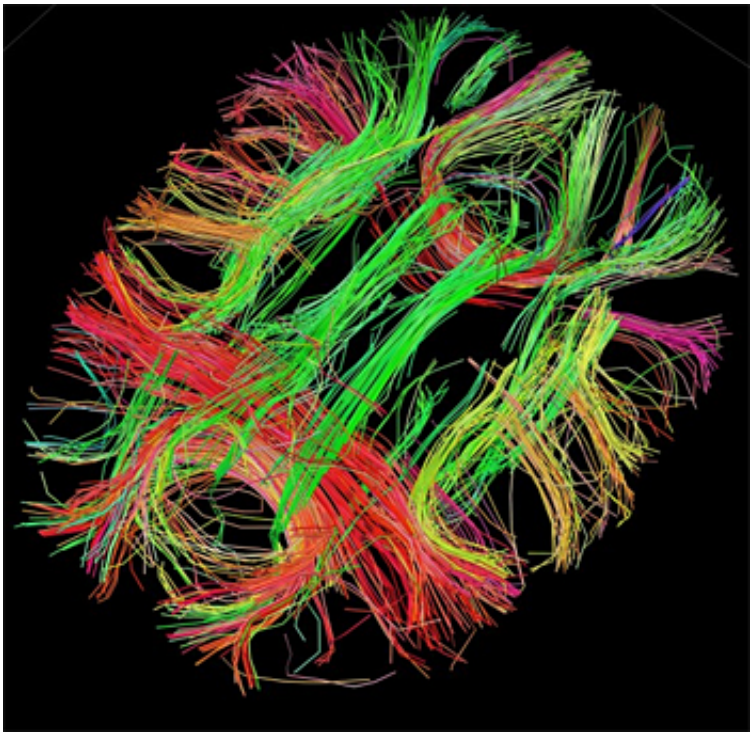

White matter fiber architecture of the brain. Credit: Human Connectome Project.

When musicians play instruments, their brains are processing a huge amount and variety of information in parallel. Musical styles and strengths vary dramatically: Some musicians are better at sight reading music, while others are better at playing by ear. Does this mean that their brains are processing information differently?

This is a question posed by Eriko Aiba, an assistant professor in the Graduate School of Informatics and Engineering at the University of Electro-Communications in Tokyo, Japan. During the 172nd Meeting of the Acoustical Society of America and the 5th Joint Meeting with Acoustical Society of Japan, being held Nov. 28-Dec. 2, 2016, in Honolulu, Hawaii, Aiba will present research that delves into the various ways the brain engages in music signal processing.

Aiba began learning to play the piano when she was five years old, and quickly realized that musicians might be roughly divided into two groups: sight readers and those who play by ear.

"When considering a human brain as a computer, playing a musical instrument requires the brain to process a huge amount and variety of information in parallel," explained Aiba. "For example, pianists need to read a score, plan the music, search for the keys to be played while planning the motions of their fingers and feet, and control their fingers and feet. They must also adjust the sound intensity and usage of the sustaining pedal according to the output sound."

Such information processing is too complicated for a computer, so how do the brains of professional musicians handle such complex information processing?

One piece of this puzzle is that pianists who are good at playing by ear are also good at memorizing, according to the group's findings when they put it to the test.

"Some were able to memorize almost the entirety of two pages of a complex musical score—despite only 20 minutes of practice," Aiba said. This means that auditory memory may be helpful for memorizing music following short-term practice.

They also discovered that "each musician has their own strategy—even if it appears they're all playing the piano in the same way," she added. "These strategies aren't completely different, however, because most musicians have some things in common."

The group's findings extend well beyond professional musicians to experts within other fields who also practice extremely hard every day to excel in their skills.

"It's difficult to validate individual differences ... and the conclusion that 'the strategy depends on individuals' could not be assumed to be scientific research," said Aiba. "On the other hand, it may now be possible to categorize professional musicians based on their type of prioritizing modality information—in terms of visual and auditory processing."

This work may help contribute to several research areas exploring expertise and performance. One, in particular, is language learning.

"To learn a language, some people prefer to read phrases aloud repeatedly—combining auditory and motion information. Others prefer to write phrases repeatedly—combining visual and motion information," Aiba explained. "But some prefer to simply read—visual information. They're all studying a language, but their brains are processing the information in different ways, depending on the strategy best suited to them."

It will take more time to "reveal our brains' brilliant strategy," Aiba noted, but it may lead to the development of efficient, individualized learning methods in the future.

More information: Presentation 2pMU11, "Music signal processing by the human brains: Studies on the strategies used by professional

pianists to efficiently sight-read music," by Eriko Aiba is at 4:50 p.m. HAST, Nov. 29, 2016 in Room Hibiscus.

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