All wound up: A clearer look at electric guitar pickups

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Pickups can be seen as the "heart" of the electric guitar, turning vibrations from the strings into electricity for sound. Credit: Yamaha Corporation of America

The electric guitar has been a core element of popular music for much of the past century. Pickups are the components that turn vibrations from the strings into electricity for sound and can be seen as the "heart" of the instrument. Electric guitarists have long known that the magnetic force from pickups affects the quality of their sound and how smoothly the sound transitions, known as timbre.

Takuto Yudasaka, visiting scholar at McGill University and researcher at Yamaha, present their work on the physics behind electric guitar pickups Wednesday, May 15, at 10:30 a.m. EDT as part of a joint meeting of the Acoustical Society of America and the Canadian Acoustical Association, held May 13–17 at the Shaw Center located in downtown Ottawa, Ontario, Canada.

"In electric guitars, the vibration of a magnetized string generates an electric current in the pickup coil," said Yudasaka. "This current is very weak, but by winding the coil thousands of times, more signal can be detected."

The details of how the pickup coil is wound has a significant impact on the resulting sound of the instrument. Winding the coil more will increase the output volume, but a coil wound too much can begin to lose its clarity. A minuscule winding of the coils, even as small as a hundredth of a millimeter, can make a noticeable sound change to a trained ear.

Furthermore, variables such as the type and thickness of the wire, the winding pattern, the shape and size of the pickup, and even the type of magnets used can all influence the guitar's sound. While the average listener may not pick up on it, electric guitarists have both noticed and been intrigued by these physical phenomena.

With such a range of choices, finding the perfect sound can be a

challenge, one Yudasaka and their colleagues hope to address.

"We were able to understand how the magnetic force of pickups affects the sound of electric guitars and how we can simulate it," said Yudasaka. "This simulation has the potential to not only reduce design time but also to enable the development of electric guitars with new timbres."

This understanding allows guitarists to make customary pickup selections and adjustments purposefully, removing most of the guesswork involved.

Yudasaka and their collaborators will continue their research on how pickups affect timbre through future simulations.

More information: Technical program: https://eppro02.ativ.me/src/EventPilot/php/express/web/planner.php?id=ASASPRING24

Provided by Acoustical Society of America