

## Drawing a violin bow to new lows in music

Scraping a bow across a string, a beginning violin student can readily create a remarkably diverse array of ear-jangling screeches, whines, and grunts.

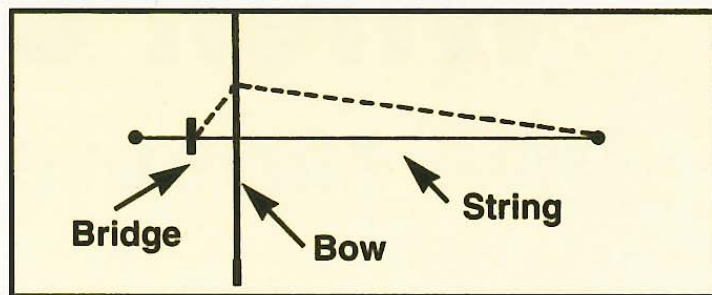
Now, a leading violinist has developed a new bowing technique that transforms some of the sounds unintentionally created by beginners into steady, clear, and loud musical tones. This method also enables a performer to play notes of much lower pitch than those customarily played on a violin.

"A violin can reach the range of a cello," says Mari Kimura of New York University. She described and demonstrated her technique at last week's Acoustical Society of America meeting, held in Washington, D.C.

When the hairs of a violin bow travel across a string, they alternately stick and slip. Each time the hairs stick, they in effect pluck the string, sending a pulse in the form of a kink up and down the string (see diagram). Such pulses cause vibrations in the wooden bridge over which violin strings stretch.

Several years ago, physicist Roger J. Hanson of the University of Northern Iowa in Cedar Falls and his coworkers noticed that by pushing down very hard when drawing a bow across a string, it was possible to create low-pitched sounds having frequencies below a string's fundamental frequency.

Studying this effect experimentally, the researchers discovered that these "anomalous low frequencies" occur when the bow force is great enough to prevent a propagating kink from triggering the normal release of the string from the bow hair. As a result, a violin's bridge vibrates less often than usual, transmitting an abnormally low pitch to the violin's body.



*The stick-slip motion of a violin bow drawn across a string excites pulses that travel along the string, making the violin's bridge vibrate.*

Recent computer simulations by Knut Guettler of the Norwegian State Academy of Music in Oslo support the experimental findings.

"But we did not initially consider these sounds as having much musical significance," Hanson says.

Meanwhile, unaware of the scientific work, Kimura had become intrigued by low-pitched tones that she could hear while doing a certain bowing exercise. She decided to explore the possibility of creating such sounds with sufficient control and precision to use them in performance.

Eventually, she learned how to handle her bow, drawing it with a large, steady force across the string, to consistently produce musical notes an octave or more below the string's normal frequency. Sound quality also depended on string type.

Though it requires considerable effort to perfect, her technique can be taught to other violinists, Kimura says. She has also written a number of solo violin compositions to take advantage of this new capability.

Musicians using stringed instruments with bows now have a new type of sound to play with.

— I. Peterson