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Digging Up Sound

Math—and an archaeologist's touch—brings back Brahms.

Photo: Peter Stember

IN THE GROOVE: Music chair Berger restores early recordings.

By Eva Ciabattoni

In late 2001, with anthrax on everyone's mind, associate professor of music Jonathan Berger received an unexpected package in the mail. The plain brown wrapper gave no hint of the contents. There was no return address. Curiosity triumphed over caution—Berger opened the package to find a cassette tape. Baffled, he popped it into his car's deck.

A frail, elderly voice identified itself as "Cigar Bill" Neiman. After apologizing that he was no longer able to write, Neiman said his lifelong hobby was collecting Thomas Edison cylinder recordings. He feared his treasures would be liquidated in a garage sale after his death. Because he had heard Berger talk about restoring an old cylinder recording of Johannes Brahms, Neiman wanted to bequeath the entire collection to him. Berger suggested contacting the Smithsonian Institution or another library to house such a valuable and fragile archive, but Cigar Bill was adamant: he did not want his collection to sit gathering dust. He wanted people to hear it and students to use it for research.

Berger acquiesced, and Stanford's Center for Computer Research in Music and Acoustics (CCRMA, pronounced karma) gained 1,500 pre-1920 cylinder recordings including classical, popular, folk, spiritual and march music; vaudeville routines; speeches; two Edison phonographs; and peripheral equipment. Cigar Bill died shortly after his gift was safely stowed at the Knoll, home to the newly renovated CCRMA offices and studios.

Demonstrating the Edison player in the corner office he inherited when he became department chair last September, Berger mounts a cylinder on the spindle and turns the hand crank on the side of the oak housing (the player uses no electricity). His face breaks into its trademark gap-toothed grin as music emerges through a cone-shaped amplifier—the technological equivalent of two hands cupped around a mouth.

Berger began work on his Brahms project at Yale, where he was a founding director of the Center for Studies in Music Technology before coming to Stanford. Archivist Richard Warner had set him on a quest to unearth the music in an acetate LP transferred from a wax cylinder recording. One musicologist described it as so noisy that "any musical value heard can be charitably described as the product of a pathological imagination." Most listeners could not tell that a piano was playing. Various attempts to filter and enhance the recording had yielded nothing of musicological significance. Berger's challenge was to separate out the noise, then digitally represent the music, staying true to the original. He likens the process to a paleontologist painstakingly removing layer upon layer of dirt with a toothbrush to reach the dinosaur bones hidden underneath.

The original wax cylinder of the Brahms recording has disappeared, but an introduction recorded with the music tells something of its origin. After inventing the dictaphone, Edison—who could have added marketing genius to his extraordinary résumé—sent emissaries to record the voices of famous people for use as advertisements. One of his representatives, Theo Wangemann, recorded Brahms playing piano at the home of Dr. Richard Fellinger in Vienna on December 2, 1889. Following the introduction, presumably by Wangemann, the composer plays measures 13 through 72 of his 1872 arrangement of Hungarian Dance No. 1 for solo piano.

The first step in excavating a musical dinosaur is to transfer the sound onto a computer, where it can be displayed as a graph (typically a series of waves) and subjected to visual scrutiny as well as mathematical manipulations. Berger used an algorithm called Best Basis—similar to choosing the right size chisel—to decompose the signal, isolating its well-structured components (the music) and removing anything left over (the noise). In a paleontologist's terms, too large a chisel and dinosaur bones might be damaged; too small and they will remain embedded in hard-packed dirt.

One challenge is figuring out the difference between an undesirable artifact like a scratch and a cymbal clash—both show up as spikes on the graph. Once the spike is removed and replaced with a flat line, the musicologist must postulate

what size and shape of wave might have been hiding under the spike—just as an archaeologist must make an educated guess about filling in missing pieces of dinosaur bones. Best Basis helps evaluate the range of reasonable musical probabilities. Just as in speech, where the phrase “in the event” has a high probability of being followed with “that,” so the structure of musical phrases has a degree of predictability.

For Berger, the results of his analysis were illuminating. While not perfect or musically pleasing—the fidelity was low and the sound gritty—the excavated performance revealed some surprises about how Brahms interpreted his own music. He improvised. He played in an unconventional manner Berger calls an inverse Robin Hood syndrome: borrowing from the short note to give to the long note, nearly doubling the length of some eighth notes. Berger describes his excitement at hearing the composer: “To me, Brahms is second only to God and to hear what might have been his voice . . . and more, to hear him perform his own music, it’s thrilling.”

Not everyone thinks so. When he published his findings, Berger received hate mail. Music restoration is as controversial a pursuit as art restoration, where one school of thought holds that works should be restored to their original vibrancy, while another says any modification is heresy. However, unlike art restoration, music restoration leaves the original intact.

One of the problems with the Brahms recording is that it begins at measure 13, a harmonically unsettled moment. Berger had to use his analysis of the available fragment to extrapolate what the entire composition would have sounded like. Knowing that the original piece was for four hands, he also reconstructed the second pianist’s part. The refurbished performance is playable on an acoustic reproducing piano such as Yamaha’s Disklavier. In effect, it recreates Brahms playing a duet with himself.

Straddling technology and art, Berger brought his talents as a composer to bear, guessing the dynamics and pedaling that Brahms might have employed. “Not being a scientist, I give myself artistic license to go beyond what can absolutely be determined from the recording,” he explains.

As for Cigar Bill’s collection, in keeping with his wishes, it is available for undergraduate and graduate research. Learning from Berger’s work and pioneering their own methods, students are cataloging and restoring the recordings so that eventually they will be available online for the general public to enjoy.

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