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UNH Mathematician Nominated for Grammy Award

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DURHAM, N.H. -- A biosketch of Kevin Short would read: Ph.D. in physics from the Imperial College of Science and Technology in London, professor of mathematics at the University of New Hampshire, teacher, researcher and entrepreneur, founder of UNH's first spin-out company, and Grammy Award nominee.

What?

Short was honored Dec. 6 in the 50th annual Grammy nominations for his role as a mastering engineer in the restoration of a 1949 bootleg wire recording of a live Woody Guthrie concert. It is the only known recording of Guthrie performing before an audience. Guthrie, known as the Dust Bowl Balladeer, wrote more than 1,000 songs in the 1930s and '40s, most as political commentary on poverty and social injustice.

Short is renowned for his discovery of Chaotic Compression Technology, which applies a mathematical theory known as chaos to audio, speech, video and image data. This allows the compression of large files to a fraction of the size and, with encryption, enables transmission in a wireless environment, such as downloading to a cell phone.

UNH filed for patents in 1998 and two years later, Short started a company, Chaoticom, the university's first spin-out. In 2006, after returning to UNH fulltime, Short began to dabble in music restoration.

Old analog tapes often were distorted by the mechanical effects of the recording instrument. The sprockets and gears that rotated the spools could cause warps and warbles in the sound, unlike the precision of modern digital recording equipment.

"I had been working on the mathematics of compression techniques and did lots of analysis of audio to figure out what's going on in this music," said Short.

His papers at scientific conferences caught the attention of Jamie Howarth, founder of Plangent Processes of Nantucket, Mass. Plangent's patented Clarity Audio Restoration technology uses a software algorithm to correct the speed and musical pitch distortions in analog recordings.

Howarth is an Emmy-award winning musical producer, engineer and session musician. He has an analytical mind and "golden ears," said Short. "He would watch how these machines move and he could hear what's going on. He's an expert in 'de-wowing' old music, the audio tracks from old movies and classic rock."

Short had worked with Howarth on the audio restoration of the Spielberg movie "Close Encounters of the Third Kind" and restoration of a Grateful Dead classic from 1976, "Live at the Cow Palace." When Howarth was called for the Woody Guthrie project, he brought in Short. "I wanted to be sure we gave these rare performances every possible opportunity, and Kevin's mathematical analyses gave us a better understanding of this antiquated medium," said Howarth.

In 2001, a heavy package had been mailed to the Woody Guthrie Archives in New York City. Received shortly after the World Trade Center attacks of September 11, this strange package from an unknown sender, containing two spools of wire, was at first suspected to be a bomb, according to published accounts.

As it turned out, the box had been sent by an elderly man who pulled it out of a closet in the process of moving. Paul Braverman, as a student at Rutgers University in 1949, had brought a wire recorder to Woody Guthrie's concert at Fuld Hall in Newark, N.J., and captured the songs and dialog.

Never capitalizing on his unauthorized recording, Braverman put the spools in a shoe box and stored it in a closet, where it remained for a half-century. He donated it to the Woody Guthrie Archives and died two years later without knowing the result of his beneficent bootlegging.

After determining the mysterious box was indeed not a bomb, Nora Guthrie, daughter of the late performer and director of the archives, searched for a year for a wire audio recorder. Finally, she found an audio restoration specialist who had converted a tape player to read wire, and hired a team of sound engineers led by Howarth and by Steve Rosenthal of The Magic Shop, a recording studio in Manhattan.

These engineers began the difficult work of transferring the sound. "The brittle wire would snap and sproing," said Short, and the loose ends of the hair-thin wire would tangle in knots. "It took them a heroic 36-hour session to get the sound off the wire," he said.

"I was not part of those efforts. I came in at the end, when everything had been digitized. The sound engineers cut and pasted and mixed the sound to reduce the hums and crackles to get a good signal so we could figure out what was going wrong with the recording."

Relying on Howarth's "golden ears" to indicate satisfactory results, Short applied the precision of mathematics to the signal data. "It sort of broke the bounds of our assumptions," Short said. "It really tested everything we had."

Howarth said, "Kevin led us to a greater understanding of how best to reclock the sound to undo the wows and flutters caused by the original machine's mechanical imperfections. This is what we do routinely with film and tape, but the special challenge of the wire required a new angle on the mathematical model we ordinarily employ, and Kevin was instrumental in that regard." The resulting album, "The Live Wire: Woody Guthrie in Performance 1949," was one of five Grammy nominees for best historical album. Awards will be announced Feb. 10.

What's next for Short? He has two new projects in the works: multiple channel sound analysis, which may lead to the development of better stereo hearing aids, and the refinement of techniques to detect trace materials used in making improvised explosive devices.

"Signal processing is one of the coolest places to test mathematical modeling and representation theory," said Short. "You have to scramble and come up with new mathematics to make it work."

Short's love of math paved the way to a Marshall scholarship which allowed him to study abroad, six U.S. patents, a successful company, a university professorship, an open door to fascinating research opportunities and yes, maybe a Grammy Award—all by the age of 44.

What advice does he have for his students—and his four children—about career choices? "The nice thing about mathematics is once you get a good model, it can be used over and over and it's right," said Short. "Applying mathematics to real life can be very cool."

A photo is available to download at: http://unh.edu/news/img/Short_CD.jpg

Dr. Kevin Short, professor of mathematics at UNH, has been nominated for a Grammy award for his role in the restoration of a 1949 bootleg wire recording of folksinger Woody Guthrie.

Credit: Douglas Prince, UNH Photo Services

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