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COMPUTER MUSICIAN CHRISTINE SOUTHWORTH | MEETING THE MINDS

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Dancing to the beat of a robot drummer

By Kimberly W. Moy, Globe Correspondent | January 23, 2006

Shortly after she graduated from college with a minor in music, Christine Southworth found herself composing tunes no one could play.

So the MIT alumna took the next logical step: She had a friend invent a robot that could perform her polyrhythmic, Indonesian-inspired compositions.

On Wednesday at the Museum of Science, Southworth, now a student of computer music, will show off her ensemble's compositions and her latest robotic instruments -- which lie at the nexus between science and art. The relatively new Bot(i)Cello, whose \$1,000 in parts include fans, strings, a wooden bowl and three windshield-wiper motors, will play alongside fellow robots, real-life Balinese gamelan players, and more-traditional instruments, such as a guitar, a violin, a bass, and a lyricon (a vintage wind instrument).

"My music, I just want it to be pretty and rhythmic," Southworth said. "I like music that you can dance to, if you want to. A lot of music you think of as robotic is ugly, like robots making their own music."

Southworth, 28, who majored in math at the Massachusetts Institute of Technology, said it took her a long time to find her voice as a composer/inventor. She liked jazz and African music classes but struggled to write her own pieces.

"I definitely hadn't found any sort of voice. The music was pretty bad."

Then she took a class in gamelan, a traditional Indonesian instrumental ensemble of percussion instruments like the xylophone, gong and cymbals. Forced to play by ear instead of relying on Western music theory, Southworth felt liberated. She focused her senior math thesis on the tuning of the gamelan, traveling to Bali to do research.

Once she knew what she wanted to write, she had to figure out a way to play it, which is where robotic instruments come in. She was still working out the robots' kinks as of last week, though, carving new spools for Bot(i)Cello's three strings, which are attached to bows on one end and motors on the other. The strings change pitch when the motors reel them in and out and are plucked by fans, producing sounds like an electric guitar, she said.

Unlike typical electronic music, "a robot is an actual physical being," said Evan Ziporyn, Southworth's music professor at MIT, who composed two of the pieces to be played Wednesday. "It gives you the possibility of what electronics can do -- in terms of precision and playing impossible rhythms -- but it's an actual acoustic sound."

But while a robot has advantages, computer programming doesn't get around the difficult physics of creating ear-pleasing sounds with mail-order parts.

"You'd think it'd be straightforward," said Giles Hall a computer programmer working with Southworth. But in the case of the ensemble's first robot, Heliphon: "For the longest time it sounded like a slot machine," Hall said. Then he pulled an all-nighter writing computer code to allow the robot to vary its volume. The Heliphon "actually sounds like an instrument now," he said.

"It's easy to make sound effects. It's difficult to make instruments," said Andy Cavatorta, another of Southworth's collaborators and creator of a robot named BlowBot that uses compressed air to play the pipes. Cavatorta mail-ordered antique organ pipes to improve BlowBot's sound quality in time for Wednesday's show.

Southworth has big plans for the robot ensemble, including concert tours and collaborations in other states and countries.

But it's taken three years of hard work just to get this far. "We thought we'd be able to whip out five robots, but it doesn't quite work that way," Southworth said. "They cost a lot to make, and there's a lot of trial and error."

FACT SHEET

Home: She was raised in Harvard, Mass., and now lives in the North End.

Family: Her father, Bill Southworth, an entrepreneur, was part of the team that in the early 1980s invented MIDI, the musical instrument digital interface that allow keyboard and other musical instruments to input musical data into computers and to be run by computers.

Education: Earned a bachelor's degree in math with a minor in music from the Massachusetts Institute of Technology in 2002. Expects to receive a master's in computer music from Brown University this spring.

The history: Southworth and Leila Hasan, who built Heliphon, founded the group Ensemble Robot in 2003. Their goal was to design and build robotic musical instruments and write music for these instruments, both alone and in collaboration with human musicians. "We are interested in making beautiful sounding amplified acoustic instruments," controlled by music software, Southworth said.

The robots: The **Heliphon** is an 8-foot tall double-helix-shaped xylophone played by electromagnetic hammers that strike the keys from beneath. It can press an unlimited number of keys at once, 20 times a second -- far faster than its human creator.

The **Bot(i)Cello** is a flower-like instrument that opens and closes, with small, motor-powered fans to pluck strings. Three of these string-motor setups are arranged in a circle, and each is controlled separately, playing long, sustained notes known as glissandi.

The **BlowBot** is the group's newest robot. It is a large tetrahedron of air pistons, controlled by compressed air. Each of the six sides can expand from 2 feet to 4 feet, contorting the BlowBot into numerous shapes and orientations. The BlowBot plays organ pipes as each side changes but also will accompany the music as a dancer. The plan is to add more pipes, Southworth says, giving it more musical versatility.

To see them: Southworth and her robots are scheduled to perform at 7 p.m. Wednesday in the Cahner's Theater, at the Museum of Science. The concert will be followed by a discussion of the impact of technology on music. Tickets are \$10. Call 617-723-2500, or go to www.mos.org or www.galaktika.org/mos/. ■

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