Powered up and programmed to perform

By Geoff Edgers
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Several months ago, during a rehearsal for "Death and the Powers: The Robots' Opera," a robot began to throb, vibrate, and power down.

DEATH AND THE POWERS: THE ROBOTS' OPERA At: Cutler Majestic Theatre, March 18, 20, 22, 25. Tickets: $25-$110. 617-824-8000; www.aestages.org

A programmer ran onstage with a screwdriver, aiming to fix the machine. But the opera's director, Diane Paulus, had a different response. She was thrilled. During that moment of unpredictability, the robot had behaved like an actor.

"That's great," said Paulus. "Can you get it to do that again?"

Tod Machover, the MIT Media Lab-based composer and creator of "Death and the Powers," laughed about the moment during a recent interview, as he readied the Boston premiere of the opera. He acknowledged that he's not particularly interested in any surprises on Friday night, when "Death" opens at the Cutler Majestic Theatre, presented by American Repertory Theater in collaboration with MIT's *FAST* Arts Festival and Chicago Opera Theater.

"I'm not a big malfunction guy," he said. "I personally like things to work the way I want them to."

Machover's opera, which features a libretto by poet Robert Pinsky and a 15-piece orchestra conducted by Opera Boston's Gil Rose, centers on a character named Simon Powers, a businessman-inventor. Nearing the end of his life, Powers decides to "download" himself into his surroundings. That turns his walls, books, and chandelier into a network called "The System," a place other characters in the production are forced to explore.

But there's a decent argument that the true onstage stars of "Death" are made of wires, metal, and LED lights. These are the robots, including a dozen "Operabots," as Machover calls them, with plastic, pizza box-shaped heads. There are also three towering, lit-up, moving wall sections and a Teflon-strung chandelier that can be played as an instrument. The robots can operate autonomously, and they also respond to an operator's joystick and performers' voices, which cause the robots to tilt their heads and light up. The Operabots also sing, in the prologue and epilogue.

Machover and designer Alex McDowell hope the machines will come to life for the audience.

"They're sort of a defunct early experiment that was part of the process of developing "The System," sort of left on the scrap heap as all of the humans go into the system," said McDowell, known for his work on such films as "Minority Report," who developed the robots. "They've been left behind, and somewhere in their programming they retell their story."

Building the robots required a focus on dependability as much as technological wizardry. The robots need to work all the time, operate with software that's easy to program so changes can be made in rehearsal, and use parts that are not hard to replace.

Team "Powers," as Machover likes to call the group that worked on the opera, has spent close to a decade trying to perfect the robots.

At first, the prototype for the Operabots was a simple 2-foot cube. McDowell came in five years ago and developed the current model, which can be adjusted height-wise from 4 1/2 to 7 1/2 feet, features a body made of rods that light up, and can make sharp turns, stops, and starts.

"We've all been hearing about "Spider-Man," said Bob Hsiung, the production's technical development manager, alluding to the big-budget Broadway musical that's fallen victim to a series of mishaps largely due to its many technical challenges. "We don't want things to break onstage."

Mike Miller, an MIT graduate, wrote the program that allows the robots to be controlled. It operates in a similar fashion to GarageBand and Final Cut Pro, Apple programs for mixing and editing music and film tracks. Miller built the code as part of his master's thesis, working daily for six months.

The hardware came from various sources, ranging from online stores to the "You-do-it" Electronics Center in Needham. Forty-three computers are used in total. The "brain" of each robot, slid into a chamber near its wheels, is a tiny "One Laptop per Child" model computer. (One Laptop per Child was created by Media Lab cofounder Nicholas Negroponte.) The joystick used to control the robots comes from an Xbox.

"We built them all in-house with students one summer, and they're going to be maintained and driven by students," said Hsiung. "If it's technology too specialized, we're in trouble for the shows. We want to be able to run to Radio Shack or Best Buy if we need a part."

"Death and the Powers" is the brainchild of Machover, 57, a composer whose career has included creating "hyperinstruments" that can be played by virtuosos and amateurs alike, writing operas that have been performed around the world, and leading the Media Lab's Opera of the Future group, which developed "Death and the Powers."

Machover won't reveal this project's budget. But it wouldn't have been possible without his meeting Kawther Al-Abood, the president of Association Futurum in Monaco. She visited the MIT Media Lab in 1999 to ask if Machover had some ideas for creating futuristic art projects, the mission of her nonprofit. "Death and the Powers" made its world premiere last September in Monte Carlo, largely funded by the Association Futurum.

In 2002, Machover and Pinsky created the first aria, called "Original Response," about a girl and her robotic toys, and presented it in Monaco. The next year, a theater-world colleague introduced Machover to Paulus and her husband, playwright Randy Weiner. Pinsky and Weiner are credited with developing the story that became "Death."

Early on, there was the question of what appearance to give the robots. In the end, the designers settled on creating figures that could be life-size, but also could be much taller or shorter than the average human.

"That's a reason to make robots that are geometric and don't look like people," said Machover. "I also personally think the more you try to make artificial things look like the real things, it makes you feel uncomfortable and it's not real."

At first, the designers wanted all the robots to be completely autonomous. But they couldn't do everything that the production's choreographer Karole Armitage wanted. So that's where the joystick, operated offstage by humans, came in. The designers also listened to Paulus and other members of the creative team about the way they wanted the robots to move.

As an example, Hsiung picked up a joystick and had a robot cut quickly across the room and stop short with a shake.

"That's something we tried to avoid at all costs," he said, laughing. "We don't want the thing to fall over. But they loved it. They were like, 'More of that.' "

Throughout the creative process, the developers would send Paulus video clips of how the robots worked. She would provide feedback.

"In terms of expressivity of the robot, I looked at the degree of rotation of the head, the lighting, how fast the head could go up and down," she said.

There was a dress rehearsal at the Cutler Majestic. Finally "Death and the Powers" opened in Monte Carlo.

Hsiung admits that he was surprised the performances in Monaco came off without a hitch. There were problems up until the final dress rehearsal, much of them from the electrical system in the theater, which kept shutting down unexpectedly.

This time, the designers say, a series of redundancies have been put in place to make sure that even if certain things on the robots break, the machines will still work.

"Our pre-show checklist is now very, very long," said Hsiung. "You look at the screen. Is everything getting power? Is it on the network? We do the wiggle test, as well. Does the robot wiggle to the left, does it wiggle to the right?' "

In Monte Carlo, during one of the dress rehearsals, one of the moving walls stopped cold. It took a few minutes to figure out the problem, which had nothing to do with the technological innovations. There was a more basic problem: Somebody had kicked out the power cord.

Matt Berlin, an MIT graduate who has been working on software issues in the opera, came up with a simple solution.

"We plugged it back in."

Geoff Edgers can be reached at gedgers@globe.com. ∎