

Inventors of a virtual music machine try to overcome objections by giving it musicality.

THREE scholars who won a patent for a computerized, virtual orchestra that has been at the heart of a dispute between theater producers and musicians both on and off Broadway, say their system will keep musical theater alive by cutting costs without sacrificing orchestration.

Musicians argue that the machine, which can not only synthesize various instruments and produce musical notes, but also match tempo and other more subjective elements with a live performance, will eliminate their already dwindling job opportunities.

The debate has already led the musicians' union in New York City to demand a ban on the invention, and to an unfair labor practice claim from the system's manufacturer. After nearly two years of battling the musicians' union in New York, the inventors are focusing on using their idea to enhance a smaller orchestra, rather than fully replace live orchestras.

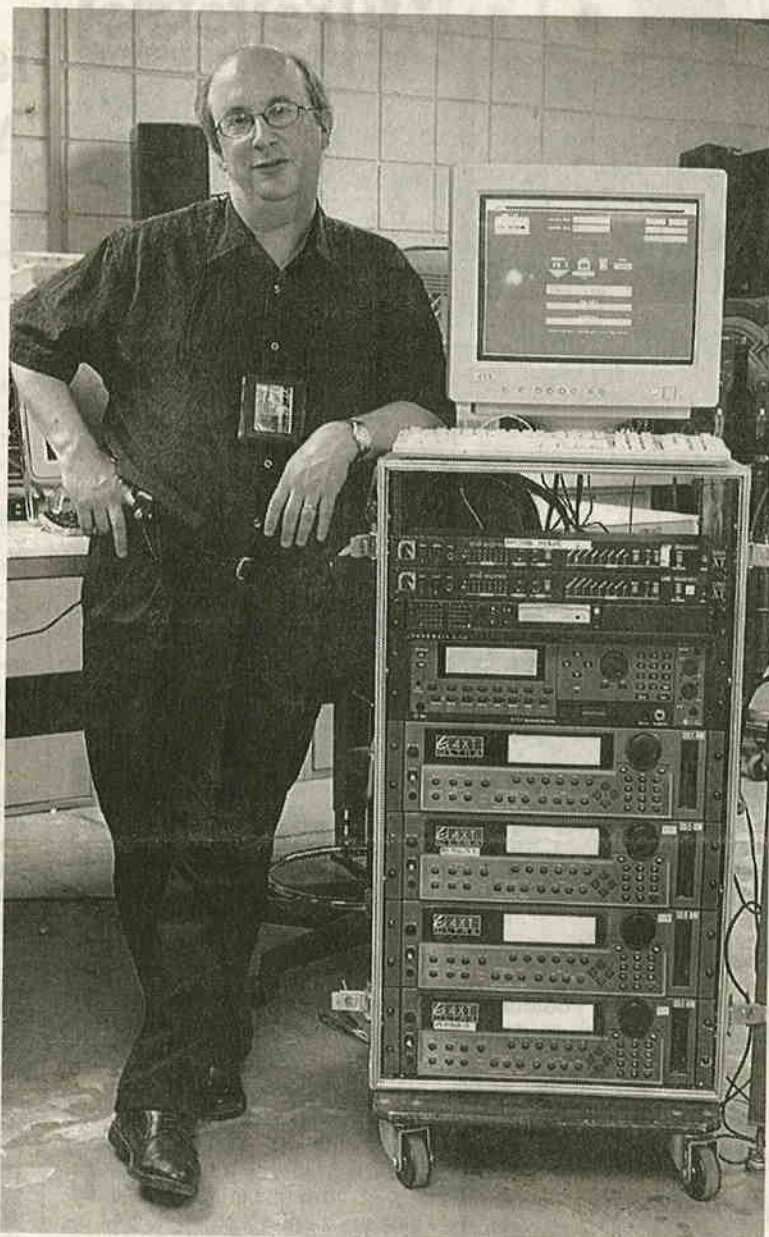
The hardware and software behind the invention are examples of how high technology can reshape the way things have long been done in just about any industry.

The beleaguered invention belongs to three professors: David B. Smith, chairman of the entertainment technology department at the New York City College of Technology; Frederick Bianchi of Worcester Polytechnic Institute; and Kojiro Umezaki of McGill University in Montreal.

The three created a system based on music sequencing, the technology that allows every element of a piece of music to be broken down into digital data.

"Think of a traditional recording as a sound file you put a microphone out and record a voice," explained Mr. Smith, who is also a partner in *RealTime Music Solutions*, a Manhattan company that manufactures the system under the name *Sinfonia*. "But that recording is stuck in time and space. Once you've recorded it, you can't make any changes.

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Ruby Washington/The New York Times

David B. Smith, an inventor of a system that simulates missing instruments in a smaller orchestra, complete with tempo variations.

"The idea with sequencing is that every note, every sequence, every change in volume, is programmed into the system," he added.

Mr. Smith said the invention was intended to "develop an interface between the way music is stored in sequencing and the way it is manipulated in real time, so we can modify various parameters of music, based on the requirements of the moment."

The system's hardware uses "what basically looks like a normal musical keyboard," he said, "but is really more like a computer keyboard with different functions for different keys." The orchestral parts are recorded into the equipment during preparations for a production, and during the live performance, the absent instruments are reproduced in a way that

blends them into the tempo and dynamic of the real performers.

The virtual orchestra system divides a performance into two parts, he explained, those that never change, and those that vary.

"What we try to do is determine those aspects of a musical performance that are fixed and not changing," he said, like the musical notes in a song. "We give those to the computer system.

"However, in a live performance, the singers sing differently every night," he said. "Ideally, everything that is considered musical or the expressive aspect of the performance, we keep for the performer. One of the most important areas of performance is tempo flexibility, how you speed up and slow down."

To manipulate tempo in real time, the invention can be pro-

grammed with what Mr. Smith calls tap parameters. "Like tapping your foot," he said. "As you tap faster, the music will speed up or slow down. That's the basic template of how we control tempo."

The system requires a considerable amount of custom programming before a live performance.

"Each instrument has to be recorded in, with every note, each articulation and shape programmed in beforehand," Mr. Smith explained. "Then we have a shaping session with the music director, and go through every note, go through a whole process of making the synthesized music correspond as closely as possible to the music."

The next step is a rehearsal with the live orchestra to be sure the machine is integrated with the remaining orchestra members. That is followed by another rehearsal with actors, singers and other performers, during which the person operating the system manipulates the tempo in real-time by following cues from the performers on stage.

The software for the virtual orchestra can also be used to replace other people who work behind the scenes in a theater, like those who control lights, sound, video and other elements that are linked to a show's music. In that case, it would mimic the systems already in use during large rock shows that include music, video, elaborate lighting and pyrotechnics.

Last year, during a musicians strike, Broadway producers threatened to replace picketing musicians with the virtual orchestra machine. The result was a labor agreement with the musicians' union allowing the system to be used on Broadway only as a supplement, as long as the number of live musicians in an orchestra pit meets an agreed minimum.

Even so, last winter the union reached a separate deal with the Opera Company of Brooklyn to entirely ban use of the system there. And last month, an off-Broadway theater owner reached an agreement with the union to use the system only when the union permitted. The union immediately said it hoped that agreement could be applied to all other off-Broadway theaters.

Still, Mr. Smith says the system has been used in more than 9,000 performances around the world. Among them were two productions staged by students at the school where Mr. Smith is chairman of the entertainment technology department, with help from the Opera Company of Brooklyn, which has since agreed to ban the machine.

The system has been awarded Patent No. 6,696,631.