

# Piano tutor is a computer at CMU

By Marcia Dunn  
Associated Press Writer

**P**ractice makes perfect in piano playing, especially when the tutor is a computer.

A new computer tutor keeps beginning pianists in line by selecting appropriate lessons, then monitoring the students' efforts on an electronic keyboard.

Piano Tutor, as it's called, is just one example of how music-minded researchers are tapping technology and pushing beyond the boundaries of the familiar Moog synthesizer of the 1960s and 1970s.

"What we're doing is learning how to control the technology that is part of our culture, and that's not just for the sake of using technology," says Craig Harris, president of the Computer Music Association.

"We need to re-evaluate how we learn, how we think about sound, how we think about music and art."

Piano Tutor accomplishes that as an instructional tool, missing nary note nor beat.

"There was something extra between these notes. Try again," the computer flashes on a screen after a less-than-perfect performance by a student.

Or:

"You waited too long before playing this note."

"You played this note too soon. Be sure to give the preceding rest its full value."

"Your rhythm was very uneven. Try keeping a steady beat."

During downright awful renditions, the computer interrupts and instructs students to begin again — and again and again, if necessary.

"We're trying to model this after real teachers, and a real teacher would interrupt right at the beginning," says Roger Dannenberg, a research computer scientist at Carnegie Mellon University.

His collaborators, Annabelle Joseph and Marta Sanchez, music professors at Carnegie Mellon, have interrupted countless piano students over the years for mistakes mysteriously materializing in practice.

The three entered exercises and tunes such as "Yankee Doodle Dandy" into the computer by describing how the music appears on the written page and by performing the selections on an attached electronic keyboard.

"Always as piano teachers, you're concerned about what happens with a student between lessons," Joseph says. "No matter how carefully you

explain things, strange things happen in the week between, so you spend a lot of time correcting."

Another Carnegie Mellon researcher, Paul McAvinney, has invented VideoHarp, a computerized instrument capable of sensing gestures to reproduce the sound of any instrument, including an entire orchestra.

Images of a performer's fingers are reflected by mirrors into an optical sensor McAvinney designed. From this pattern of light and shadow, the position and velocity of each fingertip are deduced. The information subsequently is translated by computer and transmitted to synthesizers that produce the sound.

The kind of sound emanating from amplifiers — string, woodwind, percussion, brass — is determined by

programs stored in the computer.

"It is neat that an absolute musical idiot like myself can make a good sound by just having enough flexibility," says McAvinney, a senior research programmer at Carnegie Mellon and chairman of Sensor Frame Corp.

While speaking, McAvinney hazily brushes his hands across both sides of the 13-pound, trapezoid-shaped instrument, just as a harpist might. A stream of deep, lush notes never before heard — and likely never to be heard again — fills the small music laboratory.

"A lot of people ask me if I'm a musician. I tell them no, but I don't believe Stradivari was either," he says.

Each finger is capable of repro-

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ducing a particular instrument's sound, successively or simultaneously. Four fingers consequently can sound like a string quartet, with practice, of course.

"You certainly can't play each of those instruments the way that a person in the orchestra plays each instrument," McAvinney says. "No human is capable of that. But if anybody ever wants to try, there it is."

Until five or so years ago, so-called computer music was impractical for live performances since it took longer to compute the sound than the sound actually lasted, says Stephen Pope, editor of the Computer Music Journal.

That changed in the early 1980s with the advent of digital synthesizers, which enabled instruments to sound like something else — anything else, in fact — while played the usual way.

VideoHarp goes a step further by incorporating totally new ways of playing. Brushing one's toes against the instrument, for example, can generate sounds the same as using one's fingers.

While other researchers around the world are trying to communicate with computers on an artistic level, the Carnegie Mellon projects are "really good, major examples of it," Harris says.

"How do you get a machine to be expressive? A lot of people have complained about that," he says. "Even the piano is a machine. But the leap from the piano to a device like VideoHarp is a rather large leap, especially when it involves creating many sounds that are new to our hearing."

Piano Tutor is significant, Harris says, in that it moves beyond routine instruction.

"There are many programs out there for doing exactly what we did in 1950, but now doing it in computers — treating learning as if it were a notebook, a classroom, going page

by page by page and not really paying attention to what that particular person needs right now."

Piano Tutor also features a built-in metronome and provides accompaniment on request.

Piano Tutor is still evolving, according to Dannenberg, and should be commercially available in three years.

Some people, most notably musicians, worry that computers eventually may replace instrumentalists. Even if those concerns prove true, Harris believes there will be more, not fewer, jobs.

"It's not that we're taking six people's work and turning it into one who's using a synthesizer," he says. "That's a real myth because we're creating many new fields and we're creating new uses of instruments and we're creating a huge need for teachers who understand where it's going."

While admittedly unconventional, "there is nothing radically new or weird" about computer music, according to Pope.

"It's just composers using the state-of-the-art technology of our time, which happens to be software and computers," he said. "It's no less musical if a composer is involved in technology."



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Roger Dannenberg, behind the piano tutor, with his collaborators Marta Sanchez, left, and Annabelle Joseph.