

## The Multimedia Piano Teacher

■ A new, highly interactive, Mac-based, multimedia workstation developed by music professors at Carnegie Mellon promises to eliminate the frustrations aspiring pianists have faced for years.

Intended to supplement traditional instruction during a student's first year of lessons, the Piano Tutor combines an expert system with state-of-the-art music recognition software and multimedia tools to help beginner students by targeting lessons to a student's skill level and by correcting mistakes *before* they become ingrained.

The system is the brain child of Marta Sanchez and Annabelle Joseph, Carnegie Mellon's professor of music and former head of the music department, and associate professor of music, respectively. "When learning to play piano, you should be in a one-on-one situation, but that's expensive in terms of teacher time and student lessons," explains Roger Dannenberg, a research computer scientist on the faculty of the university's School of Computer Science and co-developer of the Piano Tutor. "So weekly piano lessons are more the norm, because people can usually afford to have a private tutor only once a week."

With the Piano Tutor, students practicing between their weekly lessons can receive immediate feedback when they're making mistakes, thus saving them from acquiring bad habits that must then be corrected. "Designating a computer to look after the routine errors students make during their first year of instruction leaves more time for them to interact with and to cover the more interesting material with human teachers," Dannenberg says.

The Piano Tutor consists of an electronic keyboard/synthesizer hooked through a MIDI interface to a Mac IIci, the Mac monitor displays music notation, textual instructions, and simple computer animations (for example, a bouncing ball that counts in time for a student learning pulsation). Hooked up to the Mac are a video-disc player and video monitor

which stores and displays audio/videotaped piano performances that serve as models for the students.

The central component of the Tutor is an expert system, developed in collaboration with piano teachers and through observation of these teachers at work. In a typical Piano Tutor lesson, the system chooses a lesson that's appropriate for the student's skill level and delivers an audio/video presentation to the student. The student is then asked to demonstrate mastery of the material by performing an exercise at the keyboard. As the student plays, the Mac records the pitch, starting time, duration, and loudness of each note and compares the student's performance to a model performance stored with the lesson.

Based on the student's performance, the Tutor will either point out errors, present remedial instruction, ask the student to try again, or select a new lesson.

For example, "If the student played a wrong note, the system will say in a synthesized voice, 'Watch out, you played a wrong note here, and it will circle the note on the music notation displayed on the Mac monitor'" Dannenberg explains. "Or if the student plays notes in a disconnected fashion and

## The Subtle Sounds of Watermelons

■ One of the challenges faced by watermelon growers is determining when a watermelon is ripe. Unlike other melons, a watermelon stops ripening once it's picked from the vine. So picking it at the right moment is crucial.

Unfortunately the only way to tell whether a melon is ripe is to thump it by hand and listen to the sound. That's tricky business at best, and only experienced pickers can hope to make the right decision. But all that may change as the result of a new watermelon thumping device

he or she is supposed to be connecting the notes in 'legato' style, a video segment will come up that says, 'Connect the notes like this,' and the student will see and hear a human performer playing piano in legato style."

Eventually, the student either passes the lesson or the Tutor decides the material is too difficult; in either case, the lesson is ended. At this point, the student model is updated according to the objectives specified by the lesson, so that the next time the student sits down to a lesson, the system knows what level the student is at and chooses a new lesson accordingly.

Currently, the Piano Tutor exists in the form of two prototype systems—one in Dannenberg's lab and the other in the School of Fine Arts—neither of which is being used for classes or for formal training. However, according to Dannenberg, the Piano Tutor application software has been licensed to an unnamed company. "Once the licensee fine-tunes the software," he says, "they plan to release it as a commercial hardware/software product within the next few years at a cost of about \$2000 to \$3000, including computer and keyboard."—Audrey V. Doyle, managing editor

being developed at Oklahoma State University (Stillwater, OK).

The device, temporarily known as the Thumper, is an ingenious frequency measurement device using graphics and sound to produce an exact acoustical "signature" of a melon's ripeness.

The watermelon industry says

