

## Stanford professor “invents” electronic keyboard

Did you know that Stanford helped to create the first electronic keyboard?

In 1957, Max Matthews at Bell Telephone Laboratories, began experimenting with digital computers to see whether they could become a viable means for generating audio signals. Matthews was far ahead of his time, if only because he realized that unlike the primitive analogue signal generators of the time, computer generated digital audio could be controllable. Matthews wrote a program called *MUSIC 1*, programmed in assembly code for an IBM mainframe computer. It was only capable of generating very basic sounds but he continued its



development. He followed up with other off shoots that were capable of much more interesting sounds.

At this point, we move to Stanford’s computer department. Two researchers, John Chowning and Leland Smith were working on a new version of the programs developed by Matthews. The music industry would be a very different place today without them. Chowning was experimenting with huge amounts of vibrato, applying this to the audio-frequency signals generated by the digital oscillators within the *MUSIC* program. It was a unique tone unlike anything he had heard before but was a common technique

used to broadcast radio transmissions. FM radio signals exist at frequencies around 100 MHz, and the human ear cannot hear the audible effect from the modulator. Chowning continued to develop FM synthesis, adding functions that allowed him to control the evolution of the sounds he created. In 1971, Matthews suggested that Chowning should create a range of recognizable sounds, such as organs or brass, to demonstrate that FM was musically useful and a possible basis for a commercially viable product. Chowning did this and with a view to licensing the technology, persuaded Stanford’s Office of Technology Licensing to approach companies.

Hammond and Wurlitzer turned down the FM audio idea. All of the American manufactures that the university contacted also turned down the patent. Stanford thought outside the box and contacted the California office of a well know manufacturer of motorbikes, powerboat engines and construction



equipment, Yamaha. Yamaha dispatched a young engineer, who after a brief evaluation, recommended that the company take out a license on Chowning's system. In 1973, Yamaha's organ division began development of a prototype FM monosynth.

Despite the commercial development taking place elsewhere, Chowning was still an academic, and he continued working at Stanford on *MUSIC 10*. Unfortunately for him, the University failed to see the value of his work so he moved to Europe to continue his research. This proved to be an embarrassment for Stanford because when Yamaha approached to negotiate an exclusive commercial license, Chowning was no longer a member of the faculty. The University saw the error of their ways and reinstated Chowning as Research Associate for the newly developed Center for Computer Research in Music and Acoustics, CCRMA. Chowning then assigned the copyright to Stanford, and the lucrative license went to Yamaha.

CCRMA is pronounced "karma" (the first "c" is silent) and is housed in the Knoll Building. Concerts at CCRMA feature new and recent computer music by graduate students and faculty. Classic works and recent music from other studios and composers are also occasionally programmed. Go to their web site for current schedule of performances  
<https://ccrma.stanford.edu/>

