MAX V. MATHEWS

1926–2011

Elected in 1979

*"For contributions to computer generation and
analysis of meaningful sounds."*

BY C. GORDON BELL

MAX VERNON MATHEWS, often called the father of
computer music, died on April 21, 2011, at the age of 84. At
the time of his death he was serving as professor (research)
emeritus at Stanford University's Center for Computer
Research in Music and Acoustics.

Max was born in Columbus, Nebraska, on November 13,
1926. He attended high school in Peru, Nebraska, where his
father taught physics and his mother taught biology at the
state teachers college there. Peru High School was the training
school for the college. This was during World War II (1943–
1944). One day when Max was a senior in high school, he
simply went off to Omaha (strictly on his own volition) and
enlisted in the U.S. Navy—a fortunate move because he was
able to have some influence on the service to which he was
assigned, and after taking the Eddy Aptitude Test, he was
selected for radar school. Radar, however, was so secret, that
Max was designated a "radio technician." After basic training
he was sent to Treasure Island, San Francisco, where he met
Marjorie (Marj), who became his wife.

After returning from the war, Max applied to the California
Institute of Technology (Caltech) and to the Massachusetts
Institute of Technology (MIT). On graduating with a bachelor's
degree in electrical engineering from Caltech in 1950, he went
to MIT to earn a doctorate in 1954.

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In an oral history interview, Max describes his career at Bell Labs:

> I went to the Acoustic Research Group at Bell Telephone Laboratories in 1955. And in those days, speech transmission facilities were both expensive and very limited. . . . And so the Acoustic Research Department worked very hard to try to make speech coders that were efficient enough so that we could put more channels . . . onto an existing communication link.
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> So I developed the equipment to put speech into a computer via magnetic tape, and to take speech out of a computer. And this proved to be a real revolution in speech research, and in the development of good digital codes. And so that instead of working for years before finding out something was no good, we could write a program in a couple of weeks. . . . This led to speech coders that are very good and very efficient, which are in use today. And so the computer became the great research tool for speech coding.[1]

Max's serendipitous transition to music occurred through John R. Pierce, who headed Bell Telephone Laboratories:

> Although I'm not a musician—I'm an engineer—I love music, and I learned to play the violin, and I still love to play the violin, whether or not I can play it very well. And I still play the violin. And I was very lucky in that in those days the boss's boss, John Pierce, also loved music. And we went to some concerts together. . . . And in the intermission, John turned to me and said, "Max, now you've gotten telephone speech into and out of a computer. Could you write a program to make a computer synthesize music?" And I said, "John, I would love to do that!" And so John said, "Well, take a little time off from your regular job, and write a musical program." And so I was delighted to do that. And that was the source of Music I, which was really the precursor of programs II through V that I think are the seeds from which most of the digital music in the world today sprouted."

Music V, written in FORTRAN for portability, led to later programs, including Csound, Cmix, and MAX, a visual programming language for music and multimedia. It was written in the 1980s and named in honor of Mathews.

Max recalled the famous song "A Bicycle Built for Two," which was accompanied by synthesized singing that John Kelly provided. He said, "That's the only composition that I have orchestrated really."

> The piece came to Stanley Kubrick's attention for the movie "2001." An assistant heard "Bicycle Built for Two,"[2] and Kubrick was enchanted with this idea, then put it in as when the computer went crazy, its final utterances as they took him apart, as you remember. . . . The music you hear in the movie is not the original digital synthesis. Kubrick had Hollywood make a copy of my version of "Bicycle."

Max chronicled the first 50 years of progress in computer-generated music:

> In those days it took 100 seconds to make a second of sound. And if you divide that by 10,000, that means that you can produce about—you can control about 100 instruments in one laptop computer. So you could make sound, not for a single instrument in the laptop computer, but for a whole symphony orchestra of instruments.

And he outlined the future challenge:

> Nowadays, that's not the limiting factor. There's more power in the computers than anyone knows how to make use of. And the limiting factor is what sounds and what timbres, and our understanding of what the human listener thinks is beautiful in music. And this, to me, points the road to a very interesting future, and this is not the development of more technology. This is the understanding of the human mind and the human ear, and the kinds of sounds and timbres and rhythms and sequences that light up the pleasure center in the human mind. And there's no question what is lit up.

We've known that for centuries. But now we must know more about what new things can we put into the ear and make sounds out of that that will be music that is both exciting and, I think, necessary, because human beings really want music.

Mathews went on to create major programs for orchestral performances, the GROOVE system (Generated Real-time Output Operations on Voltage-controlled Equipment), and a system for conducting using two batons where a "conductor" is able to control three variables with each arm. In the online version of the Computer History Museum Revolution Exhibit, Max gives a fine demonstration of the batons for controlling an orchestral piece in much the same fashion as a conductor.[3]

From 1974 to 1980, Mathews was scientific adviser to the Institut de Recherche et Coordination Acoustique/Musique (IRCAM) in Paris, a center founded by composer/conductor Pierre Boulez and devoted to research into the science of music, sound, and avant-garde electro-acoustical music. John Pierce also served on the technical advisory board. I was privileged to be in their presence and served several years as an adviser, particularly with regard to the design of several IRCAM synthesizers.

Mathews served as director of the Acoustical and Behavioral Research Center at Bell Laboratories from 1962 to 1985. He continued his research as a professor of music at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University. At CCRMA, various collaborators included John Pierce and CCRMA founder John M. Chowning, who acknowledged: "Mathews gave us a whole new way to imagine and create music. He has had an enormous effect on how music has evolved in the past 50 years."

Mathews was a member of the National Academy of Sciences (1975) and the National Academy of Engineering (1979). He was also a fellow of the American Academy of Arts and Sciences, the Acoustical Society of America, the Institute of Electrical and Electronics Engineers, and the Audio Engineering Society. He held a Silver Medal in Musical Acoustics from the Acoustical

Society of America and the Chevalier dans L'Ordre des Arts et Lettres, from the Republique Francaise.

Max Mathews lived in San Francisco. He is survived by his wife, Marjorie; three sons, Vernon (of San Francisco), Guy (of Palo Alto), and Boyd (of Berkeley Heights, New Jersey); and six grandchildren.

Marjorie, his wife, remembers:

> Both our families had enjoyed camping and Max and I continued that tradition, making a number of trips around the U.S. and in Europe with our children. We were also fond of boating, working up through a series of small boats to our 30-foot ketch *Nimble* on which we made many trips on the East Coast anywhere from Norfolk to Nova Scotia. We rented sailboats in the Aegean and in the Caribbean. Max did the navigation when we sailed with John Chowning on his boat from San Francisco to Hawaii. We managed several trips with our friend Derek Scovil, sailing in Puget Sound and the Gulf Islands of Western Canada.
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> Max hadn't done any skiing in Nebraska, but when we married he took it up to humor me, and we had many fine ski vacations with our children in New England, Eastern Canada, Austria, Switzerland, and the Sierras of California.

Notes

1 Computer History Museum, *Max Mathews Oral History* (Mountain View, California).

2 M. Mathews, 1961, Daisy Bell: Computer generated "A Bicycle Built for Two," Accompanied by Synthetic Speech. Available at: http://www.youtube.com/watch?v=41U78QP8nBk.

3 M. Mathews, 2011, *Max Mathews Using Two Batons Providing Six Degrees of Control to Conduct an Orchestra.* Available at: www.computerhistory.org/revolution/computer-graphics-music-and-art/15/221/2304.