

# MEMORIAL RESOLUTION JOHN ROBINSON PIERCE

(1910-2002)

John Robinson Pierce, the father of communications satellites and a writer of science fiction who came to Stanford to pursue his longtime interests in computer music and psychoacoustics, died April 2, 2002 at the age of 92. Pierce was born March 27, 1910, in Des Moines, Iowa. He attended the California Institute of Technology, where he studied electrical engineering, earning a bachelor's degree in 1933, master's degree in 1934 and doctorate in 1936. That same year he took a job with Bell Telephone Laboratories in Murray Hill, N.J., where he held various positions through 1971 and did some of his most innovative work. He became director of electronics research in 1952 and research director of communications principles in 1958. After retiring from Bell in 1971, Pierce took an engineering professorship at Caltech and, from 1979 to 1982, was chief technologist at the Jet Propulsion Laboratory.

Pierce's Stanford period began in 1983 when he joined the faculty of the Center for Computer Research in Music and Acoustics (CCRMA) holding the unusual title of visiting professor of music, emeritus. He "visited" for more than 15 years, and during his tenure helped bring intellectual and much-needed financial support to the center.

Colleagues and friends remember him for his charisma, warmth and keen intellect. He commanded attention, not in an obvious way but by virtue of his verbal cleverness. It was a natural gift of his -- without pretense.

In 1948 he coined the term "transistor" for the small, electronic switch invented at Bell Labs. But he is probably most famous for proposing the scientific groundwork that made unmanned communications satellites a reality. He urged NASA to build a satellite based on his design, and it was launched in 1960. Essentially a large polyester balloon covered with aluminum foil, Echo I bounced radio waves from a Jet Propulsion Laboratory antenna near Goldstone, Calif., to a Bell Labs station in New Jersey. The first message was recorded by President Eisenhower. The project's success led to the construction and 1962 launch of the first commercial communications satellite, Telstar I, which broadcast the first live television signals across the Atlantic.

Later, as executive director of Bell Labs' Communication Sciences Division, Pierce oversaw work on mathematics, statistics, speech, hearing, behavioral science, electronics, radio waves and guided waves. His own work was chiefly focused on electron devices, especially traveling-wave tubes and microwaves. He was inventor of the Pierce Gun, a vacuum tube that transmits electrons and is used in satellites and, among other things, the klystrons that power the Stanford Linear Accelerator. Richard Lyon, one of his younger colleagues in the later years at Caltech, notes that his 1948 paper 'The Philosophy of PCM' with Claude Shannon and Barney Oliver marked the beginning of the inexorable conversion of analog media to digital, starting with the digitization of short-haul telephony by the Bell System in the 1960s.

It was at Bell Labs in the late 1950s that Pierce became deeply interested in acoustics, speech, hearing and computer music. As a director at the labs, he threw his support behind his colleague Max Mathews' pioneering research in the field of computer music.

When Pierce arrived at CCRMA, the center was under financial strain, but he quickly helped to turn things around. He convinced the Systems Development Foundation to fund computer music, which resulted in a gift of \$2.7 million to the center. He also recruited Mathews, who is now a research professor of music. Both were deeply involved in the art and science of music, and Pierce had decided to go full-time with what he described as an "unreciprocated love of music." CCRMA was then at the old D.C. Power Laboratory, the former Stanford Artificial Intelligence Lab, which is now the subsoil of a horse stable up behind the radiotelescope dish out on Arastradero Road.

At Stanford, Pierce worked in the area of psychoacoustics-- the science of how people perceive sound -- as well as computer music. He was particularly interested in pitch perception but looked into all aspects of acoustics -- how a sound is produced, how it travels through the air and how it is processed by the ear and brain.

A tireless inventor, age barely interfered with his productivity. A favorite example is his invention in 1992 of a new stringed instrument bridge. For untold millenia, musical instruments have either been built with violin-style or sitar-style bridges. Someone pointed out to Pierce the sonic qualities of Chinese gongs and a year later he had it worked out in terms of the physics. It turns out the same principle can be used in a third type of bridge, one with a unique tonal quality first heard when his team built one in the lab, and now the basis for an entire class of digital models for percussion and strings.

He was a constant source of observations otherwise known as Pierce's Aphorisms. Even back in the early 1960s at the Bell Labs, Roger Shepard says his colleagues had talked about how someone should compile a little book of them. For example, "What we understand is not the natural world but the machines we have built to populate this world, or apropos semiconductors. Nature abhors a vacuum tube." He had a true, sincere interest in listening to others' opinions. Marco Trevisani, a composer at Stanford noticed him attending a series of composer meetings at CCRMA, With all these young composers... trying to fix the universe of the arts, John was the only participant that didn't miss one meeting. In his 1965 article for Playboy, "Portrait of the Computer as a Young Artist," he wrote "As a musical instrument, the computer has unlimited potentialities for uttering sound. It can, in fact, produce strings of numbers representing any conceivable or hearable sound. Wonderful things would come out of that box if only we new how to evoke them." He once gave the Argentine composer Francisco Kroepfl a copy of his book "The Science of Musical Sound." Francisco thanked him adding, "Your book will be extremely useful in my composition classes." "Fine," John said, "but tell them to make music."

Pierce authored or co-authored roughly 20 books and wrote more than 300 papers and book sections, and he was granted about 90 patents. He also was a prolific author of science fiction, sometimes under the pen name J. J. Coupling. Roughly two dozen of his short stories were published in journals and magazines ranging from Fantasy and Science Fiction to Penthouse. His first published science-fiction piece appeared in the March 1930 issue of Science Wonder Stories. He knew science-fiction writers Isaac Asimov, Ray Bradbury and Arthur C. Clarke, and told the story of when as a young man he made it to H.G. Wells' doorstep. In 1995, Pierce shared the prestigious Charles Stark Draper Prize with

communications satellite collaborator Harold Rosen. Pierce also was awarded the Japan Prize in 1985 and accumulated dozens of honorary degrees, medals and awards.

He is survived by his wife; a son, John Jeremy Pierce of Bloomfield, N.J.; and a daughter, Elizabeth Anne Pierce of Summit, N.J. A memorial service was held May 3, 2002 at Stanford's Memorial Church which was followed by an outdoor concert at the Knoll Building, CCRMA's home.

“One day I read that a wonderful new American satellite called Echo was that day put into a polar orbit -- and could actually be seen with the naked eye, for it was 160 feet in diameter! It was predicted to be in the north sky the next morning just before daybreak. So next morning I was looking up above my garage; and the revelation was wondrous: there was an extra star in the Big Dipper -- a bright star! And it was moving in a stately, inexorable way. The stately, inexorable star was the decisive beginning of satellite communication; and with it, of the vast American stake in space.”

--Robert Cannon

A compact disc of the memorial concert is available from CCRMA and can be ordered by email to [info@ccrma.stanford.edu](mailto:info@ccrma.stanford.edu).

Committee:  
Chris Chafe, Duca Family Professor,  
Director CCRMA  
John Chowning, Professor Emeritus,  
Founding Director CCRMA  
John Sanford, Stanford Report