1921–2015

Harry C. Gatos: Musician and interdisciplinary pioneer

A solemn group of people stood in a cemetery in Concord, Mass., on May 6, 1962. They were gathered to commemorate the 100th anniversary of the death of the renowned naturist and philosopher Henry David Thoreau. Since Thoreau was an avid flute player, it was appropriate that the instrument be played at the ceremony. The flutist for the occasion was an equally avid musician, Harry Gatos.

Harry was well known in the region for his musical avocation. He was an accomplished amateur musician who hosted and played chamber music with many Boston-area musicians, including members of the Boston Symphony Orchestra and Boston Pops. He served on the board of directors of the Longy School of Music, the Cambridge Society for Early Music, and the James Pappoutsakis Memorial Fund.

His vocation however, was a pioneering researcher and educator at the Massachusetts Institute of Technology (MIT), where by 1962, he was already teaching a new graduate course on electronic materials. In short order, he would resign his position as associate head of Lincoln Laboratory to accept the first dual appointment as professor in MIT's Department of Metallurgy (precursor to Materials and Engineering) and Department of Electrical Engineering (later Electrical Engineering and Computer Science).

Harry would continue to pioneer many more important "firsts" in materials science over the next several decades, including helping to found the Materials Research Society (MRS). But without some parental guidance at an early age, he might have chosen instead a career as a lawyer.

"'We have enough lawyers in the family,' young Harry's father had told him. 'You will be a scientist.'" Harry's son Cobey Gatos recited these words of his grandfather. "My father loved telling that story," Cobey said. "Over and over again."

However, rather than becoming a lawyer like his father and two older brothers, Harry dutifully studied chemistry. And he excelled, taking first place in the Chemistry Department of the University of Athens in his native Greece. In 1946, at age 25, he immigrated to the United States on a fellowship to attend graduate school at Indiana University. His future looked bright, even though upon his arrival in the country, he had only $50 in his pocket and was unable to speak a word of English.

His broad intellectual interests became apparent at Indiana. While writing his master's thesis on the electrodeposition of lead, he was simultaneously researching the diffusion of oxygen in air in hospitals. After receiving his PhD degree from MIT, where he would work for most of his career, he conducted research on electrodeposition, metallic corrosion, superconductors, high-pressure phase transformations, and semiconductors. With co-researcher Gus Witt, he designed the first crystal growth experiments in space for Skylab and Apollo-Soyuz. He approached all of his work from the perspective of more than one discipline.

"Harry was the bright light in electronic materials," said MIT Professor Lionel C. Kimerling, who studied under Harry as an undergraduate and doctoral candidate beginning in the late 1950s, at a time when the vacuum tube was being replaced by solid-state electronics. He founded the Electronic Materials Group at MIT's Lincoln Laboratory, the world's first such interdisciplinary group. His students and postdoctoral scientists would become the next generations of materials researchers and industrial leaders.

"He brought an unprecedented numbers of students to MIT from around the world."[1] said Kimerling. "He was ahead of his time."

He was also energetic and engaging. "I met him when I was at Harvard, and he asked me to be on a thesis committee for one of his students," recalled MRS past president Ken Jackson. "And then I worked with him as MRS was being formulated. He was pragmatic, charming, and personable."

"He had the gift of being able to find common ground in any issue and linking fundamentals to application," added Kimerling. "And he had magnificent style—he was the best dressed professor at MIT." Kimerling recalled the exquisite black and orange 1960s artwork that adorned Harry's office. "Even in his later retirement years, his home was impeccably decorated with fine art."

Harry held leadership positions in numerous technical societies, including serving as president of the Electrochemical Society (ECS) and founding the journal *Surface Science*. He worked tirelessly to bring innovation to formal scientific discussion as the field of Materials Science and Engineering began to take shape. He was one of the team of scientists to formulate a vision for MRS, and he served as the Society's first president. Harry was delighted with the growth of MRS. On the occasion of the 20th anniversary of MRS, he enthusiastically described the birth of the Society as the culmination of 10 years "of frustrated efforts in searching for a professional home (old, renovated, and new) for the young homeless Materials Science."

And throughout the years, Harry continued to make music. While president of ECS, he performed in quartets for flute and strings by Mozart and Haydn instead of delivering traditional formal banquet addresses. His custom-designed house overlooking a pond featured an acoustically optimized music room.[2] It was in this room that he hosted musical gatherings over the years and held annual music-centric Christmas parties for his MIT students.

"When I first met Harry on a visit to MIT in the 1980s, the conversation quickly moved to music," MRS past president Julia Phillips recalled. "I am also a flute player, and Harry told me that I was to come to his house to play music. While attending the next MRS Fall Meeting in Boston, I took my flute to his home. He took me into that magnificent music room and said, 'Let me get my flutes.' He returned with an armload of gold, silver, platinum, and antique flutes!"

He also found opportunities for his music and science to intersect. He consulted with flute makers in Boston to solve materials problems that arose in instrument fabrication and co-organized the first "Materials for Musical Instruments" symposium during the 1994 MRS Spring Meeting.[3] MRS past president Alan Hurd, who was a Spring 1994 Meeting Chair, recalled encountering Harry in the hallway during that meeting. "Harry was ecstatic," Hurd remembered. "He said 'this [symposium] is the best thing I've ever seen at a MRS meeting.' Harry had clearly been swept up by both the science and the music!"

At the Thoreau commemoration in 1962, Harry raised his flute and played the sweet notes of Debussy's *Syrinx*, a lament of loss concerning the mythical god Pan from Harry's native Greece. Pan, who reveled in philosophy, nature, and music, could have been designated the god of interdisciplinarity, if the concept had been given a name that long ago. The possibility was probably not lost on Harry and likely would have also received Thoreau's approval. Thoreau might also have given a nod to Harry Gatos for being the embodiment of Thoreau's man who hears that different drummer and who "steps to the music which he hears, however measured or far away."

Notes

1. In recognition of the many students Harry brought from Japan, the Harry C. Gatos Distinguished Lecture and Prize in Materials Science and Engineering was established at MIT in 1992 through a gift from Sumitomo Electric Industries. The 2014 lecture was titled "Age of silicon."
2. The Gatos house was designated a Record House (*Architectural Record*, May 1965) and detailed in "Planned for Music" (*House and Garden*, July 1966).
3. Harry's co-organizers of the symposium were Terry Garino (Sandia National Laboratories), Uwe Hansen (Indiana State University), David G. Monette (David G. Monette Corp.), and Delwin D. Fandrich (Fandrich Piano Co.).

Gail Oare

First crystal growth experiment in space

In the 1960s, Ken Jackson, then at Bell Laboratories, served on a review panel for NASA that was wrestling with the problem of how to sustain the US space program. The conclusion, he recalled, was that the program needed to manufacture something in space that had a practical use. Growing gems, he said, was deemed unfeasible due to the unwieldy size of the equipment. Marshal Space Flight Center Director Wernher von Braun began looking at the problem of producing high-quality hollow ball bearings for precision guidance systems in space. He asked MIT scientists Gus Witt and Harry Gatos whether they thought producing them in microgravity would provide perfect spheres.

Witt and Gatos were skeptical and began to consider alternative experiments. "We had just concluded that one of the primary complications of optimizing properties of semiconductors is the obstacle of gravitational interference," Gatos earlier recalled. So instead, the two scientists designed semiconductor crystal growth experiments that were then conducted on Skylab and on the 1975 Apollo-Soyuz Test Project.

The scientists learned that in space impurities became evident and more evenly spread. These results led to higher performance of materials and better scientific understanding of physical characterization of crystal growth. In the Proceedings of the Third Space Processing Symposium (May 1974), Witt remarked that "On the basis of the present results, it is no longer a matter of speculation that fundamental data necessary for bridging the gap between theory and experiment can be reliably obtained in the absence of gravity, and that outer space presents one of the greatest opportunities ever afforded to science and technology."

A crystal from this work was placed in the collection of the Smithsonian Air and Space Museum.

Note

From interviews with Ken Jackson (April 28, 2015) and Cobey Gatos (May 31, 2015), and from *Challenges of Human Space Exploration*, Marsha Freeman (Springer Science & Business Media, 2000).