In Memoriam

"I think that he's the only genuine genius that I have met."
—Stanley Lipshitz

Michael Gerzon, AES Gold Medalist, died on May 6 in the John Radcliffe hospital, Oxford, UK, after suffering a severe asthma attack and cardiac arrest. Best known in connection with Surround-Sound, he produced pioneering work in many fields. His approach displayed exceptional levels of insight and intuition, coupled with an absolutely firm grasp of mathematics, which he used to model the possibilities for an audio design and to see quickly what might and might not be achieved.

Other designers conceive a surround sound reproduction system or a reverberation algorithm in terms of filters, delay lines and matrices, but Michael would start by obtaining a precise theory and intuitive understanding of what could be achieved by connecting up the available building blocks in different ways. It is like the difference between the ancient Greeks, who spent centuries trying to trisect the angle, and modern mathematicians, who have a very clear theory of what geometrical ratios can and cannot be obtained by ruler-and-compass construction, and who, therefore, do not spend time on attempting the impossible.

Michael had a child-like delight in new ideas, and his bubbling enthusiasm was conveyed in intense and often lengthy conversations. He had a commitment to truth, a passion for music and a strong desire to achieve the best for the consumer.

Michael spent his childhood in Birmingham, UK, and in 1963 went

Michael Gerzon
Dec. 4, 1945–May 6, 1996

to read mathematics at Corpus Christi College, Oxford. He graduated in 1967 and stayed on as a research student in axiomatic quantum theory at the Mathematical Institute, Oxford. At that time he became heavily involved in audio through live recording, and started to make connections between math and audio, especially between quantum mechanics and Surround-Sound reproduction.

On the 8th of May 1971, Michael organized a "Tetrahedral" recording of the Mozart *Coronation Mass* in Merton Chapel, Oxford. He bought four Calrec cardioid capacitor microphones and mounted them with their capsules as close as possible, but pointing at the four corners of an imaginary tetrahedron. These signals were recorded and played through four loudspeakers, again mounted at the four corners of an imaginary tetrahedron, two being above the level of listener's head and two below. This was probably the first full-sphere ("periphonic") reproduction ever attempted. It was organized by a penniless researcher with no backing from his organization—the Maths Institute was exactly that, and had no money for audio equipment! These early experiments provided valuable lessons for the future and, even though the sound images were unstable, all who heard it were impressed by the extra realism over 2-channel reproduction. The difference was just as audible for listeners standing outside the tetrahedron of loudspeakers and was remarkable even for people outside the room listening through closed doors.

At about the same time Professor P. B. Fellgett in Reading had taken the first steps towards the invention of the "Ambisonics" reproduction system. Michael started to collaborate with the Ambisonics group and quickly became the main driving force behind all the later inventions. Ambisonics was the result of Michael's mathematical insights, his psychoacoustic knowledge and his ability to listen analytically. He would pick up on small effects that most people would not even notice and integrate them into his own theoretical framework. Often when he was designing a system, he would recall something he had heard years earlier, e.g. at the Tetrahedral experiments, and use this information to steer the design away from a psychoacoustically dangerous area. Unfortunately, the marketing of the Ambisonic system was not successful, although one product that did receive acclaim was the "Soundfield" microphone, which contains four cardioid capsules pointing at the corners of an imaginary tetrahedron. Michael never received any money from the many Ambisonic patents on which he worked in the late 1970s, and Ambisonics has remained a relatively little used and misunderstood system. ➥

By 1992, Michael's published output had reached about 100 papers. Topics ranged from the erudite, such as "Decomposition of Nonlinear Operators into 'Harmonic' Components, with Applications to Audio Signal Processing" (1976) and "Optimal Noise-shaping and Dither of Digital Signals" (1989) to articles intended for home-studio audiences such as "Fixing It Outside The Mix" (1990), or "Stereo Recording of Live Amplified Music" (1987), giving advice on how to record a typical rock group playing in a village hall with a "back line" of guitar amplifiers and loudspeakers.

He had a vast collection of recordings, both old and new. Old recordings he wished to be preserved as well as possible. His last conference paper, "The Need to Preserve Originals of Archive Sound Recordings," delivered posthumously in Copenhagen by Sean Davies, colleague, was on this subject. He was also concerned that contemporary musical performances should be recorded as accurately as possible for posterity. There is an entire genre of European free improvisation that would largely have gone undocumented if not for Michael, who regularly turned up at concerts with recording equipment during the 1980s, and made many recordings now available on CD.

Another interest was the desire to produce the most flexible possible tools for synthetically produced music. Here he applied many of the psychoacoustic insights gained earlier in recording acoustic performances using "purist" techniques, for example, to create a convincing sense of acoustic space and distance on synthetic recordings, including the possibility of a "distance pan-pot."

In designing equipment for the consumer, Michael was able to bridge the gap between abstract mathematical ideals and the cost constraints of the real world. On the broader issues of standards for encoding and transmission, his unique mathematical insights enabled him to spot blunders that other good men had missed. One of the Quadraphonic systems that was launched in the early 1970s was regarded by Michael as particularly ill-conceived, and he considered it his duty to speak out publicly against it despite the considerable pressure put on him to keep quiet.

Michael's life was dogged by two chronic and life-threatening illnesses, one of which was asthma, to which he ascribed his remarkable high-frequency hearing. Although his sine-wave limit was not exceptional, Michael was severely upset when multiplex stereo transmissions were played through wide-range loudspeakers. He said it sounded like loud tin-cans rattling with the music, and he attributed the effect to the lower sidebands of the 38 kHz subcarrier (extending down to, nominally, 23 kHz).

It was the asthma that finally killed Michael. In the early 1990s he continued to lug heavy recording gear to venues in Oxford and London — he did not drive a car and relied on public transport, taxis and his own diminishing physical strength. Over the last two years he worked against extreme fatigue and repeated asthma attacks requiring hospitalization. His enthusiasm for technical discussion was undiminished even within the final week of his life.

Michael never married, and many in the audio world have assumed that his life was purely intellectual. However, the moving tributes that have come from musicians and poets whom he recorded, and other friends, show that this is a totally false picture. He made deep friendships and wrote poetry that displays remarkable insight and humanity. (See "Faith" on this page.)

His technical legacy is vast. A few of his ideas have seen commercial realization already, such as his work on dither and noise-shaping, and algorithms he designed recently for the Israeli company K.S. Waves.

He also made a very strong contribution to the recent ARA proposal for the High Quality Audio Disc, and it is possible that a standard based on this will be adopted for the mass-market. But the true significance of Michael's work, including papers and unpublished notes in which he sets forth a secure mathematical foundation for types of signal processing as yet largely undreamed of, will probably be fully appreciated only in several decades' time. He was honored and recognized for his achievements when the Audio Engineering Society named him a fellow in 1978 and awarded him its highest accolade, the Gold Medal, in 1991.

I would like to end by quoting Chris Travis, an audio engineer living in Bristol, UK, who on hearing of Michael's death, said:

"For me, the tallest tree has fallen."

Peter Craven

Faith

Do you have so little faith
that you think logic defies magic?

I embrace the logical
that deepest of mysteries.

Logic is a hard discipline,
a rigorous discipline,
a cold discipline.

But magic hides in many places,
and in the heart of pure logic
lies the purest magic.

Do you have so little faith
that you think magic defies logic?

—MICHAEL GERZON
from a collection, 1990-91