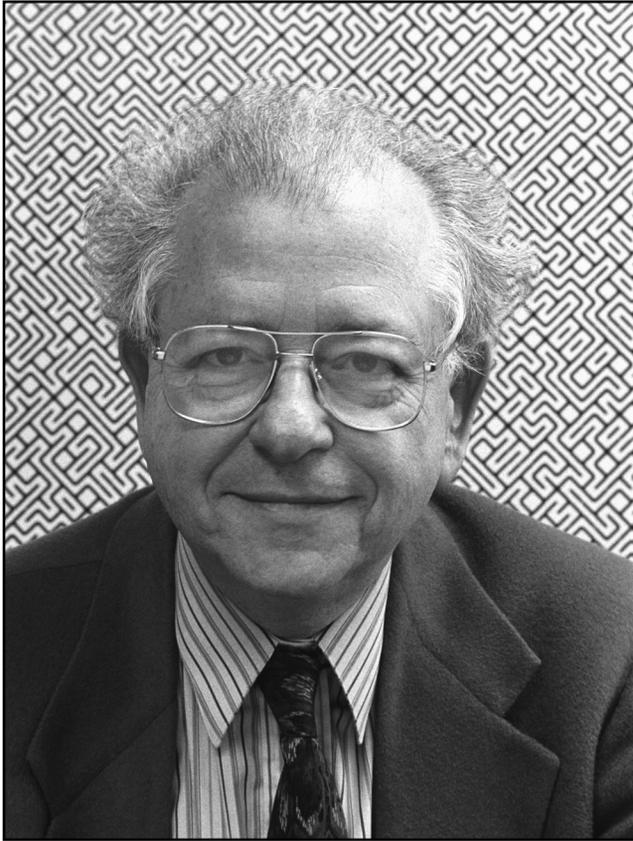

BELA JULESZ



NICK ROMANENKO, RUTGERS PHOTO SERVICES

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BELA JULESZ selected the famous adage by Horace, *Non omnis moriar* (Not all of me shall die), as the epigraph to the prologue he wrote for the re-publication of his classic book *Foundations of Cyclopean Perception*, only a few weeks before he died on 31 December 2003.

With the passing of Bela Julesz, professor emeritus of psychology at Rutgers University, the society of researchers in visual perception and, more generally, in cognitive science has lost one of its giants. Indeed, Professor Julesz started a new paradigm with his random-dot stereograms (RDS) and cinematograms, made seminal contributions in several key areas of visual psychophysics, inspired and influenced generations of investigators, was awarded patents on ingenious applications of his research findings, worked with dozens of postdoctoral associates (most of whom went on to become leaders in their own right), and pioneered important interdisciplinary collaborations among psychophysicists, neurophysiologists, and computational vision scientists to address strategic issues. He authored hundreds of significant publications in very diverse areas of cognitive science spanning stereoscopic vision, motion perception, the perception of textures, perceptual learning and attention, development of visual functions, neurophysiology of vision, computational models in vision, pattern recognition, and auditory perception. His influence reached even the world of art: Julesz's textures for RDSs were featured in the first U.S. computer art exhibition, at the Howard Wise Gallery in New York in April 1965, and Salvador Dali consulted him about producing a modified version of one of his RDSs.

Julesz was born in Budapest, Hungary, on 19 February 1928, to the affluent Julesz household of Jenő and Klementin (Fleiner). His parents valued learning enormously, and ensured that young Bela obtained a well-rounded education in the best schools of Budapest. The famous Rózsa Péter, founder of recursive function theory and author of the elegant *Playing with Infinity*, gave him private lessons in mathematics. In many conversations with the writer, Julesz recounted how his father urged him to follow a career in the sciences, offering "Johnny" (John von Neumann, an associate's son, if I recall correctly), who attended the same high school, as a role model. He received a diploma in electrical engineering from the Technical University of Budapest in 1950. He served as assistant professor in the Department of Telecommunication in 1950–51. While pursuing doctoral research, he served as a research engineer in microwave systems at the Telecommunications Research Institute in Budapest from 1951 to 1956. In 1956 he was awarded a Ph.D. from the Hungarian Academy of Sciences for his thesis, "Study of TV Signals with Correlation Methods."

He married Margit Fasy on 7 August 1953. This was a complete,

balanced, loyal union that was destined to last a lifetime, because it was based on mutual love and respect. Margit stood by Bela's side as a dedicated, loving, and caring companion. She accompanied Bela everywhere, met and associated with his close colleagues, and provided a stable environment so he could concentrate on his scientific endeavors. Her love and devotion shone especially in his last few years, when she dedicated herself to caring unselfishly for Bela, who had undergone surgery for total hip replacement.

He chose to leave Hungary after the crash of the 1956 revolution, with several colleagues, with whom Margit and he maintained strong lifelong friendships. With Margit, they crossed a river at the Hungarian border, and they decided to settle in the U.S. (he was naturalized in 1963), where he was offered a position as a member of the technical staff at Bell Telephone Laboratories in Murray Hill, New Jersey, in 1956. After 1959 he devoted his full time to visual research, particularly depth perception and pattern recognition. He served as head of the Sensory and Perceptual Processes Department 1964–82, and as head of the Visual Perception Research Department 1983–89. From 1964 to 1969 he headed both vision and neurophysiological research, while from 1964 to 1982 he was responsible for research in depth, texture, and color perception. During his employment at Bell Labs, he took frequent sabbatical leaves in academia to teach and conduct research. Thus, in 1969, he was visiting professor of experimental psychology at MIT (where his lectures served as a basis for his first book). In 1973 he visited the University of Western Australia, and he spent the 1975–76 academic year as a visiting professor at ETH and at the neurology department of the University of Zurich, teaching an advanced course in experimental psychology and developing a methodology to diagnose human infants for stereopsis. For three consecutive winter semesters (1977–78–79), he was a Fairchild Distinguished Scholar at Caltech, where he also served as continuing visiting professor in the winter semesters of 1985–93. In 1983 he was Regents Lecturer at the Berkeley campus of the University of California. In January 1989 he retired after thirty-two years at Bell Laboratories, and became a State of New Jersey Professor of Psychology and director of the newly established Laboratory of Vision Research at Rutgers University, from which he retired in September 2001, as professor emeritus.

One measure of his greatness in the field is that his classic book *Foundations of Cyclopean Perception* (Chicago: University of Chicago Press, 1971) was included among the one hundred most influential works in cognitive science in the twentieth century, according to the University of Minnesota's Millennium Project (http://cogsci.umn.edu/calendar/past_events/millennium/home.html). Indeed, this book has become a classic in the literature: even though it is currently out of print, used

copies are on sale for three to four hundred dollars. Several young researchers told Julesz that this book played a major role in their decision to pursue vision research. Parenthetically, Flip Phillips and the writer plan to reprint this book; in fact, Julesz's last scientific act was to write the preface for this reprint, only two weeks before his death. The Bradford/MIT Press published his second book, *Dialogues on Perception*, a highly personal account of his work, in 1995. Francis Crick, in reviewing *Dialogues*, called it "a unique book by a unique person." What was equally important, many of his accomplishments, such as his research with RDS and textures, were sometimes included in textbooks, articles, book chapters, et cetera, without acknowledging him. This perplexed him, and he half-jokingly said that these accomplishments are analogous to folk songs in music. Just as fine folk songs survive the test of time although their composer remains anonymous, so do some important discoveries in visual perception; in the long run, they will survive the test of time and the name of their discoverer will be of minor importance. This paradox of "anonymous immortality" came up often in our conversations.

Of course, his important contributions have guaranteed Julesz eponymous immortality as well. He was justifiably recognized with numerous prestigious awards and honors. He was a fellow of the American Association for the Advancement of Science and the Optical Society of America, and served as the chairperson of the latter's Vision Group 1980–81. He was also invited to be on the editorial boards of *Perception*, *Biological Cybernetics*, and *Spatial Vision*. In 1980 he was elected a fellow of the American Academy of Arts and Sciences. In 1982 he was elected a corresponding member of the Göttingen Academy of Sciences, as well as a neurosciences associate of the Neurosciences Research Program at Rockefeller University, a select body responsible for brain research. In 1983 he received a MacArthur Foundation Fellowship as the "first experimental psychologist and artificial intelligence researcher selected." In the same year, he was elected an honorary member of the Hungarian Academy of Sciences. In 1985, he was awarded the Dr. H. P. Heineken Prize by the Royal Netherlands Academy of Arts and Sciences, and in 1987 he was elected a member of the National Academy of Sciences. He received the Karl Spencer Lashley Award of the American Philosophical Society in 1989, and was elected a fellow of the Society of Experimental Psychologists. In 1995 he was elected a member of the American Philosophical Society.

The development of random-dot stereograms and cinematograms revolutionized research in stereoscopy and motion perception. Julesz coined the term "psychoanatomy" to indicate the tracing of the information flow in the visual system, providing the ability to examine the

hierarchical order of processing stages in the brain. Besides cyclopean perception, he was the originator of a method to study textures quantitatively, which led to many insights in preattentive vision, particularly in texture discrimination. He also was among the first to show the role of spatial frequency channels in suprathreshold vision (with L. D. Harmon, 1973) and in binocular vision (with J. E. Miller, 1975). He was always interested in medical applications of his findings. For example, he pursued work on diagnosing stereoblindness (the inability to fuse the images of the two eyes to extract depth) in strabismic (cross-eyed) infants by measuring visually evoked potentials during critical developmental periods using dynamic random-dot stereograms.

With Bela's passing, his close colleagues and former students sorely miss a guide and a mentor. Bela possessed a sharp mind, a thirst for innovation, an insatiable curiosity, the ability to "think out of the box," a calm and dignified demeanor, an extraordinary ability to engage in constructive dialogue akin to that of Socrates, a deep sense of loyalty, and an incomparably witty sense of humor. Bela often said, "I take my jokes very seriously." He never violated his rule to make only jokes that were apropos. He valued humor so much that he began many chapters in *Dialogues* with an anecdote. We will miss being asked, "What is new in your microcosm?" as he used to put it. Sadly, our microcosm is vastly impoverished without you, Bela! Indeed, for Bela Julesz, *non omnis moriar*.

Elected 1995

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