



## IN MEMORIAM

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Bruce Michael Bennett  
Professor of Mathematics and Cognitive Sciences  
Irvine  
1941–2003

Bruce Michael Bennett, professor of mathematics and cognitive science at the University of California, Irvine, died of brain cancer on January 9, 2003. He was a man of great passion, insight, spirituality, and humor.

Bruce had a wonderful enthusiasm for the exquisite power of mathematics, as well as a fervent dedication to the intellectual development of his students. He thought and wrote profoundly, with an obvious joy of learning and teaching. Throughout his lifetime, he maintained constant mental and personal development. Bridging disciplines, Bruce made significant contributions to the fields of perception and fundamental mathematics. A committed practitioner of Tibetan Buddhism, Bruce's work was deeply informed by spiritual understanding. With a rigorous mind, grounded in logic, he devoted himself to a synthesis of his understanding of spirituality and science. He loved to "play the edge," pushing the intellectual envelope and exploring beyond conventional boundaries. Bruce was intellectually fearless.

The freedom and beauty of Bruce's mind were evidenced in the depth and vitality of his diverse interests. His integrity was enormous, his memory encyclopedic. He was not a dilettante, yet his true commitment to mathematics was accompanied by a resounding and full embrace of many areas, especially jazz; Bruce was an accomplished and hugely energetic saxophonist in the renowned bebop tradition. He was also an advanced player of the Japanese board game "GO," as well as chess. He studied Karate, attaining the rank of brown belt, and continued to pursue his study of martial arts through the age of 61. For three decades, Bruce tirelessly worked on the design and construction of his magnificent home in Trabuco Canyon, California, a giant structure built on a matrix of redwood beams and endowed with hand-picked stones, French windows, and glowing hardwood floors. Over the years, countless visitors enjoyed Bruce's hospitality and took pleasure in his unique sense of humor, his verbal stylistics, and his love of animals, especially Russian wolfhounds and friendly, furry cats.

Born in 1941, a New Yorker by birth, Bruce grew up in Westchester County and Manhattan. He studied psychology at Harvard University, then studied jazz saxophone in New York City. In his late twenties, he developed and pursued a potent interest in mathematics, which led to the Ph.D. in mathematics from Columbia University, under the direction of Hironaka, in 1968. In New York City, Bruce married his first wife, Bonnie. Soon, his two children, Sebastian and Kamala, were born. Following receipt of his doctorate, Bruce was appointed Benjamin Pierce Assistant Professor at Harvard, a position which he held for three years before heading west, in 1971, to accept a position at Stanford University. In 1974, he joined the University of California, Irvine, Department of Mathematics, as an associate professor. In 1992, he married his second wife, Rhonda, and became stepfather to her son, Jerome. Over the years, Bruce's mathematical intensity and the robustness of his personality made him a strong force in the UCI Math Department.

Early on, Bruce's mathematical career was devoted to research in algebraic geometry and the theory of singularities. His dissertation, "On the Characteristic Functions of a Local Ring," first appeared in *Annals of Mathematics*, 1970. However, in a resurgence of his initial interest in psychology, Bruce spent 18 years working in the field of cognitive science to model human perception and related issues. Among his broad contributions to perception theory, object recognition, motion perception, Bayesian approaches to perception, and the logic and evolution of perception, he co-authored a book, *Observer Mechanics; A Formal Theory of Perception*, with Donald Hoffman and Chetan Prakash. This work, supported in part by National Science Foundation grants and Office of Naval Research contracts, advanced the state of the art of formal modeling in the field of perception research. *Observer Mechanics* introduced new fundamental mathematical structures and new examinations of the relationship between the formalism of quantum mechanics and observer mechanics, engendering a synthesis of both fields, firmly grounded in real science.

Continuing to focus on perception, Bruce published extensively: "Modeling Performance in Observer Theory," (with D. Hoffman, R. Kakarala), *Journal of Mathematical Psychology*; "Inferring 3d Structure From Image Motion: The Constraint of Poincaré Motion," (with D. Hoffman, J. Kim, S. Richman), *Journal of Mathematical Imagination and Vision*; "Recognition Polynomials," (with D. Hoffman, C. Prakash), *Journal of the Optical Society of America*; "Lebesgue Logic for Probabilistic Reasoning and Some Applications to Perception," (with D. Hoffman, P. Murthy), which proposes a brand new fundamental logic of probability, *Journal of Mathematical Psychology*; and "Observer Theory, Bayes Theory, and Psychophysics," (with D. Hoffman, C. Prakash, S. Richman), in *Perception as Bayesian Inference*, Knill and Richards, Eds., Cambridge University Press.

In his final years, Bruce revived his focus on fundamental mathematics. As an outgrowth of observer theory, he developed the theory of "Directed Convergence," a new general probabilistic inference setting based on the convergence of perceptual images. He explored Directed Convergence in a series of papers: "Directed Convergence in Stable Perception Acquisition," (with R. Lehman), *Journal of Mathematical Psychology*; " $L^p$  : Metric Criteria for Directed Convergence in Bayesian Recursive Inference Systems," (with R. Lehman), *Advances in Applied Mathematics*; " $L_p$  Metric Criteria for Directed Convergence," (with J. Strasser McIntosh), *Communications in Information and Systems*; and "Universal Adaptation in Probabilistic Inference," (with J. Strasser McIntosh), which presents a beautiful generalization of statistical inference, exploring how adaptation in the probabilistic inference setting should imply Bayesian consistency in statistical inference. Directed Convergence theories attracted national attention, including Bruce's presentation of Directed Convergence at the University of Illinois at Chicago. However, his last work involved a return to algebraic geometry. In June of 2001, he was invited by Stephen Yau to the Chinese University of Hong Kong to develop Algebraic Geometry Coding Theory, culminating in the paper, "Code From Infinitely Near Points," (with S. Yau and Hing- Sun Luk).

Although Bruce expended considerable time and effort on his mathematical research, this by no means eclipsed his function as a teacher and student mentor. At UCI, as Chief Undergraduate Advisor, he was "everybody's favorite mentor," always welcoming and supportive, ready to help, and lightning-quick to provide just the right answer, advice, or strategy. Bruce was an advocate, both mathematically and emotionally. He had a special ability to relate to students with genuine friendship and encouragement. Because of his generosity and talents for inspiring research ideas, he received the Chancellor's Award for Excellence in Undergraduate Research in 1998. Numerous graduating seniors recognized Bruce as their most influential teacher. He continued to mentor students until his very last days, even directing a dissertation from the confines of his hospital bed.

The reverberating tones of Bruce's saxophone music could often be heard, late at night, in the halls of the UCI math department. He was a brilliant and talented saxophone player (tenor, alto, and soprano) who began to study music at age six. From the outset, he showed an irrepressible interest in improvisation and harmonic exploration. Initially, Bruce played classical oboe, before taking up tenor saxophone in his early 20s in New York City. He played with some of the great players of the time, including Paul Chambers, Billy Higgins, and Charlie Mingus. From the 1970s onward, Bruce's mastery of bebop made him a key figure in the Southern California jazz scene. His involvement in jazz culminated in 1995 with the CD, "Little Owl," by The Bruce Bennett Quintet, also featuring James Hill, Jeff Littleton, Kevin Tullius, and Tad Weed, released by Consolidated Artists Productions. Jazz critic Bob Mariani, reviewing the music, noted that Bruce's playing had an element of "danger" in it; he was a chance-taker who played with a fascinating recklessness and abandon that always seemed just on the verge of going out of control, but never did. Bruce's fluid, highly-evolved melodic and harmonic sense was endlessly compelling.

As rich and multifaceted as his mathematical and musical involvements was Bruce's practice in spirituality. He was a long-time practitioner of Tibetan Buddhism in the Bon tradition. This conscious cultivation of awareness provided the foundation for Bruce's conviction that all forms of true knowledge are inseparable and enabled him to engage science and mathematics as mystical practices, wherein there are no true intellectual boundaries among disciplines. In 1994, the Dalai Lama invited Bruce to speak about the meaning of mathematics at Columbia University. In 2001, the Lha Tri Khenpo, Nyima Dakpa Rinpoche of the Bon tradition, asked Bruce to serve on the board of the Yeru Bon Center in Los Angeles. In association with The People for Peace Foundation, a non-profit research institute based in Burlington, California, Bruce wrote extensively on the role of information theory in the optimal unfolding of the universe. One of Bruce's definitions of mathematics was that it was, in fact, "unified consciousness theory."

Bruce Bennett was a big man: big mind, big heart, big body, big spirit. He lived a very full life, generously calling forth his many innate and cultivated abilities and openheartedly embracing each moment. He thought and wrote keenly on a multitude of subjects, his endeavors always underscored by insight, ardor, humor, and zeal for language — evidenced by his instantaneous creation of marvelous and memorable analogies. Bruce was the quintessential individuated being that has experienced and embraced a full range of emotional and intellectual capacities of the mind. He had an almost mad intensity and joy of life that pushed the edge of the ecstatic, but always delicately remained poised and balanced.

Throughout his life, in difficult and complex times, Bruce excelled in the seemingly fading tradition of the venerable Renaissance Man. He was a great thinker, friend, teacher, father, and musician. A great human being: intelligent and kind, poetic and down to earth. All who have been inspired by this unique individual will find it difficult to follow in his footsteps, but will at least be comforted by the aspects of their own personality and true nature that he helped bring to bloom. We will indeed remember his atmosphere of imminent delight.

R. Sebastian Bennett  
Kamala Bennett  
Stephen Bush  
Rafael Espericueta  
Donald Hoffman  
Rachel Lehman  
Jennifer Strasser McIntosh  
Chetan Prakash  
Ron Stern  
Tenzin Robert Thurman  
Stephen Yau