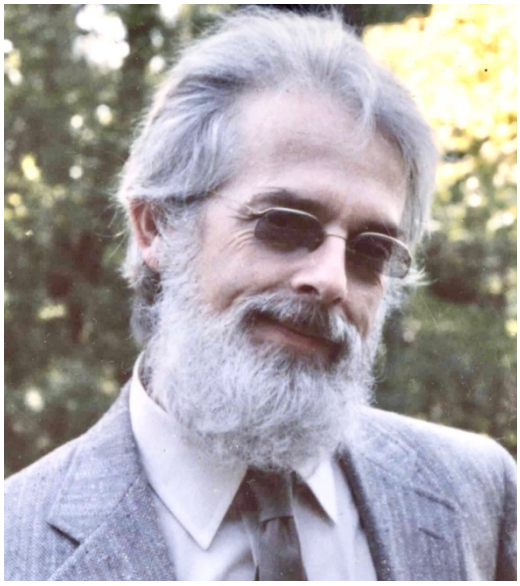
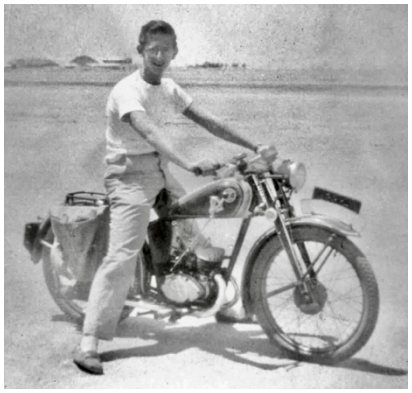
Harold I. Levine: December 14, 1928 - March 11, 2023



I'm speaking in memory of our late colleague Harold I. Levine, Emeritus Professor of Mathematics at Brandeis. Harold passed away in Asheville, North Carolina, on March 11, 2023, after a slow decline due to Alzheimer's Disease. He was 94 years old.

Much of what I will share today comes from notes from colleagues and a memorial written by his family that can be found on the Math Department's web page.



Harold grew up in Lynn, but went to college at the University of New Mexico; famously, he made the 2300-mile trip from Lynn to Albuquerque on a motorcycle (these were the days before Interstate highways). Harold received an M.S. degree in Mathematics in 1952 from the University of Chicago, and a Ph.D. from the same institution in 1957. From 1957 to 1959 he was a Fulbright Fellow at the University of Bonn in Germany, a time that was to have great impact on his life and career. In addition to his foundational mathematical work from the time, he met his wife Renée in Germany. In 1959 he returned to the US as an Instructor at Yale, and the next year he came to Brandeis as a tenured Assistant Professor.

Harold became a full Professor in Mathematics at Brandeis in 1968 and Department Chair in 1972 and again in 1988. During his many years as a senior professor, Harold was graduate studies advisor and supervised 8 PhD students. He retired in 1994.

When Harold joined Brandeis, the university had only been in existence for a dozen years. Harold arrived as part of a talented group of mathematicians who helped bring the Brandeis mathematics department to a high level in a remarkably short period of time. His earliest work was in complex analysis and differential greometry, but his interests soon shifted to differential topology, in particular the singularities of differentiable mappings. This subject would concern him for the rest of his career. His most celebrated work (joint with his Brandeis colleague David Eisenbud) computes the topological degree of a differentiable function in terms of algebraic geometry. His research was later applied to general relativity in physics, to studies of gravitational focusing, viewed through the lens of singularity theory.

During his time in Bonn, Harold signed on to take notes for a lecture series on singularity theory by René Thom. Thom was famous for his geometric insight but not for his clarity; Harold completely reworked the theory and the notes were widely circulated (with a generous acknowledgement by Thom of Harold's contribution). I believe that this, along with his earlier work, made his reputation at a very young age. In a note, our former colleague David Eisenbud tells of the origins of their important joint work:

> *"I can tell you a story of how Hal influenced the course of my life: Just after getting tenure at Brandeis I went to Paris on a Sloan Fellowship and Hal was there at the time. We had dinner together at a fancy restaurant, and he told me about the problem of the degree of a finitely determined map germ. I had a vague idea, and tossed and turned that night thinking about examples—the idea seemed to work. Hal saw how to make a better formulation than I had…. That was a very exciting time, and I spent some of it with Hal and Renée at their country place—a farm—and enjoyed Renée's French-style hospitality very much."*

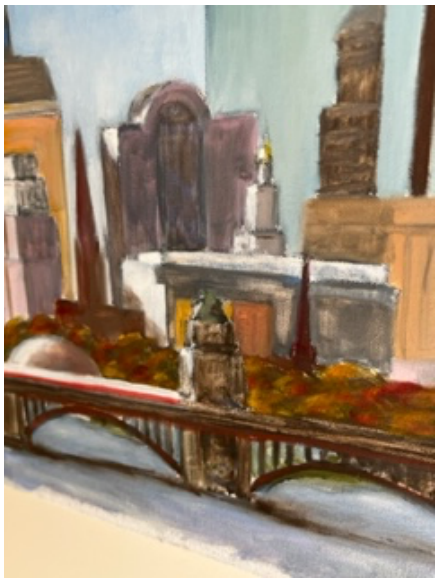
Harold was recognized in 2012 as one of eight members of the Brandeis Department of Mathematics named to the inaugural group of Fellows of the American Mathematical Society He was generous with his time and devoted to his PhD students. Terence Gaffney, who is Emeritus Professor of Mathematics at Northeastern University in Boston, got his Ph.D. from Brandeis in 1976.

> *"At the time I began with him, Harold was advising four students. Since he met with each student for an hour to an hour and a half each week, this was a heavy load…. Harold's style of thesis advising therefore tended to be psychoanalytic. I would go into his office each week, talk about what I had been thinking about that week, outline some thoughts about the week ahead, and Harold would be supportive…. (H)is approach helped me pick out problems that were significant, solvable, and for which I could develop my own tools. This gave me a great start as an independent researcher, and I will always be grateful to him for that."*

Personally, I remember Harold's generosity in welcoming me to the department, and his willingness to talk about almost anything. He invited me to play squash with him, and I was initially skeptical, being almost 30 years younger. I was quickly disabused of this notion, and we had weekly games for years until his hip required surgery. Colleagues fondly remember warm evenings and dinners with Harold and Renée at their homes in Newton and later in the South End. That generosity did not end with Harold's retirement. In 2016, Harold and Renée funded the Harold I. Levine Endowed Fellowship, which supports graduate student research in

Mathematics at Brandeis University. From 2017 through 2023, twelve students have been named Levine Fellows.

Harold and Renée (a remarkable woman in her own right) shared robust intellectual gifts and deeply progressive sentiments. They marched for civil rights and in demonstrations against the Vietnam War. They travelled extensively in Europe; and in the mid-1990s, they moved to France, living both in a rented apartment in Paris and in a house they owned in a village near Orléans along the Loire River. They lived there for many years after retirement, establishing a network of close friendships, until they returned to the US in 2010 to be nearer to family.



In addition to his mathematical works, Harold had other impressive talents. In addition to being a skilled pianist, Harold also was an artist. As a young man he took up painting, a pursuit he took up once again after retirement. Harold had a show of his paintings in a chateau near their home in the Loire Valley of France.

Harold Levine was an important early member of the Mathematics Department, and is remembered fondly by all who knew him. For people wishing to honor Harold's memory, his family suggests making a contribution to the Alzheimer's Association.