Benoit Mandelbrot

I met Benoit when he came to Harvard as a visiting Professor in 1979. At that time, the Harvard Math Department was an insulated place, a temple of pure math, and perhaps I was restless. In any case, his appearance opened a door and let in a gale of wind. He was a large man and his presence was large too. He gave lectures in a dozen departments and every lecture dealt with a different phenomenon of nature. He seemed to have studied everything and picked up grist for his mill in every corner of the world.

As is well known, he had two major iconoclastic themes. First, that most of the naturally occurring measurements of the world were best modeled by non-differentiable functions; and second the histograms of these measurements were best modeled by heavy tailed distributions. Even if he did not bring a new unifying law like Newton's $F=ma$ and even if he did not have the deep and subtle theorems which make waves in the pure math community, this vision was revolutionary. What his lectures made clear was that fractal behavior and outlier events were everywhere around us, that we needed to take these not as exceptions but as the norm. For example, my own work in vision led me later on to express his vision about outliers in this way: that the converse of the central limit theorem is true, namely “the only naturally occurring normal distributions are ones which are averages of many independent effects”.

Benoit's immediate effect on my work was to re-open my eyes to the pleasure and mathematical insights derived from computation. I had played with relay based computers in high school and with analog computer simulations of nuclear reactors in two summer jobs. But at the time I thought that only white coated professionals could handle the IBM main frames and had puzzled over what in heaven's name my colleague Garrett Birkhoff meant when I read “$x=x+1$” in some of his discarded code. But Benoit told us that complex iterations did amazing things that had to be seen to be believed. These came in two types: the limiting behavior of iterations of a single analytic function and the limiting behavior of discrete groups of Möbius transformations. The second of these connected immediately to my interests. I was always alert to whatever new tool might be available for shedding any sort of light on moduli spaces, whether it was algebro-geometric, topological, characteristic p point counting, or complex analytic. I had sat at the feet of Ahlfors and Bers and learned about Kleinian groups and how they led to Teichmuller spaces and hence to moduli spaces. Benoit told me: now you can *see* these groups and *see* Teichmuller space!

I found an ally in Dave Wright, learned C and with Benoit's encouragement, we were off and running. When he returned to his position at the IBM Watson Lab, he set up a joint project with us and we visited him and his team there. Later, Curt McMullen, who also appreciated the power and insight derived from these experiments, joined us. It turned out that in the early hours of the morning, their main frames had cycles to spare and we would stagger in each morning to see what these behemoths had churned out. There was no way to publish such experiments then but Dave and I astonished the summer school at Bowdoin with a live demo on a very primitive machine of a curvy twisting green line as it traced the limit point set of a quasi-fuchsian group. Ultimately, we followed Benoit's lead in his *Fractal Geometry of Nature* and, with Caroline Series, published our images in a semi-popular book *Indra's Pearls*. One anecdote: we liked to analyze our figures, estimating, for example, their Hausdorff dimension. We brought one figure we especially liked to Watson Labs and, thinking to test Benoit, asked him what he thought its Hausdorff dimension was. If memory serves, he said “about 1.8” and indeed we had found something like 1.82. He was indeed an expert!

I had some wonderful times socially with Benoit and his wife Aliette. They were warm and fascinating hosts who seemed to know everyone too. I remember especially talking about Gajdusek, the discoverer of the link between cannibalism and prion diseases, who was a good friend of theirs. I last saw him at the birthday celebratory meeting in his honor at Bad Neuenahr. Surrounded by his hosts who had contributed so much to his theories, he gave a moving speech on the fact that this was his first visit to Germany since the holocaust. Benoit was a completely unique person and scientist who cannot be pigeon-holed and his influence has been vast. I count myself very lucky to have known and worked with him.