The Books in the Basement

By George Johnson

From *My Einstein: Essays by Twenty-four of the World's Leading Thinkers on the Man, His Work, and His Legacy* (Pantheon 2006).

Early in my college career, I was perusing the science section of my favorite bookstore in Albuquerque—the Living Batch, where the really smart hippies hung out—when my eye was caught by the spine of a little paperback called *The Universe and Dr. Einstein*. Priced at ninety-five cents, it promised to be "the clearest, most readable book on Einstein's theories ever published." On the cover was a tantalizing portrait of a well-tanned Einstein, his wild shock of hair blowing in the cosmic wind. Behind him loomed the night sky, shining with constellations and mathematics. This was clearly the man who knew the answers and they would be imparted to me, a mere humanities major, in a book that was only 118 pages long. I bought it on the spot.

It seemed extraordinary that such a document could exist. Written by a journalist for *Life* magazine named Lincoln Barnett, it had appeared (according to the fine print on the copyright page) in shorter form in *Harper's*. Flipping quickly through the pages, I saw to my relief that it was filled with prose, not equations. There was some scary-looking algebra way back in an appendix, but I figured that by the time I had breezed through this little book, even the math would be clear. Most impressive of all, this compact artifact of scientific exposition was recommended, in a one-page foreword, by the great man himself. I probably didn't appreciate it at the time, but what Einstein had written was a miniature essay, just three paragraphs long, on what makes good science writing. "Anyone who has ever tried to present a rather abstract scientific subject in a popular manner knows the great difficulties of such an attempt," Einstein wrote.

> Either he succeeds in being intelligible by concealing the core of the problem and by offering to the reader only superficial aspects or vague allusions, thus deceiving the reader by arousing in him the deceptive illusion of comprehension; or else he gives an expert account of the problem, but in such a fashion that the untrained reader is unable to follow the exposition and becomes discouraged from reading any further.

> If these two categories are omitted from today's popular scientific literature, surprisingly little remains. But the little that is left is very valuable indeed.

He was recommending Mr. Barnett's book as one that had steered a steady course between the shoals. It was crucial, Einstein observed, that works like this be written: "Restricting the body of knowledge to a small group deadens the philosophical spirit of a people and leads to spiritual poverty."

I recently retrieved my old copy from a box in the basement of my childhood home and started rereading, experiencing all over again the excitement of confronting Einstein's science for the first time. Barnett may not have been my first cut through the brambles of relativity and quantum mechanics. I've also unearthed a yellowed copy of Bertrand Russell's *The ABC of Relativity,* and I may have dipped into George Gamow's *Mr. Tompkins in Wonderland*. But I'm pretty sure it was *The Universe and Dr. Einstein* that first made the concepts come alive—and made me realize that a person could approach this world of ideas not just as a scientist but as a writer.

From the first sentence of the book, you know you are in good hands: "Carved in the white walls of the Riverside Church in New York, the figures of six hundred great men of the ages—saints, philosophers, kings—stand in limestone immortality, surveying space and time with blank imperishable eyes." Among them, of course is Einstein, "the only one who shook the world within the memory of most living men."

Alas, Barnett lamented, hardly anyone outside the world of physics had more than the dimmest notion of just what Einstein had done. Here it was nearly half a century after his first astonishing papers (Barnett's book was first published in 1948) and the ignorance stubbornly persisted: "Today most newspaper readers know vaguely that Einstein had something to do with the atomic bomb; beyond that his name is simply a synonym for the abstruse." And it was not just the uneducated, who were missing out. As Barnett put it, "many a college graduate still thinks of Einstein as a kind of mathematical surrealist rather than as the discoverer of certain cosmic laws of immense importance in man's slow struggle to understand physical reality."

I'd been oscillating since freshman year between two poles, majoring in literature one semester and physics the next. I tried to pay attention as our stately professor, Dr. Victor Regener, led the way through Newton's laws, rolling out the inclined planes and frictionless tracks to drive

home the point that things really moved as the equations described. I struggled through the early chapters of the thick blue brick we called "Halliday and Resnick," an albatross of a textbook that I would tote in the evenings to the Casa Luna Pizzeria, where I drank coffee, flirted with the waitress, and tried to solve the problems at the end of the chapter:

> *A dog is looking out a second-story window when a ball bounces up from the street, passes the top of the window frame and returns one second later on its way back to the ground. If the window is 15 feet above the pavement, then how old is the dog?*

Or something like that. It was time for a third cup. Flipping one day through the course descriptions in the university catalog, I realized that by my senior year I would be all the way up to the nineteenth century. (I think a survey of relativity and quantum mechanics was offered as an elective.) Only many years later, when I'd earned a PhD, would I be taken into a chamber where, like a thirty-third-degree Freemason, I'd see the true mysteries revealed—the shrinking rulers and the slowing clocks . . . and why all this made E equal mc^2.

Or I could sign up for "Literature of the Beat Generation" and read Barnett after class. For me, that ~~it~~ was the right decision. Chapter 3, page 23, and I was already learning a little about Max Planck and the quantum, a prelude to Einstein's photoelectric effect. That led to a short tangent on wave-particle duality, with a little Schrödinger, Heisenberg, Bohr, and Born thrown in. Fifteen pages later and Barnett was laying the foundation for special relativity: the traveler strolling on the deck of the moving ship, the surprise of the Michelson-Morley experiment, the two trains and the lightning bolt . . . and there in a footnote were the curious zigzags of the Lorentz transformation~~s~~. The math wasn't so scary after all. You could actually see, with just a little algebra, how as something approaches the speed of light, time stands still, length goes to zero, and mass becomes infinite. No wonder you could go no faster, that there could never be the optical equivalent of a sonic boom.

By chapter 9, I was immersed in the "four-dimensional space-time continuum," riding Einstein's plunging elevator and watching the bending flashlight beam—encountering the rest of the pedagogical furniture of relativity that is hauled on stage by science writers again and again. Matter bends space and space tells matter how to move. I was amazed that I could, sort of, understand this stuff. Maybe what I was experiencing was closer to what Einstein called "the illusion of comprehension," but that was OK. All I was looking for was a toehold, something that would let me climb a little higher, reach for another rung.

Later on, I'd encounter these ideas again in another first-rate popularization, Barbara Lovett Cline's *Men Who Made a New Physics.* (I just opened up my old copy and found a letter from the pizzeria waitress, postmarked from Mexico, marking the chapter on Einstein's miraculous year.) After college, as I covered the police beat for the *Albuquerque Journal*, I tried to burrow deeper into the literature of relativity with some of the scientists' own more-or-less popular accounts: Arthur Eddington's *The Nature of the Physical World*, Einstein and Leopold Infeld's *The Evolution of Physics*, Edwin F. Taylor and John Archibald Wheeler's *Spacetime Physics.* I imagined myself at the apex of a light cone and pondered the notion that it is not just the speed of light that is absolute but the speed of signaling—that a rational world of cause and effect requires that you cannot learn of an event before it happens. Saying that Einstein proved that "everything is relative" was exactly wrong, for he identified the standard that makes comprehensibility possible.

As he and Infeld put it, if human beings could break the electromagnetic speed limit, "We could see occurrences from the past by reaching previously sent light waves . . . catch them in a reverse order to that in which they were sent, and the train of happenings on our earth would appear like a film shown backward, beginning with a happy ending." A truly weird universe would be one *without* relativity.

These insights—the insights of an amateur—fade from disuse, only to be rekindled every few years as I open a new book on Einstein and take in another production of the metaphorical stage play. The trains and the lightning bolts, the elevator and the light beam—coming upon them is like encountering old friends. With each retelling, the ideas settle in a little more comfortably.

Sometimes there is even a fresh metaphor to appreciate. The parable in João Magueijo's *Faster Than the Speed of Light* about Einstein, cows, and an electric fence made the illusory nature of simultaneity clearer to me than ever before, and a couple of pages in the second chapter of Brian Greene's *The Elegant Universe* induced nothing less than an epiphany: *c* is not just the speed of light and the speed of signaling but the speed at which everything in the universe is moving through the spacetime continuum. Wow.

Greene asks us to imagine a race car traveling at a fixed speed across a flat expanse. Its velocity is divided among two components, north-south and east-west. The faster it moves in one direction, the slower it must move in the other—a zero-sum game. An airplane divides its speed

among three dimensions, and Einstein is just asking us to add one more: In the relativistic universe, all motion is shared among four dimensions. As I sit at my desk going nowhere, I am moving full speed ahead through time. If I get up and start walking, my spatial velocity must be subtracted from my temporal velocity. My watch runs incrementally slower and I don't age quite so rapidly.

The faster you move through space, the slower you move through time. Confronting this idea from a new (for me) perspective jogged loose a memory of my favorite Robert A. Heinlein story from junior high school, "Time for the Stars," which revolves around the famous twin paradox. The brother who boards a starship as a boy returns home a few years later to find that his double is now a very old man. Was it really true I'd wondered back then, that a very smart person named Albert Einstein had proved scientifically that such an absurdity was possible?

But now the idea doesn't seem so crazy. Sometimes I can almost feel myself existing, like a star or an electron, as a ripple in four-dimensional spacetime. For a writer looking for material, it doesn't get any better than this.

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