

The Miller's Tale

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George Miller, the man who launched the cognitive revolution, traces his scientific pedigree back to genesis. No, not that Genesis; the genesis of experimental psychology. The APS Fellow and Charter Member's chain of "begats" begins with Wilhelm Wundt, who started it all in his lab in Leipzig, Germany, in 1875. Wundt taught Edward Titchener, who brought experimental psychology to Cornell University and taught Edwin Boring, who in turn taught S.S. "Smitty" Stevens, who taught Miller in his laboratory at Harvard. Miller went on to rub intellectual shoulders with some of the sharpest minds in the pantheon of 20th-century psychology: Alexander Luria, Jean Piaget, J.C.R. "Lick" Licklider, and Noam Chomsky, to name a few.

Enticed to Psychology

But it was Miller's wife-to-be, Katherine "Kitty" James, who introduced him in 1938 to psychological science. Miller was then at the University of Alabama, majoring in speech and English. He considered psychology a medical science, something his Christian Science upbringing in West Virginia had, he says, taught him to distrust.

Kitty enticed him to a seminar by the late Donald A. Ramsdell, then head of Alabama's psychology department, "in the comfort of his own living room," Miller writes in his 1989 chapter of *A History of Psychology in Autobiography*. "Ramsdell had a way of drawing everyone into the discussion," Miller recalled in a recent interview. "I don't know how he did it, but he got me interested."

Although Miller's degree was not in psychology, after graduation Ramsdell offered him a position as an instructor, and then helped him get into graduate study in summer school at Harvard. "They admitted me in spite of the fact that I knew nothing," Miller said.

It was at Harvard that Miller met APS Fellow and Charter Member Wendell R. Garner, (now at Yale University), and they struck up a lifelong friendship. They met on a bench, two new students waiting in an empty hallway for Gordon Allport — then psychology chair at Harvard — to arrive.

"A janitor told us, 'These people don't get in before ten in the summer,'" Miller writes. While they waited, they agreed to share a room since neither had a place to live yet. "We found a large, sunny room we could afford on the top floor of a boarding house," Miller writes. "Later we learned that two prostitutes conducted their business downstairs, but they, the war in Europe, absent families, and all other distractions were blotted out by our cooperative obsession with psychology."

On their first exam, both received grades in the 70s, Garner recalled in an interview. "We weren't used to that. That's when we really began to interact. We started studying, rehearsing each other. We stayed up late at night when an exam was coming up. The next exam, we got grades in the 90s. That was more like it."

‘We Agreed There is a Mind’

It wasn't all work. "We had fun," Garner said. "We were poor, but we'd go out drinking beer on weekends. We'd go down to the concerts on the Charles River, lie on the grass, and listen to the Boston Pops. We walked all over Boston 'til our feet were sore." He also remembers "late night bull sessions, usually after several beers. When you've been drinking beer and you're walking home at 1:00 in the morning and you're in your early 20s, you talk a lot. We talked about psychological things."

He recalls that, somewhere along the way, "We agreed there is a mind." This was heresy at a time when psychology considered the brain little more than a processor of sensory impulses.

After returning to Alabama for a year, Miller moved back to Harvard in 1943 with his wife and infant daughter, and Garner moved into a spare room in their apartment for the remainder of the World War II. They worked in separate labs—Garner in radar, Miller in Stevens' Psycho-Acoustic Laboratory.

"At that lab, I encountered many people who influenced me enormously," Miller recalls. "We did a lot of good research there." His colleagues included Edwin B. Newman and Licklider, whom he describes in his autobiography as "extremely intelligent, intensely creative, and hopelessly generous. I lost no time in cultivating his friendship." Two decades later, in the early 1960s, Licklider would conceive of an "intergalactic network" of computers, what we now know as the Internet.

"The politics of the psychology department at Harvard in those days were very poor," Miller said. "Stevens and Allport were deadly enemies. In fact, the department broke apart after the war because they hated each other so much." Allport co-founded the break-away department of social relations, which wouldn't rejoin the more experiment-focused psychology department until 1972.

At war's end, Garner moved to Johns Hopkins, where his interest turned to sensations and perceptions, and Miller stayed at Harvard to specialize in linguistics — work that was to reintroduce psychology to the human mind.

Pretzel Logic

In 1951, Licklider recruited Miller to help him establish a human factors research and development group at the Massachusetts Institute of Technology. There, Miller encountered Claude Shannon, considered the founding father of electronic communications, whose early work on information theory Miller described as "brilliant. ... [It] had a big influence on me." Unfortunately, he added, "I couldn't make psychology out of his statistical procedure. I got frustrated."

At MIT, Miller also worked alongside such mathematical psychologists as William J. McGill, who went on to become president of Columbia University; APS Fellow and Charter Member Bert Green, who specializes in psychometrics at Johns Hopkins University; and APS Fellow and Charter Member R. Duncan Luce, now at the University of California, Irvine and, like Miller, a recipient of the National Science Medal.

In the human factors lab, "George and Lick had the idea that the psychologists should work hand in hand with the engineers," Green recalled, "and we tried. But the engineers had little patience for our academic views and lack of engineering know-how."

“None of us viewed ourselves as primarily interested in human factors, and we felt somewhat remote from academic psychology, so we organized the Pretzel Twist, a fortnightly meeting to discuss some current psychological topic. We were inexperienced, and tended to intellectual arrogance, which was kept somewhat in check by George and Lick.”

Luce commented that what he most recalls from those years is Miller’s influence on his writing. “When I went to MIT as an undergraduate, I was immediately placed in a remedial writing class. George’s writing style is, of course, famed, and because I found clear writing exceedingly difficult, I exposed myself to and studied his prose.”

That Magical Number

Miller was working on two projects — one involving absolute judgment, the other immediate memory, when he was invited to address the Eastern Psychological Association. In his autobiography he wrote that “all my pride and ambition wanted to accept, but fear of embarrassing myself argued against it. Finally, fear won out. I wrote a long letter ... explaining that I was working on two totally unrelated projects,” neither of which he felt was worth a one-hour lecture. The program chairman wrote back “that anyone who needed two pages to say no obviously wanted to say yes, so why didn’t I reconsider. He was right.”

He asked himself what his two projects had in common and concluded “the only thing I could think of” was that both involved the number seven, more or less. So, “I thought, maybe I can fake it. I’ll pretend that I was studying the number seven.”

That resulted in his 1956 seminal paper, “The Magical Number Seven, Plus or Minus Two.” In it he demonstrated that short-term memory is limited to between five and nine items; to overcome those limits, he wrote, we group items into “chunks.”

Enter Jerome Bruner. Now at the New York University School of Law studying how lawyers use narrative, Bruner had a typical reaction to Miller’s paper. As he later wrote in his autobiography, *In Search of Mind*,* “I think if there were a retrospective Nobel Prize in Psychology for the mid-1950s, George Miller would win it hands down — and on the basis of [that] one article (though he had lots of other arrows in his quiver).”

Miller’s own assessment, from his autobiography, is matter of fact: “I don’t really understand why the paper has been so widely cited. It has some good ideas in it, but other papers I have written with equally good ideas sank from sight without a ripple.” Perhaps it was the timing, he writes. “[I]t did appear at a time when many psychologists were looking for new ways to think about their science.”

By 1956, Miller was back at Harvard’s psychology department and Bruner was in Allport’s social sciences department. Across that divide they became comrades on the barricades of the cognitive revolution.

In his autobiography, Bruner recounts one of their luncheon conversations at the Faculty Club: “George Miller said, laughing..., ‘You’re supposed to get at the mind through the eye, ear, nose and throat if you’re a real psychologist.’ And we recited together the stale joke about how psychology first lost its soul and then its mind. ... The mind was not doing well in psychology.”

They set out to change all that. “Jerry and I were both unhappy with our departments,” Miller recalled. “He was a social psychologist and I was an experimental psychologist. He got me to see what social psychology was all about, and I’ve always appreciated that.”

Bruner says of their relationship, “George and I are quite different kinds of people, but we share some deep habits of curiosity and human sympathy. I’ve never known anybody with whom I could so easily discuss both intellectual matters and matters of personal concern. I wish I were a good enough psychologist to explain what friendship is. In any case, ours has been a real friendship — even when we didn’t agree about things.”

An Interesting Summer

Another key influence during those Harvard years was a young rebel named Noam Chomsky, who wrote a scathing review of *Verbal Behavior* by B.F. Skinner, the high priest of behaviorism. “I thought it was damning,” Miller said of Chomsky’s review. “I made him take out some of the worst slurs before it was published.”

Chomsky, Miller said, is a “brilliant man, [but] he likes to argue, and I don’t.” Among other things, he added, Chomsky “turned me into a linguist.”

Chomsky and Miller spent a summer together at Stanford University, their two families living in a fraternity house. “Actually, in this respect I have a distinction no one else has: Noam was my graduate assistant at Stanford. We worked together that summer and tried to teach Chomsky’s semantics and Chomskyan syntax to students, who were all professors themselves. That was an interesting summer.”

Cognition Out of the Closet

Miller also spent the 1958-59 academic year at Stanford’s Center for Advanced Study in the Behavioral Sciences and “became infected with the youthful disease of enthusiasm,” he later wrote. “The California sun baked all the New England prudence out of us, and we competed for outrageous ideas. One idea triggered another like chained explosions in our heads.”

Back at Harvard in 1960, Miller became, he writes, “acutely unhappy with the narrow conception of psychology.... I decided that either Harvard would have to let me create something resembling the interactive excitement of the Stanford Center or else I was going to leave. ... I took my misery to Jerry.”

The Miller-Bruner collaboration culminated in the creation of the Center for Cognitive Studies at Harvard, a place “where we could do what we wanted to do,” Miller said.

The center’s very name was a bold leap for Miller. “To me, even as late as 1960, using ‘cognitive’ was an act of defiance,” he writes. “It was less outrageous for Jerry, of course; social psychologists were never swept away by behaviorism the way experimental psychologists had been. But for someone raised to respect reductionistic science, ‘cognitive psychology’ made a definite statement. It meant that I was interested in the mind — I came out of the closet.”

The center quickly attracted a parade of notable visitors: Piaget came from Geneva; Luria from Moscow; Peter Wason (1924-2003), who pioneered the study of human reasoning, from London; Nelson Goodman (1906-1998), from Brandeis University; and of course, Chomsky.

From the Center Outward

One of Miller's students at the center was APS Fellow and Charter Member Donald Norman, who now divides his time between Northwestern University and the Neilsen Norman Group in Palo Alto, California, a consulting firm he co-founded.

"When I became his postdoctoral fellow at Harvard," Norman says, "he helped transform me from a technological nerd into a more humane, much broader humanist. George probably does not realize this, but he also was my inspiration in learning how to write. ... When I started at the center, I was a horrid writer. When I left I was passable. Today, I call myself an author. I was never able to tell him how profound his impact had been, and how much I am indebted to his wisdom."

Thomas Bever, University of Arizona, describes Miller as "the most durable" of the academic influences in his life and one of his "most engaging" teachers. "He was enormous, tall, gangly, and informal, at least by Harvard standards. He sat on the desk at the front of the room, legs crossed, and generally started the class with a few random jokes. His lectures flowed like a country brook."

In 1964-65, Miller and Bruner went to Oxford University as Fulbright Research Professors, and when they returned, Miller was named chair of Harvard's psychology department. He found running a department "impossible," he said. "I decided to hell with it and after three years I went to Rockefeller University, where they didn't have departments; they had professors and each professor was a department unto himself."

Miller brought his star student, Bever, with him and turned him loose to conduct his own experiments. "At first I was a bit hurt," says Bever. "I had not really expected to work with George, but when he embargoed it, I had many moments of confused doubt. Of course, as I later developed experience with my own students, I realized that this [being freed to conduct his own research] was a high compliment."

APS Fellow and Charter Member Susan Chipman, Office of Naval Research (ONR), remembers Miller from an undergraduate course in "Psychological Conceptions of Man" that he and Bruner taught at Harvard. She had been a math major, but "this course was almost undoubtedly responsible for the fact that I eventually became a graduate student in psychology at Harvard."

During that course, Chipman says, she "never talked personally with either Miller or Bruner. I just watched them perform. Both were outstanding lecturers."

By the time Chipman entered graduate school, however, Miller was on his way to Rockefeller University. "She's always sort of fussed at me for leaving Harvard," Miller said. Since then, "She's had a good effect on me from the point of view of being a critic and being a contact. I got to know other people through her. That has been very important in my life."

When a new president took over at Rockefeller in 1979, Miller said, "It was clear I didn't have any future there." He moved to Princeton, where he spent the remainder of his academic life and became very interested in what he calls "the mental dictionary — how it is people can know all those words and be able to recall them and recognize them immediately as they are spoken. That seemed to me such a wonderful thing."

One result of that interest is Miller's capstone contribution to science: WordNet, a computer simulation of human word memory. WordNet is being translated into multiple languages and is widely used by linguists in language processing systems. Chipman and her colleagues at ONR were the first to support the project.

Miller is now the James S. McDonnell Distinguished University Professor of Psychology, Emeritus, at Princeton University. It has been an exciting journey from his days as a speech and English major in college.

References

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