

‘Bownet’ An Intellectual Genealogy of Gordon Bower

October 01, 2006

Ask Gordon Bower about the first great influences in his life and he’s likely to name a couple of Lous — Lou Gehrig and Louis Armstrong. You can thank a high school teacher and the Korean War for the fact that Bower is in the pantheon of modern psychological science instead of in the Baseball Hall of Fame or playing trumpet for a jazz band.

Not long ago, Stanford University’s renowned authority on learning theory and memory was asked what he would do differently if he could relive his life.

“My first wish,” Bower wrote to his former student, APS Fellow and Charter Member Robert Sternberg, Yale University, “...would be to be born in an era devoid of wars, so I could (try) my luck at pitching professional baseball.... I had a good career as a college baseball pitcher and yearned to play professional baseball. But the Korean War draft prevented that: My option ... was to either go on to graduate school or go to Korea with the Army for four years. I had to forget about a career in baseball, which I’ve often regretted.”

Gehrig, the legendary Yankee first baseman, had been Bower’s first hero, at age 8, in Scio, Ohio. After high school, Bower turned down offers to play professional baseball and accepted a baseball scholarship from Case Western Reserve University. (Years later, his former students would recall that he could still hit a softball so far he could walk around the bases.)

In high school, the future APS President, Fellow, and Charter Member also developed a second passion, jazz trumpet, and a second hero, “Satchmo” Armstrong; he wound up playing trumpet in a Dixieland band. A high school teacher finally snared him into science — his third and ultimate passion — by introducing him to the writings of Sigmund Freud.

“I became so captivated,” he told the Psychonomic Society in 2003, “...that I planned to become a psychoanalyst. Those plans were dashed by the dismal reality confronting me when I worked as a research assistant for a year at the Cleveland State Mental Hospital. That experience shattered my romantic illusions about curing psychotic patients” (Bower, 2003).

He found experimental psychology instead. At Case, Charles Porter, an experimental psychologist with a freshly minted doctorate from Yale, “got me interested in doing quantitative theory,” Bower said in a recent interview. “He motivated me to take a lot of classes in mathematics and the philosophy of science.” These led to a year of postgraduate study in those subjects at the University of Minnesota and his graduate studies at Yale.

Bower had two mentors at Yale — both of whom traced their academic lineage back to Wilhelm Wundt in Leipzig. The first was the late Neal Miller (1909-2002), recognized in 2000 by the Association of Neuroscience Departments and Programs as “among the most accomplished behavioral neuroscientists of the 20th century.” Miller had been a student of Walter Miles at Yale, who had studied under Carl

Seashore, a student of E. W. Scripture, who studied under Wundt.

With Miller, Bower investigated brain mechanisms in reward and punishment, electrically stimulating the brains of rats to pinpoint the reward center. The “reward” didn’t last very long: A second or two after a rat pressed a lever to turn on the pleasure center, the electric shock “became painful and the rat would run across the cage and rotate a wheel to turn it off, then go back and turn it on again. The rats would continue this on-off cycle until they dropped from fatigue.”

“I did that kind of work for a while,” Bower said, “but I was not that interested in the brain. I was more interested in the external conditions of learning, so I studied the conditions of conflict in animals.”

His second Yale mentor, the late Frank Logan (1924-2004), had studied under Kenneth Spence, a student of Robert Yerkes at Yale, who was a student of Hugo Munsterberg, another Wundt graduate. With Logan, also an APS Fellow and Charter Member, Bower investigated what became his doctoral dissertation — how reinforcement could train rats to scamper down a runway at just the right speed to maximize their reward and minimize the delay in getting it.

“My graduate-school imprinting,” Bower said. “persuaded me that the universal principles of learning could be discovered by studying rats in mazes and pigeons in Skinner boxes.” (See Bower’s tribute to Logan in the *Observer*, Vol. 19, No. 7, July 2006.)

Midway through Yale, in 1957, he and his wife spent their honeymoon living in a student dormitory at Stanford while he attended a six-week Social Science Research Council Institute on mathematical learning theory, taught by the third major influence on his scientific trajectory, APS Fellow and Charter Member William K. Estes, Indiana University. (Next door, George Miller and Noam Chomsky were running their own workshop on psycholinguistics. See *Observer*, Vol. 19, No. 6, June 2006.)

“That summer of 1957 completely transformed my personal and professional life,” Bower told the Psychonomic Society. He found himself cast into “a very rich collection of intellects for a second-year graduate student.”

“Since I didn’t know any of them, I was fearless in speaking up and presenting my ideas throughout the workshop. Bill Estes told me much later that as a student I had been allowed into the workshop on the expectation that I’d be a passive, silent observer — a role hardly in character for me. During that workshop, I formed a valued intellectual kinship with Bill that has continued over the years.”

“Gordon was not cut out for the role of passive observer,” Estes agrees in an as yet unpublished memoir of Bower. “When first we met at the workshop, I was greeted with ‘Hello Dr. E., I have a couple of results I’d like to show you.’”

After Bower received his doctorate in 1959, his career-long love affair with Stanford began. It wasn’t long before “Stanford was ranked number one in the world in psychology, especially in my area,” he said (a success due in no small measure to Bower himself). “Frankly, there wasn’t much motivation to go elsewhere.”

Estes, then (and again now) at Indiana University, came to visit often. “On each occasion, Gordon met me with a bundle of yellow scratchpads containing new findings on several fronts of the now flourishing mathematical learning theories that absorbed us both.”

Estes joined the Stanford faculty in 1962, “with the effect, curiously, that the pace of my interchanges of ideas with Gordon slackened a bit...I rarely had patience to wait out the lengthy line of students that queued up outside Gordon’s office door waiting for criticism, advice, or inspiration from the master.”

Bower’s impact cannot be overstated, Estes writes. “Bower has been a central figure in the evolution of cognitive science, not only because of his own towering record of research accomplishment, but because of his influence on his students and postdoctoral associates, many of whom have become stars in their own right, and on colleagues of all varieties,” a cohort he dubs the “BowerNet.”

“My career has led me on a winding but exciting path to the topics I study today,” Bower told the Psychonomic Society. “Given the interests I started with in graduate school, I would never have predicted my current topics.... In retrospect, I’ve observed that scientists who stand still while the herd is stampeding in one direction will be trampled to death. The best tactic is to join the herd for a while, but then be willing to risk venturing off to another intriguing topic.”

He lists no fewer than six areas of research he has specialized in: animal learning, mathematical models, memory organization and mnemonics, emotional influences on cognition, narrative memory and mental models, and human associative memory (the title of his classic 1973 book with another star student, APS Fellow John Anderson, the work he considers his proudest scientific achievement).

Why so many specialties? “Partly because I had so many students to work with me,” Bower explained, “Often I would get into a field because one of my students would say, ‘Let’s go work on this.’ In the beginning, when you first get graduate students, you give them a lot of guidance on research topics you’re working on, but as time goes on you try to get them to be totally independent, treating them like colleagues rather than students. [The student becomes] a member of a great adventure team. That’s what my mentors did for me...and I did the same with my graduate students.”

Much of Bower’s work focused on how emotion affects memory and recall: If people learn something when they are sad, it is easier to recall that thing later if they are sad than it is to recall things they learned when happy, and vice versa. Sad people recall the sad parts of a story, for example, while happy people remember the more pleasant parts (mood-congruent recall).

Then came a visiting social psychologist from the University of New South Wales, Australia, APS Fellow Joe Forgas, who helped Bower and his colleagues “shift gears and extend our emotion research into studies of social cognition,” Bower told the Psychonomic Society. Together they showed, for example, “how people’s mood influenced their on-line perception of their own social interactions” when viewed on videotape, detecting differences that were “all in the eye of the beholder.”

They also found variables that moderate these effects, “corrections to our earlier simple story of mood congruence (that) underscored an important lesson for [Bower]: In psychology, an early report about a phenomenon does not remain the whole story for very long because subsequent research slowly reveals the complexities and interacting factors that moderate the initial effect.”

Forgas describes Bower as a “subtle guiding influence” on his career, a man with a “wonderful, dry, offbeat” and somewhat salty sense of humor typically delivered in a “John Waynesque drawl.”

He isn't alone in likening Bower to the movie icon. APS Fellow Stephen Kosslyn, Harvard, said he first met Bower in a Friday seminar at Stanford. One chair remained empty as students sat on the floor or leaned against the walls, waiting.

"At that point a very large man, who looked remarkably like John Wayne, entered. He ambled to the empty chair, sat down, and said, 'Okay, we can begin.' I wondered who he was. Within minutes he began asking extraordinarily insightful and blunt questions. He was very quick on the uptake, very confident, and unusually assertive."

The professor challenged the presenting graduate student, another student challenged Bower, and Kosslyn said he watched it all "in a state of semi-shock. Not only did I feel totally inadequate, having no idea what any of them were talking about, but I also was impressed by Gordon's ability to extrapolate and search for implications of empirical findings. More than that, I was amazed that he did not mind being interrupted and corrected. Gordon clearly wanted to 'get it right.'"

Those who have worked closest with him seem unanimous about one thing: his no-nonsense approach to mentoring, but with heart. He has had five festschrifts — one at age 50, one at 70, one when his last students graduated, and two at retirement in 2005. (Approaching his 74th birthday, he still teaches one course a year.) Here's a sampling of comments from former students and colleagues:

Alan Lesgold (1971), APS Fellow and Charter Member, University of Pittsburgh: "You taught me that the goal of any scientist is not merely to see further than those on whose shoulders he stands, but also to convey to others whatever new insights he might have, so that others can benefit from them and evaluate their empirical grounding...."

"You taught me that methods and tools should never be a barrier to one's work, that new analytic techniques can and should be mastered if needed to test a hypothesis. In that sense, especially, you were probably one of the very first role models for the modern interdisciplinary scholar."

John Anderson (1972), Carnegie Mellon, quoting from the introduction to *Essays on Learning and Memory* which he and Kosslyn edited: "... (I)n all cases, we carry with us a splinter of Gordon's integrity, respect, and love for good science. It is clear to us that our work and our lives bear the mark of our experience with Gordon. It is as if the rolling stone never completely leaves behind the influence of the forces that guided its initial movement." (Anderson 1984)

Roberta Klatzky (1972), Carnegie Mellon: "I remember my Stanford days with pleasure, beginning with your first words to me: 'You sure don't look like a genius!' I went on to enjoy...your course in 'math psych.' I was just starting to understand how my background in mathematics could be relevant to such a different endeavor. My whole career can be viewed as furthering that understanding."

Robert Sternberg (1975), Tufts University: "Gordon Bower was the best possible advisor one could hope to have... (H)e has been a mentor not only during my three years of graduate school, but also through my entire career."

David Rosenbaum (1977), Penn State: "(Y)ou have been an inspiration to me and all your students, not just for your abilities as a scientist but also for your decency and humanity. Seeing you hold a door open for a janitor at Stanford taught me as much about how to be a professional as did your patient tutoring on

the formulation of theory and design of critical experiments. Thank you for encouraging me to pursue my interest in motor control, a topic far from your own academic specialty. My work on the cognitive control of movement bears your stamp.”

Joe Forgas (1977), University of New South Wales: “(M)eeting Gordon Bower in 1980 was one of those chance events that profoundly affected my interests and research, decidedly for the better. I had a great deal of fun, learnt much, and gained a charming, generous, kind and supportive friend. Our collaboration...stimulated an impressive amount of research during the last few decades.”

John D. Mayer (1982), University of New Hampshire: Conceding that “memory can play tricks on you over time,” he remembered, “I went into him one day and asked if he thought I should apply for a faculty position in cognitive psychology or personality psychology.... ‘Well,’ he said to me, in that wonderful combination of bluntness, sincerity, and the respectful conviction that others were strong enough to hear what he had to say, ‘I can tell you this.’ And then, in a slightly bemused tone, ‘You’re sure no cognitive psychologist.’ He was, of course, absolutely right.”

Lera Boroditsky (2000), Stanford University: “My most valuable lessons learned at Stanford come from observing your unerring candor, your lack of tolerance for airs or self-importance of any sort, and your refusal to take anything too seriously. So, most of all, thank you for teaching me to laugh at myself (and the preferable nature of getting there first). There is probably no skill more important for doing good honest science.”

Mark Gluck (1987), Rutgers University, writing in a forthcoming book based on Bower’s retirement festschrift, *Learning and Memory: From Brain to Behavior*: “Bower never fulfilled his early dream of pitching a no-hitter at Yankee stadium.... However, in his chosen career of psychology, where he went up to bat time after time against a broad and diverse lineup of the most challenging problems in learning and memory, Bower hit a string of home runs worthy of his childhood idol, Lou Gehrig.” t

References

Anderson, J. R., & Kosslyn, S.M. (Eds.), (1984). *Essays on Learning and Memory*. San Francisco, CA: Freeman.

Bower, G., (2003). *Memories of My Memory Research* (Address to Psychonomic Society) Vancouver, BC: Nov. 6, 2003.