

MEMORIAL RESOLUTION

LEE J. CRONBACH

(1916 - 2001)

Lee J. Cronbach, the Vida Jacks Professor of Education Emeritus at Stanford University, died of congestive heart failure in his Palo Alto home on October 1, 2001 at the age of 85. One of his children, Janet, was at his bedside.

Lee made major contributions in the fields of educational psychology, psychological testing, and program evaluation throughout a career that spanned over five decades. Harbingers of his career in testing were evident at an early age in Fresno, California, where he was born on April 22, 1916 to a homemaker and salesman. According to his sister, Lee was overheard at age 4 in a grocery market calculating the unit price of potatoes, drawing the conclusion that the market his mother shopped at charged far more than the market he was in with a babysitter. The eavesdropper reported this feat to Blanche Cummings, a school psychologist and disciple of Lewis Terman, who gave him an IQ test in 1921, publicized his test score (200), used him in Binet demonstrations, and enrolled him in the Terman gifted program. His mother was eager for him to begin school and enrolled him in the upper second grade just as he turned 5 years old; she continued to push him and others to advance him throughout his schooling. He graduated from Fresno High School at age 14 and Fresno State College (majoring in chemistry and mathematics) at 18.

Lee's awareness of Terman and IQ testing attracted him to psychology and as a college junior he came across a monograph by Thurstone and Chave on measuring attitudes. He was particularly impressed with Thurstone's inventive use of mathematics to sharpen the central construct and ferret out equivocal items; the virtue of rigorous engineering analysis of psychological measuring devices became fixed in my mind" (Cronbach, 1989, p. 65). The connection between psychology and education came in a course on history of American Education at Fresno State (then a teachers' college). Asked to review and present a curriculum-improvement study to his fellow students, in a class he "detested," he dissected the study with the scorn of a chemistry student. After the presentation, which the students loved, the professor asked if he'd thought of a career in education research; Lee asked if there were such a thing. The suggestion came at a time when he had decided against pursuing chemistry and the path was set toward educational psychology.

To become employable upon completing college, in 1937 he completed a master's program while also getting his teaching credential at Berkeley. He was hired by his old high school where he taught chemistry and mathematics from 1936 to 1938 before completing a doctorate in education at the University of Chicago in 1940, getting married to Helen Claresta Bower along the way and having a family of 5 children between 1941 and 1956. He rushed through the doctorate "so fast that Chicago had little chance to educate me" (1989, p. 67) but did meet up with Ralph Tyler and became his research assistant on the Eight-Year

Study; this exerted a lasting influence throughout his life. In 1940 Lee took an assistant professorship in psychology at Washington State University teaching introductory, social, child, applied and industrial psychology and operating a reading clinic as well! Toward the end of the war, he served as a military psychologist at the Navy's sonar school in San Diego becoming deeply engaged in instructional psychology. Following the war, he returned to Chicago as an assistant professor in 1946, then went to the University of Illinois in 1948, and finally to Stanford University in 1964. He retired in 1980 but remained intellectually active right up until the time of his death, completing a book begun by his close colleague, Dick Snow, on a new theory of aptitude [Corno, Cronbach et al., 2001] and subsequently working on a paper in which, upon the 50th anniversary of the coefficient alpha paper, he reflected on the uses, misuses and misunderstandings of the reliability coefficient.

Lee's research can be clustered into three areas: measurement theory, program evaluation, and instruction. His most widely cited measurement paper was "Coefficient Alpha and the Internal Structure of Tests," published 50 years ago (Cronbach, 1951). The coefficient, known as "Cronbach's alpha," proved useful for (at least) three reasons. First, it provided a measure of reliability from a single test administration so that repeated occasions or parallel forms of a test were not needed to estimate a test's consistency (following on the work of, for example, Hoyt, Kuder and Richardson). Second, the formula was general; it could be applied, for example, to dichotomously scored multiple-choice items or polytomous attitude scales. And third, it was very easily calculated at a time before computers, using statistics well known by students with only a first course in statistics. Perhaps more importantly, his work on alpha linked mathematics with the "real world"; he came to the realization that, "[c]riticizing test theory [e.g., Kuder-Richardson's assumptions] thus becomes a matter of comparing what the mathematician assumes with what the psychologist can reasonably believe about people's responses" (1989, p. 82).

As was his want, Lee was dissatisfied with reliability theory, recognizing that, in practice, different methods of calculating a reliability coefficient defined "true score," the consistent part of a respondent's performance, and measurement error, the inconsistent part, somewhat differently. For example, remembering an answer to a particular question when the same test was administered twice meant that "memory" contributed to a respondent's consistency or true score, but not so upon taking parallel forms of the test. Moreover, he reasoned that error was more complex than a single undifferentiated error term revealed; measurement error had multiple sources such as variations over occasions, raters, forms, tasks, and the like. What started out to be a handbook on measurement with Goldine Gleser became a major re-conceptualization of reliability theory in the form of "Generalizability Theory." G theory provided a melding of the psychological with the mathematical and produced a comprehensive framework and statistical model for identifying sources of measurement error.

His work on validity theory – the extent to which an interpretation of a test is conceptually and empirically warranted – was no less significant. With Paul Meehl, he placed this idea at the center of psychological, educational and social testing. Just as in other

areas of science, for Lee validation was a process of theory building and testing. Validation, a never-ending process, examined a proposed test interpretation—a construct—by testing it logically and empirically against counter-interpretations. Moreover, what was validated, according to Lee, was not the test itself for a test could be used for many purposes (e.g., prediction, diagnosis, placement). Rather what was validated was a proposed interpretation. Moreover, while reliability was an important characteristic of a test, Lee believed that ultimately it served its master, validity, where sometimes trade-offs were necessary between broadly gauging a construct and narrowly constructing a homogeneous set of items to improve reliability. The Cronbach and Meehl paper, “Construct Validity in Psychological Tests,” laid the groundwork for 50 years of work on validity.

Lee’s research went beyond measurement and testing and included work on program evaluation and instruction. He was skeptical of the sterile view of evaluation as detached, objective, scientific activities with test content matched to curricula, appropriate experimental designs, and proper statistical tests. “[I] spoke up for the more constructive assignment of providing feedback on students’ accomplishments and difficulties week by week, not delaying inquiry until the final examination; most of the conventional prescription was wrong for that kind of evaluation. I was, obviously, extending Tyler’s view beyond the local teacher, using evaluation to reshape a course of study that would be widely distributed” (Cronbach, 1989, p. 89).

In the 1970s, Cronbach directed the Stanford Evaluation Consortium, a research, service and training organization sponsored by the School of Education that included faculty from the Communications and Psychology departments, as well as Education. The Consortium worked with the state of California to examine its relationships with local school districts, among other projects. The evaluation research influenced program evaluations across many fields, from health programs to juvenile delinquency programs; his work recognized the merits and limitations of randomized field trials, the importance of local contexts on performance, and the social and political aspects of program evaluation. Two influential books resulted from this work—*Towards Reform of Program Evaluation* which was written by a team of consortium faculty led by Lee, and a parallel volume, *Designing Educational Evaluations* where Lee pushed his own ideas further (and was selected as one of the top 100 education-related “Books of the [20th] Century” by The Museum of Education, University of South Carolina, 2000).

Lee’s instructional research with Dick Snow focused on matching learning environments with students’ aptitudes (Cronbach & Snow, 1977). This research can be traced to early work with Goldine Gleser on personnel decision theory, and on his presidential address at the American Psychological Association. In the work on personnel placement, he and Goldine concluded that optimal decisions about person-job matches must acknowledge the interaction of individual differences with job demands. Individuals with one profile of characteristics would be expected to perform well in one type of job while individuals with a second profile would be expected to perform well in another job with different task demands.

At about the time the Cronbach and Gleser book, *Psychological Tests and Personnel Decisions*, went to press, Lee was preparing his presidential address for the American Psychological Association. The work on personnel theory gave him a fresh look at the schism in scientific psychology, one that formed the basis of his presidential address in 1955, "Two Disciplines of Scientific Psychology" (Cronbach, 1957). He called for a rapprochement between the "two disciplines" of differential and experimental psychology. On the one hand, correlational studies that focused on differences in individuals' abilities assumed these differences generalized across situations; on the other hand, experimental studies that focused on differences between situations ("treatments") viewed individual differences between people as noise ("error").

He pointed out that these individual differences might be highly predictive of performance in one type of instructional condition (situation) and much less so in another. If individual-difference and experimental psychology came together, he reasoned, it just might be possible to find a link between these individual differences and performance in different learning environments.

Lee's work on personnel decisions and his presidential address sent him and Dick Snow on a 10-year trek in search of aptitude-treatment interactions (ATIs)--statistical interactions (different regressions of learning outcome on aptitude under different instructional treatments). They sought allocation rules something like: Assign people with one aptitude profile (high verbal ability, low spatial) to Treatment A and people with the opposite profile to Treatment B to optimize learning (Cronbach & Snow, 1977). In the end, "[a]lmost no ATI effects were confirmed by multiple studies.... The evidence was negative. A spatial pretest, for example, may or may not predict outcomes from instruction filled with diagrams" (1989, p. 85). The strongest ATIs involved general ability where students with above average intellectual development profited from instruction that provided them with considerable responsibility for organizing and interpreting while those below average profited from a highly structured learning environment. Roughly 14 years later, Lee (1975) revisited his presidential address in, "Beyond the Two Disciplines of Scientific Psychology," where he had come to recognize that ATIs were highly complex -- as if a simple ATI were reflected in a hall of mirrors -- sometimes rapidly changing, and context bound, far more than he had imagined earlier on. He concluded that "[o]ur troubles do not arise because human events are in principle unlawful; man and his creations *are* part of the natural world. The trouble, as I see it, is that we cannot store up generalizations and constructs for ultimate assembly into a network" (Cronbach, 1975, p. 123, italics in original).

In the end, Lee found himself caught between science and practice, whether in the classroom or in policy. Science took him just so far, and he demanded science as far as it would take him. But he also recognized the contribution that other ways of knowing had to make in understanding teaching and learning, and human action more generally. "The special task of the social scientist in each generation is to pin down the contemporary facts. Beyond that, he shares with the humanistic scholar and the artist in the effort to gain insight

into contemporary relationships, and to align the culture's view of man with present realities. To know man as he is is no mean aspiration" (1975, p. 126).

Lee's teaching and service to the University were equally prodigious. He taught three "signature" courses, each of which profoundly influenced graduate students in education and psychology: Test Theory, Advanced Measurement, and Curriculum Evaluation. In Curriculum Evaluation, for example, students worked iteratively with Lee through an entire program evaluation simulation in a single quarter. As was true of all his teaching (work as an RA or TA, or dissertation) each and every student was taken seriously and held to the same high standards to which he held himself. A window into a student's mind for Lee was written language. If the language wasn't clear, neither were the thoughts or logic. He had a lot of repair work to do! He often wrote more on and about a student's work than the student did, intellectually challenging the student while teaching.

He was equally giving in his university service. He served on Graduate Division (1966-67), the Committee on Graduate Studies (1969–71), and the Advisory Board (1970-76) which he chaired in 1972-73. During the period of his Board service, the Bruce Franklin case was acted upon which led to Professor Franklin, a tenured faculty member, being dismissed from the university. In 1985, he served on the Committee on the Relation between the Hoover Institution and the Stanford Professorate. In the School of Education he chaired a highly influential curriculum and program review committee and served on numerous other committees.

Lee's professional honors were numerous. He was president of the American Educational Research Association, the American Psychological Association and the Psychometric Society, and a member of the National Academy of Sciences, the National Academy of Education, the American Philosophical Society and the American Academy of Arts and Sciences. He received many honorary degrees, including ones from Yeshiva University, the University of Gothenburg, Sweden, and the University of Chicago. And he was honored by, for example, the Educational Testing Service for contributions to educational measurement, by the American Psychological Association for distinguished scientific contributions, by the American Psychological Society as a William James Fellow, by the American Educational Research Association for contributions to research in education, and by the Evaluation Research Society for contributions to evaluation methodology.

Lee's wife, Helen, and three of his five children – Janet, Bob, and Joyce – survive him, as does his sister, also named Helen.

Committee:
Richard J. Shavelson (Chair)

Elliot W. Eisner
Ingram Olkin

Corno, L., Cronbach, L.J., Kupermintz, H., Lohman, D.F., Mandinach, E.B., Porteus, A.W., & Talbert, J.E. (2001). *Remaking the concept of aptitude: Extending the legacy of Richard E. Snow*. Mahwah, NJ: Erlbaum.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297-334.

Cronbach, L.J. (1957). The two disciplines of scientific psychology. *American Psychologist*, *12*, 671-684.

Cronbach, L.J. (1989). Lee J. Cronbach. In G. Lindzey (Ed.), *A history of psychology in autobiography*, Vol. VIII, (pp. 64-93). Stanford, CA: Stanford University Press.

Cronbach, L.J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist*, *30*, 671-684.

Cronbach, L.J. with Shapiro, K. (1982). *Designing evaluations of educational and social programs*. San Francisco: Jossey-Bass.

Cronbach, L.J. and Associates. (1980). *Toward reform of program evaluation: Aims, methods, and institutional arrangements*. San Francisco: Jossey-Bass.

Cronbach, L.J., & Snow, R.E. (1977). *Aptitudes and instructional methods: A handbook for research on aptitude-treatment interactions*. New York: Irvington.