

IN MEMORIAM
LLOYD ALEXANDER JEFFRESS

Lloyd Alexander Jeffress died on April 2, 1986, at the age of 85. He was born in San Jose, California, on November 15, 1900, the only child of Minnie Weaver Jeffress and Alexander Mitchell Jeffress. Within about a year of Lloyd's birth the family moved to Portland, Oregon, where Lloyd grew up and was a student through high school. Lloyd's mother died of pulmonary tuberculosis when he was 15, and his father died in 1917 of complications from an earlier gall bladder operation, so Lloyd was primarily raised by an aunt and uncle, the Braymans, beginning about 1915.

From grammar school on, one of Lloyd's closest friends was Linus Pauling, who has credited Lloyd with showing him his first chemistry experiment when they were both 13. Later, many a graduate student experienced similar firsts at Lloyd's hand and thereby had his life's ambition altered, but some may not have realized how long Lloyd had been doing such things, or what good company they were in. In 1918, Lloyd enrolled at Oregon Agricultural College (later to become Oregon State University) at Corvallis, where Pauling had gone the year before. Lloyd spent a year as a major in electrical engineering only to discover that his true interest was in physics, and the next year he transferred to the University of California at Berkeley as a physics major. Lloyd did eventually graduate in physics, but not before an infatuation with physiology enticed him towards pre-med, only to have an early-morning organic chemistry course lead him into a one-semester scholastic suspension. (That semester was spent back in Portland where Lloyd learned enough about the saxophone to make some money playing with a dance band.)

As an undergraduate, Lloyd's well-established habit of reading detective stories brought him into contact with Balmer and MacHarg's *The Achievements of Luther Trant*, in which an ambitious graduate student employs the techniques and apparatus of the "new psychology" to solve one mystery after another. The cardiograph, the pneumograph, the pendulum chronoscope, and the skin galvanometer all piqued Lloyd's curiosity sufficiently for him to enroll in a psychology course, and while he remained a physics major, experimental psychology was his primary interest from then on.

Lloyd was accepted as a graduate student in psychology at Berkeley--the only school he applied to--in 1922. He soon associated himself with Warner Brown, a dissertation concerned with the galvanic skin response was completed in 1926, and the two men remained close friends until Brown's death. (Brown himself had been a student of Woodworth, who was a student of Cattell, so Lloyd's academic lineage went directly to Wilhelm Wundt in four steps, and for his students in

five.) While finishing his dissertation, Lloyd had four job offers to consider--instructorships at NYU and Wesleyan (Connecticut) at \$2000 each, an Assistant Professorship at Arkansas at \$2600, and an Adjunct Professorship at Texas at \$2800. The decision went to Texas not only because of the money, but because it was explicitly billed as a one-year-only arrangement. To his mentor, Brown, this meant that "there was no chance of (Lloyd's) staying and getting in a rut." It was with this advice and positive attitude that Lloyd began a teaching career at Texas that lasted 51 years.

As a college senior, Lloyd met Sylvia Bloomberg who was then a first-year graduate student in psychology working with E.C. Tolman, and as fate would have it, a roomer in the same boarding house with Lloyd. For a time, he and Sylvia were both graduate teaching assistants in Psychology at the salary of \$750 per year--each!--but as a result of their romance, Sylvia's plans changed. She got a teaching certificate, and she and Lloyd were married in 1923 in the Pauling's apartment in Pasadena (simple reciprocity since Lloyd had earlier served as Pauling's best man). Sylvia taught as a substitute with the Berkeley and Oakland school systems until the young couple left California, and then she did occasional psychological testing for the Austin school district. Lloyd and Sylvia had no children--a regrettable loss to the gene pool--but she was a generous "aunt" to every child that crossed her path. For decades, she gave engraved silver napkin rings to all new-borns within her field of view. Sylvia was active in Austin's Little Theater for years, serving in every imaginable capacity except lighting director, which was Lloyd's job. (Lloyd always maintained that his famed color weakness was no deterrent to his ability to correctly light a stage production, but many who saw evidence of his color weakness in everyday situations were very skeptical; he was always especially proud of the fact that he had been asked to assist in the design and installation of the lighting system in Hogg Auditorium.) Lloyd and Sylvia lived in a succession of rented houses until 1963, when Lloyd "decided they probably were going to stay in Austin a while," and they bought a house on Bullard Road that backed up to Shoal Creek. The new house was spacious, and it had a pool designed for swimming laps which Lloyd used regularly, but he did not live there long. Sylvia died in 1968 after a prolonged illness, and Lloyd moved to a small apartment.

Two things about Lloyd that all his friends will remember were his whimsical sense of humor and his personal enjoyment from (re-)telling an old story. A favorite example of his whimsy was his solemnly announcing at the beginning of a lunch meeting one day near a November election that he "had just joined a minority that was soon to become a majority." He later explained with a glint in his eye that he had that morning renewed his car license tags. And once, after spending a couple of hours with some ex-students, and their current students, he confided--with a twinkle, of

course--"I find that I have an infinite capacity for praise." One type of story Lloyd enjoyed telling was about car trips, and one of his best was of the two-week trip he and Sylvia made from Berkeley to Austin in a 1922 Durant roadster in the summer of 1926. The roads were few and dusty, flat tires were common, and they had to wire for money at least once.

The year after his "one-year-only" stint as Adjunct Professor, Lloyd was promoted to Associate Professor with tenure and given a raise from \$2600 to \$3000. That was the year (1927) that Psychology first became a department separate from Philosophy, and Lloyd helped the new department move out of Garrison Hall into the third floor of Sutton Hall, which they were to share with Educational Psychology for the next 25 years. When the depression hit, Lloyd's salary was reduced to \$2400, where it stayed until the mid-1940's. He was promoted to Full Professor in 1937, and was Chairman of the department from 1936 to 1947. During those early years, the department's annual budget for maintenance and equipment was \$200, meaning that there was never much money for research.

Lloyd's career was unusual in an interesting way. Unlike so many modern scientists who have a great flurry of activity when young and then gradually fade away, Lloyd's research career began slowly and gradually picked up speed. Of his approximately 70 published papers, about 80% were published after he was 50 years old. His explanation of this pattern was typically candid; he claimed to be "the laziest man in the world," and it was only after he began his long association with UT's Defense Research Lab in 1950 that he had assistants capable of, and interested in, doing all the menial work necessary to implement and run the experiments Lloyd had been thinking about all along. Beginning about 1940, Lloyd's primary research interest was the auditory system, especially the mechanisms underlying sound localization. Surely his most cited article is the one in the *Journal of Comparative and Physiological Psychology* in 1948 in which he described a hypothetical neural network capable of cross-correlating the temporal information at the two ears and thereby extracting the small differences that can exist in the time of arrival of a wavefront at the two ears. His proposed network later received support from electrophysiologists recording from single neurons at various brain locations in animals, and for new and old students alike, Lloyd's network continues to function as a valuable mnemonic and explanatory basis for many of the facts of binaural hearing. Some research by Licklider and Hirsh on what later came to be called masking-level differences caught Lloyd's attention in the early 1950's, and that began him on a two-decade research program in which he and his students documented various aspects of the binaural system's performance in signal-detection tasks. Lloyd also had a long-standing interest in pitch perception, and published on

such issues as short-term fluctuations in the tuning of the auditory periphery and the continuously changing pitch of a beating two-tone complex.

Lloyd's approach to understanding sensory and perceptual behaviors was always to first carefully examine the physical stimulus in an attempt to isolate those aspects of it that appeared to be critical. Perhaps the best example of this was his treatment of signal-detection theory as applied to human observers. In a series of JASA papers in the 1960's, Lloyd developed what he called a "stimulus-oriented" view of human detection performance. His approach was in the tradition of building and testing models to simulate components of the auditory system. In particular, he simultaneously developed mathematical and electrical models of monaural signal detection and compared their performance under a number of stimulus manipulations to that of humans detecting under the same stimulus conditions. The final versions of these models were highly successful at predicting numerous psychophysical facts.

At the outset of World War II, Lloyd was able to draw directly upon his undergraduate training in physics. Professor Paul Boner of the Physics Department took leave from Texas to work at the Underwater Sound Lab at Harvard, and Lloyd was asked to take over his freshman physics courses--rather an unusual teaching assignment for the Chairman of the Psychology Department! (As evidence of just how much things have changed, the other teacher of freshman physics during the war was David Miller of the Philosophy Department.) During that same period, Lloyd began a series of affiliations with on-campus organizations doing research for the military. The first was the War Research Lab where he helped with the development and testing of a new gun sight for the B-29 and B-36 bombers, and from 1945-50 he worked with the Military Physics Research Lab. In 1950, Lloyd became a parttime member of the staff of the Defense Research Laboratory (DRL; later renamed the Applied Research Laboratories).

Lloyd's first project at DRL was to determine whether the improvement humans show when detecting binaural rather than monaural signals could be adapted to navy sonars. Lloyd designed and built an experimental binaural sonar which he and his students tested at Lake Travis. This specific project proved not to be very successful, but it initiated a program at DRL on masking and binaural hearing which endured, and was highly productive for more than 20 years. The binaural sonar project demonstrates an important characteristic of Lloyd's personality. None of his projects were ever failures. If an experiment was not working out well, or was not yielding useful results, he would, without hesitation, redirect the effort--often drastically so--along a more productive path. In 1953, DRL had collected extensive raw data during the evaluation of several U.S. Navy

minehunting sonars. These data, which were in the form of photographic and magnetic tape recordings, had to be analyzed in detail to provide quantitative measures of target detection probability, location errors, etc., as a function of a number of variables. Since Lloyd had a much better knowledge of probability and statistics than anyone else then on the DRL staff, he was invited to undertake the necessary analyses. With typical enthusiasm, he quickly planned the analysis operation, invented and built the complex analysis hardware, analyzed the data, and published the results, all in the matter of a few months. Almost overnight Lloyd had established his reputation as an expert in minehunting, a reputation that was to grow steadily over the next two decades. This initial work, together with subsequent similar evaluations, led Lloyd to the development of a minehunting technique known as clustering. Typical of his nature, he first used data collected at sea to develop the technique, he then proceeded to use numerical models (which involved random number theory), and finally he developed a theoretical model (in closed analytical form). The Navy readily accepted his work and requested that he write the tactical doctrine on clustering. This document, together with other reports he wrote, remain the standard works on minehunting and are still to be found on every minehunting craft in the U.S. Fleet.

Lloyd made too many contributions to mine countermeasures to describe them in detail, but his contributions to devising precise navigation systems, both radio and acoustic, deserve note. (In the course of this work, Lloyd felt that he should learn how to do celestial navigation, so he bought a sextant and every night he would determine the location of his front yard--initially, it seemed to wander about rather drastically, but gradually it settled down to a relatively fixed location.)

Lloyd loved to go on sea trips, and he was never happier than when he was on the bridge of a minehunter, smoking a cigarette and drinking a cup of black coffee. He was universally liked by the officers and crews of these ships, and strictly against regulations, they taught him to con the ship and even to bring it into port and dock it at the pier. He simply had to learn to do everything. As a consequence, he had unusual rapport with the Navy. Typically, a telephone call to the Fleet would suffice to set up an entire exercise at sea; today, such a method of operation is unthinkable. All of Lloyd's projects were interesting (such as his designing, building, and testing a radio-controlled catamaran for use in minehunting), and almost all were useful. An exception was a "computer" he built when he first became interested in such machines. This device used relays to add and subtract binary numbers, and Lloyd delighted in calling it "the world's slowest computer."

To his many friends at DRL, Lloyd was remarkable because he was able to pursue his university teaching, do his fundamental research in psychoacoustics, and do his very applied work

in minehunting all at the same time, and because he was so successful at each. It is interesting to note that Lloyd's basic research in psychoacoustics at DRL was sponsored by the Navy's Bureau of Ships, an agency which normally deals with the development and procurement of hardware, while much of his applied work in minehunting was funded by the Office of Naval Research (ONR), whose charter is to sponsor fundamental research. Lloyd had a knack for operating in his own way.

At Berkeley, one of Lloyd's and Sylvia's closest friends was Hugh Blodgett. He was a student of E.C. Tolman, as had been Sylvia, and he was interested in both psychology and physiology, as was Lloyd. Blodgett's dissertation on spatial learning brought him instant national attention, but no attractive job offers. He served one-year stints at Harvard and Lehigh before Lloyd convinced him to accept a position at Texas in 1927. Blodgett remained on the UT faculty until 1971 and died in 1972. Judging from the stories that have filtered down through the years, it appears that Lloyd and Hugh raised considerable hell together during the thirties and forties. Then, in the fifties (also their fifties), they finally began publishing together. Blodgett's interest in audition stemmed in part from his having perfect pitch and being an expert pianist. (By some accounts, he was politely tolerant of Lloyd's less-than-polished performance on the violin during their attempts at music-making.)

Lloyd and Sylvia were also close to Clarence and Gwen Ayres. Clarence was a famous social philosopher and economist, who was a major presence on campus and who managed to attract the eye of witch-hunting regents and legislators on several occasions. (In the small-world department, Gwen and Lloyd had attended Washington High School together in Portland years earlier without knowing each other.) Lloyd's version of prudent liberalism presumably matched well with the politics of the Ayres, as did his and Clarence's mutual interest in science and technology. The Ayres owned a cabin in Cloudcroft, New Mexico, which Lloyd and Sylvia shared with them regularly. One of the primary activities on these visits was mushrooming, which--in Lloyd's telling--was invariably excellent in Cloudcroft.

Lloyd was absent from Austin for only one year following his arrival in 1926. In 1947-48 he was the Hixon Visiting Professor at the California Institute of Technology in Pasadena. This arrangement developed out of a casual conversation Lloyd had had with Pauling--then at Cal Tech--about possible mechanisms of memory. Pauling was intrigued by the problem and recognized that this topic fell under the directive given the newly formed Hixon Committee to support biological investigations. The Committee was in fact interested in the topic, and Lloyd was brought to Cal Tech for a year to organize and conduct a symposium on neural mechanisms in

general. The participants included luminaries from a number of disciplines--Halstead, Kluver, Kohler, Lashley, Lindsley, McCulloch, Lorente de No, Von Neumann, Pauling--and, as might be expected given this list, many of the papers of the Hixon symposium became classics. The book appeared in 1951 and was re-issued in 1969.

At the age of 72, Lloyd began to feel he was getting a little out of date technologically and that it was time he did something about it. So, he sold a piece of land in Portland that had been in the family for decades, and used the money to buy a Digital Equipment Corporation PDP-8 mini-computer which he had installed in the second bedroom of his apartment. In those days, one communicated with mini-computers using a teletype and a paper-tape punch and reader, both of which were quite noisy. The noise was no problem for Lloyd, who had severe presbycusis by this time, but it must have been annoying for the unfortunate souls whose apartments abutted his, especially given his habit of solving problems while dreaming and then immediately arising to implement the solution. Over the first few months of ownership of the PDP-8 what must have been the world's oldest (new) student of programming regaled all of his friends with stories of his successes and failures with programs for accomplishing this and that, and, frequently, of his strong conviction that the machine was broken--the evidence being that some new program did not run as it should. It wasn't long before Lloyd had mastered the PDP-8, and when the opportunity arose to move on to one of the, then-new, Radio Shack microcomputers, he jumped at it. Within a year or so, he had two Radio Shack machines set up side-by-side in his apartment; they were different models, and not designed to communicate with each other, but Lloyd persevered until he was able to transfer programs and data back and forth between these reluctant machines. About 1981 Lloyd bought an NEC machine that became his pride and joy. This was a machine with extraordinary potential that--for some inscrutable reason--the manufacturer did not support well, and Lloyd's greatest enjoyment came from discovering how the machine accomplished certain tasks, or how it could be tricked into doing those tasks. He loved to demonstrate his many graphics programs and games to anyone with the time and interest, and he had extensive correspondence with program developers in Australia who took the machine as seriously as Lloyd felt it deserved. It is sobering indeed to contemplate the technological developments that occurred within Lloyd's lifetime--the Wright brothers' first flight, the invention of the vacuum tube, man's first walk on the moon, and 32-bit microprocessors for use in inexpensive personal computers.

In 1971, Lloyd retired from fulltime teaching at The University and went on Modified Service. In this latter role he taught courses in mathematical statistics to graduate students and

introductory statistics to undergraduates. In 1977, Lloyd retired fully from The University, and became Professor Emeritus. But instead of living quietly in retirement, he took a job in industry! He worked at Dynastat, Inc., an Austin company specializing in testing speech communication systems that is owned by one of Lloyd's first doctoral students, Bill Voiers. Lloyd took responsibility for getting the everyday operations of Dynastat more computerized. This included developing a number of valuable programs for analyzing speech perception data. He clearly took great delight in the fact that he was actually receiving a paycheck for work other than college teaching. Lloyd continued working for Dynastat, on and off, until 1984.

Lloyd joined the Acoustical Society of America in 1939 and was elected a Fellow in 1948. He served the ASA for eight years as Associate Editor for Psychological Acoustics beginning in 1962. This is among the longest terms of service for any Associate Editor, and it is the longest for an Associate Editor in Psychological and Physiological Acoustics. Upon Lloyd's retirement as Associate Editor, the job was examined and found to be too much for one person, and two sub-sections were formed with an Associate Editor for each. Lloyd was also a Fellow of the American Association for the Advancement of Science (AAAS) and of the American Psychological Association (APA). Although nominated for membership in the elite Society of Experimental Psychologists, he was never invited to join.

In 1966 some of Lloyd's former students honored him by having a special session at the annual meeting of the Southwestern Psychological Association, and similar events were arranged for the Austin meetings of the Acoustical Society held in 1975 and 1985. (His "public address" opening the 1975 ASA session was typical Jeffress whimsy--it was one sentence to the effect of thanking us all for holding this event now rather than after he was dead.) In 1971, Lloyd's published papers were assembled into a volume in honor of his last year of fulltime teaching; several hundred copies were eventually distributed to friends and admirers in the academic world and in government. Also in 1971, Lloyd received the Beltone Award for distinguished accomplishment as an educator, and in 1978 the UT Psychology Department honored his long and distinguished service during its Golden Anniversary activities. In 1979, Lloyd received the Distinguished Service Award of the American Speech Language and Hearing Association. But surely the honor that Lloyd was most proud of was the Silver Medal awarded by the Acoustical Society of America in 1977 "... for extensive contributions in psychoacoustics, particularly binaural hearing, and for the example he has set as a teacher and scholar." Being officially recognized by his beloved ASA was a source of unique pleasure and satisfaction for Lloyd. He was the first recipient of the Silver Medal from

Psychological and Physiological Acoustics.

Lloyd lived a full life, but in the end some old sins caught up with him. Smoking and drinking had affected his heart and lungs, and his bones had been weakened by drugs he had taken for arthritis and various other ailments. The consequences were that he was weak, and both physically and mentally unable to interact with his beloved computer or to read his favorite mystery novels with enjoyment. This naturally left him unhappy and without an adequate outlet for his still-young mind, and he was understandably depressed by the prospects of never being able to return to past days of intense mental activity. In the end, when it was clear that the quality of the life left to him was low, he asked that all medication and treatment be stopped--a request that the physicians heeded--but he was the scientist to the end as he objectively described details of the hallucinations known to medical professionals as ICU psychosis. Lloyd kept his whimsical sense of humor and curiosity about the brain until the end.

Lloyd's legacy to his many students and to all who knew him, includes knowledge about how the brain works, insight into how best to approach Nature's secrets in order to understand them, and a model for how to be a considerate, caring human being. Accordingly, his headstone reads "Scientist, Teacher, and Friend."

William H. Cunningham, President of
The University of Texas at Austin

H. Paul Kelley, Secretary
The General Faculty

This Memorial Resolution was prepared by a special committee consisting of Professors Dennis McFadden (Chairman) and Robert K. Young, and Dr. Chester McKinney.