
Alvin M. Liberman (1917–2000)

Alvin Meyer Liberman, a pioneer in the experimental study of speech and, with his wife, the late Isabelle Yoffe Liberman, in the development of the modern understanding of the role of speech in learning to read, died on January 13, 2000, in Mansfield, Connecticut, following complications from heart surgery. He was professor emeritus at the University of Connecticut and Yale University and former president of Haskins Laboratories.

Al's contributions to the scientific community were substantial. His research and writings have influenced the scientific understanding of speech more than the work of any other experimental psychologist. No theory of speech perception is cited more frequently than Liberman's motor theory. His work has had an effect outside the domain of speech, as well. Recent examples of its influence include research by Viviani and colleagues on the role of motor competence in perception quite generally and the developing understanding of the function of mirror neurons in the brains of monkeys, which respond both when monkeys perform an action and when they see the action performed by someone else. Among speech researchers, Al's theoretical claims are considered quite radical and have led others to develop experimental tools to refute them. His theoretical work has also provoked the development of alternative perspectives.

At Haskins Laboratories, the loss is especially great. For the employees, Al was a major source of scientific direction, their goal to do their best work, their fiercest critic, their fiercest proponent, and their dear friend.

Al was born in St. Joseph, Missouri, on May 10, 1917. He received his bachelor of arts and master of arts degrees from the University of Missouri in 1938 and 1939, respectively, and his doctor of philosophy degree from Yale University in 1942. Al accepted his first academic appointment in 1946 at Wesleyan University. In 1949, he took a faculty position in the Department of Psychology at the University of Connecticut, where he remained until his retirement in 1987. Beginning in 1944, Al also worked as a research scientist at Haskins Laboratories, where he served as president from 1975 until 1986. In 1968, he was appointed adjunct professor of linguistics at Yale University.

The course of Al's scientific career was influenced enormously by his early experiences on the staff of Haskins Laboratories. His training as a learning psychologist qualified him to supervise the training of users of a reading machine for the blind to be developed at the laboratories. This early device was designed to provide a distinct, arbitrary sound for each letter of the alphabet, thereby substituting an acoustic alphabet for the written one.

Despite considerable effort by Al, his colleague Franklin Cooper, and a dedicated group of listeners who were trained with many different kinds of sounds representing letters, training failed to produce fluent, practically useful reading. If the sounds were sequenced slowly enough that listeners could

identify the individual sounds and determine their order, the rate was too slow for practical use. Listeners had little hope of remembering the beginning of a sentence by the time its end came around. Faster sequencing caused the sounds to integrate into a holistic blur, and different blurs characterized the same word presented at different rates.

Al recognized that the failure of these efforts raised deep and interesting questions. Why had the variety of acoustic alphabets that he and his colleagues tried failed to be useful when speech is used so readily? Is speech not an acoustic alphabet itself? These questions led to investigations of the acoustic support for speech perception that charted and put the Liberman stamp on the course of scientific research on speech, a stamp that endures to the present time.

Investigation of the acoustic support for speech perception was helped by use of the sound spectrograph, which displays acoustic signals optically in revealing ways, and the Pattern Playback, developed at Haskins Laboratories, which turns spectrograms or painted caricatures of them into sound. Al and colleagues used spectrograms to discern possible acoustic cues to consonants and vowels. They next painted stripped-down spectrographic patterns on acetate belts and fed them to the Pattern Playback; the resulting acoustic output revealed which of the possible acoustic cues were perceptually effective. As Al described that work (e.g., in his intellectual autobiography entitled *Speech: A Special Code*, published in 1996), he and his colleagues ran dozens of experiments daily, using themselves as listeners. Findings served to crack the speech code. The researchers learned that speech is not an acoustic alphabet. Rather, because speakers coarticulate—that is, they overlap production of consonantal and vocalic segments spatially and temporally—the speech signal is not composed of discrete, segment-sized units, and the acoustic structure for consonants and vowels is highly context sensitive.

These findings distinguished speech signals from acoustic alphabets, but they did not explain why speech perception is easy and efficient whereas perception of acoustic alphabets is difficult and inefficient. To the contrary, acoustic alphabets appear to be more transparent to the consonants and vowels that they represent than is the acoustic speech signal.

Research by Al and others suggested an explanation. The research yielded findings that convinced Al that speech perception is special—distinct from perception of other acoustic signals—and is a consequence of the human biological adaptation to language. Three of the findings fostering that conclusion were categorical perception, the discovery of the 1950s that first drew the attention of experimental psychologists to the study of speech; dichotic listening studies of the 1960s that showed a right-ear, left-hemisphere advantage for identifying competing syllables but a left-ear advantage for nonspeech sounds; and duplex perception in the 1970s, a finding that, apparently, the same acoustic fragment can be heard simultaneously in two ways: phonetically as part of a syllable and

auditorily as a stray sound accompanying the syllable. In addition, early findings suggested that listeners, as a result of their perceptions of speech, tracked talkers' articulatory behaviors in producing speech signals more closely than they tracked the acoustic speech signals themselves. These latter findings provided the initial foundation for Al's controversial motor theory of speech perception. In turn, the motor theory fostered development of a continuing line of research at Haskins (pioneered by Katherine Harris) on the coordination of the articulators in speech production.

In the motor theory, refined over a period of more than 40 years, Al identified speech perception as a component of the human biological adaptation for language use. Coarticulation, which allows efficient production of speech segments, also causes acoustic signals that are complex codes on the consonants and vowels of the language. In Al's view, the speech code necessitated evolution of a perceptual system that could disentangle effects of coarticulation on consonants and vowels. Findings that listeners tracked articulation on the basis of their percepts convinced Al that the biological adaptations underlying the abilities to produce and perceive coarticulated speech were the same adaptation. In later years, he identified the adaptation as a phonetic module (in the sense of Fodor in *Modularity of Mind*, 1983).

In the 1970s, with Isabelle Liberman and Donald Shankweiler, Al asked why reading is difficult whereas speech perception is easy. (I.e., spoken language is universal to human cultures, whereas literacy is not. In literate cultures, not everyone learns to read. Children have to be taught to read but not to perceive speech.) The difference in difficulty exists despite the fact that alphabetic writing systems, unlike the acoustics of speech, provide discrete, invariant signals that map more-or-less consistently to the consonants and vowels of the language. The Libermans ascribed the greater difficulty of reading than of listening to speech to the human biological adaptation to speech. The phonetic module extracts consonants and vowels automatically from acoustic speech signals, and, like other modules, its inner workings are opaque to consciousness. Accordingly, children can perceive speech while attending as they should to utterance meanings. And so they do. The Libermans and their colleagues discovered that prereading children and children who are failing to learn to read on schedule characteristically lack *phoneme awareness*—an awareness that word forms break down into meaningless parts. Accordingly, they cannot appreciate the alphabetic principle. This finding and its importance for learning to read are now well-accepted. Al would be especially pleased to know that Haskins researchers Anne Fowler and Susan Brady, in cooperation with the Connecticut State Department of Education and the University of Rhode Island, are beginning to take these findings to the classroom by providing training procedures to reading specialists in some Connecticut and Rhode Island schools.

At the University of Connecticut and Yale University, Al supervised many students who went on to develop further the burgeoning field of speech research. In addition, he collaborated with students, postdoctoral fellows, scientific staff members, and visiting scientists at Haskins. Former students include, among many others, Peter Eimas, Douglas Whalen, and, most recently, Yi Xu. Postdoctoral fellows and visitors include Virginia

Mann, Catherine Best, Christopher Darwin, David Pisoni, and others. Al's outstanding article, "Perception of the Speech Code," written with Franklin Cooper, Donald Shankweiler, and Michael Studdert-Kennedy and published in *Psychological Review* in 1967, brought both Carol A. Fowler and Louis Goldstein to the field of speech: Fowler to graduate school in psychology at the University of Connecticut and Goldstein to graduate school in linguistics at the University of California, Los Angeles (and ultimately to Yale University and Haskins Laboratories).

Al received many awards and honors for his scientific accomplishments. He was elected to the National Academy of Sciences and received, among other awards, the Award for Distinguished Scientific Contributions and the Hilgard Lifetime Achievement Award from the American Psychological Association, the Warren Medal from the Society of Experimental Psychologists, and the Outstanding Scientific Contribution Award from the Society for the Scientific Study of Reading. He received honorary doctoral degrees from the University of Connecticut; the State University of New York, Binghamton; and the Universite Libre de Bruxelles. He was a fellow of the Acoustical Society of America and of the American Psychological Association and a member of the exclusive Society of Experimental Psychologists.

After retiring from Haskins Laboratories in 1986 and from the University of Connecticut and Yale University in 1987, Al remained an active, influential presence in the international scientific community. His publication record, which began in 1944 with an article in the *Journal of Experimental Psychology*, ended in 2000 with an article, coauthored with Douglas Whalen of Haskins Laboratories, in *Trends in Cognitive Sciences*. He continued to give much-lauded invited presentations at conferences and to serve as a catalyst for research at other laboratories, most recently the Brain Research Laboratory at the University of Technology in Finland. While there, he received the last of his many honors, an award from the Finnish Academy of Sciences.

Al also remained active at Haskins. There, he was both famous and infamous for his strolls down the hallways of the laboratories, during which he would stop to ask sometimes flustered colleagues to recount their latest scientific discoveries and to tell them of discoveries he had made or had learned about. In this and every other regard, his colleagues included graduate students and postdoctoral fellows, as well as junior and senior scientists.

Al was an eloquent speaker, an elegant writer, and a great scientific thinker and achiever. The staff at Haskins will miss him forever.

Al is survived by two sons, Mark Y. Liberman, professor of linguistics and director of the Institute for Research in Cognitive Science at University of Pennsylvania, and M. Charles Liberman, professor of Otology and Laryngology at Harvard University; a daughter, Sarah Ash, assistant professor of nutrition at North Carolina State University at Raleigh; and nine grandchildren.

Carol A. Fowler
Haskins Laboratories and
the University of Connecticut