The Vi: Stories Lives Tell presents
Richard C. Atkinson
Memoir by Half: 1944-1980
Entrepreneurial President
Richard Atkinson and the University of California, 1995–2003

PATRICIA A. PELFREY

Richard C. Atkinson
The Pursuit of Knowledge
Speeches and Papers of Richard C. Atkinson
Edited by Patricia A. Pelfrey
With a Foreword by David S. Saxon
Welcome

I'm Richard Atkinson, president emeritus of the University of California and professor emeritus of cognitive science and psychology at the University of California, San Diego. I'd like to welcome you to my home page. On these pages you will find a compilation of my recent speeches, published articles, commentaries and a biographical profile. I hope this material serves as a catalyst for comment and discussion.

Speeches, Articles, and Commentaries

Biography and c.v.

History of the Atkinson Presidency

Selected Scientific Papers
University of Chicago / Summer 1944

- Nicholas Rashevky
- Committee on Mathematical Biology / Ph.D. Program
- Artificial neural networks / Artificial Intelligence
- Second-order difference equations
William Estes, Indiana University / Summer 1950

- Stimulus Sampling Theory
- A stochastic model for rote serial learning (Ph.D.)
U.S. Army / Summer 1954

- HumRRO (Human Resources Research Organization)
- NPS (Naval Postgraduate School)
- NCR (National Cash Register Company): 102-A computer
- Game Theory
- Visits to Stanford
Stanford University / Fall 1956

- Lecturer in Statistics
- Game Theory vs. Learning Theory / Behavioral Economics
- Patrick Suppes / Professor of Philosophy and Statistics
- Ken Arrow / Professor of Economics / Nobel Prize
- Fred Terman / Provost / Father of Silicon Valley
Fred Terman at Stanford: Building a Discipline, a University, and Silicon Valley (Stanford, California: Stanford University Press, 2004).
UCLA / Fall 1957

· Western Data Processing Center UCLA (IBM)
· Mathematical Methods in the Social Sciences (campus-wide seminar)
  · Jacob Marschak / Father of Econometrics
  · Norbert Wiener / Father of Cybernetics
· Course / Introduction to Psychology
· Sputnik / October 4, 1957
Stanford University / Fall 1959

- IMSSS
  (Institute for Mathematical Studies in the Social Sciences)

- Academic appointments in four departments
  - Department of Psychology
  - Department of Engineering-Economic Systems
  - School of Education
  - Department of Statistics
Ventura Hall: Institute for Mathematical Studies in the Social Sciences
Student terminal used for tutorial instruction
Life Magazine / January 27, 1967: The Computer as a Tutor

'Hello, Jimmy,' said the machine,
'I've been waiting for you.'

by EZRA BOWEN

Inside the low, windowless building, 18 computer terminals—each with a teletype keyboard, cathode-ray tube, earphones and microphone—were lined up in back-to-back rows. One wall of the room looked like a dark mirror but actually was one-way glass. Near it, a half-dressed man and woman holding clipboards waited anxiously; the results of four years of planning and preparation in the complex world of electronic education were finally about to be put into regular classroom use.

A side door burst open and in trooped a dozen shuffling little first-grade children, some wide-eyed, some yawning, some little scared. The children were seated at the terminals and the computer quickly took them in hand. "Well, hello, Jimmy," the machine said into an astounded 6-year-old's earphones. "I've been waiting for you." Thus began the most exciting—and perhaps the most promising—dialogue ever carried on in a United States grade school.

The windowless chamber was a new first-grade room of the Brentwood Elementary School at East Palo Alto, Calif., and the exotic computer system was Brentwood's new math and reading teacher. Since that first day, Nov. 1, 1966, half the kids in the first grade at Brentwood have been taking all their arithmetic and the other half of their reading from the IBM 1500 computer, and they will continue doing so for the rest of the current school year. Other elementary school children have occasionally faced off with a computer for short-term experiments, but this is the first time a machine has ever been handed the responsibility for a full-chunk of the regular first-grade curriculum. Furthermore, the 1500 is taking up the challenge in a neighborhood where teaching has not always flourished. The Brentwood area is a mixture of gas stations, drive-ins and tiny ranch houses, where 85% of the population is Negro, and too many of the school children are a year or two behind the national norm in elementary reading. But in these first few months at least, the 1500 has thrived in this environment.

"We really wanted something like this," says Brentwood's principal, William Ryboshky. "We're committed here to innovation." Indeed, Brentwood has over 100 of its children to the computer, and the machine's program, programmed and assorted by space carriers outnumber the rest of the Brentwood faculty. So far, everyone involved in the experiment seems absolutely delighted with it.

The IBM Corporation is especially happy since it has invested some $300,000 in the research and development of computer-based instruction. "There may be a lot of profit in this one day," says Leonard Muller, Director of Instructional Systems Development for IBM. Executives of other heavy-duty electronics corporations agree. They have begun to hear the sounds of the new money that is falling like autumn leaves onto educational ground.

Most important, the kids love the experiment, although that first day, when they confronted the 1500 terminals, they were a bit daunted. One of the procedures assigned to teach the children how to send the program through the face of the cathode-ray tube and clipped on a set of earphones. Reassured, the girl and her classmates allowed themselves to be seated and the earphones drawn over their heads. Only when the terminals in front of them began to dance with images

Touch the dog with your light pen and see what he does, each child, at his own terminal, touched the dog with the light-projecting pen he held, and the dog walked before him. An electronic image materialized onto the tube, veered away from a turtle and went to visit his friend, a butterfly. The voice at each terminal murmured new instructions—"Touch the dog" or "Touch the turtle." As the lessons progressed, a child who touched the correct image heard the voice say a gentle "Good." When an incorrect image was touched, the voice softly said "Oops." then repeated the original command. Sometimes a tiny arrow popped onto the screen above the correct picture, if there was a hesitation of more than five or 10 seconds, the voice said, with a slight rigidity, "Do it now." And if a child made two or more mistakes, or did nothing at all, the computer tapped out a distress signal on a monitor, and the teacher came—even as she once did for you and me—to find out what the trouble was and correct it.
TEACHING CHILDREN TO READ USING A COMPUTER
HUMAN MEMORY: A PROPOSED SYSTEM
AND ITS CONTROL PROCESSES

R. C. Atkinson and R. M. Shiffrin
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

I. Introduction ............................................................................................................................................. 90
II. Structural Features of the Memory System ....................................................................................... 92
   A. Sensory Register .......................................................................................................................... 94
   B. Short-Term Store ......................................................................................................................... 96
   C. Long-Term Store ......................................................................................................................... 103
III. Control Processes in Memory ............................................................................................................. 106
   A. Control Processes in the Sensory Register ................................................................................ 107
   B. Control Processes in Short-Term Store ...................................................................................... 108
   C. Control Processes in Long-Term Store ...................................................................................... 117
IV. Experiments Concerned with Short-Term Processes ........................................................................ 123
   A. A Continuous Paired-Associate Memory Task (Experiment 1) .............................................. 123
   B. The “All-Different” Stimulus Procedure (Experiment 2) ....................................................... 133
   C. A Continuous Paired-Associate Memory Task with Multiple Reinforcements (Experiment 3) ................................................................. 141
   D. Overt versus Covert Study Procedures (Experiment 4) ....................................................... 153
   E. Additional Variables Related to the Rehearsal Buffer (Experiments 6, 6, and 7) .................. 158
V. Experiments Concerned with Long-Term Search and Retrieval ....................................................... 164
   A. A Serial Display Procedure Involving Single Tests (Experiment 8) ...................................... 165
   B. Free-Verbal Recall Experiments .............................................................................................. 174
   C. Further Considerations Involving LTS .................................................................................... 183
VI. Concluding Remarks .......................................................................................................................... 190
References .................................................................................................................................................. 191

1 This research was supported by the National Aeronautics and Space Administration, Grant No. NGR 05-020-006. The authors are indebted to W. K. Estes and G. H. Bower who provided many valuable suggestions and comments at various stages of the work. Special credit is due J. W. Hulseford who was instrumental in carrying out the research discussed in Section IV and whose overall contributions are too many to report in detail. We should also like to thank those co-workers who carried out a number of the experiments discussed in the latter half of the paper, rather than list them here, each will be acknowledged at the appropriate place.
The Control of Short-Term Memory

Memory has two components: short-term and long-term. Control processes such as "rehearsal" are essential to the transfer of information from the short-term store to the long-term one.

by Richard C. Atkinson and Richard M. Shiffrin

The notion that the system by which information is stored in memory and retrieved from it can be divided into two components dates back to the fifth century. Theories distinguishing between two different kinds of memory were proposed by the English associationist James Mill and John Stuart Mill and by such early experimental psychologists as Wilhelm Wundt and Ernst Meumann in Germany and William James in the U.S. Reflecting on their own mental processes, they discerned a clear difference—between thoughts currently in consciousness and thoughts that could be brought to consciousness only after a search of memory—that was often laborious. (For example, the sentence you are reading is in your current awareness; the name of the baseball team that won the 1905 World Series may be in your memory, but to retrieve it takes some effort, and you may not be able to retrieve it at all.)

The two-component concept of memory was intuitively attractive, and yet it was largely discarded when psychology turned to behaviorism, which emphasized research on animals rather than humans. The distinction between short-term memory and long-term memory received little further consideration until the 1950s, when such psychologists as Donald E. Broadbent in England, D. O. Hebb in Canada, and George A. Miller in the U.S. reintroduced it in "Information and Memory," by George A. Miller, SCIENTIFIC AMERICAN, August, 1950.

The concept development of computer models of behavior and of mathematical psychology accelerated the growth of interest in the two-process viewpoint, which is now undergoing considerable theoretical development and is the subject of a large research effort. In particular, the short-term memory system, or short-term store (STS), has been given a position of pivotal importance. That is because the processes carried out in the short-term store are under the immediate control of the subject and govern the flow of information to the memory system; they can be called into play at the subject's discretion, with enormous consequences for performance.

Some control processes are used in many situations by everyone and others are used only in special circumstances. "Rehearsal" is an overt or covert repetition of information—as in remembering a telephone number until it can be writ-
On Human Memory: Evolution, Progress, and Reflections on the 30th Anniversary of the Atkinson-Shiffrin Model

Edited by Chizuko Izawa

With a Foreword by Richard C. Atkinson
50 years of research sparked by Atkinson and Shiffrin (1968)

Kenneth J. Malmberg 1 · Jeroen G. W. Raaijmakers 2 · Richard M. Shiffrin 3

Published online: 28 January 2019
© The Psychonomic Society, Inc. 2019

Abstract
In this article we review the framework proposed in 1968 by Atkinson and Shiffrin. We discuss the prior context that led to its production, including the advent of cognitive and mathematical modeling, its principal concepts, the subsequent refinements and elaborations that followed, and the way that the framework influenced other researchers to test the ideas and, in some cases, propose alternatives. The article illustrates the large amount of research and the large number of memory models that were directly influenced by this chapter over the past 50 years.
Atkinson & Hilgard’s Introduction to Psychology
Richard Boone, Johnson Aide and Advocate on Poverty, Dies at 86

By Adam Clymer

Richard W. Boone, who played a central role in President Lyndon B. Johnson's war on poverty in the 1960s and led private organizations pursuing political and social change, died on Feb. 26 at his home in Santa Barbara, Calif. He was 86.

His son Wade said the cause was complications of non-Hodgkin's lymphoma and Parkinson's disease.

Mr. Boone went to Washington in 1962 to work at the Justice Department on juvenile delinquency, an issue he had dealt with as a police captain in Cook County, Ill. He was close to Attorney General Robert F. Kennedy and worked with him when, as a senator from New York, Kennedy became deeply involved in antipoverty efforts.

“He was one of four or five people who had the senator’s ear, always,” Frank Mankiewicz, press secretary for Kennedy as senator, said in a recent interview.
The National Science Foundation (NSF) is a United States government agency that supports fundamental research and education in all the non-medical fields of science and engineering. Its medical counterpart is the National Institutes of Health. With an annual budget of about U.S.$ 7.8 billion (fiscal year 2018), the NSF funds approximately 24% of all federally supported basic research conducted by the United States’ colleges and universities. In some fields, such as mathematics, computer science, economics, and the social sciences, the NSF is the major source of federal backing. The NSF’s director and deputy director are appointed by the President of the United States, and confirmed by the United States Senate, whereas the 24 presidentially appointed members of the National Science Board (NSB) do not require Senate confirmation.
National Science Foundation / July 1975 - July 1980

- Deputy Director
  - appointed by President Ford

- Acting Director

- Director
  - appointed by President Carter
NSF Initiatives

- Science Education Programs
- Golden Fleece Awards
- Reorganization of Foundation
- Technology Transfer
- Engineering Program
- US - China Exchange (January 1979)
I was pleased to accept Roger Hahn’s kind invitation to participate in this colloquium series. It gave me an opportunity to rethink some events I was associated with at the National Science Foundation (NSF) in the 1970s. I would like to review briefly U.S. science policy since World War II from the perspective of the National Science Foundation, and in particular from the narrower perspective of science education and the social sciences at NSF. This is a personal account, not a scholarly one, and I would be delighted if my remarks were to stimulate some aspiring young historians to undertake a more careful study of the events I am going to discuss.

My story begins with World War II and the remarkable success of U.S. science in the war effort—a critical factor in our victory. President Roosevelt’s science adviser, Vannevar Bush, had been a long-term member of the faculty at the Massachusetts Institute of Technology; he was one of the key people responsible for building the quality of that institution. Bush had a close personal relationship with Roosevelt. Near the end of the war the president asked him to define a plan for American science in the postwar period. That request led to Bush’s landmark report, *Science, The Endless Frontier*, one of the great documents of American history. The Bush report defined science policy for the post-World War II era.

What was the nature of that report? No summary could do justice to Bush’s masterful analysis, but essentially he made three principal arguments about the future of the U.S. scientific enterprise. First, he argued that most aspects of R&D were the responsibility of the private sector. But he also recognized that market mechanisms would discourage the private sector from investing adequate funds in basic research.

---

1 This paper was read at the Colloquium Series on the History of Science and Technology, University of California at Berkeley, 10 November 1997.
Welcome

I'm Richard Atkinson, president emeritus of the University of California and professor emeritus of cognitive science and psychology at the University of California, San Diego. I'd like to welcome you to my home page. On these pages you will find a compilation of my recent speeches, published articles, commentaries and a biographical profile. I hope this material serves as a catalyst for comment and discussion.

Speeches, Articles, and Commentaries

Biography and c.v.

History of the Atkinson Presidency

Selected Scientific Papers
Chapter 2—The Education of a Chancellor


**University of Chicago Alumni Medal**

Remarks on the occasion of receiving the University of Chicago Alumni Medal (6/7/03).

**Foreword to Biography of Fred Terman**

_Ced Terman at Stanford: Building a Discipline, a University, and Silicon Valley_ (Stanford, California: Stanford University Press, 2004).

**Vannevar Sets the Stage (Computer Assisted Instruction)**


**Atkinson and Shiffrin Model at 50 Years**

The journal _Memory & Cognition_ has devoted a special issue to recognize five decades of research on human memory inspired by Atkinson and Shiffrin (1968). Here is a list of articles in the special issue and the lead-off article.

**The Golden Fleece, Science Education, and U.S. Science Policy**


**Connect Founders Award (Technology Transfer)**

Drawn from Atkinson's remarks at the CONNECT ceremony in San Diego upon receiving the award (November 29, 2017).

**Recollections of events leading to the first exchange of students, scholars and scientists between the United States and the People's Republic of China**

A memorandum describing a US delegation's visit to China in 1978 (12/14/06).