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PANEL:HISTORY OF ARTIFICIAL INTELLIGENCE RESEARCH, 1956-61

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Understanding the history of the development of a body of ideas is often a precondition for a creative contribution to that body of ideas. The AI field seems to lack a sense of its own history. It is a field of practitioners rather than scholars. This is paradoxical since the field is not yet a quarter-century old, and many of the principal scientists attending its birth are still vigorously active in its development.

Realizing this, the IJCAI Program Committee organized a panel on the history of AI at IJCAI77, and the current Program Committee chose to continue this biannual educational event. As it happened, the members of the 1977 panel chose to range broadly over the "prehistory" of the field--from the Greeks through post-war cybernetics. Not discussed in detail were the critical intellectual events of the formative period, 1956-61. It is to this period that the IJCAI79 panel will devote its attention.

The formative period can be characterized by its intellectual themes, by the programs that were written to test ideas, and by the individuals who made the contributions.

The two major themes of AI work--machines that reason and perceive, and information processing models of human cognition--were much more closely intertwined then than they are now. For example, the Logic Theorist (LT, 1956), along with Samuel's Checker Player (1955-56) the first heuristic programs that ran on computers, helped to launch the "smart machines" work of our field. LT also was a major event in Psychology when its description appeared in Psychological Review as "Elements of a Theory of Human Problem Solving" (Newell and Simon). Similarly, the General Problem Solver (GPS, 1957-59) was for years a major focus of AI's problem solving research, while at the same time standing as the most complex and detailed model of a human thought process that had ever been constructed and tested.

In the formative period, the major events were clustered in a Carnegie Tech/RAND Corporation collaboration, led by Newell, Shaw, and Simon; an MIT group led by McCarthy and Minsky; and IBM projects of Samuel and Gelernter, et. al. In a remarkable burst of creativity that began in late 1955, Newell, Shaw, and Simon conceived LT; invented list processing (IPL1 and II) to handle the novel programming problems of writing LT; conceived and programmed GPS and the NSS Chess Player; and made various programming innovations that were embodied in IPLIII, IV, and V (all 1957-59). Seminally related to these events were papers by Newell (1955) on an adaptive chess machine and by Simon on a behavioral theory of rational choice and the influence of the environment on problem solving and decision making. These two papers of Simon were in a sense the culmination of years of study on the bounds of individual and organizational information processing and rationality; and the processes by which people and organizations made decisions and solved problems within these bounds. It is for this work, initially addressed to economists and behavioral scientists, that Simon won the Nobel Prize in 1978. The students of Newell and Simon also produced a number of key programs of the time including: the EPAM model of human verbal learning and memory (Feigenbaum, 1959); a model of hypothesis formation in binary-choice decision making (Julian Feldman, 1959); an early natual-language understander, SAD-SAM (Lindsay); and an application to a management science problem of assembly line balancing (Tonge).

At IBM, Gelernter and his group, with support from Rochester, proceeded to program the Geometry Theorem Prover. They too created a list processing system, FLPL (Fortran List Processing Language, 1959). Samuel continued developing and experimenting with his

Checker Player, particularly the learning feature in which self-improvement of the play took place by a "hill-climbing" adjustment of the weights of an evaluation function. And Bernstein, a programmer/chess master, developed another of the early chess programs.

Other important activity had a New England locus. Two important early conferences were held there: the Dartmouth Summer Conference on Artificial Intelligence (1956) and the meeting of the IEEE Professional Group on Information Theory (1956, a conference noted as the first formal presentations of LT and of Chomsky's linguistic theory). At Lincoln Laboratory, Selfridge and Dineen wrote the first character recognition program (approximately 1955); and later Selfridge and his group wrote the influential pattern recognition system Pandemonium (1959).

McCarthy formulated a number of problems of the interaction of mathematics and mathematical logic with programming and artificial intelligence. Understanding the importance of the list structure and list processing innovations, and merging these with his thinking about formal representations and about proofs of the properties of programs, he invented the LISP notation that was the basis for the development of LISP translators at MIT in later years. Slagle, at MIT, extended ideas on heuristic search with his Symbolic Integration program, SAINT. Minsky labored to organize the cascade of early ideas and produced his important paper "Steps toward Artificial Intelligence". And McCarthy suggested the idea of time-sharing a computer, reflecting the concerns of the AI community for both economical interaction with running AI programs, and with programming efficiency.

Fortune smiled upon the editors of the collection Computers and Thought (Feigenbaum and Feldman, 1963), which turned out to contain an almost unblurred image of the intellectual activity of the formative period. Participants of this formative period have organized the IJCAI79 panel on the History of AI (1956-61). They are:

Professor Saul Amarel, Professor and Chairman, Computer Science, Rutgers University

Professor John McCarthy, Professor of Computer Science, Stanford University

Professor Herbert A. Simon, Professor of Computer Science and Psychology, Carnegie-Mellon University

Professor Edward A. Feigenbaum, Professor and Chairman of Computer Science, Stanford University.

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