Award for Distinguished Scientific Contributions

The Awards for Distinguished Scientific Contributions are presented by the Association at the annual convention. The awardees for 1996, along with those for the preceding years since the establishment of the custom, are as follows:

1956 Wolfgang Köhler, Carl R. Rogers, Kenneth W. Spence
1957 Carl I. Hovland, Curt P. Richter, Edward C. Tolman
1958 Frank A. Beach, Paul E. Meehl, B. F. Skinner
1959 Leon Festinger, Donald B. Lindsley, Neal E. Miller
1960 Harry F. Harlow, Charles E. Osgood, S. Smith Stevens
1961 James J. Gibson, Donald O. Hebb, Henry A. Murray
1962 Jerome S. Bruner, William K. Estes, Harry Helson
1963 Roger G. Barker, George A. Miller, Carl Pfaffmann
1964 Gordon W. Allport, Wendell R. Garner, J. P. Guilford
1965 Floyd Allport, Fritz Heider, Paul Thomas Young
1966 Nancy Bayley, Clarence H. Graham, Richard L. Solomon
1967 Solomon E. Asch, Ernest R. Hilgard, James Olds
1968 James E. Birren, Eleanor J. Gibson, Muzafer Sherif
1969 Jean Piaget, Stanley Schachter, Herbert A. Simon
1970 Donald T. Campbell, David Krech, R. Duncan Luce
1971 Roger William Brown, Harold H. Kelley, Roger Wolcott Sperry
1972 Edwin E. Ghiselli, Dorothea Jameson and Leo Hurvich, Patrick Suppes
1973 Lee J. Cronbach, Brenda Milner, Benton J. Underwood
1974 Angus Campbell, Lorrin A. Riggs, Richard F. Thompson
1975 Donald E. Broadbent, Robert R. Sears, David Shakow
1976 Beatrice C. Lacey and John I. Lacey, Theodore M. Newcombe, Roger N. Shepard
1977 Richard C. Atkinson, Russell L. De Valois, Edward E. Jones
1978 Julian Hochberg, Philip Teitelbaum, Robert B. Zajonc
1979 John W. Atkinson, Gordon H. Bower, John Garcia
1980 Albert Bandura, Alvin M. Liberman, Michael I. Posner
1981 David M. Green, Irving L. Janis, James L. McGaugh
1982 Daniel Kahneman and Amos Tversky, Walter Mischel, Mark R. Rosenzweig
1983 John W. Thibaut, Endel Tulving, Hans Wallach
1984 Noam Chomsky, John H. Flavell, Floyd Ratliff
1985 Clyde Coombs, Mortimer Mishkin, Allen Newell
1986 Robert P. Abelson, Gunnar Johansson, Robert A. Rescorla
1987 Morton Deutsch, Jerome Kagan, David C. McClelland, Saul Sternberg, Niko Tinbergen, Ledyard R. Tucker
1988 Irving T. Diamond, Frederic M. Lord, Eleanor E. Maccoby, William J. McGuire, Julian B. Rotter, George Sperling
1989 Mary D. Salter Ainsworth and John Bowlby, J. Douglas Carroll, Richard S. Lazarus
1990 Frances K. Graham, John A. Swets, Anne Treisman
1991 Paul Ekman, Patricia S. Goldman-Rakic, Richard E. Nisbett
1992 Ursula Bellugi and Edward S. Klima, Walter Kintsch, K. Warner Schaie
1993 Peter J. Lang, Paul Slovic, Larry R. Squire
1994 John R. Anderson, Jon Kaas, Neil Schneiderman
1995 Rochel Gelman, William A. Mason, Michael L. Rutter
1996 Robert W. Goy, James L. McClelland and David E. Rumelhart, Shelley E. Taylor

Award citations, biographies, and selected bibliographies for Goy and Taylor appeared in the April 1997 issue of the American Psychologist. *Goy, McClelland and Rumelhart, and Taylor will each be presented an engrossed citation of his or her contribution to the development of psychology. In accordance with established custom, the award winners have agreed to present addresses on some phase of their scientific work at the 1997 convention. The presentation of awards will be made by Cheryl B. Travis, chair of the Board of Scientific Affairs. Members of the Committee on Scientific Awards were Thomas J. Bouchard, chair; Walter Kintsch; Rachel K. Clifton; Kenneth J. Sher; Larry R. Squire; and John T. Cacioppo.*

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James L. McClelland

James L. McClelland and David E. Rumelhart

Citation

"For their imaginative conception of a comprehensive architecture for theories of cognition that are based on parallel processing of distributed memories. They mobilized the cooperative efforts of a cadre of specialists, the Parallel Distributed Processing Group, to implement the architecture with formal methods and computational models drawn from an array of disciplines that span mathematics, neurobiology, cognitive psychology, network theory, and philosophy. In their own pace-setting research on basic processes in reading, speech perception, language learning, and cognitive development, McClelland and Rumelhart demonstrated the power of their theoretical approach for catalyzing and shaping analyses of empirical phenomena over much of the domain of human information processing."

Biography

McClelland and Rumelhart began to collaborate in the late 1970s, at the University of California, San Diego (UCSD). The collaboration grew out of a shared interest in exploring the role of context in perception and cognition. Their first joint project, the interactive activation model of word perception (McClelland & Rumelhart, 1981; Rumelhart & McClelland, 1982) exploited propagation of activation through weighted connections to account for such context effects. Propagation was bidirectional to allow for top-down and bottom-up influences, and the activation process took place on many levels of processing simultaneously, thereby allowing the results of processing all aspects of a larger unit (e.g., a whole word) to influence processing of all of its component parts (e.g., the letters in the word and the features of these letters).

This collaboration was grounded in earlier independent work. Rumelhart brought a background in explicit mathematical and computational modeling of cognitive processes to the collaboration. With a BA in psychology and mathematics from the University of South Dakota and a PhD in mathematical psychology from Stanford University, Rumelhart joined the faculty of the department of psychology at UCSD in 1967 and applied the tools of mathematics to a range of problems in perception and cognition. With Donald Norman in the early 1970s, Rumelhart contributed to the exploration of symbolic paradigms for representing knowledge in memory. Toward the end of the 1970s, he gradually became dissatisfied with the rigidity in these paradigms and sought alternatives that were grounded in probability and information theory, proposing an interactive model of reading and language processing (Rumelhart, 1977b).

McClelland brought a strong commitment to the experimental analysis of behavior and cognition. With a BA in psychology from Columbia University and a PhD in cognitive psychology from the University of Pennsylvania, McClelland joined the department of psychology at UCSD in 1974. In research that began with James Johnston, McClelland explored the visual, structural, and attentional factors that influenced perception, using lines and objects as well as letters and words as stimuli. In his early efforts to construct an explicit account of the processes that give rise to perception of wholes and parts, McClelland became convinced of the limitations of thinking of cognitive and perceptual processes as a series of discrete stages carried out in strict succession and developed the cascade model of information processing (McClelland, 1979) to capture the idea that processing takes place through the propagation of graded signals in a multilayer network.

The interactive activation model provided an excellent vehicle for the synthesis of computational and experimental research. Its use as a vehicle for modeling cognition and perception extended beyond its ability to account for context effects in perception of previously familiar objects such as words. Even more important was the discovery that this framework could provide new answers to questions about the basis of generalization to novel but structurally regular stimuli. McClelland and Rumelhart (1981) showed that in the interactive activation model,

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partial activation of units representing known words could account for contextual facilitation of the perception of letters in structurally regular "pseudowords" (such as *mave*), suggesting that systems of explicit rules might not be necessary to account for sensitivity to structure in novel stimuli. This led to novel experimental predictions about what structural factors were crucially responsible for producing facilitation effects that were confirmed by Rumelhart and McClelland (1982).

These developments led McClelland and Rumelhart to orient their research programs toward the exploration of what they began to call the Parallel Distributed Processing (PDP) framework. Research of this type required grounding in neuroscience and theoretical computer science as well as psychology and cognitive science. To obtain such background, McClelland began a program of study in neuroscience supported by a National Institute of Mental Health Research Scientist Development Award and began to study and teach the application of neural network models to cognition. Rumelhart pursued a similar program during a sabbatical at Stanford. Reuniting at UCSD in the fall of 1981, Rumelhart and McClelland joined together with Geoff Hinton, Paul Smolensky, Francis Crick, and several other members of what became the PDP Research Group. This group undertook a systematic exploration of the possibility of understanding human cognition as arising from the interactions of large numbers of simple processing units, each propagating information about its state of activation to other units through weighted, adaptive connections.

During the next several years, Rumelhart and McClelland pursued issues at the heart of the effort to determine the viability of the PDP approach as an alternative to traditional symbolic approaches to cognition. In these efforts, each collaborated sometimes with the other and sometimes with other members of the group. Fundamental apparent limitations on the ability of networks of interconnected units to learn were addressed with the backpropagation learning algorithm by Rumelhart, Hinton and Williams, and a paradigm for recasting the "frames" and "schemata" used to capture structured knowledge in symbolic approaches was developed by Rumelhart, Smolensky, McClelland, and Hinton. McClelland and Elman extended the interactive activation framework to address speech recognition, showing that the framework allowed the unification of a large body of disparate phenomena, and McClelland and Kawamoto pioneered the use of distributed representations in the syntactic and semantic processing of sentences.

Together, McClelland and Rumelhart explored issues in learning, memory, and development. In one collaborative project, Rumelhart and McClelland proposed a model of learning the past tense of English verbs, which sparked a vigorous debate about the nature of psychological representations underlying productive use of language. These ideas are now under active exploration in many aspects of language and cognition. The debate is far from settled, however, and explorations of the issues are ongoing. In another collaboration, McClelland and Rumelhart proposed a distributed model of memory that addressed the coexistence of general and specific knowledge and extended work of Hinton and James Anderson in the application of distributed representations to issues in implicit and explicit memory.

These and other developments were synthesized in a two-volume work entitled *Parallel Distributed Processing: Explorations in the Microstructure of Cognition* by Rumelhart, McClelland, and the PDP Research Group (1986a, 1986b). Taken together with the contributions of other neural network or connectionist researchers, these volumes called the attention of researchers throughout the cognitive and neural sciences to the appeal of modeling cognitive functions in terms of the interactions of simple processing units and raised fundamental questions about the acquisition and representation of knowledge.

McClelland and Rumelhart continue to pursue research issues related to PDP. Rumelhart, now professor of psychology at Stanford University, has focused on the relation between learning in neural networks and fundamental mathematical and statistical conceptions of learning and has begun to explore the implications of PDP for theories of emotion. McClelland, now professor of

psychology at Carnegie Mellon University and co-director of the Center for the Neural Basis of Cognition (a joint project of Carnegie Mellon and the University of Pittsburgh) continues to emphasize the application of PDP models to many aspects of human cognition. Most recently, he has sought to incorporate findings from neurophysiology and neuropsychology into theories of learning, memory, and cognitive development.

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