

MEMORIAL RESOLUTION DAVID E. RUMELHART (1942-2011)

David E. Rumelhart, Professor of Psychology (Emeritus) and a pioneer in computational modeling of mind and brain, died on March 13, 2011, at 68, from complications of a progressive neurodegenerative disease. Rumelhart's work proved helpful in the development of a computational theory of the basis of human thinking, with implications for machine learning and artificial intelligence.

Dave was born on June 6, 1942, in Wessington Springs, S.D., the eldest of three sons born to Everett, a printer, and Thelma, a librarian. He grew up in an environment of constant competition and an expectation of self-reliance. He chose to attend the University of South Dakota, graduating in 1963 with a degree in psychology and mathematics. Dave completed his Ph.D. in mathematical psychology at Stanford in 1967. That year he joined the faculty of the University of California at San Diego, where he remained until joining the faculty at Stanford.

While at UCSD, Rumelhart began to explore the then-dominant symbolic computational framework for modeling human cognition. In collaborative work with Donald Norman, Peter Lindsey, and the 'LNR Research Group', Rumelhart laid out important issues for a computational theory of mind. This work led to an influential book, 'Explorations in Cognition', that applied this new framework to perception, language, and other aspects of human cognitive processes. Then, in the mid-1970's, Rumelhart became dissatisfied with the symbolic paradigm, finding it too brittle and too rigidly structured to allow him to address the flexible, open-ended, and integrative nature of human cognition. During this period he envisioned an interactive model of the perceptual and interpretive processes that occur in reading; sketched out a schema for story comprehension; and developed a cogent critique of the then-existing efforts to represent structured knowledge in a computationally explicit formalism.

Late in the 1970's Rumelhart began to explore the idea that human cognitive processes arise from a mutual constraint satisfaction process implemented via bi-directional interactions among neurons in the brain. These ideas had resurfaced after a period of quiescence, and Rumelhart was among the first to appreciate their appeal. Building on ideas of pioneers in this area, Rumelhart began working on what he called 'brain-inspired' computational models of cognition, spearheading a group of enthusiastic younger cognitive scientists including Geoff Hinton, James McClelland, and Paul Smolensky.

Several major contributions flowed from this effort. First was a neural-network instantiation of the interactive model envisioned in the earlier interactive models paper. This was followed by a series of papers exploring the concept of distributed representation.

Instead of the simpler notion that neurons in the brain correspond to distinct thoughts or concepts, Rumelhart's idea was that thoughts and concepts must correspond to *patterns* of activation distributed across a population of neurons. He re-envisioned the representation of structured knowledge in terms of such distributed patterns, applied the idea to the development of a model of how we learn regularities in language, and went on from there to his most profound individual contribution: The development of a method for training neural networks to discover useful distributed representations. This algorithm – known as the back-propagation learning algorithm – revolutionized the investigation of neural networks and set the field of cognitive science and machine learning off in exciting new directions. In all of this work, Rumelhart collaborated with others, but the mark of his intellect and deep-seated commitments to fundamental ideas, framed in the papers he wrote in the 1970's, shines through all of these lasting contributions.

Several of the papers described above became central elements of a two-volume work entitled *Parallel-Distributed Processing: Explorations in the Microstructure of Cognition* by Rumelhart, McClelland, and the Parallel Distributed Processing Research Group, published in 1986. Coming at the crest of a new wave of interest in neural networks, and introducing powerful new ideas and algorithms for training brain-like machines, this work had a huge impact on research in cognitive science and machine learning.

Rumelhart returned to Stanford in 1987, and for several years he led a vigorous and vibrant team of graduate students and post doctoral fellows in the further development of the parallel distributed processing framework. He began, however, in the early 1990's, to experience a decline in health, culminating in the neurodegenerative condition that robbed him of his formidable intellectual powers. He stepped down as Professor in 1998, retiring to Ann Arbor, Michigan where he benefitted from the companionship and support of his brother, Donald Rumelhart and Donald's wife, Judy Rumelhart. He is survived by his brothers, Donald and Roger; his former wife, Marilyn Austin; their two sons Karl and Peter; and four grandchildren.

Throughout his life, David was known as a fierce competitor. Many were struck by his intensity, whether playing ping-pong, tennis or volleyball. In fact, David's approach to sports and games was of a piece with his approach to science: a desire to take on the biggest challenges, a focused determination to act with every bit of skill and energy he had, and a hope that everyone around him would do their best work. In turn, he was always generous in giving credit to his colleagues.

Rumelhart's contributions were recognized by a wide range of honors and awards. He received a MacArthur Genius Award, he was elected to the National Academy of Sciences, and he received the APA Distinguished Scientific Contribution Award, the Warren Medal from the Society of Experimental Psychologists, and the IEEE Neural Networks Pioneer Award. In the year 2000, his former student, Robert J. Glushko, and Bob's wife, Pamela Samuelson, established a major international prize in his honor, the David E. Rumelhart Prize for Contributions to the Theoretical Foundations of Cognitive Science.

David Rumelhart Memorial Resolution—continued...

Through the imaginative formal and heuristic approaches that he introduced, through his broad impact on the development of theory and implementation, and through the legion of former students, advisees and colleagues whom he inspired, David Everett Rumelhart remains a towering figure in our lives. Many continue to be inspired by his example of what can be accomplished in life, even one cut tragically short, by never holding anything back. He will be sorely missed.

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