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BOOK REVIEWS

From Acquisition to Deterioration of Semantic Knowledge: A Mechanistic Theory of Semantic Cognition

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Semantic Cognition: A Parallel Distributed Processing Approach, by Timothy T. Rogers and James L. McClelland. (2004). Cambridge, MA: MIT Press, 425 pp., $50.00/£32.95.

Reviewed by Anna Adlam, Ph.D., *Career Development Fellow, Cognition & Brain Sciences Unit, Medical Research Council, Cambridge, United Kingdom.*

This book is aimed at all scientists interested in semantic cognition, even those with limited experience of computational modeling. It benefits from concise and logically presented text and the effective use of figures and illustrations, with details of simulations tucked away in the Appendix. The length of the book defines it not only as a useful addition to a reference collection, but also an excellent primer for young researchers, postgraduates, and even advanced undergraduates.

This timely text provides an account of the parallel distributed processing (PDP) approach to semantic cognition. Building on the work of Geoffrey Hinton (1981, 1986) and David Rumelhart (1990; Rumelhart et al., 1986) and the observations of Frank Keil (1979, 1989, 1991) and Jean Mandler (1988, 1990, 1992, 1997, 2000a, 2000b, 2002), the authors propose that distributed connectionist networks provide a promising mechanism for implementing and studying semantic cognition. This approach integrates the strengths and overcomes many weaknesses apparent in more "classical" approaches to this topic.

In the PDP framework, all cognitive performance arises through the propagation of graded signals in a system of interconnected processing units. The representations used in performing these tasks are patterns of activation across units, governed by weighted connections among them. Semantic knowledge is acquired through the gradual adjustment of the strengths of these connections in the course of day-to-day experience. In line with Rumelhart's earlier work, the model remains in a simplified form to maintain clarity and tractability. However, the authors extend Rumelhart's model to address the progressive differentiation of conceptual knowledge in development and the progressive deterioration of conceptual knowledge in some forms of dementia.

As a whole, the book is well structured with a pleasant conversational style. Each chapter begins with a brief introduction outlining its aims, tying in the new topic with those discussed in earlier chapters, and ends with an overall summary. Key points are elucidated in each chapter and tangible examples are given to explain complex concepts. Relevant subheadings throughout the book help guide the reader through the text. The authors have a talent to predict the reader's questions and answers are often found in subsequent paragraphs.

The book begins with a short preface outlining the authors' perspective and introducing the key elements of their approach. The first chapter reviews findings and theories central to the field of semantic cognition (e.g., Carey, 1985; Collins & Quillian, 1969; Keil, 1989, 1991). It also introduces the intriguing observation that conceptual knowledge undergoes a progressive differentiation in development, resulting in the gradual elaboration of a conceptual hierarchy, and that this process is reversed in some forms of dementia, resulting in progressive loss of first the finest and later the coarser conceptual distinctions. Chapter 2 provides an overview of PDP theory, with a focus on the seminal work of Rumelhart and Hinton. In the third chapter, the authors describe preliminary simulations addressing the reasons for the observed patterns of development and disintegration of semantic knowledge. The subsequent chapters (4 through 7) in turn describe more targeted simulations to address specific issues including, preverbal conceptual development, naming ability, category coherence, and inductive projection. Each of these chapters conjoins experimental findings with results from the simu-

lations. Readers with minimal knowledge of computational modeling will appreciate the simplicity with which the simulations are described. Chapter 8 reviews the role of causal knowledge in semantic task performance, with a return to the discursive approach used in the opening chapter. In the final chapter, the authors discuss the key principles of their model in relation to the work presented in earlier chapters, and speculate on remaining questions, such as "how is PDP theory implemented in the brain?"

In describing their contribution to understanding human semantic cognition as "a small step in the right direction" (p. 380), I believe that the authors provide a modest description of their work. Indeed, they provide a much-needed mechanistic model of semantic cognition, filling an essential gap often overlooked in most theories of semantic cognition.

For example, although a number of theories of conceptual development have been put forward (Carey, 1985; 2000; Mandler, 2002; Quinn, 2002; Quinn & Eimas, 1997, 2000; Rakison, 2003), the authors of this book are the first to provide a mechanism for an infant's ability to associate different objects as belonging to the same category (Chapter 4). Here, they describe coherent covariation (Chapter 3); a process whereby changes are made to the connection weights in the network capturing shared properties among related items (e.g., *can move* is shared by all animals, and covaries with properties such as *has wings* and *has feet*). Using this process, the network rapidly learns shared properties, and thus forms general categories (e.g., animals). With time, and therefore development, categories become fine-tuned forming specific-level properties, such as, *a canary is yellow*. This progressive differentiation results from the gradual accumulation of weak error signals associated with unshared properties.

Building on previous theories, coherent covariation can account for the shift in development from general categories to specific-level categories, the acquisition of property salience (see Rakison, 2003), and provides a mechanism for the extraction of conceptual representations from perceptual experience (see Mandler, 1990, 2000a, 2000b, 2002). Although the authors suggest that there are no innate "core" properties on which category formation is based (e.g., Carey, 1985, 2000), they do suggest that the influence of coherent covariation on concept development depends on the infant's initial (and therefore, possibly innate) ability to detect similarities and differences among particular events.

This book will provoke a great deal of discussion and debate in the field of semantic cognition, and hopefully will generate new research ideas. With this in mind, I have no hesitation in recommending that you read this book.

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Stress and the Brain: A Fresh Perspective

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Stress, the Brain and Depression, by Herman M. van Praag, Ron de Kloet, and Jim van Os. (2004). Cambridge, UK: Cambridge University Press. 293 pp., $110.00, £65.00.

Reviewed by Geoffrey Tremont, Ph.D., ABPP-CN, Assistant Professor of Psychiatry and Human Behavior, Brown Medical School, Providence, Rhode Island.

This book addresses one of the fundamental questions in the etiology of depression: Does stress cause depression? Although intuitively one may answer yes to this question, the book presents detailed psychological and neurobiological evidence to show the complexity of the issue. The book focuses on three major themes: (1) pathophysiology of stress in depression; (2) stress-inducible subtypes of depression; and (3) diagnosing depression to understand biological underpinnings of the condition. Although each of the three authors wrote individual chapters (with van Praag writing most chapters), the book is well organized and flows smoothly. The book is well written in an entertaining style, especially the chapters written by van Praag. For example, when discussing the problems with the current *DSM-IV* diagnostic system, van Praag states, "psychiatric diagnosing is locked up in a nosological straightjacket, and thus immobilized" (p. 8). It is this type of commentary, sprinkled throughout the book, that holds the reader's interest. In addition, the authors provide a fresh perspective on diagnostic issues in depression, stress/negative life events, and the neurobiology of depression. I expect the volume will stimulate research ideas. To get the most out of the book, it should be read in its entirety. Exceptions are the chapters reviewing the psychobiology of stress and depression, which provide very comprehensive summaries of the research literature, and may serve as a good reference. The initial chapters build the theoretical foundation for the presentation of the biological data, and the final chapters integrate the biological data with the initial hypotheses. The authors take issue with diagnostic trends in psychiatry, definitions of stress and life events, and to a lesser extent, neurobiological approaches to psychiatric research. The authors do not rehash old findings, but include the most recent literature. For example, when discussing corticotrophin releasing hormone (CRH) receptors, they present new findings supporting a possible parallel parasympathetic-related system in addition to the traditional sympathetic response. When the data presentation becomes complex, information is summarized in easy-to-read tables.

Chapter 1 discusses the diagnosis of depression, providing an argument against the current nosological approach used in the *DSM-IV* system. The authors argue for a sophisticated diagnostic methodology (i.e., multi-tier diagnosing) that includes nosological cluster, syndromal analysis, symptom analysis, psychic dysfunction underlying symptoms, symptom severity, course and duration, personality features, and functional effects of the symptoms. The multitiered approach is shown to have relevance to treatment as well as study of the neurobiology of depression.

Chapter 2 presents an introduction to traumatic life events. The authors provide a brief history of the study of stress and how stress has been handled by the different psychiatric diagnostic systems. Definitions of stress and coping are also discussed. There is an interesting section on the interaction between personality structure and life events. Chapter 3 then goes on to discuss basic issues related to traumatic life events and depression. The authors highlight, for example, how there is confusion in the literature between distress and depression. They offer a definition of life events and describe the heterogeneity of events themselves, as well as their consequences. Again, the authors offer a unique prospective, arguing that much of the research on the impact of life events on mood state has been "de-subjective." They suggest a research approach that includes an experiential perspective that captures the heterogeneous response to stress.

Chapter 4 explores the causal connection between traumatic life events and depression. Data are presented that support the increased risk for depression in individuals exposed to negative life events. The authors again emphasize the role of personality characteristics in the interaction between stress and depression. They also discuss very interesting stress-vulnerability models. Chapter 5 begins with a nice review of genetic concepts and types of genetic research. They go on to summarize the family, twin, and adoption study findings. The authors allude to molecular genetic studies, but spend little time discussing the difficulty with these types of studies in depression. After reviewing this literature, the authors suggest that gene–environment interactions are clearly more important than either factor alone. Chapter 6 deals with the correlation and interaction between genes and environment in depression, termed ecogenetics. The authors spend most of the chapter discussing differences between synergistic, parallel, and multiplicative models. The little available data are presented to highlight the importance of gene–environment interactions in the expression of depression.

Chapters 7 and 8 make up the bulk of the book. These chapters present (in great detail) the history and research findings of the two major biological research domains on the etiology of depression. The chapters are dense with research findings, but the authors do a very good job summarizing within sections and bulleting key concepts. Chap-

ter 7 discusses the monoamine hypothesis. For each neurotransmitter system (i.e., serotonin, noradrenaline, dopamine), the authors describe location of circuits in the brain, as well as receptor sites. In addition, relevant animal work and human findings are summarized. Behavioral correlates of monoamine disturbances in depression are discussed and lead to an interesting discussion about affiliation and aggression in the animal literature. In Chapter 8, the authors extensively review the role of stress hormones in depression. Important concepts such as homeostasis and allostasis are presented. The hypothalamic-pituitary-adrenal (HPA) axis is carefully reviewed and the complex literature is presented, including the role of CRH and cortisol. The reader comes away from the discussion appreciating the heterogeneity of the stress response, as well as the potentially powerful effects of the HPA system on brain structure and function. Interesting clinical data on the interaction between early life stress, the HPA axis, and structural brain changes are presented. The authors complete the discussion by linking the HPA axis with functioning of the monoamine system.

The final chapter (Chapter 9) is the title chapter of the book, in which the authors combine their previous discussions and present an argument that certain forms of depression are associated with the stressed state. To support their argument, they discuss comorbidity between depression, anxiety, and aggression, as well as an interesting depressive syndrome involving reversed vegetative symptoms. They indicate how anxiety/aggression may be the "pacemaker symptoms" of certain forms of depression. They use anxiety/aggression-driven depression as a model disorder that emphasizes "functionalization" (i.e., psychic disturbance rather than disease entity) and "verticalization" (i.e., attempting to distinguish symptoms directly related to the neurobiological substratum).

Overall, this is a valuable book for clinicians, researchers, and students interested in the neurobiological underpinnings of stress, negative life events, and depression. The writing style is engaging, and the authors present a point of view that challenges standard practice of psychiatric diagnosis and research.

Body and Mind: Motor Disorders in Children

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Developmental Motor Disorders: A Neuropsychological Perspective. Deborah Dewey and David E. Tupper (Eds.). (2004). New York: Guilford, 501 pp., $70.00.

Reviewed by KAREN WILLS, Ph.D., ABPP-CN, Department of Psychological Services, Children's Hospitals of Minnesota, Minneapolis, Minnesota.

This book is thorough, thoughtful, and uniquely useful in the questions it asks and attempts to answer. Included, for example, are discussions of problems associated with the use of traditional neurological "soft signs" to detect and predict long-term motor impairment; patterns of newborn movement that predict childhood cerebral palsy; strengths and weaknesses of tests and observational checklists to assess motor proficiency; how best to diagnose and treat phonological disorders *versus* verbal apraxia, or dysgraphia *versus* motor dyspraxia; analysis and treatment of handwriting problems; brain systems that subserve proprioception and how these systems develop or derail; neuroimaging that assists in making the diagnosis of periventricular leukomalacia; and, treatment approaches for children with Developmental Coordination Disorder.

Dewey and Tupper relied on an international group of 38 authors to discuss a broad range of movement disorders, yet managed to craft a book that is entirely readable. The book's focus is on infants and children and, to a lesser extent, adolescents. In Part I, "Foundations," Tupper and Sondell provide an historical overview of clinical studies of motor disorders (Chapter 1), Dewey and Bottos describe neuroimaging in motor disorders (Chapter 2), Roy, Bottos, Pryde, and Dewey discuss alternative theoretical approaches to understanding motor disorders (Chapter 3), and Barnett and Peters review tests of motor proficiency, and include a useful descriptive Table (Chapter 4).

The six chapters of Part II, "Clinical Disorders," include discussion of cerebral palsy and the muscular dystrophies by Blondis (Chapter 5), motor function in children with mental retardation (including Down syndrome and Williams syndrome by Elliott and Bunn (Chapter 6), autistic spectrum disorders by Smith (Chapter 7), acquired motor disorders due to traumatic brain injury, stroke, leukemia, human immunodeficiency virus (HIV), meningitis, hydrocephalus, toxic exposure, and malnutrition by Dewey, Bottos, and Tupper (Chapter 8), and involuntary movement disorders such as Tourette's syndrome, tics, and choreas by Dewey, Tupper, and Bottos (Chapter 9). Chapter 10, by Williams and Ho, about disorders of balance and postural control associated with a wide variety of clinical conditions, doesn't quite seem to fit in this section but is nonetheless intriguing. This chapter addresses lifespan issues regarding balance and posture and includes a practical discussion about prediction and prevention of falls in elderly patients.

Part III, "Neuropsychological Manifestations," includes five demystifying chapters on motor speech problems by

Hodge and Wellman (Chapter 11), motor learning and coordination by Ahonen, Kooistra, Viholamen, and Cantell (Chapter 12), visuospatial and related problems by Wilson (Chapter 13), motor problems related to Attention Deficit Hyperactivity Disorder by Piek and Pitcher (Chapter 14), and writing disorders by Berninger (Chapter 15). These chapters, particularly those concerned with writing and speech disorders, are rich with "news you can use" about how to evaluate and interpret observed developmental difficulties. The authors offer suggestions for intervention and provide numerous references for the reader interested in further study.

The final six chapters in Part IV, "Issues and Applications," attempt to integrate specific motor difficulties in relation to development of "the whole person," and to discuss those factors, such as hand preference, that might moderate a child's response to a motor disorder. This section includes a chapter about handedness and manual asymmetry by Hiscock and Chapieski (Chapter 16), and an overview of dynamic systems theory and its notion of "constraints" on motor development by Gueze (Chapter 17). Chapter 18, on comorbidity of motor problems with other diagnosed childhood disorders by Dewey, Crawford, Wilson, and Kaplan, rounds out the content of previous chapters about specific motor disorders, although discussion of some conditions (e.g., neurofibromatosis) is cursory. Chapter 19 by Miyahara and Cratty and Chapter 20 by Larkin and Summers are concerned with how motor disorders affect children's emotional, social, and play behaviors; this adds a clinical perspective although cited findings focus on environmental and psychosocial variables (e.g., children with motor disabilities have a hard time, but supportive family members and school personnel can foster self-esteem and social success). A future edition would benefit from an emphasis on the contribution of subcortical brain systems to mood, emotion, arousal, and consummatory drives, that is, subcortical impairment resulting in motor disorder may also contribute to neurologically based emotional and behavioral differences. Such a chapter would be speculative now, as empirical research on social-emotional aspects of subcortical dysfunction only recently has received deserved attention for the adult population and is virtually nonexistent for children. Finally, Chapter 21, an overview of management and treatment of children with motor problems by Polatajko, Rodger, Dhillon, and Hirji, introduces some less familiar approaches, and reviews the few, generally discouraging, empirical outcome studies of popular methods such as "sensory integrative" and "neurodevelopmental" therapies that have been broadly applied to various motor problems. One hopes this chapter will serve as an incentive to those in need of a dissertation topic and all who are searching for a challenging and rewarding topic of investigation.

More so than in most edited books, each of these scholarly, well written chapters is structured to provide coherence of tone and content. For example, rather than taking a narrow or polemic stance, each chapter presents a concise summary of alternative theoretical models and important controversies relevant to its particular topic. Normal development of a specific aspect of motor function is described briefly. Chapters on specific conditions include discussion of how the normal developmental pattern can be disrupted or derailed, how atypical motor development may result in an array of cognitive, academic, psychological, and social differences, and a cascade of further developmental differences within the motor system. Research and clinical perspectives are well represented, and well integrated, throughout most chapters. A frequent refrain is the need for further research on motor disorders, but the research questions are clearly framed and formulated. Conscientious editing is evident. Cross-referencing among the different chapters within the book is unusually good, as is the indexing of topics and accuracy of citations.

Three additional chapters would be especially welcome in a future edition. The first suggestion is for an overview of normal motor developmental milestones discussed in the later sections of this volume. A second suggestion is for discussion of motor developmental variation related to social, cultural, or environmental factors (e.g., childrearing methods, exercise opportunities, and expectations for fine and gross motor activity). A third suggestion is for inclusion of medical/physiological interventions, such as bracing, surgery, "Botox," systemic medications, and other current treatments, along with a discussion about how these interact with behavioral/rehabilitative intervention strategies. But, no one book can accomplish everything. In this volume, Drs. Dewey and Tupper have made a signal contribution to our understanding of the causes, impact, and treatment of motor disorders, and, more broadly, the role of motor assessment in pediatric neuropsychological practice.