

digits involved in movement, and introducing an intermediate link between the hand and the environment. The authors rely on a complex two-dimensional taxonomy derived from studies in the mid-1980s as a foundation for understanding the distinction between power and precision grasp; however there is no critical review of the advantages or limits of this scheme, how it has advanced our understanding of prehensile movement, nor alternative models. This chapter also includes research on bimanual movements and hand preference; however the authors missed another opportunity by not developing important evolutionary, maturational, and neural organizational aspects of handedness.

Chapter 9 focuses on hand function across the lifespan. This is perhaps the strongest chapter of the book. It is well organized, provides side-by-side comparisons of many hand functions across a wide range using tables and figures and covers topics that the reader is by now familiar with. As someone interested in motor programming, I was particularly impressed with the subsections on the Fitts' task. Chapter 10 is predominantly a review of assessment of sensory-

motor dysfunction of the hand with sections on sensory testing, functional tests, and ways in which persons with visual impairment can benefit from an environment that capitalizes on the hand's strengths at decoding tactile sensory input. The chapter concludes with a review of the literature on hand function and robotics, design of computer interfaces, and gaming.

The only substantive criticism I have with this book is that much of the supportive literature included throughout many chapters is somewhat old. This should not be confused to mean that the literature is outdated; in fact, quite the opposite. The authors should be commended for including the classic works in the field of hand function. In fact, one of the fundamental references cited throughout the chapters on sensory function is a textbook I used as an undergraduate 30 years ago. Still, some readers might be left wondering why research in this field seems to have tapered off in the last decade. In conclusion, *Human Hand Function* is an outstanding volume that will enhance any upper-level undergraduate or first year graduate course on hand psychophysiology.

## Cognitive Reserve: Where We've Been and Where We're Going

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*Cognitive Reserve: Theory and Applications*. Yaakov Stern (Ed.). 2007. New York: Taylor and Francis, 344 pp., \$99.00 (HB).

Reviewed by AARON NELSON, PH.D., ABPP-CN, *Chief of Neuropsychology and Psychology, Brigham and Women's Hospital, Assistant Professor, Harvard Medical School, Boston MA*

Successful aging has been on my mind more and more these days. Time flows forward and I am now reasonably certain that I'm not getting any younger. Thankfully, cognitive reserve (CR) gives me a reason to be hopeful: although I never made it to the Boston Symphony Orchestra or the Olympic medals platform, perhaps all those French horn lessons and 6 AM swim-team practices will ultimately pay off.

Cognitive reserve has been a fertile heuristic for the past 20 years. CR explains the observed diversity of clinical expression across individuals with similar levels of underlying neuropathology. The history of the CR construct dates back to the observation of differential vulnerability to Alzheimer's disease pathology as a function of years of education (Katzman et al., 1988). Yaakov Stern stands out as the most articulate and productive thinker in the CR arena. Stern and his group at Columbia have pushed the CR concept forward and catalyzed a wide array of collateral investigations on everything from the genetics of CR factors to the influence of social activities on late-life cognitive function. *Cognitive Reserve: Theory and Applications* is an edited volume that provides a panoramic view of this field. The book updates and extends a 2003 special issue of the *Jour-*

*nal of Clinical and Experimental Neuropsychology*; six new chapters extend the scope of the original collection of 12 papers. The chapters take the reader on a wide-ranging tour of where the CR construct has traveled in the 20 years since Katzman's report.

Stern clearly articulates the structure of CR in the opening chapter, distinguishing between *brain reserve* and *cognitive reserve*. The former is viewed as a passive form and relates to physical aspects of the brain, such as size, neuronal count, and synaptic density. Cognitive reserve is construed as an active process, relating to information processing efficiency and capacity for compensatory function. Clearly, these two forms of reserve are interrelated. Stern describes two input streams that form the basis for CR: *neural reserve*, which entails utilization of more efficient or flexible neural networks, and *neural compensation* through which new brain networks are activated in response to disease or injury. CR applies to acute and gradually progressive disorders, as well as normal age-related change. Because of the experiential input to CR, it is dynamic and malleable and closely related to the concept of lifespan plasticity.

Although the chapters comprising *Cognitive Reserve: Theory and Applications* are not explicitly grouped, several

threads run throughout the volume. The first three chapters provide a conceptual framework for the CR construct, reviewing the genetics of cognitive abilities and surveying the categories of acquired experience that constitute a major component of CR. In Chapter 2, Lee reviews numerous studies of genetics and cognitive function and highlights the enormous challenge of parsing gene  $\times$  environment interactions. Richards et al. (Chapter 3) present a *simple structural model* for the development of cognitive function and their *life course model*, enumerating classes of variables that interact to give rise to and modify CR, ultimately shaping the clinical expression of a disease.

The next four chapters and two later chapters consider CR in the context of various disease states. In Chapters 4 and 5, Dennis et al., and Bigler, respectively, consider the role of CR in the clinical contexts of early brain injury and TBI in the mature individual. Bigler cites studies correlating brain size with IQ and posits total brain volume as a marker of CR. Boyle et al. (Chapter 6) propose electroconvulsive therapy and coronary artery bypass graft surgery as pseudo-experimental designs which provide naturalistic opportunities for further understanding the way in which premorbid CR factors influence recovery from cerebral insult. Bieliauskas and Antonucci (Chapter 7) briefly review data on the influence of premorbid functioning on disease progression, including cardiovascular disease, chronic obstructive pulmonary disease, dementia, hepatitis C, human immunodeficiency virus (HIV), and systemic lupus erythematosus/autoimmune disorders and emphasize the importance of considering baseline CR measures in evaluating outcomes from clinical trials. Reinhard et al. (Chapter 12) and Mortimer et al. (Chapter 14) utilize CR as a lens through which to better understand the cognitive course in HIV and neurodegenerative dementia.

Chapters 8 through 11 focus on the accrual of CR across the lifespan. Particularly intriguing is the connection between early-life physical activity and late-life cognitive function, found in a large longitudinal study from the Netherlands and reviewed by Dik et al. in Chapter 8. Manley et al. make the point, in Chapter 13, that common indices of CR (e.g., years of education) may not be universally applicable, for example, among minority cohorts with limited educational opportunities caused by adverse socioenvironmental factors. Chapters 15 through 17 explore the neural basis for CR through functional magnetic resonance imaging (fMRI) and evoked response potential (ERP) paradigms. Stern (Chapter 15) presents functional magnetic resonance imaging and positron emission tomography data that identify networks and functionally connected regions that may form the neural basis for CR. He describes voxel-based and covariate analyses to illuminate differences in task processing as a function of CR. In Chapter 16, Grady examines the compensatory impact of CR in both normal aging and Alzheimer's disease. An emphasis is placed on the importance of viewing the entire brain to understand the compensatory response engendered by CR; recruitment of networks and regional deactivations are viewed as aspects of this response.

Friedman (Chapter 17) acknowledges that we are at the earliest phase of understanding the meaning of ERP data in studying age-related processing differences in tasks of episodic memory and executive function. Do these differences reflect bona fide evidence of CR, or are they simply reflecting differences in the way older brains function? Friedman advocates the integration of ERP and fMRI in order to glean the respective advantages of these two techniques in optimizing temporal and spatial resolution.

Although the term *reserve* is nowhere to be found in Kozorovitskiy and Gould's final chapter (18) on brain plasticity and neurogenesis, it is clear that these concepts are central to the brain's response to normal aging and injury. In turn, gaining an understanding of the complex gene  $\times$  environment interactions previewed in Lee's earlier chapter will be fundamental to illuminating the link between plasticity and CR.

CR is an enormous, sprawling construct. It comprises genetic and acquired/experiential inputs as well as the complex interactions between these sets of factors. Perhaps the major challenge posed by the magnitude of CR is delimiting where it begins and where it ends. Between innate factors, life experiences, and their associated interactions, what isn't included in CR? The need to further sharpen and focus the CR construct is reflected in the occasional inconsistency in terminology used by the authors from chapter to chapter. For example, brain reserve and cognitive reserve are used interchangeably in some instances. This inconsistency in terminology both reflects and seems to drive inconsistencies in independent variable measures being utilized in various studies. Should we be measuring intracranial volume or lexical ability? Or both? Composite variables (factors) have been proposed and seem promising.

Dependent variable issues also need to be addressed. To understand how CR operates as a neuroprotective factor, should we be measuring differences in absolute terms? Or, should measurements be based on proportional change from an estimated baseline? Or, perhaps we should simply set cross-over from normalcy to disease as the dependent variable event. Does CR delay the onset of clinical dementia in an extremely intelligent elder simply because the individual has further to decline before crossing an admittedly arbitrary threshold? In viewing CR in the context of brain injury or disease, accounting for size and location of lesion would seem to be critical, particularly if we take the neural networks model seriously. Given the strength of preliminary investigations using functional imaging technology, Stern and colleagues will continue to lead the discussion on advancing methodological approaches.

Like the black hole in astronomy and the subatomic particle in physics, CR's importance and power of explanation become manifest in its influence on adjacent phenomena. Since its introduction into our thinking about the brain, CR must be part of the dialogue in any serious discussion of normal aging and response to disease/injury. CR has become fundamental to our understanding of the neuropsychological cosmos. *Cognitive Reserve: Theory and Applications*

provides clinicians and researchers with a detailed recounting of CR's journey to date, and a glimpse of the distant horizon. Despite some of its flaws and because of the many important questions it raises but cannot yet answer, I highly recommend *Cognitive Reserve: Theory and Applications* to clinicians and researchers alike.

## Learning Disabilities: A Framework for Understanding Unexpected Underachievement

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*Learning Disabilities: From Identification to Intervention.* Jack M. Fletcher, G. Reid Lyon, Lynn S. Fuchs, and Marcia A. Barnes. 2007. New York: The Guilford Press, 324 pp, \$38.00 (HB).

Reviewed by GAYLE K. DEUTSCH, PH.D., ABPP-CN, *Stanford Institute for Reading and Learning (SIRL), Stanford University, Stanford, CA*

Four senior leaders in the fields of neuropsychology, cognitive neuroscience, and special education tackle the complex issue of learning disabilities in *Learning Disabilities: From Identification to Intervention*. They summarize research conducted over the past 30 years that has contributed to our understanding of how to assess, identify, and treat learning disabilities. Determining the presence of a learning disability is different from measuring the manifestations of brain damage caused by brain injury or disease states that neuropsychologists typically evaluate. Fletcher et al. point out that the construct of a learning disability is a *latent variable*. It is not observable directly and is consequently difficult to operationally define, identify, and measure. They also show that characteristics associated with a learning disability are dimensional and occur along a continuum. Adding to the intricacy is the difficulty keeping abreast with education policy and knowledge of how federal law drives clinical practice.

The Individuals with Disabilities Education Act was reauthorized in 2004 (IDEA 2004). This act removed the requirement of showing a significant discrepancy between achievement and intellectual ability before a child is considered to have a learning disability. In addition, an educational agency is allowed to use a "scientific, research-based intervention" to see if a child responds to intervention and the educational agency is allowed to "use up to 15% of its federal funding to develop and implement . . . early intervening services." Thus, IDEA 2004 provides a foundation for implementation of Response to Intervention (RTI) programs. Although advantages and disadvantages of RTI are outside the scope of this review, it is important that neuropsychologists be aware of the education law change and how it will impact their assessment of learning disabilities. Knowledge of RTI is essential to understand the viewpoint of this volume's authors.

This book is comprised of 10 chapters. Chapter 1 is an introduction in which the authors provide their rationale

## REFERENCE

Katzman, R., Terry, R., DeTeresa, R., Brown, T., Davies, P., Fuld, P., Renbing, X., & Peck, A. (1988). Clinical, pathological, and neurochemical changes in dementia: A subgroup with preserved mental status and numerous neocortical plaques. *Annals of Neurology*, 23, 138–144.

and a model of how they view learning disabilities. It includes a framework and description of factors that influence learning disabilities. They explain their focus on reading disorders, math disorders, and disorders of written expression and explicitly note that they do not address nonverbal learning disabilities, or social or executive functioning.

Chapter 2, *History of the Field*, traces the evolution of the definition of the major forms of learning disability. They begin with Gall's observations of individual differences and step through the influences of early neurology. They then proceed to the concept of minimal brain dysfunction, and how reactions to this term influenced U.S. education policy and law. They also discuss how the American Psychiatric Association (DSM-IV) and the World Health Organization (ICD-10) codified and defined a specific learning disability. Many of these early definitions did not appreciate the heterogeneity of learning disabilities, nor did they operationally define a learning disability by what it constituted, but rather by exclusionary criteria. The notion that a learning disability is characterized by unexpected underachievement is brought forth and continues to be reinforced in later chapters.

Chapter 3, *Classification, Definition, and Identification of Learning Disabilities*, presents models of learning disability classification along with reliability and validity research detailing the advantages and disadvantages of each model. Specifically, the authors review four major models: Aptitude-Achievement Discrepancy, Low Achievement, Intraindividual Differences, and RTI. One example is that they provide reliability data showing the weakness of assessing an individual at one solitary point in time (single status model). The authors conclude the chapter with their proposal of an integrated or hybrid model that merges the Low Achievement and RTI models, along with a rationale why this type of model needs to be incorporated.

Chapter 4, *Assessment of Learning Disabilities*, is the authors' application of how to assess a child for a learning