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## BOOK REVIEWS

# Bridging the Gap Between Neuroscience and the Social World: Theory, Research, and Mechanisms in Social Neuroscience

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*Essays in Social Neuroscience*. John T. Cacioppo and Gary G. Berntson (Eds.). 2004. Cambridge, MA: The MIT Press, 168 pp., $32.00/£20.95.

Reviewed by Pauline Maki, Ph.D., *Departments of Psychiatry and Psychology, University of Illinois at Chicago, Chicago, IL.*

*Essays in Social Neuroscience*, edited by John T. Cacioppo and Gary G. Berntson, is a slim collection of highly engaging and—for the overextended neuropsychologist—enjoyably brief essays surveying current research and theory in the emerging field of social neuroscience. Each contributor attests to the variety of examples of research bridging the historic divide between neuroscience and social psychology. For neuropsychologists, this volume offers enlightening demonstrations of the potential for traditional methods in neuroscience to speak to the complex and reciprocal interplay between neural systems and the social world. From Sue Carter's essay "Oxytocin and the Prairie Vole: A Love Story" to Shelley E. Taylor's contribution "The Accidental Neuroscientist: Positive Resources, Stress Responses, and Course of Illness," these essays speak to such diverse issues as interpersonal attraction, loyalty, emotional reactivity, and environmental contributions to autoimmune disease. Some essays speak more to the potential for bridging the gap than to demonstrated success in this effort, but those essays remain pleasurable, rewarding reads. The large majority of essays, four of which are described in more detail below, beautifully exemplify the fruitfulness of this area of inquiry.

Among the most impressive examples of efforts to bridge the divide between social neuroscience and social psychology is the opening essay by Michael J. Meaney. His research focuses on consequences of maternal behavior in rats to illustrate a behavioral transmission of parental traits to offspring (nongenomic inheritance). The extent to which a mother licks her pups is a stable, individual difference trait that is associated with stable differences in hypothalamic-pituitary-axis (HPA) responses to stress in her offspring. Mothers who are high-frequency lickers have offspring that show lower stress reactivity as measured in both behavioral and endocrine markers. A first attempt at explaining this might be genomic inheritance, likely focusing on a mechanism grounded in the HPA axis. However, studies of cross-fostering (basic science equivalents of foster families) show that the offspring of low-lick mothers who are raised by high-lick mothers will show the same resiliency to stress as the offspring of high-lick mothers. This behaviorally transmitted resiliency appears to be mediated through tissue-specific effects on gene expression. The mechanism of this resiliency has been mapped to the level of DNA methylation, in particular the exon $1_7$ glucocorticoid receptor promoter. Cross-fostering offspring of low-lick mothers with high-lick mothers reverses the pattern of methylation in this promoter and protects the offspring of low-lick mothers from over-reactivity to stress. This is a particularly impressive example of success mapping the broad concept of social influences on stress responsivity onto genetic mechanisms.

Child-rearing patterns also influence propensity for aggressive behaviors through effects on the serotonergic system. In an essay dedicated to his colleague, the late Markku Linnoila, Steven Suomi describes his research on rhesus monkeys and the influence of serotonin and patterns of child rearing on aggression, tendency toward alcoholism, and impulsivity. This research demonstrates that serotonin expression interacts with child rearing patterns to influence the propensity for these antisocial behaviors and provides an intriguing parallel to human behavior. Particularly interesting was the report of an interaction between a candidate gene, serotonin transporter gene 5-HTT and mother rearing: animals with a heterozygous short allele (LS) who were raised apart from mothers became aggressive and impulsive later in life whereas those raised with mothers did not exhibit those behaviors. Moreover, because female rhesus monkeys adopt the child rearing practices of their mothers, this interaction suggests a generational transference of the factors leading to this trait. It also raises the intriguing possibility that inheriting the LS allele can lead to psychopathy, but competent mothering can mitigate this unfavorable outcome.



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In his essay "Protecting and Damaging Effects of Stress Mediators" Bruce McEwen revisits and redefines the stress response originally described by Hans Selye. Here he presents his well-known work expanding the concept of homeostasis and extending it to the concept of allostasis, allostatic states and allostatic load/overload. Allostasis refers to how the systems that maintain homeostasis are themselves kept in balance and adapted to ensure homeostasis. Allostatic states such as hypertension refer to altered and sustained levels of the mediators of allostasis—stress hormones, cortisol, adrenaline, other components of the sympathetic and parasympathetic nervous system, oxytocin, vassopressin, neurotransmitters, neuromodulators, and the immune system—beyond what is adaptive for homeostasis. Allostatic overload refers to the consequences of an imbalance in these mediators when maintained for an extended period of time and includes, for example, abdominal obesity. The clinical relevance of this overarching reconceptualization of the stress response is immediately apparent. Allostatic states and overload contribute to leading health problems in the United States that are less prevalent in other cultures, including obesity and atherosclerosis. Allostatic overload is manifest in the neural systems that underlie memory. When an organism is acutely threatened, say with a pink slip from the NIH—cortisol secretion results in an adaptive response—improved memory for the comments so that the individual can learn to write better grants in the future. However, if stressors are repeated over several weeks, the normally adaptive cortisol response results in neuronal atrophy and heightened responsivity of neural systems mediating the fear response. The conditions under which stressors are experienced play a large role in determining the health consequences of stress mediators.

In a particularly illustrative example of social behaviors regulating neural systems Martha McClintock presents a chapter on "Pheromones, Vasanas, Social Odors and the Unconscious." We learn that "vasanas" is a term coined from Sanskrit philosophy meaning "to perfume . . . an unconscious impression left on the mind." McClintock shows how vasanas modulate—without conscious detection—a woman's behavioral and sympathetic response to the presence of a man. An example of this is androstadienone, a natural steroid secreted in body fluids. Women respond differentially to this social chemosignal depending on whether a man or a woman is running an experiment. If a man is running the experiment, women experience a change in mood and sympathetic tone. If a female experimenter is running the experiment, no change is evident. Men respond in the reverse manner to this vasana by decreasing positive mood and increasing sympathetic activity. Neuroimaging studies show how the presence of this vasana alters patterns of brain activation during visuomotor tasks despite the fact that the signal is undetectable. These chemosignals appear to modulate our emotional responses to varying social encounters.

These four essays, as well as the other seven essays, challenge the external validity of our purposefully simplified and controlled studies to the broader social world. Each essay presents an opportunity to understand the factors in the organism—not just genetic and systemic but social—that can alter what takes place at a cellular and molecular level. Take for example a challenge to basic neuroscientists—the fact that drugs often work differently in isolated cell cultures than they do in organisms. This example, raised by Esther Sternberg, eloquently describes the challenge to researchers attempting to reconcile phenomena that take place on a human time scale in the larger social world to phenomena that take place at the cellular and molecular level within potentially much more rapid time frames. Overall, the collection of essays is a gratifying read for the busy undergraduate or graduate student seeking knowledge and the seasoned researcher seeking continued inspiration.

## Signs of Mental Activity: An Essential Guidebook

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*Event Related Potentials: A Methods Handbook*. Todd C. Handy (Ed.). 2005. Cambridge, MA: Bradford/MIT Press, 404 pp., $60.00.

Reviewed by Gerry A. Stefanatos, D. Phil., *Director, Cognitive Neurophysiology Laboratory, Moss Rehabilitation Research Institute, Albert Einstein Medical Center, Philadelphia, PA.*

The dramatic increase in interest in functional magnetic resonance imaging in recent years has been accompanied by a wealth of literature on the scientific foundations of the procedure and the highly complex methodological issues that must be considered during experimental design and data analysis. To some extent, progress in this exciting area has eclipsed significant developments in other areas of neuroimaging, particularly the "neuromagnetic" approaches that study time-locked brain electrical potentials or magnetic field changes produced in the course of processing perceptual, cognitive, and motor events. However, there has been increasing recognition that the study of event-related electrical potentials and neuromagnetic responses remains a critical complement to "hemodynamic" approaches because of their exquisite temporal resolution and because they provide a more direct index of neural activity related to stimulus events than procedures dependent on the coupling of brain activity with cerebral blood flow. In this context, *Event Related Poten-*

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*tials: A Methods Handbook*, edited by Todd C. Handy, represents an important and long overdue handbook. It provides practical and concise information on ERP methods that is comparable to literature available for fMRI techniques.

The 15 chapters of this volume present essential information on the design, analysis and interpretation of experiments using event related potentials (ERPs). The first section, comprised of four chapters, lays the foundations of ERP methodology. The introductory chapter by Otten and Rugg nicely addresses basic concepts and assumptions underlying the interpretation of ERPs. Steven Luck then provides useful guidelines for designing ERP experiments and Handy addresses important methodological issues regarding ERP quantification. The section closes with a nicely executed tutorial by Dien and Santuzzi on the application of multivariate statistical methods to high density ERP datasets.

The second section is comprised of seven chapters that focus on data analysis. Edgar, Stewart and Miller's detailed discussion on the use of digital filtering techniques is complemented by Talsma and Woldorff's excellent review of methods for estimating and removing artifacts. Slotnick addresses the difficulties of source localization of ERP generators and Srinivasan balances this with a meticulous theoretical and practical review of quantitative measures of the spatial information that can be derived from EEG data. The treatment of surface Laplacian methods is supplemented with some useful practical examples. Dien and Frishkoff then provide a very nice discussion of the application of principal components analysis to ERP data and Spencer provides a welcome review of methods for analyzing single trial ERPs. Herrmann, Grigutsch and Busch close this section on advanced analytic techniques with a discussion of wavelet analysis.

The third and final section consists of 4 chapters focusing on the use of the ERPs in specific populations and in special settings. DeBoer, Scott and Nelson discuss the distinctive issues associated with studying ERPs in developmental populations, while Swick provides an overview of the extant literature on ERPs in neuropsychological populations such as patients with amnesia, traumatic brain injury, and aphasia. Soltani, Edwards, Knight and Berger describe the highly specialized methods of intracranial recording, deftly addressing the various methodological concerns inherent in intraoperatve procedures including the effects of the anesthetic agents. Finally, Hopfinger, Khoe and Song provide a highly topical discussion on multi-modal imaging where ERP data is integrated with information obtained from PET, MRI, and fMRI.

The goal of this volume was to "meet the need for practical and concise information on the methods of ERPs in a manner intelligible to novice ERP investigators, but sufficiently rigorous so as to be informative to the most seasoned of electrophysiology experts." These lofty goals have, for the most part, been admirably achieved. The wide coverage of topics and methods encompasses the most important technical details of the latest experimental techniques. These are discussed in a nicely balanced manner, addressing the strengths and pitfalls of each of these approaches. As might be expected, there are some shortcomings associated with the broad scope insofar as the depth of treatment is sometimes compromised. For example, independent components analysis is briefly discussed in chapters by Luck, Talsma and Woldorff, and DeBoer et al., but the overall coverage falls short, in my opinion, of current views of the merits of the technique to ERP analysis. This may be, in part, a function of the inevitable delay from book inception to the bookshelf. In addition, the content focuses overwhelmingly on ERP methods in cross-sectional studies and some treatment of special considerations inherent in longitudinal designs (e.g., clinical trials) would have been invaluable. Finally, some coverage of steady-state techniques might be considered for future editions.

Overall, this volume represents an important contribution to the field. It provides an essential complement to well-thumbed but now dated standards such as David Regan's *Evoked Potentials in Psychology, Sensory Physiology and Clinical Medicine*, Chiappa's *Evoked Potentials in Clinical Medicine*, or more recent theoretically-oriented volumes such as *Electrophysiology of Mind* by Rugg and Coles. It succeeds in presenting sophisticated coverage of cutting-edge experimental techniques to broaden the horizons of seasoned researchers yet is sufficiently accessible and provides a level of tutorial content to satisfy newcomers to cognitive neuroscience and ERP methods. It would make an excellent reference text for a graduate level course on human cognitive neurophysiology and serve equally well as an essential lab resource book. It is precisely the type of book that the field needed to redress some of the imbalance that emerged with the prodigious advancement of hemodynamically based methods of functional neuroimaging.

## Larrabee Sets the Precedent

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*Forensic Neuropsychology: A Scientific Approach*. Glenn Larrabee (Ed.). 2005. New York: Oxford University Press, 479 pp., $68.50.

Reviewed by Paul Spiers, Ph.D., *Boston University School of Medicine, Boston, MA*.

As a practitioner of the art and as an instructor for a course in "neuropsychology and the law," I can assure you that all of my students will be assigned Larrabee's *Forensic Neuropsychology* in coming semesters. The editor and his co-

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authors have assembled a thoughtful and comprehensive introduction to a rapidly evolving area of science and practice. The unique contributions that neuropsychological assessment and an understanding of brain-behavior relationships can provide are fast becoming the rule, rather than the exception, in civil, criminal, and, sometimes, even probate litigation.

The volume essentially divides into two sections. The first five chapters establish the context for this evolving clinical specialty. In chapter 1, Larrabee discusses and advocates for having the forensic neuropsychologist (FN) view clinical application as a scientific enterprise, and recognize the importance of adhering to a careful methodological approach. I wonder only about Larrabee's observations, even though patently correct, concerning base rates of detection for various instruments. While important, such science is, in my experience, beyond the level of concern typically addressed by the Court and may sometimes even undermine rather than clarify a witness' expertise.[1] Chapter 2 by Greiffenstein and Cohen, the latter also an attorney, provides a more practical approach to the FN's role. It describes pitfalls and provides good solutions for establishing and maintaining a productive working relationship with an attorney. Translations of legal terminology and a glossary of lay terms to explain neuropsychological findings are included. The authors appropriately emphasize that the FN must remain flexible, that the lawyer is the client, and that the goal is to answer the questions posed by that client. This requires flexibility in choosing appropriate test instruments, and the ability to translate results into lay terms for the jury, the attorneys, and the court. The authors also appropriately underline that the process in such cases will be adversarial rather than clinical, and discuss the probable ways the relationship between the attorney and the FN may unfold. My only disappointment, and a very minor one at that, was that the authors chose not to provide a more detailed overview of the existant expertise and research that address such matters by experts in the field of forensic psychology. While a relatively new specialty, and one that often addresses research rather than clinical questions, a grounding in forensic psychology is critical, in my opinion, for any neuropsychologist who plans to function as either a declared expert witness or an undeclared consulting expert.

In chapter 3, Grote properly stresses the importance and perils of conducting oneself ethically in the forensic context. Any introduction to forensic neuropsychology would be incomplete without a careful consideration of the issue of response set validity (malingering), which Larrabee provides in a comprehensive chapter 4. The logistics and science pertaining to neuroimaging are thoroughly covered by Ricker in chapter 5, and serve to highlight the potential that this approach may hold in better understanding brain function in relation to injury or to the production of abnormal behavior. In no other area are more evidentiary precedents likely to be set in the coming years and chapter 5 provides a means for better understanding the enormous potential of this brain–behavior methodology.

The remaining chapters, 6 through 13, each deal with areas commonly encountered in neuropsychology and the law. Each of these provides an excellent overview of research and the factors encountered by the neuropsychology scientist–practitioners, as they try to apply their methods and knowledge to specific, legal questions. The first three of these "application" chapters deal with traumatic brain injury (TBI), beginning with Donders' chapter 6 on pediatric cases. Adult TBI is divided into mild injuries, which Larrabee deals with in chapter 7, and moderate to severe TBI, addressed by Sherer and Madison in chapter 8. Neurotoxicity is addressed by Bolla in chapter 9, and some of the more unusual, but commonly encountered, diagnoses in forensic practice, such as chronic fatigue, solvent exposure, and chemical sensitivity, to name but a few, are effectively overviewed in Binder's chapter 10.

The determination of civil and criminal competencies takes up the last three chapters, with Marson and Hebert, in chapter 11, guiding the prospective FN through matters of consent and capacity, with an emphasis on the aged population. Chapters 12 and 13 by Denney on criminal competencies and responsibility are especially comprehensive, and appropriately emphasize that the practice of neuropsychology in this setting must adopt an investigative attitude that goes beyond simply the evaluation of cognitive functioning.

As stated at the outset, I will be assigning this textbook. It is not a "how-to" manual, nor a recipe book for changing over one's practice from clinical to forensic neuropsychology. And neither is it a reference guide to forensic test instruments, *à la* Lezak, nor a treatise on forensic psychology. It is, however, an excellent, thoughtful and thought-provoking introduction to this area of practice, one that will remain a useful resource for addressing the controversies surrounding the practice of forensic neuropsychology.

Larrabee's text is a must-read for students and professors who wish to include this area of practice in their curriculum. It is ideal for clinicians and attorneys who know a little but want to better understand and appreciate how these two professions intersect, though "collide" might often be a better descriptor. And finally, even for those neuropsychologists who consider themselves seasoned in the legal arena, this text will remind them of the complex and myriad factors influencing their practice, as well as providing an overview of how the science of understanding brain-behavior relationships can be better and more carefully applied to legal cases.

[1]Spiers, P.A. (2003) CSA will not be prosecuted scientifically: A comment on Sbraga & O'Donohue. *Clinical Psychology: Science & Practice*, *10*, 364–366.

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