

Book Review

Introduction to Neuropsychology, edited by J. Graham Beaumont. New York: Guilford Press, 1983 (\$18.95).

WITH the explosion of information from the cellular and molecular levels in the neurosciences, the importance of psychological constructs for the neural sciences has often been neglected. In recent years, as the analysis of brain function has become "microtized" and the analysis of brain-behavior relationships has focused on simpler or more manageable model systems, the field of human neuropsychology remains one of the few actively concerned with complex psychological processes.

One of the difficulties of introducing neuropsychology to the student is defining what constitutes the field and what are the essential and relevant constructs and methodologies. Among professionals, the answers to the question "What is neuropsychology?" would undoubtedly reveal a gamut of responses, depending on the background and biases of the individual. For the student, though, the range of disciplines may seem bewildering, covering basic neuroscience, neurology, psychiatry and physiological and experimental psychology. The task of an author of selecting and integrating material from many potential sources of information is especially difficult, and the final product obviously depends on the particular orientation of the reviewer.

In the present text, Prof. Beaumont has divided neuropsychology into two basic areas—clinical and experimental. The first section of the book is a short introductory description of the history and issues of neuropsychology and an all-too-brief overview of the structure of the nervous system. The major portion of the text constituting the next two sections presents the basic principles of clinical and experimental human neuropsychology. From clinical neuropsychology he has chosen to outline specific functions of cortical divisions derived from studies of brain-damaged, adult humans. From experimental neuropsychology, he has reviewed the findings of perceptual and performance measures of cerebral asymmetries in normal adults using the specialized techniques of divided visual field and dichotic listening and electrophysiological techniques. The last section addresses the applications of neuropsychological assessment and treatment, including a chapter devoted to a discussion of cerebral lateralization in psychiatric populations.

Surely one of the most difficult problems in organizing a text in neuropsychology is how to achieve a balance between structural and functional details of the nervous system and the organization of behavioral and psychological processes. In this case, the chapter from the first section of the text covering the structure of the CNS provides little more than an introductory chapter for a physiological psychology text. Since the anatomy chapter barely advances beyond identifying the brainstem, diencephalon and lobes of the cortex, the text provides no firm basis for an understanding of the anatomical organization of the brain and would have to be supplemented by a short course and/or text in neuroanatomy. Since the goal was to present a systematic and comprehensive review of clinical and experimental data concerning localization or lateralization of function, the

neuroanatomical data was necessarily given limited treatment. Nevertheless, it is disconcerting to see a neuropsychology text which discusses functions of various cortical areas without acknowledging the major afferent and efferent connections. There is no place in this text where the integrative activity of various levels of the nervous system is indicated. Since this text is intended for both undergraduate and graduate students, it seems even more imperative that a strong anatomical basis for psychological processes be established.

Section II covering clinical neuropsychology opens with a discussion of research problems related to diagnosis and interpretation of brain damage in humans. Again, the emphasis is on specifying functions which are affected by discrete lesions of a particular cortical area, and "controlling" for factors other than the site of the lesion. Since these methodological issues set the tone for the reader, the text encourages a pigeonhole approach to understanding the organization of the brain, when other, less clearcut principles concerning behavioral and neurological plasticity should be underscored. For example, the author rightly includes age and type of lesion as critical factors, but does not pursue these topics in later discussions of the various cortical lobes. A growing experimental literature exists concerning the differential effects of brain damage across the life span, as well as the effects of slow, progressive damage versus radical, single-stage damage. As Goldman-Rakic and others have shown, the developmental state of an organism may determine the type and extent of functional deficits seen with specific damage induced at early ages, with animals growing into or out of functional disabilities. Even in mature animals, the effects of apparently similar damage may lead to different behavioral effects depending on their pre-operative or post-operative experience. Behavior genetics has contributed further "complicating factors," showing that similar brain damage can produce different outcomes in different strains or selected lines of rodents. The general lack of consideration of such factors which may produce *individual differences* in response to brain damage should be viewed as a weakness of this text.

Related to the above, the text can also be faulted for not including sufficient discussion of the dynamic nature of the response to brain damage. Recovery of function issues are touched only briefly in a section on rehabilitation near the end of the text. The author's decision to concentrate on human clinical syndromes and to omit discussions of experimental animal models of neuronal plasticity and recovery of function may be understandable. However, the cursory treatment of behavioral and neurological recovery denies the student a glimpse of one of the most fascinating and mysterious aspects of clinical neuropsychology. Why do some individuals show marked improvement of symptoms over time in the face of massive damage? What are the limits of recovery and how are they determined? What is the time course of changes following particular damage, and can it be enhanced by biological or behavioral procedures? In the attempt to categorize and classify behavioral effects of brain damage primarily on the basis of localization of function, the picture

of the dynamic nature of brain function is lost. One way for the instructor to overcome this deficiency is to include an additional text or material of case reports of individuals, which would necessarily address recovery of function.

The strength of the clinical neuropsychology section lies in the author's ability to describe the general functional disabilities and the clinical syndromes following localized brain damage in an organized and understandable fashion. He makes a positive attempt to present an organized scheme of the functional effects of damage to the various lobes of the cerebral cortex, and uses well-chosen, clear figures of materials used in neuropsychological testing. The author points out the difficulty of drawing generalizations from clinical studies, though to a less extent than this reviewer would prefer, and includes a discussion of methodological difficulties at the onset of the section. To its credit, the text is well referenced throughout, and additional review articles are pointed out.

The chapter on frontal lobes is organized around four functional subdivisions—premotor, prefrontal, orbital and Broca's area. Though the anatomical groundwork was not provided for these (and other) divisions in the text, the behavioral descriptions are well-presented and represent a nice attempt to organize a difficult set of data. The descriptions and formulations of the effects of damage to the temporal, parietal and occipital lobes (e.g., the amnesic syndrome, unilateral hippocampal damage, sensory neglect) are likewise concise and informative. Thankfully, the text does not fall into a litany of tests available and what they may show, but is selective within the framework of the functional concerns of the various lobes. In addition, every chapter includes a section on the effects of unilateral damage, a theme which is emphasized throughout the text, particularly in the later sections.

Two of the better chapters of the book conclude the section on clinical neuropsychology—one on language representation in the brain and the other on psychosurgery. Since the author was forced to address the functional organization of language across the arbitrary anatomical divisions of the brain, this chapter comes closer to a functional analysis of neuropsychology than any other. In particular, the clear presentation of various forms of aphasia (the "Boston classification") made this a highlight of the text. It would seem the student would benefit from a similar functional treatment of attention, memory, movement or any other behavior process we can conceptualize, regardless of the depth of our ignorance of the neural organization of such functions. For whatever reasons, the temptation for the author to describe the effects of localized damage to one of the lobes must have been too strong to avoid. The chapter on psychosurgery provides the book with an historical and ethical flavor, but text comes disturbingly close to a full endorsement of such "modern psychosurgical" treatments as cingulectomies and amygdalectomies. This controversial area should provide an introduction for further reading on the dark history of prefrontal leucotomy and the hope for a rational surgical treatment of behavioral disorders.

In the third section covering experimental neuropsychology, the heavy emphasis on the specialized methodology and the conceptual level of analysis of hemispheric lateralization make this text unique. However, comparisons between the experimental and clinical sections make for a stark contrast in their philosophy and scope of data and little substantial integration of the two is achieved beyond the obvious distinctions of verbal and non-verbal processing. As the author

recognizes, the demonstration of lateralized information processing advantages have not provided any clues or insights into the underlying mechanisms of information processing in humans. Since the cerebral asymmetries demonstrated by experimental techniques are in terms of speed or efficiency of processing, and since processing of certain types of information in only one hemisphere is highly unlikely, one must wonder whether the emphasis on hemispheric specialization at the expense of hemispheric integration is worthwhile as an organizing principle for the text.

The experimental section begins with the best chapter in the text covering the historical beginnings of Sperry's experimental analysis of perception, performance, language and consciousness in "split-brain" preparations. This chapter covers the crucial issues related to the subjects, methods and analysis of hemispheric specialization within the context of the abnormal conditions invoked by commissurotomy. A critical discussion of the lateralization of consciousness completes the chapter and leads into the chapters concerning the experimental techniques used to study normal humans.

The chapters concerning divided visual field and dichotic listening techniques cover the details of the two methods and the nature of the evidence of lateralized advantages of the left and right hemispheres. Although we are warned not to conceptualize the hemispheric advantages as verbal vs. non-verbal and that "a whole host of variables may influence any lateral advantage that emerges," the discussion that follows does little to refute this generalization.

One of the more interesting parts of these chapters arises from the review of theoretical psychological models of information processing. In the authors's words, "The general idea behind <structural> models is that psychological functions may show lateral asymmetries. . . . and these functions may be localized in cerebral structures which are lateralized to one of the cerebral hemispheres." The structural models are contrasted with dynamic models allowing flexible allocation of attention via differential activation of the hemispheres. These attempts to force hemispheric specialization as a neurological fact into models of information processing based on psychological concepts seem premature. But the blame for the inadequacies of matching structure and function should not be cast at psychology for grasping at straws any more than at other disciplines neuroscience for not making progress in the area of attention, learning and memory. Even in an introductory text, it would be exciting to see a greater attempt at integration of clinical and split-brain data, along with comparative neuropsychological studies, with findings from experimental data from normal humans to make inroads into the difficult issue of attention.

The experimental section includes a chapter on electrophysiological analysis of hemispheric specialization, primarily EEG and evoked potential recording techniques. As in the previous chapters, the presentation of the technique is straightforward and understandable. The only quibble here is that much emphasis is placed on EEG and evoked response analysis as techniques which may provide major advances in our understanding of cerebral lateralization. In truth, these techniques have been used for years experimentally, and are much less likely to provide major breakthroughs than other, newer methods such as *in vivo* metabolic tracers. The last chapter of this section is a sketchy description of sex differences and handedness in the quest for characterizing hemispheric specialization.

The final section of the book contains two chapters concerning applied aspects of neuropsychology, but they are so

short and lacking in substance that they would have better been omitted. The chapter on testing is so diffuse and without purpose that it really detracts from the quality of the text. Likewise, the review of differences in lateralization in schizophrenia and affective disorders fails to capture the essence of any support for the various claims of differences in hemispheric specialization in psychiatric patients.

It is perhaps easier to evaluate a text by its sins of omission rather than its sins of commission. In the present case, the failure to include consideration of the neuropsychology of development and developmental disabilities is distressing, even with the author's stated apology. As he notes, a well-organized, comprehensive account of developmental neuropsychology is lacking for students, and a developmental organization to the text would have been refreshing. The exclusion of ontogenetic determinants of brain damage is a serious drawback to the clinical section, and the failure to discuss reading disabilities, learning disabilities and attentional disorders while including weak sections on psychiatric populations is questionable. Overall, a developmental approach could have served as a powerful organizing principle for the text instead of (or in addition to) the standard lobe by lobe analysis.

A second glaring omission, causing concern for physiologically oriented psychologists, is the limitation of the clinical section to brain damage in humans. The author defends this by giving the usual arguments of problems of generalizing from non-humans to humans, particularly when "high-level" functions are involved. Curiously, he maintains that animal studies are still of value with regard to subcortical structures, which he claims "deal with relatively basic aspects of sensation, perception, learning, memory and emotion." This distinction of low-level and high-level processing escapes me (other than the tautology with the dubious cortical-subcortical distinction), and his dismissal of comparative neuropsychological data cannot be easily rationalized. The general anatomical and physiological organization of the brain is similar across mammals, and our knowledge of structural characteristics of the brain are derived largely from comparative studies. Likewise, comparative studies of behavior, neuroanatomy and neurophysiology using non-human primates continue to provide useful insights into such "high-level" functions as focused attention and modulation of behavior with motivational state, voluntary movement, performance of complex behavioral sequences, and memory function.

Despite the initial disavowal of animal studies in the introduction, there are several places in the text where brief references to comparative analyses are made but where expanded discussions would have been useful. Animal models of several "high-level" functional disorders have been studied in primates, e.g., perseverative deficits following prefrontal damage and sensory neglect following unilateral parietal lesions. Indeed, as the author notes in the conclusion

of the chapter on the frontal lobes, comparative evidence indicate that the frontal lobes do not perform markedly different functions nor are they particularly special in humans. The exclusion of an explicit comparative tone to the text deprives the reader of the experimental foundation of much of what is known about the neural basis of behavior.

While the criticisms of comparative approaches were mentioned in the introduction of the text, and the lack of control in analyzing brain-damaged human populations was emphasized in the clinical section, no mention is given to the problem of interpretation of the performance of brain-damaged individuals. The author claims that "the relative importance of the animal studies of comparative neuropsychology has declined." Hopefully the lessons of the past have not been forgotten. Criticisms of the subtractive logic of lesion methods and the associated brain-center concepts are well-known and should have been made clear in an introductory text. Only the performance of the remaining tissue, not the contribution of the removed tissue, can be directly assessed by behavioral analysis after lesions. In the unlikely prospect that a lesion is well localized with little interruption of fibers of passage, and even diagnosed in terms of a behavioral battery, the definition of a function is more difficult than a description of behavioral changes induced by specific damage. The recent demonstrations of selective memory capabilities in the absence of conscious awareness in hippocampectomized individuals underscore this point.

In summary, this text was intended to fill a gap identified by the author as a lack of an adequate introductory text for neuropsychology for students without an advanced knowledge of psychology. In the case of experimental approaches to brain lateralization, the text is generally successful, though some may view this as a rather limited, single-minded topic. The clinical neuropsychology section provides an adequate summary of specific functional deficits following localized brain damage in humans, but fails to provide an overview of the dynamic changes in brain-damaged individuals or the limitations of lesion-localization for comprehending the integrated activity of the brain. The failure to integrate clinical and experimental approaches, with the possible exception of language function, leaves this text short of the mark on several fronts. Except for language, integrated functional analyses of behavior are not attempted, as the text is organized around gross anatomical or methodological divisions. Nevertheless, the text is one of the few which covers both clinical and experimental approaches to neuropsychology with any completeness, and if combined with a neuroanatomical text and case studies, it would provide an adequate foundation for an advanced undergraduate course.

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