ucational inflation that preserves the relative standing of persons from advantaged backgrounds. Although Olneck's results on the nonlinear effects of schooling on achievement are suggestive, he correctly concludes that his analyses do not permit him to rule out any of these possible interpretations. Analyses of the kind he presents cannot speak directly to the question of how the observed effect of education on success comes about.

Olneck's chapter is not weaker in this regard than the others in the volume: on the contrary, this issue is raised more starkly here than elsewhere because Olneck embroiders his statistical analysis with theoretical possibilities. Time and again the authors of *Who Gets Ahead?* are forced to admit that their data do not enable them to adjudicate among alternative interpretations of the workings of schools, families, labor markets, and firms. Instead, the best that can be said is that the elaborate analyses of the joint distributions of achievement and background characteristics "bear upon" questions of social policy in some general way. Unfortunately, it is not clear that any understanding of ways to ameliorate the conditions of the disadvantaged either in practice or in principle has been gained by the refinements and elaborations of the study of the socioeconomic achievement process over the past 15 years.

This is doubly unfortunate because, after all, the major questions of social policy closely coincide with some of the most basic questions of the way society works. What are firms doing when they reward persons with more schooling more highly? What is really learned in school? What would happen to the intergenerational transmission of inequality if children spent less time in nuclear families and more time in other child-raising situations? What would happen if formal educational qualifications were equalized or if employers were prohibited from discriminating on the basis of educational status? What would it take to alter the association between the socioeconomic levels of parents and those of their offspring? These are questions of equal concern to those who would alter the opportunity structure and attainment process and those who have a scientific interest in the structure and functioning of social institutions.

There is no shortage of speculations about these issues. Indeed Jencks himself in the final five pages of *Who Gets Ahead?* offers some good insights into the possible consequences of equalizing the credentials and resources that persons bring to the workplace. To investigate the issues, however, requires different analyses and data from those contained in *Who Gets Ahead?*—historical and comparative analyses, both within and between societies, coupled with detailed study of the behaviors of families, schools, and firms. Nonetheless, the kind of technical acumen displayed by the Harvard group and others in the analysis of achievement is required as well. Questions of basic scientific and policy interest will remain matters of speculation and ideology until the generation of researchers who have learned so well how to estimate achievement models turns to direct empirical evaluation of ideas about how stratification really works.

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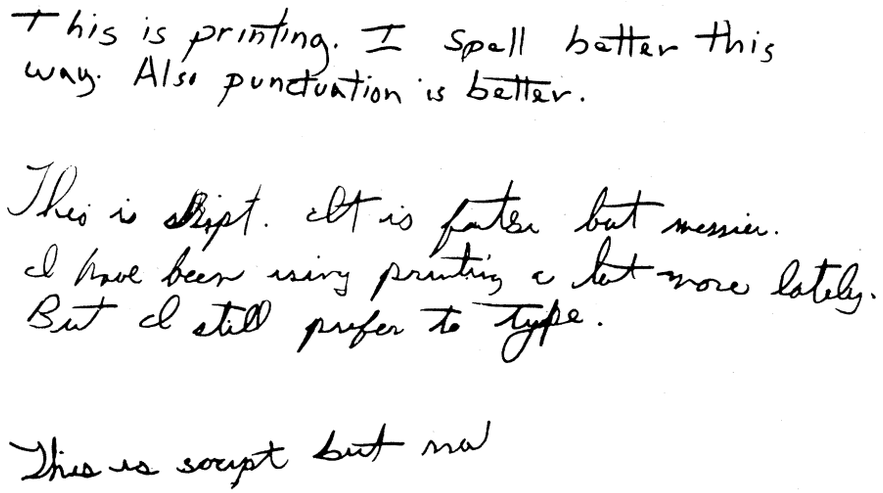
Handedness and Mental Function

Neuropsychology of Left-Handedness. JEANNINE HERRON, Ed. Academic Press, New York, 1979. xiv, 358 pp., illus. $24.50. Perspectives in Neurolinguistics and Psycholinguistics.

Any right-hander who has sat next to a left-hander at the dinner table or has faced one across a tennis net can testify to the practical significance of hand preference. But why should anyone besides baseball coaches and manufacturers of school desks care about the prevalence of left-handedness, much less its causes? The answer lies in research findings on the localization of mental functions within the brain. The right and left sides of the human brain (or more accurately the right and left cerebral hemispheres) are specialized for different cognitive operations. Language skills are organized primarily within the left hemisphere, visuospatial skills within the right. This generalization is true, however, only for a certain segment of the population—right-handers. Soon after it was first proposed that the left hemisphere had a special role in language, it became obvious that non-right-handers (that is left-handed and ambidextrous persons) had to be considered separately. Not only do they often differ from right-handers, they differ substantially among themselves. A great deal of work (much of which is reviewed in this book) has gone into determining how a person's hand preference is related to the localization of mental processes within his or her brain. Even though the exact nature of this relationship is far from clear, enough has been discovered for some investigators to use handedness as a marker for various patterns of hemispheric specialization. This allows them to deal with experimental questions not easily approached in any other way. If, for example, we accept the hypothesis that in right-handers language processes are present only in the left hemisphere, while in ambidextrous persons they are likely to be present in *both* hemispheres, it becomes possible to investigate whether lateralization of language skills to one hemisphere has some advantage over a more bilateral organization. We have only to compare the performance of ambidextrous and right-handed persons on various cognitive tasks. Similarly, if hand preference is a reliable marker, we can more easily study such issues as the role of inheritance and pathology in the origin of hemispheric specialization. Handedness has thus become an extremely important topic in neuropsychology.

The present book consists of 16 papers covering everything from the prevalence of left-handedness in artists to anatomical asymmetry of the two sides of the brain in right- and left-handers. If you are seeking a simplistic or self-consistent description of handedness research, look elsewhere. The papers in this book are directed at issues that are the center of active research and just as active controversy. Though many of the chapters are literature reviews, they are definitely theory-oriented. Often adjacent chapters review some of the same literature and arrive at quite different theoretical interpretations. Since the quality of the reviews and of the theoretical arguments is generally quite good, such conflicts serve to sharpen the issues, allowing readers both to increase their understanding and to better formulate their own views. Many of the chapters are fairly technical (dealing, for example, with the methodology for making neuroanatomical measurements or for separating environmental from genetic influences in twin studies). The writing is clear enough, however, that readers with some background in psychology should be able to follow the arguments.



Examples of writing from a left-handed subject. (Top) Printing with the noninverted hand posture. (Center) Writing with the subject's usual inverted hand posture. (Bottom) Attempting to write with the noninverted hand posture. [From J. Herron's chapter in *Neuropsychology of Left-Handedness*]

The book is divided into three sections, the first of which deals with the etiology of handedness. Why do some persons prefer to use their right hand, others their left, while still others have no strong preference at all? Some readers may be tempted to skip the first chapter since it deals with antiquated theories. This would be a mistake. Not only is it extremely well written, it provides a valuable context for subsequent chapters. Though many of the early theories (for example, that right-handedness originated because people had to hold a shield with their left hand to protect their heart in combat) may today seem bizarre or absurd, the general issues raised are still with us: inheritance versus environment, anatomy versus training, normal development versus pathology. One specific topic in this historical survey deserving of special mention is the educational fad in the late 1800's for training up the left hand so as to produce an "ambidextral culture." Proponents of this view felt that if the underutilized right hemisphere was more fully developed through training it would be possible to double brain power. The parallel with recent suggestions that modern-day education is slighting the special abilities of the right hemisphere is striking.

Most of the remaining papers in this section come down fairly firmly on the side of an inherited basis for handedness. Witelson covers in substantial detail evidence that anatomical asymmetries between the right and left cerebral hemispheres vary as a function of hand preference. If we accept the hypothesis that such asymmetries are causally related to the varying patterns of hemispheric specialization seen in right- and non-right-handers, these results would support a neuroanatomical substrate for hand preference. The next two papers examine handedness concordance among monozygotic and dizygotic twins in order to tease out genetic versus environmental influences. These two papers differ fairly sharply in their interpretation of the twin data, showing that what appears on the surface to be a straightforward approach to this question is not. The matter of pathological left-handedness due to brain damage, for example, may cloud the issue. The next chapter demonstrates that though genetic theories of handedness may predominate environmental causation is not dead. Corballis argues that in most persons a dominant gene produces a developmental gradient favoring the left hemisphere–right hand. If an individual lacks this gene, however, his or her hand preference will be environmentally determined. The exact nature of the environmental factors that could produce everything from strong left-handers to weak right-handers is unfortunately not discussed.

In the final chapter of this section, Kinsbourne proposes an interesting new model for the development of language laterality. Rather than having the left hemisphere specialized for language because it is gifted with some unique processing capacities, this model stresses the determining role of asymmetric arousal of the two hemispheres by the brainstem. Kinsbourne suggests that in situations calling for the establishment of a "response set" the brainstem selectively activates the left hemisphere. Thus, when a child is learning to speak, the left hemisphere is more aroused than the right and will therefore be more likely to acquire language skills. In non-right-handers, this brainstem selector system is more symmetrical in its activation, allowing both hemispheres to develop language to some degree. This model fits in nicely with Kinsbourne's general theoretical position on the role of lateralized attention in hemispheric specialization.

The second section deals with one of the central issues in neuropsychology: the relationship between individual characteristics (such as handedness, eye preference, and sex) and hemispheric lateralization of function. Most of these chapters concentrate on language skills. This is understandable, for language was the first set of cognitive processes shown to be lateralized and remains the best studied. The first chapter continues in the tradition of early neuropsychology by examining the patterns of deficits that follow focal brain damage. Satz reviews the various models of how language processes are distributed between the hemispheres in non-right-handers and for each model predicts an upper limit for the incidence of language disorders following unilateral brain injury. A comparison of these predictions with published data leads him to conclude that a small percentage of non-right-handers have language in their right hemisphere, while the rest have it either in their left hemisphere or in both hemispheres.

Several of the remaining chapters focus on asymmetries in the level of arousal in the two hemispheres. They suggest that, when a person is given a task that requires abilities located primarily in one hemisphere, that side of the brain becomes selectively activated. The evidence for such differential activation is indirect and correlational in nature, such as changes in relative blood flow or EEG frequency in the two hemispheres. It is also suggested that certain individuals do not show such task-dependent activation but instead have a constant asymmetric arousal related to a preferential use of one hemisphere for all types of tasks. This is the idea that there are such creatures as "right hemisphere" persons and "left hemisphere" persons. One important finding in this context is that individuals who show task-dependent activation (for example, left-sided arousal to verbal tasks and right-sided arousal to spatial tasks) perform the tasks better than do those whose balance of activation is constant.

Gur and Gur, after extensively reviewing these ideas, present preliminary evidence that non-right-handers are less likely to show task-dependent activation than are right-handers. This may be due

to their cognitive functions' being less well lateralized. Herron in a later chapter finds similar results but also shows that the sex of the subject as well as the strength of his or her hand preference is a strongly interacting factor.

One other individual characteristic that has recently been linked to the lateralization of language is writing posture. Levy has suggested that persons who hold their pen in an inverted or crooked position have their expressive language skills in the hemisphere ipsilateral to their writing hand. Thus, a left-handed writer who uses an inverted posture would have left-hemisphere language, while a left-hander with a standard writing posture would have right-hemisphere language. If this relationship is valid, we would be able to determine the lateralization of language from a simple behavioral marker—hand posture. Herron spends a substantial portion of her chapter reviewing evidence for and against this model. After much discussion of the peripheral muscular adaptations required by the two writing postures and of EEG evidence she has obtained on the relative arousal of the two hemispheres during writing, she concludes that an inverted writing posture is not indicative of ipsilateral expressive language. Instead, it may be related to visual processing of verbal material.

The third section deals with "sinistral abilities." Are there certain kinds of cognition in which non-right-handers are superior to right-handers and others in which they are inferior? If so, how does this relate to the variations in brain organization discussed in section 2? Rather than giving broad reviews of literature and theory, these papers tend to focus on specific research issues (for example, perception of tones or tactile patterns). They are closer in style and content to journal articles, presenting methodology and data in detail. One noteworthy point is an emphasis in some chapters on psychological tasks in which non-right-handers may actually have an edge over right-handers. Until recently, most research in this area appeared devoted to demonstrating the inferiority of non-right-handers on everything from intellectual to motor skills. Levy, among others, has suggested that the poor performance of non-right-handers on certain cognitive tasks is a direct result of their hemispheric organization (for example, bilateral language representation). If, however, we are to believe that individual variation in cognitive abilities results from differences in hemispheric lateralization, then we might expect non-right-handers to actually excel on some tasks. This is just what two of the present chapters demonstrate. Employing the same logic used to predict deficits in left-handers, they predict and find superiorities. One of these superiorities (tone perception) is based on performance data, the other (artistic ability) on career orientation. Even those chapters that report poorer performance in left-handers stress the need for caution in interpreting such data. In this respect, the chapter by Swanson *et al.* is especially important for educators and psychologists interested in the relationship of handedness to intelligence.

The studies presented in this volume demonstrate that hand preference is more than purely a matter of practical significance. It has assumed a theoretical importance that makes this book worth reading not only for specialists in handedness research but also for anyone concerned with how patterns of individual differences interact with cognitive performance and brain organization.

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Thirst and Drinking

The Physiology of Thirst and Sodium Appetite. J. T. FITZSIMONS. Cambridge University Press, New York, 1979. xvi, 572 pp., illus. $69.50. Monographs of the Physiological Society, No. 35.

In 1972, Fitzsimons published a review entitled "Thirst" in *Physiological Reviews*. That influential paper has altered the teaching of the physiology of thirst. Fitzsimons's view that the primary stimuli for thirst are extracellular and intracellular dehydration has displaced the older "dry mouth" theory. Eight years of research later, he has expanded and updated the 1972 paper in a book that is a masterly and definitive summary of present knowledge of thirst.

There are few textbooks or monographs written today in which the author has taken time to give a scholarly account of the history of the subject. Fitzsimons's first chapter is a readable survey of historical changes in our thinking about the stimuli for thirst. Cannon emerges from this as the malevolent influence behind the disproportionate place of the "dry mouth" theory in physiology. The second chapter, on the causes of drinking, is an interesting review of fluid balance as related to thirst signals. One of Fitzsimons's contributions has been to bring the physiology of fluid balance to the attention of researchers on drinking, many of whom are motivational psychologists. As Fitzsimons points out, "it is still unusual for a physiologist to work with that truly physiological preparation, the conscious animal. In experiments on thirst and sodium appetite we are of course obliged to."

Each chapter provides a self-sufficient, critical overview of a well-defined topic. The reader is drawn on from chapter to chapter, eager to proceed from the chapter on the comparative physiology of drinking behavior in vertebrates to read about cellular dehydration as a cause of drinking, then on to extracellular dehydration, then on to hormones involved in drinking.

Another of Fitzsimons's contributions has been his study of the role of the renin-angiotensin system in drinking behavior. By ligation of the inferior vena cava, he developed a model for producing hypovolemia or extracellular dehydration, which causes release of renin from the kidneys. He proposed that renin acts as a "thirst hormone." When their kidneys were removed, animals drank less in response to the stimulus, a finding that implies that renal renin stimulates thirst. This logic was extended by injecting angiotensin II and finding that it was a powerful stimulus for drinking in every species tested. Discussion of the role of angiotensin II in thirst and its action on the brain brings the book essentially to its climax, because the subject is at the frontier of thirst research. The mechanisms of angiotensin-induced thirst are currently being debated, and the role of the renin-angiotensin system in natural thirst is being filtered out from the numerous other mechanisms that are activated during dehydration. In the book, Fitzsimons offers "the vascular hypothesis" to explain the action of angiotensin II on the brain. He proposes that the subfornical organ and the organum vasculosum lamina terminalis, which are both circumventricular organs without a blood-brain barrier, function as extracellular fluid volume receptors. Angiotensin is viewed as causing a vasoconstriction in these regions that is detected by stretch receptors and serves as a stimulus for thirst. It is Fitzsimons's privilege to state his hypothesis, as he has, in the strongest terms, but the reader is left a little confused. If these organs act as stretch receptors, then the only necessary stimulus is a change in blood volume and not an action of angiotensin II. However, there is evidence, both from binding studies and from electrophysiological studies, that angiotensin