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

acts directly on cell membranes, which could initiate the stimulus for thirst. The stimulation of sodium appetite by angiotensin II appears to rest on a different mechanism because, as Fitzsimons admits, "only intracranial administration of angiotensin produces an increase in sodium intake. Peripheral administration of angiotensin is ineffective."

The final chapter is a salient essay drawing together the many isolated reports on clinical aspects of thirst. This provocative, scholarly, and well-written monograph will become a bible for researchers on thirst.

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Psychology and the Law

Eyewitness Testimony. ELIZABETH F. LOFTUS. Harvard University Press, Cambridge, Mass., 1980. xviii, 254 pp., illus. $15.

The Psychology of Eyewitness Testimony. A. DANIEL YARMEY. Free Press (Macmillan), New York, and Collier Macmillan, London, 1979. xviii, 286 pp., illus. $15.95.

It is probably fair to say that in judicial systems in most parts of the free world the guilty are usually convicted and the innocent set free. No system is perfect, however, and all too often miscarriages of justice are discovered, and, probably more often still, errors occur that remain forever undetected.

During the course of this century behavioral scientists have occasionally made attempts to examine the likely sources of error in testimony evidence and to investigate how juries arrive at their decisions. Often these efforts have met with opposition from the legal and law-enforcement professions, which tend by nature to be conservative. In many cases their instinct to be suspicious of innovations has served them well, for much of the experimental work reported has been poorly conducted, with little systematic or theoretical forethought.

Happily, today these objections are less valid, for in recent years there has been an upsurge of interest in relating experimental psychology and the law, and numerous laboratories are busy examining various aspects of the process that starts with a crime being witnessed and ends with a judge pronouncing sentence. The books by Loftus and Yarmey both attempt to apply principles derived from cognitive psychology to the study of eyewitness testimony. Both books are aimed at interesting lawyers and criminologists in psychological research and at instructing psychologists on the aspects of legal processes that they can tackle.

Loftus and Yarmey are each particularly interested in various aspects of memory that are fundamental to many of the errors that occur. Loftus has worked mainly on recall and Yarmey on recognition processes, and these slightly different interests are reflected in their books. Loftus devotes most of her space to her own research on verbal testimony, and Yarmey concentrates on person identification, although he generally adopts a more diffuse and eclectic approach than is found in Loftus's book.

Both authors spend time developing and applying the ideas about perception and memory first advanced by Sir Frederic Barlett almost 50 years ago. These were amplified by the "New Look" psychologists of the late 1940's and have recently been brought up to date by Ulric Neisser. Essentially, the ideas put forward by these workers are that the perception of an event may be distorted by social pressures, prior expectations, knowledge, stress, and individual needs and that the memory of an event not only may be colored by these same factors but, in addition, may be systematically altered by later information that may be factually incorrect.

Loftus's own work cleverly shows how information given after an event can influence a person's testimony about the details of the event. In one experiment her subjects saw a film of two cars colliding and were subsequently asked to answer questions about the accident. At one point half the subjects were asked about the cars "bumping" into one another, while the other half had the same question but with "smashed" instead of "bumped." At a later recall session subjects in the latter group were found to be more likely to remember, erroneously, seeing broken glass following the accident. Loftus cites numerous other experiments that explore this theme and concludes that often postevent information can actually change memory itself, rather than merely coexisting with it and producing some confusion at recall. The implications of this conclusion for criminal processes are quite obvious: collusion among witnesses and suggestions by investigating police officers and lawyers are possible sources of memory contamination that could easily lead to miscarriage of justice.

Perhaps the most dramatic instances of such errors arise when an innocent person is wrongly identified as the perpetrator of a crime. There is a growing catalog of such cases from both sides of the Atlantic, some of which are described by Loftus and Yarmey. Yarmey gives the fuller treatment of this problem and, in addition, presents a fairly detailed account of the large literature concerning memory for faces, to which he has contributed in no small measure.

This brings me to an overall criticism of both books. Neither Loftus nor Yarmey makes much effort to assess the generalizability of neat laboratory research using university students as subjects to real-life, messy problems involving the testimony of people from all walks of life. I am sure that many of the phenomena are similar in the two situations, but much more work is needed to bridge the existing gaps. The most obvious illustration of the point I am making is the likely effects on memory of a witness's extreme excitement or fear when viewing certain criminal acts. It is virtually impossible to simulate such crimes in the laboratory without crossing ethical boundaries, and so the relationship between the state of arousal experienced by a witness and his or her subsequent memory can only be assessed from actual case studies.

Here is also an example of the sorts of dangers that lie before a psychologist who acts as expert witness in a trial. Loftus, in advocating that psychologists should be willing to give their opinions on the accuracy of perception and memory, sometimes overstates her otherwise excellent case. She appears to believe, for example, that high arousal will automatically impair memory—and, indeed, shows in a small opinion study that not all students know this "fact." Actually the relationship between arousal and memory is not entirely clear, and there are some models that predict that long-term memory, at least up to a point, is improved by increasing a subject's state of arousal during stimulus presentation. It could therefore be irresponsible for a psychologist to testify that a witness who was frightened at the time of viewing a crime is likely to give less accurate testimony than a calm witness. This must remain a hypothesis until we have more