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

evidence on the matter. This example illustrates some of the difficulties in treating expert psychological evidence with quite the same degree of confidence that other forensic scientific advice has earned. But it is clear from the books of Loftus and Yarmey that forensic psychology is a field that has already made some worthwhile contributions and could easily provide much more information to help reduce the number of miscarriages of justice.

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Limitations of Judgment

Human Inference. Strategies and Shortcomings of Social Judgment. RICHARD NISBETT and LEE ROSS. Prentice-Hall, Englewood Cliffs, N.J., 1980. xvi, 334 pp. $14.95. Century Psychology Series.

The irrational, "hot" image of humans embraced by Freud and his followers has for the most part been superseded in psychology by a more rational, "cool" image. The present book takes issue with both the current flattering conception of human rationality and the earlier Freudian view. It is Nisbett and Ross's position that humans are characterized by considerable irrationality, but irrationality that stems from cognitive limitations rather than unconscious drives or conflicts.

The focus of this fascinating book is human inference, and the authors begin with the premise that the lay person, like the formal scientist, is continually involved in attempts to understand, predict, and control events. From this premise, the authors proceed to measure the "intuitive scientist" against the standard of the formal scientist. The conclusion reached by Nisbett and Ross is that the intuitive scientist, despite numerous formidable strengths, displays various shortcomings.

Nisbett and Ross describe these shortcomings as taking one of two general forms. First, the intuitive scientist in his or her everyday life fails to follow certain logical and formal statistical principles in performing the tasks of data description, covariation detection, causal inference, and prediction. For instance, the intuitive scientist often makes erroneous generalizations about populations or objects because he or she is ignorant of the problems associated with small or biased samples. Other shortcomings of this type that lead to errors in inference include tendencies to nonregressive prediction and inability to discern covariation.

The intuitive scientist also relies too heavily on certain intuitive inferential "tools" or strategies. These strategies, although generally valid, are often applied where formal principles of inference would be more appropriate. Some of the most important strategies employed by the intuitive scientist are judgmental heuristics that serve to reduce complex inferential tasks to simple judgmental operations. One such heuristic, first identified by Kahneman and Tversky, is the "availability" heuristic, which is used when judging frequency, probability, and causality. The application of this heuristic results in events' or objects' being judged as frequent, probable, or causally efficacious to the extent that they are readily "available" in memory. This heuristic is generally valid, but, because many factors unrelated to frequency, probability, or causal potency can affect the availability of objects and events in memory, its application will occasionally lead to errors.

A second heuristic, labeled the "representativeness" heuristic by Kahneman and Tversky, is used by individuals when they are faced with the task of determining the category to which an object or event belongs. Through the application of the representativeness heuristic an object is assigned to one conceptual category rather than another according to the extent to which its principal features represent or resemble one category more than the other. The representativeness heuristic is inappropriate, of course, if the known features of an object are ambiguous guides to its categorization. In such an instance the relative frequency of the categories in the population under consideration becomes the normatively appropriate guide to categorization. Unfortunately, the intuitive scientist tends to apply the representativeness heuristic even in these inappropriate contexts.

In addition to overutilizing judgmental heuristics, the intuitive scientist is also described as being unduly influenced by preexisting "knowledge structures," such as beliefs, theories, propositions, and schemas. These structures, like judgmental heuristics, are necessary to reduce the informational complexity of life but occasionally can lead to inferential errors. Knowledge structures mislead the intuitive scientist to the extent that they are poor representations of reality or preclude attention to the details of the data at hand.

The authors build their case concerning the intuitive scientist with care and conviction. Their style is lucid and accessible. Many of the data they present come from the research on attribution and social inference processes that they and their colleagues have conducted over the last decade. This work already has had considerable impact on the field of social psychology, and the expanded discussion of it here is most welcome. Nisbett and Ross also discuss extensively the influential research of Kahneman and Tversky on judgmental heuristics as well as a great deal of other research that focuses on the limitations of human judgment. The authors also relate stories about the failings of the intuitive scientist in everyday life. These anecdotes not only leave the reader with the feeling that "there but for the grace of anonymity go I," they convey the great range of situations in which the lay person is actually in the role of an intuitive scientist.

Despite the aggressiveness with which Nisbett and Ross make their case concerning the shortcomings of the intuitive scientist, they are careful not to impugn his or her general competence. Their sympathy for the intuitive scientist is nowhere more in evidence than in the chapter they entitle "Assessing the damage." Here they not only remind the reader that the intuitive scientist has many exemplary qualities, they also demur from harshly condemning his or her shortcomings. In fact, the conciliatory mood of the chapter strikes one of the few discordant notes in the book. In their attempt to avoid outright condemnation, they appear unnecessarily charitable.

Anyone interested in the human mind should read this book. Nisbett and Ross have given coherence and substance to the study of human inference and in so doing have made a significant contribution to our understanding of the strengths and limitations of human intelligence. Social and cognitive psychologists will be particularly interested in the book, since Nisbett and Ross have succeeded in forging an interface between these two fields that will be the impetus of much future exploration and debate. I suspect the book will also intensify interest in bridging the long-lamented gap between social cognition and behavior.

Like all major books, this book will generate controversy. Arguments will be made that Nisbett and Ross unjustly accuse the intuitive scientist of normative errors. Some social psychologists undoubtedly will also challenge the authors' claim that most errors of human inference reflect "cool," cognitive ori-