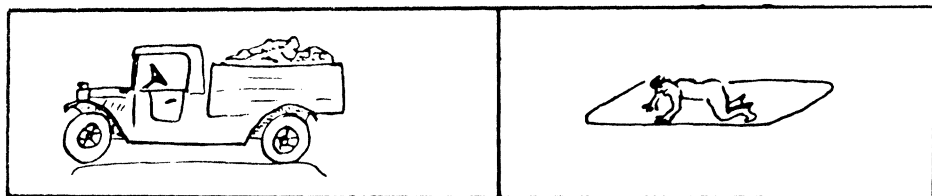


Drawing from a dream journal obtained by the author of *The Dreaming Brain*. According to the dreamer (shown, upper left, "hanging perilously from the tracks"), Rock Island locomotive 1142 (center) "has an engineer who speaks only French and therefore (*sic*) denies passengers permission to ride in the engine." [From *The Dreaming Brain*]

count for the major features of dreams, their apparently hallucinatory or delusional content, their disorientation and alteration of emotional content, and, finally, the amnesia that occurs unless wakefulness supervenes. The activation-synthesis hypothesis is interesting and provocative, but it is worth noting that we know much more about the physiology of activation than we do of synthesis. Indeed, Hobson is presented with the same nearly overwhelming problem that confronts any neurobiologist who wishes to understand human cognitive function. The complexity of the processes appears to transcend our current capacity to analyze them in a reductionist framework. Hobson clearly understands this, and he proposes a formal behavioral analysis of dreams as one beginning to the effort to attack the problem.

In my view this is both an interesting and an important book. It is the only detailed

attempt to use an experimental analysis to deal with dreams as behavior reflecting the function of the nervous system. In it Hobson makes four important contributions. First, he traces the development of our knowledge of sleep and dreaming in a cohesive and comprehensible account. Second, he shows how the techniques of modern neurobiology can be applied to behavior analysis by beginning the explication of the physiology of dreaming as a mental activity. Third, he removes dreams from the realm of mystery, particularly from the mystification of psychoanalytic dogma. This is not to state that he believes dreams are meaningless. Indeed, he clearly recognizes that dreams are meaningful behavior and that, in some circumstances, they can be employed to the dreamer's advantage. Finally, he provides a basis for a formal analysis of dreams as behavior that is not only valuable as a contri-



"Commonplace and exotic vehicles" (truck and flying carpet) shown in the dream journal. A high proportion of the drawings depict modes of conveyance. [From *The Dreaming Brain*]

bution to the field but is critical if we are to proceed in the principal challenge of neurobiology, the understanding of the human mind.

ROBERT Y. MOORE
Department of Neurology,
State University of New York,
Stony Brook, NY 11794

Learning in Simple Systems

Memory Traces in the Brain. DANIEL L. ALKON. Cambridge University Press, New York, 1988. x, 190 pp., illus. \$39.50; paper, \$14.95.

The search for memory traces in the brain has challenged researchers in the neurobiology of learning and memory. The difficulty of locating traces for specific memories has prevented most serious attempts at attacking the question of the nature of the memory trace itself. Nevertheless, RNAs and proteins have been successively proposed to be memory molecules, and ingenious theories have been devised to account (in general poorly) for the properties of memory processes. The failures of biochemists to identify clearly the chemical nature of memory traces have been attributed to the impossibility of accomplishing the double task of measuring necessarily small correlates of a specific memory and proving the specificity of any change large enough to be measurable. In the '70s, a number of laboratories decided that an alternative and more promising strategy with which to search for the "engram" was to study "simple systems," be they simple because they involve a small number of neurons or because the nature of the "learning" is (or appears) simple. The hope in pursuing such a strategy was to be able to describe the wiring diagram of the systems in such detail as to predict where the memory trace was most likely to be found, then to follow the molecular and cellular events occurring at that location during the different phases of the learning process. Although most researchers were aware that the price of such an approach was that the relatively limited behavioral repertoire restricted the memory ensemble of these systems, it was assumed that the richness of human memory was the result more of quantitative than of qualitative differences.

Memory Traces in the Brain comes out of this tradition and describes the patient and meticulous search that Daniel Alkon and his co-workers at the National Institute of Neurological and Communicative Disorders and Stroke and the Marine Biological Laboratory at Woods Hole have conducted for the last 10 years using a marine mollusk, *Hermissenda crassicornis*, as a simple system. In

the opening chapters, the author takes the reader through the successive steps of the complex analysis of the selected behavior (classical conditioning), the neuronal circuitry involved in this behavior, and the neural changes observed during learning. The description of the learning paradigm that has been studied (association between a light stimulus and rotation) is used to illustrate the constraints imposed upon any underlying mechanisms by the properties of the learning. The wiring diagram is then presented (schematically in the text but in exquisite detail in the appendix), and the author demonstrates that the anatomy of the system dictates the location of the memory traces. A brief (too brief perhaps) description of the basic mechanisms involved in neuronal communication is provided in order to allow the reader to follow what constitutes the main and most interesting part of the book. The author gives a clear presentation of the biophysical nature of the changes in membrane properties that accompany learning and shows how these modifications are sufficient to account for the learning and the retention of the association between stimuli. This section is followed by a less successful attempt at presenting a hypothetical chain of biochemical events, including protein kinase activation, protein phosphorylation, and protein synthesis, which is ultimately responsible for the formation of the memory trace. Whereas until now the author was using data obtained only in *Hermisenda*, this section introduces data obtained in a different preparation (rabbit hippocampus) to complete the model. Most of the evidence in favor of the model is rather indirect, and the book conveys the false impression that the essential steps of the biochemical machinery have been discovered. It is also confusing to read that an inhibition of protein synthesis is associated with an increase in turnover of messenger RNA, and one wonders about the putative changes in DNA synthesis—are the neurons still dividing? Moreover, the mixture of hard data and speculative interpretation or extrapolation is not always well balanced.

The last chapters of the book present some recent data that suggest that similar mechanisms might account for classical conditioning in rabbit brain, more specifically in the hippocampus, a structure that has been shown to play a critical role in memory formation in mammals. The author can then make a relatively strong argument that most of the learning mechanisms discovered so far in "simple systems" are remarkably similar, thus a posteriori justifying the approach. The similarity of the biophysical mechanisms present in hippocampal neurons and

in *Hermisenda* is exploited to present a model for associative learning in mammals based on the principles discovered in *Hermisenda*.

Overall I found the book interesting, not only because of the information it contains but perhaps even more because it raises more questions than it provides answers. It will undoubtedly generate new experiments, since several aspects of the general hypothesis can be tested, as well as much discussion among the researchers in a field already rich in controversy. It represents a good example of what can be done with a simple-system approach, even though a question persists after one closes the book: *Is it that simple?* The author is well aware of the problem, and at the same time that he leads us with

the assumptions that all learning is reducible to the formation of associations between stimuli and that the traces formed by the associations can be found in simple systems, he recognizes the possibility that additional mechanisms have evolved in mammals and especially in humans that could account for most of what we would call learning and memory. The book should be of interest to a wide range of readers and especially to biology students and to researchers from other fields who want to know more about the biological bases of learning and memory.

MICHEL BAUDRY
Center for Neurobiology of
Learning and Memory,
University of California,
Irvine, CA 92717

Contending with Language

Cultural Models in Language and Thought.

DOROTHY HOLLAND and NAOMI QUINN, Eds. Cambridge University Press, New York, 1987. xii, 400 pp. \$49.50; paper, \$15.95.

Discourse and the Social Life of Meaning.

PHYLLIS PEASE CHOCK and JUNE R. WYMAN, Eds. Smithsonian Institution Press, Washington, DC, 1986. 232 pp., illus. \$22.50. Anthropological Society of Washington Series.

Cultural anthropology is in the throes of an identity crisis. Like other social sciences, it is having its "inward turn"—its time for self-questioning and self-reflection. Some anthropologists see this turn as a coming of age as anthropology frees itself from the shackles of a borrowed positivism, renews faith in its distinctive methodology, and develops its own theoretical stance. Others see it as a "navel gazing" that leads nowhere. Anthropology has always been riven with conflict—over its status as a discipline (is it a science? is it an art?), its theoretical orientation, its methodology, its purview. Some have argued that it is not a discipline in any traditional academic sense of the word but an "approach" that is mastered in the doing, and they take a certain arrogant pride in this Wild West pragmatism. Others argue that it is precisely the lack of definition that has to be corrected by the development of rigorous methodologies and epistemologically sophisticated delimitations of the field. And still others take a middle-of-the-road position. They argue that anthropologists do many things, some of which can be treated with scientific rigor and some, perhaps less systematically, with literary and interpretative finesse.

A concern for language, for discourse and

text (and, by implication, for meaning), has recently become the arena for the articulation of these positions. Many of the data anthropologists collect are, after all, linguistic and can be subject to rigorous linguistic analysis. They can also be subject to subtle literary critical interpretation. Most anthropologists who opt for the literary critical approach recognize its (traditional) limitations: its failure to regard the literary work as a cultural artifact whose conditions of production have to be understood. A few (and I have some sympathy for their concerns) have succumbed to the lure of Theory, that grab bag of epistemological niceties, of readings and misreadings of Nietzsche, Marx, Freud, Saussure, and Lévi-Strauss, of involuted plays with discourse and metadiscourse, with the dynamics of interlocation, and with the presumptive referentiality of language and its performative, its illocutionary and perlocutionary, effect that has captivated many of today's literary critics.

Proponents of both the linguistic and the literary approaches are represented in the two collections under review. *Cultural Models*, the more "scientific" of the two, is concerned with the organization of "cultural knowledge"—those shared presuppositions about the world that so easily elude formal linguistic and cognitive analyses and are perhaps the greatest hindrance to progress in Artificial Intelligence. Such cultural knowledge is organized, Holland and Quinn, the editors of the volume, argue, in sequences of prototypical events they call "schemas" or "cultural models" that are hierarchically related to one another. And many of the 15 contributions to this volume are attempts to render explicit such models (of