Surprisingly, most of these workers have evaded the question of how the adult fluke actually procures host blood when surrounded by grossly thickened bile-duct walls.

One of the most astonishing of all trematode life cycles is that of the lancet fluke (*Dicrocoelium dendriticum*), a trematode of importance in sheep and cattle. The story of how the larva in the ant host produces a kind of "lockjaw" that anchors the ant to a plant, thereby making it vulnerable to ingestion by a browsing sheep, so taxes my credulity that I wanted to know what Erasmus makes of it. I looked in vain, for Erasmus considers the life cycle "well-known." So, although much attention is given to the migration of larval trematodes, the antics of this strange and important larva are not mentioned—and Hohorst and Lammler, who described them, are not to be found in the author index. Indeed, Erasmus seems rather capricious in his choice of references. Considering the multitude of references that had to be omitted, one wonders about the need for references in support of the conclusion that we do not yet understand the final step in the localization of *Fasciola* in bile ducts.

For the experienced researcher or teacher, the book's unorthodox selectivity is likely to be one of its great strengths; for the advanced student the emphasis on modern developments will be a similar strong point. Despite some discrepancies between text and indices and some inconsistencies in terminology the book is an accurate compilation of reported observations. It is comprehensive within its chosen limits and makes readily available a vast amount of information on this very important group of parasitic worms.

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Semantic Memory Models

Organization of Memory. A conference, Pittsburgh, 1971. ENDEL TULVING and WAYNE DONALDSON, Eds. Academic Press, New York, 1972. xiv, 424 pp., illus. $17.50.

This volume serves the valuable function of documenting the recent emergence of semantic memory as a central concept in psychological thought about language and memory. "Semantic memory," as the editors state in the preface, "is concerned with storage and utilization of knowledge about meaning of words, concepts, relations among them, and rules for the use of such knowledge." Semantic memory is by no means the only topic covered in this symposium, four of the papers being very competent reviews of memory organization written with emphasis on various current problems including organization in free recall, measurement of organization, and organization and recognition memory. A fifth article, by Greeno, about an imaginative sequence of studies on the learning of mathematical formulas, is rather misplaced in this volume. In this review, I will confine my attention to the remaining five papers, all of which are concerned with semantic memory.

A major purpose of Bower's contribution is an attempt to answer the question "How far can you get without a semantic memory?" He describes FRAN—a program written by John Anderson which uses a simple association network to simulate human behavior in free recall tasks. A free recall task is one in which the subjects learn lists of words and are free to recall them in any order they choose. Like all the memory models to be discussed below, FRAN consists of a data base representing information in long-term storage and a processor that operates on that data base. Its data base, the association network mentioned above, consists of 262 words—all nouns—each of which is linked to some of the others by simple associative bonds. Two words are linked if either appears in the dictionary definition of the other. All the bonds are of the same kind. The task is to learn a list of, say, 24 words from the data base and later to recall them in any order. To perform this task, FRAN makes use of a probabilistic learning process which tags these items in the data base and finds and marks associative pathways in the data base between tagged items. In recalling the list, FRAN, starting from a small set of remembered items, searches along marked pathways to find other list items.

This relatively simple scheme performs remarkably well in simulating free recall in humans. Its learning is influenced in just the same way as is human learning by the amount of time spent studying the list, the length of the list, the position of the to-be-remembered word in the list, and a surprising number of other such variables. In a very few cases, FRAN has clearly failed to simulate human behavior in standard free recall situations. Despite an occasional failure, however, Bower has ample reason to claim that "FRAN is the most powerful explicit model of free recall now available." Only when we go beyond the usual limits of the free recall experiment does FRAN begin to fail seriously. For example, if the list of words to be learned is structured as a sentence, people learn it much more rapidly than they do a list of the same words in scrambled order. For FRAN, however, all word orders are about equally memorable, since none is intelligible to it.

What can we conclude from FRAN's successes and failures? First, we can agree with Bower that, if one stays within the confines of the usual free recall experiment, there is very little reason to prefer a semantic memory to FRAN's simple associative network. This fact, we should note, may be taken either as an indication of the failure of the more complex models or as an indication that the standard free recall experiment fails to reveal some of the interesting processes of human memory.

The failure of FRAN to understand language was, of course, expected. If the semantic memory models are to be judged an improvement over FRAN and other simple associative models, they must successfully simulate a human behavior which depends on language comprehension. Winograd's [*Cognitive Psychol.* **3**, 1–189 (1972)] success in designing a program that understands natural language in a highly restricted environment is a sign that successful simulation of human comprehension may not be far off.

Three of the papers in this volume —by Rumelhart, Lindsay, and Norman; Kintsch; and Collins and Quillian —are directly concerned with the design of semantic memory systems. The three approaches have much in common. They all include a semantically structured data base, that is, one in which the concepts are linked by many types of relations (rather than just by associations) in ways that facilitate the representation of the meaning of sentences. In the Rumelhart, Lindsay, and Norman model, for example, the data base employs the relations subset of, property of, location of, actor, instrument, and at least a dozen more. The memory representation of the sentence "The rock rolled down the mountain"

includes the relations "OBJECT, ROLL, ROCK," "TIME, ROLL, PAST," and "PATH, ROLL, DOWN THE MOUNTAIN."

The three systems attack many of the same problems. For example, all are concerned with economy of storage. Kintsch's treatment of this problem is the most detailed. He proposes a set of deletion rules for removing redundant information from the memory store and a parallel set of inference rules which will generate the deleted information (and presumably much more). Among Kintsch's deletion rules is one that has the effect of removing the last of the following three sentences from memory:

A collie is a dog.
A dog is an animal.
A collie is an animal.

A second rule has the effect of changing sentences such as

Poodles, setters, and collies bark.
Poodles, setters, and collies are dogs.

into

Dogs bark.
Poodles, setters, and collies are dogs.

This second rule of Kintsch's appears to encompass the treatment of this problem by the other theorists, although they would likely hold that the rule operates by preventing information from entering memory rather than by removing it from memory.

The various approaches differ from one another in important ways. For example, Kintsch defines as semantically acceptable those propositions that can be generated from memory by the inference rule. He treats metaphors as semantically unacceptable propositions to which a special set of analogy rules apply. In the view of Collins and Quillian, however, "there is a continuum from semantic acceptability to metaphor to anomally," so that it is appropriate to deal with acceptability and metaphor by a single process rather than by two processes.

None of the three approaches has yet reached a sufficient state of development to allow testing of more than a small part of its full capability. All are rich in ideas. In the next few years, experience in implementing them and in comparing the implementations to human behavior should yield a great deal of insight into the nature of human memory.

In the final contribution to the volume, Tulving proposes an extremely interesting distinction between memory processes that are semantic and those that are episodic. He defines episodic memory as a highly autobiographical process which records personal experiences in spatial and temporal relation to other such experiences. Such items of information as "Before I went to the grocery store, I met George in the bank" and "The second item on the list was 'FAP' " would be recorded in episodic memory. Semantic memory is "the memory necessary for the use of language. It is a mental thesaurus, organized knowledge a person possesses about words and other verbal symbols, their meanings and referents, about relations among them, and about rules, formulas, and algorithms for the manipulation of these symbols, concepts, and relations." Such items of information as " 'DO' is a verb," "All birds have wings," and "Two plus two is four" would be recorded in semantic memory. He notes that "laboratory studies of human memory and verbal learning have almost exclusively been concerned with phenomena of episodic memory."

Tulving says, "If it is true that past research in human learning and memory has been concerned primarily with episodic memory, and if it is true that classroom learning has little to do with students' remembering personally experienced events, then it is not surprising that empirical facts and theoretical ideas originating in verbal learning and human memory laboratories have little bearing on theory and practice of acquisition of knowledge." The exciting possibility is that with the advent of studies of semantic memory, psychologists are turning to topics that will be rich in implications beyond the laboratory.

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Power in the Domestic Sphere

Male Dominance and Female Autonomy. Domestic Authority in Matrilineal Societies. ALICE SCHLEGEL. HRAF Press, New Haven, Conn., 1972. xvii, 206 pp. Cloth, $8; paper, $6.

Societies with matrilineal descent systems have long fascinated Europeans. Perhaps the most puzzling, and interesting, fact of matrilineal organizations is that authority over material resources and over persons (especially women and children) is split between a man and his sister's husband (or a man and his wife's brother). Curiously enough, and contrary to the matriarchal evolutionary myth, these arrangements involve allocating authority among men, not among women. Although women control access to lines of descent, nowhere do they exercise primary authority over the descent group. Recently, Schneider, Gough, and others have discussed the characteristics of matrilineal systems in a more comparative framework. Particular emphasis has been placed on examining the structural consequences of the distribution of authority.

Schlegel's book is a cross-cultural study of various solutions to this "matrilineal puzzle" (as Audrey Richards called it). Schlegel differentiates between domestic groups and descent groups, and chooses to confine her inquiry to the domestic sphere. She concludes that there are three basic forms of adult male dominance: dominant husband, dominant brother (wife's brother), and balanced dominance between husband and brother. ("Brother" stands for "male consanguines in the woman's descent groups.") A further finding is that the total amount of male authority over women is less in the societies where affine and consanguine males have a balance of power than in either of the other two. An obvious conclusion, which Schlegel doesn't make explicit, is that women win power when their men split theirs and that for females, as well as males, the rule of divide and prevail seems to operate.

There are relationships between authority and the forms and variants of preferential cross-cousin marriage, as well as strengths of incest prohibition within the nuclear family. Husband-dominant societies are associated with matrilateral cross-cousin marriage and with father-daughter incest's being regarded as worse than the brother-sister type. Brother's dominance is associated with patrilateral cross-cousin marriage and with brother-sister incest's being regarded as worse.

Sampling problems, data quality control, Galton's problem, and coding reliability are all adequately handled and, more important, adequately reported in the book. Especially useful and unusual is the complete list of page references for each coding.

After a long series of 2×2 correlations of the authority type with 40 other variables by means of χ^2, Schlegel concludes that there are strong