that performance was limited by the fact that the human operator could process only a relatively small portion of the information available to him. As a result, investigation turned to how the human allocates his limited resources among different informational inputs.

One important early influence on these studies was the development of information theory by Shannon and Wiener in the 1940's. Experimental psychologists hoped that the theory of selective information would provide them with a universal metric for specifying the amount of information in various stimulus displays. As it turned out, however, the development of cybernetics and the related discipline of artificial intelligence had a greater influence on the information-processing approach, whose practitioners have gone on to create many ingenious experimental arrangements for isolating and operationally specifying the mental structures and operations ("routines" and "subroutines") that the human employs to accomplish a variety of tasks.

Garner's work has followed a different path. He was in the forefront of those experimental psychologists who sought to exploit the possibilities of an information metric. His earlier book *Uncertainty and Structure as Psychological Concepts* (1962) presents the culmination of that approach. Since its appearance experimental psychologists, including Garner, have generally abandoned the information metric as an independent variable. But in doing so the information-processing psychologists have lost sight of the real contribution of information theory. At the end of his lectures, Garner makes this telling point (p. 190):

> As much as I generally like the information-processing approach to the study of perception, I do at times worry that the stimulus, that which provides the information part of information processing, is being neglected too much. We must understand the nature of information if we are to understand its processing.

Garner repeatedly emphasizes that the lesson of information theory is that the information is carried not by what the stimulus is but by what it could have been. One message of these lectures is that the information-processing approach cannot reach its full potential until it recognizes and acts upon this lesson. Garner's own work focuses on the stimulus rather than on the processor. In his system, a stimulus can be characterized by its values on a number of dimensions. All the combinations of values generated by the dimensions defines the *total set* of stimuli of which the particular stimulus is an instance. The informational properties of the stimulus can be determined only in relation to its total set. So one of Garner's major independent variables is the size of the total set. This much of his system is what was standard in the early applications of information theory.

But Garner adds the important concept of the *inferred subset*. The perceiver deals with the stimulus not only in terms of the total set but, more importantly, in terms of the subset to which it belongs. The smaller the inferred subset, the more the stimulus corresponds to a "good figure" in the sense of Gestalt psychology. So another of Garner's independent variables is the size of the inferred subset. Subsets by definition contain redundant stimuli. Subsets of the same size from a given total set all have the same amount of redundancy but can differ significantly in the form it takes. And, as Garner amply demonstrates, the form of the redundancy, or the structure, is crucial in its effects upon the human processor. Garner is at his best in demonstrating that redundancy per se is neither good nor bad but that its effects upon performance depend on the kind of redundancy in relation to the kind of stimulus dimensions and the task requirements.

Garner is widely recognized as one of today's leading experimental psychologists. So far as I can tell, those psychologists who are at the forefront of the contemporary information-processing approach readily concede that his research is important and provocative. Yet they seem at a loss about how to connect it with their own work. Along with the difference in orientation toward processor and stimulus go differences in experimental strategies and in ways of conceptualizing and talking about the data. Information-processing psychologists organize their experiments and discussions around concepts that refer to internal mental entities—mental structures and mental operations. Garner organizes his around stimulus properties, on the one hand, and a variety of experimental tasks, on the other. The information-processing psychologist uses different stimulus materials and a variety of tightly constrained tasks to focus upon a single mental structure or process. Garner exhaustively analyzes a stimulus structure by varying tasks in which it is used over a wide range of constraints and mental operations. Garner is inductive in his approach. He employs converging operations to allow the concepts to emerge and be explicated. The information-processing psychologist is more deductive. He postulates models of the mechanism under study, derives testable consequences, and devises his experiments to test these consequences.

Garner and his associates are thus actively pursuing a creative and productive program of research that so far has had little impact on information-processing psychology. It seems obvious that the two approaches should complement one another. Certainly, as Garner says in his concluding lecture, we need to understand what both the environment structure and the perceiver contribute to the actual performance, and Garner has many important things to tell us about how performance may be understood or partially accounted for by a more sophisticated treatment of the stimulus. It is to be hoped that either Garner or the information-processing psychologists will soon find a way to bridge the gap between them.

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Lipid Biochemistry

Form and Function of Phospholipids. G. B. ANSELL, J. N. HAWTHORNE, and R. M. C. DAWSON, Eds. Second edition. Elsevier, New York, 1973. xiv, 494 pp., illus. $45. B.B.A. Library, vol. 3.

This is the second edition of a work that was first published in 1964. The intervening ten years have seen marked increases in our knowledge about phospholipids. We now have a rather complete picture of their chemical structures and an understanding of most of the enzymatic reactions involved in their biosynthesis. Moreover, a picture of the physical arrangement of phospholipids in membranes and the different modes of their interaction with membrane proteins has emerged. All these developments have been incorporated into the revised edition, with the result that for all purposes it is a new work.

The editors have compiled 15 chapters, some written by them and some by other experts in lipid biochemistry, that cover almost every conceivable

aspect of the metabolism of phospholipids in plants, animals, and bacteria. The transport of phospholipids in the hepatoportal system is a complex subject that is clearly summarized. In addition, there are comprehensive chapters on the chemical and physical properties of phospholipids.

It has long been clear that the phospholipids in biological membranes serve as the primary permeability barrier. Although specific functions for individual lipid classes in membranes have been suggested on many occasions, there is little direct evidence to support these suggestions. Two chapters in this book deal with this issue. One is a comprehensive summary of phospholipids in the nervous system that includes a consideration of their function. The other deals with the metabolism of phospholipids in relation to transport of material across the cell membrane. The concluding chapter should prove particularly valuable because it provides, in tabular form, compositional analyses of the phospholipids of a number of animal tissues. In addition, analyses of the phospholipid composition of subcellular fractions of different tissues from various animals are reported. All the chapters have comprehensive bibliographies, which in some cases contain references as recent as 1972. This book will stand as *the* treatise on phospholipids for some time to come.

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(Continued on page 760)