Graphic Conceptual Models

A report in brief by George Kent

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Graphic conceptual models for the explanation of communications have been proposed in several AVCR articles. Since these diagrams in themselves are means of visual communication, they are worthy of analysis. Semanticists have studied the relationships between words and their referents and have devised rather comprehensive rules for their good and proper use, but a similar set of principles for the evaluation and use of this kind of diagram has not yet been developed.

The term model is used here to mean a diagrammatic representation of a theoretical system, used to illustrate its elements and their interrelationships. They are schematic, abstract and, very frequently, generalized. Illustrative examples are those previously described in AVCR, the familiar Shannon model (7:5), block diagrams used in electrical engineering, and the flow charts used to describe the procedure of policy-making and many other processes. We shall attempt here to establish a rationale for the usefulness of these graphic conceptual models, and we shall also survey some of their more important practical and theoretical characteristics as a means of communication.

Function and Value of Models

The function of a model in any particular situation depends on the purposes of the person using it. The ultimate test of the value of a model, therefore, is its utility for the particular individual. There are, however, several values, or reasons for using them, which are generally true for all users. As suggested by Karl Deutsch, two of the major functions of models are the heuristic and the organizing functions (1). Although these are closely related, they can be described separately.

Heuristic Function

Models can be useful to students because they provide a different way of "looking at" certain theories or ideas, and it is well known that to explain a complex idea in a new way can often be extremely helpful. Models provide an alternate point of view.

Over and above that, the visualization of an idea has special values in itself. Some people are more visually-oriented
than others, and for them a concept which is obscure in its verbal form often can be made clear through the use of a diagrammatic representation. Further, more can be absorbed in a short time through the visual sense. This faster intake provides one of the most important elements of effective communication: rapid access to information. And because the eye can scan a diagram quickly, there is a more or less simultaneous presentation of its various aspects to the mind, rather than a sequential presentation as in purely verbal explanations. All of these factors contribute to the value of models as teaching devices.

Organizing Function

Deutsch described the organizing function as meaning “the ability of a model to order and relate disjointed data, and to show similarities or connections between them which had previously remained unperceived (1:360).” Models of the kind to which we refer are especially able to fulfill this function because they are flexible and generalized. The same model system can be used to describe a process at virtually any level of abstraction, and to describe almost any particular situation, no matter how simple or how complex.

Since the same model system may be used to illustrate processes at various degrees of complexity and abstraction, the similarities between represented systems become immediately apparent. Correspondences between different situations become clear from the similarities in the models used to describe them.

While referring to communications models, Bruce Westley described the organizing value of graphic models in this way:

Conceptual models are efforts to stake out significant concepts in the field, to codify scattered findings of the past and weave them into a single conceptual framework which will give direction and focus to future work (9:225).

Introducing their own conceptual model, Westley and MacLean said:

We are trying to develop a single communications model which may help to order existing findings. It also may provide a system of concepts which will evoke new and interrelated research directions, compose old theoretical and disciplinary differences, and in general bring some order out of a chaotic situation (8:3).

Because the same point of reference, the model, is used, associated theoretical principles become more closely related to one another, and the total theoretical system tends to become more organized, integrated, and unified. Thus, in any field, a conceptual model is an aid toward synthesis of theory.

To describe these two basic functions in a different way, we can consider models (a) as an aid to teaching and (b) as an aid to thinking. They serve as an aid to teaching by providing a vehicle for conveying thoughts from one person to another. Models also help us in thinking by articulating the raw material for the formation of ideas. Although we shall take up the language character of models shortly, an observation by Peter Roget, compiler of the Thesaurus, can be appropriately cited here.

The use of language is not confined to its being the medium through which we communicate our ideas to one another; it fulfills a no less important function as an instrument of thought; not being merely its vehicle but giving it wings for flight. . . . Into every process of reasoning, language enters as an essential element. Words are the instruments by which we form all our abstractions, by which we fashion and embody our ideas, and by which we are enabled to glide along a series of premises and conclusions with a rapidity so great as
to leave in the memory no trace of the successive steps of the process; and we remain unconscious how much we owe to this potent auxiliary of the reasoning faculty (6: ix).

These characteristics of verbal language can also be found in the language of models.

Limitations of Models

Models do, of course, have a number of limitations and disadvantages. Probably their greatest weakness is that they often seem to oversimplify highly complex phenomena. They have only a very few of the characteristics of the systems that they are used to illustrate.

But this reduction of the number of characteristics taken into consideration at any one time is simply the process of abstraction, a process which must be performed (cf. 4:168-170). “We use maps or anatomical atlases precisely because we cannot carry complete countries or complete human bodies in our heads (1:357).” Complex processes or systems cannot be studied without first being reduced to manageable proportions. By discarding detail irrelevant to his immediate purposes the student or scholar can better focus his attention on what does concern him.

The limitations and difficulties encountered in the use of graphic models do not differ in character from those encountered with the use of words. The problems that do arise are due primarily to the fact that the language of graphic models is still in its infant stage, and has not yet developed as fully as the language of words.

Language of Models

As we have suggested, models use a language of their own. The graphic elements of a model, its lines, blocks, arrows, etc., are its vocabulary, and its rules of organization are its grammar. Just as is true with words, the elements in a conceptual model do not have a direct and immediate relationship to elements in the world of physical reality. Rather, they are abstractions of their corresponding real-life entities, and thus cannot be expected to have all of their characteristics.

The common vocabulary of models is still small and crude. There are only a few basic elements that are widely known: closed blocks, which indicate discrete elements or subsystems; connecting lines, which indicate some functional relationship between terminal elements; and arrows, which indicate direction of flow. Similarly, very few rules of grammar in models have been broadly accepted. One such rule is the notion that a model should, where possible, “read” from left to right.

Design and Use of Models

Because of the present limitation in the degree to which the symbol systems of models are shared, specialized usages and forms should be explained in every application. The meanings of some of the basic elements used in diagrams may seem—especially to their author—to be natural and obvious, but it must be recognized that their meanings are in fact learned, just as new words are learned. Much of the knowledge of semantics could be usefully applied to the study of models as a means of communication.

The difficulties encountered in the use of models can be overcome by being certain that the definitions, limitations, and assumptions associated with any given model are explicitly stated. Those who are not accustomed to dealing with visualized representations of theory often do not have a good command of the
vocabulary of graphic models, and thus it is necessary that the proper interpretations of the various symbols be explained. A model by itself does not and can not explain theory, and it cannot be treated as a substitute for theory. A model is useful only as an aid in the thinking and teaching processes.

Models take the place of words by representing, in abbreviated form, complex theoretical systems. But a graphic model alone cannot explain anything; verbal language is always needed for explaining the proper interpretation of the model. The language of models and the language of words complement each other, and the two together can often be used to communicate more effectively and more efficiently than either one alone.

REFERENCES