THE LOGIC OF QUESTIONS AND ITS RELEVANCE TO INSTRUCTIONAL SCIENCE*

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ABSTRACT

This paper discusses the notion of a logic of questions, its relevance to instructional science, and the problems involved in developing a logic of questions that will be adequate from the standpoint of instructional science. Several systems of question logic — particularly those of Belnap and Åqvist — are noted. The notion of pedagogical question, in a wide sense of "pedagogical", is discussed. A system adequate to deal with pedagogical questions will be an erotetic logic in a wide sense of "erotetic", covering not only individual interrogative sentences but also sets of sentences of various kinds, and sets of appropriate replies of various kinds. An erotetic logic of this sort is outlined in the paper and more fully in the Appendix. Questions are then raised concerning its adequacy.

Introduction

To clarify the idea of a logic of questions it will be useful to begin with a look at mathematics. On the one hand, and probably earliest in time, there are the human activities of counting, comparing, measuring, bargaining, and trading. These are carried on in a language having certain expressions for numbers, comparisons, and the like. Then, on the other hand, humans develop systems of counting and measuring, and perhaps also theories about the nature of numbers and measures. These systems might have been foreshadowed in a crude and fragmentary way by the grammar of the language; what is new is that these systems are now made explicit, are refined and filled out. Mathematicians study these systems, evaluate them, and integrate them in higher-order systems. In the course of their study mathematicians come upon new concepts, systems, and entities — such as the number zero, non-Euclidean geometries, or the

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continuum of real numbers — entities that were not envisioned in the original activity or the original language but that can now enhance theory and facilitate practice. The refined systems of counting and measuring generate new mathematics at more and more abstract levels, but they also continue to serve their original purpose; they stand as tools that can be used whenever needed to aid the original activity — to provide illumination, critique, or detailed guidance.

Look next at human communication, the sort used for information exchange. First there are the activities of asserting, denying, stating, describing, and the like. These are carried on in a language primarily by means of declarative sentences. The grammar of these sentences is explored by linguists; the art of asserting and describing is developed by journalists, novelists, and others. In addition to the activity, the grammar, and the art, however, there is the logic of stating, or more abstractly the logic of statements. Humans develop systems for correctly asserting, validly arguing, and the like. These systems are made explicit and are gradually refined and filled out; logicians study, compare, extend, and integrate them. In the course of this study logicians come upon new concepts, systems, and entities — such as the null entity in the theory of descriptive phrases — entities that were not envisioned in the original activity or the original language but now can enhance theory and facilitate practice. The refined systems of asserting generate new logical theory, but they also continue to serve their original purpose; they stand as tools that can be used whenever needed to aid the original activity — to provide illumination, critique, or detailed guidance.

In this light, look at questions. There are the activities of asking questions, posing problems, and the like. These are carried on in a language by means of interrogative and other sentences. The grammar of these sentences is explored by linguists; the art of questioning is developed by teachers, lawyers, doctors, and others. In addition to the activity, the grammar, and the art, however, there is the logic of questions. Humans have developed systems for asking valid questions, giving direct answers, correcting invalid questions, and the like; we should expect that these systems will be made explicit, refined, and filled out. Discussion of questions and their logic is a relatively old activity, dating at least from Aristotle, but until recent years the discussion has been fragmentary and

1 There has been much philosophical controversy concerning the nature of logic and its relation to natural language. For a presentation of logic that emphasizes its usefulness in connection with arguments in natural language, and for presentation of a theory of descriptive phrases and discussion of the null entity, see Kalish and Montague (1964).