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PROBLEMS OF REPRESENTATION IN HEURISTIC
PROBLEM SOLVING; RELATED ISSUES IN THE
DEVELOPMENT OF EXPERT SYSTEMS

by

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STUDY AREA: Artificial Intelligence

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ABSTRACT

The problem of representation in problem solving is concerned with the choice of formulation of a problem for a system which is organized in accordance with a given problem solving schema. Key issues are: (a) understanding the relationships between such a choice and the efficiency with which the system can be expected to find a solution to the problem; (b) finding ways of choosing an 'appropriate' problem formulation - from the point of view of minimizing the computational effort needed to construct a solution; and (c) finding ways of shifting from one problem formulation to another in a manner that increases problem solving performance. Progress in this difficult area has been stimulated in recent years by work on expert systems and by related research on theory formation and expertise acquisition. In this paper, a conceptual framework is presented for handling problem representations. The grammatical specification of solutions for a problem class plays an important role in this framework. A detailed analysis of representational shifts in a specific class of problems - the Tower of Hanoi problems - is presented in terms of the proposed framework. Ten formulations of this class of problems are considered in the context of production, reduction and relaxed reduction schemas of problem solving. Possible developmental paths for moving between these formulations are explored. The emphasis is on an analysis of the acquisition and transformation of various bodies of knowledge that are components of problem formulations, and on the characterization of problems encountered in trying to mechanize knowledge transformations that lead to problem formulations of increased power.

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