MENTAL REPRESENTATION IN MULTISTAGE DECISION MAKING

by

OSWALD HUBER

University of Salzburg/ Austria

Abstract: This paper is about multistage decisions. In this type of decision problems the decision maker performs a series of interdependent decisions. Throughout the paper a simple investment task is referred to, which can be interpreted as a multistage betting game. This task is described in section 1, and also a specific operationalization (breeding lizards task). In Section 2 a first coarse analysis of the the general process of dealing with a multistage task is presented. Five global subprocesses are distinguished. One of these concerns the mental representation of the system the decision maker has to control. This topic is dealt with in greater detail in section 3. Section 4 concerns the decision maker's perceived control of the target system, which is related to the concept of locus of control of reinforcement. In section 5 the function of the mental representation in the definition of goals is discussed. Sections 4 and 5 contain some experimental results.

Decision making under risk and uncertainty has been studied most often as a static or single-stage task. In a single-stage decision problem the decision maker's task is to make one decision. The unit of theoretical analysis is one single decision, even if the decision maker performs a series of such single-stage decisions. In the latter case the single-stage decisions are assumed to be independent. Multistage decision theory concentrates on series of decisions as units of analysis explicitly. This type of analysis rests on the assumption that the decisions in a series are interdependent. Many everyday situations can be regarded as a multistage decision task, in which a decision maker has to govern a system by series of decisions. Examples are an executing manager and the factory he/she is in charge of, a head of a department and his/her department, or a person and his/her personal economical situation.

A typical task in multistage decision making is a simple investment task. In such a task the decision maker tries to increase his/her capital in a series of trials (stages). Anything valuable to the decision maker can be the capital, for example, money, time, social relations, published papers, and so on. If the decision maker wants the capital to increase he/she has to invest something valuable in each trial.
Mental Representations

(for example, any proportion of his/her current capital, work, time, etc.). However, the outcome in each trial is not in the hands of the decision maker, but depends, for example, on random events. If the decision maker is lucky, the capital increases, if not, the investment is lost. The decision maker has to decide in each trial how much to invest. The gamble ends when the decision maker has lost the whole capital, or after a number of trials fixed in advance.

Such an investment task can be interpreted as a multistage betting game, that is a gamble, which is played repeatedly. Decisions in this gamble are clearly interdependent. If, for example, in trial n the decision maker invests nearly all the capital and loses he/she has left only a small part of the capital at his/her disposal in trial n+1. In analyzing a multistage decision process the theoretical framework of system theory (for example, KLIR, 1969) is useful. The multistage process is interpreted as an interaction between a decision maker and an (open) system S (for example, the factory the decision maker has to govern), see also MACKINNON & WEARING (1985). I call the system S the decision maker has to control the target system. In this interpretation the decision maker is an (open) system too. Both, the decision maker and the target system together may be combined into a superior system. Decision theory usually prefers to study the decision process at the level of the superior system (see, for example, RAPOPORT, 1975). I am interested especially in the interaction between the decision maker and the target system, and in the decision maker's mental representation of the target system and its behavior. Therefore, analyzing the process at the level of two distinct, but interacting systems (target system and system decision maker) seems to be more appropriate.

Two lines of psychological research explore behavior in multistage decision tasks. One is multistage or dynamic decision theory, where multistage betting games (embedded in different contexts) represent the main research-paradigm (see, for example, RAPOPORT & WALLSTEN, 1972; RAPOPORT, 1975; SLOVIC, FISCHHOFF & LICHTENSTEIN, 1977). The other tradition is the psychology of complex problem solving, which studies tasks much more complex than those investigated in multistage decision theory (see, for instance, DÖRNER et al., 1983; FUNKE, 1984; SCHWEIGER, ANDERSON & LOCKE, 1985; VOSS et al., 1983). Unfortunately, the two lines of research seem not to be aware of each other.

Throughout this paper I refer to the simple investment task sketched above. In section 1 first I present a more precise general formulation of this task. Then I describe a specific operationalization, in which the investment problem is embedded into an ecological context. Multistage betting games like the investment problems as sketched above