

DECISION RESEARCH WITH DESCRIPTIVE, NORMATIVE, AND PRESCRIPTIVE PURPOSES – SOME COMMENTS^{*}

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The first problem encountered in discussions about the three closely linked purposes of decision research is a lack of agreement about the meanings of the three terms – descriptive, normative, and prescriptive. The goal of these comments is to illustrate my understanding of the terms and suggest areas for future prescriptive research. Normative decision research identifies logically compelling properties with which decision behavior should conform. For a simple example, it can be forcefully argued that a person's preferences among alternative actions should be transitive.[‡] Sets of compelling properties can be combined to identify various normative preference theories, such as expected utility theory as derived from axioms by von Neumann and Morgenstern [6]. On the other hand, descriptive decision research identifies the way people actually make choices. Often, this research has explicitly compared people's choices with normative choices or models. Thus, continuing the example of transitivity, people have been shown to sometimes violate the transitivity principle (MacCrimmon [4,5]).

There is a gap between the descriptive observation that people are sometimes intransitive and the normative principle that people ought to be transitive. Research with a prescriptive purpose is designed to bridge this gap by developing and testing methods for aiding people in conforming with desired normative principles. This can also be called decision engineering, since it requires a series of model building and testing phases. In his dissertation, MacCrimmon found that verbally pointing out to subjects their intransitive orderings led people to readjust their orderings and become transitive.

Transitivity is a good introductory example since it allows a fairly clear-cut division among the three purposes for decision research. In many actual research projects, all three aspects may be present, though in different strengths. I profess to

^{*}These comments are based on my panelist's comments at the Decision Analysis: Normative, Descriptive, and Prescriptive Approaches Session chaired by Robert L. Winkler at the ORSA/TIMS St. Louis meeting in October 1987.

[‡]If A is preferred over B and B is preferred over C, then the transitivity principle requires that A should be preferred over C.

be prescriptively driven in my research, but confess that my usual approach is to start at the normative end of the spectrum and work backwards, approaching the ultimate development of practical prescriptive decision aiding methods. Two areas of decision research can be used to illustrate the three linked purposes in decision research, and to identify areas for future research which would carry prescriptive benefits.

Using visual problem representations to aid in increasing conformance with normative principles

The substitution (common ratio) and sure-thing (common consequence) principles are required by normative expected utility theory. Many studies have shown that subjects often systematically violate these principles. Kahneman and Tversky [1] developed prospect theory as a modification of expected utility theory which has the potential of being a good descriptive model of the way people make choices in decisions under uncertainty. Such a model will be useful when the purpose is to predict unaided choices, such as in choices among non-durable consumer products. However, when the purpose is to aid a decision maker in conforming with the normative substitution and sure-thing principles, the model may provide few clues for the development of methods for aiding conformance.

In light of the observed violations of the normative principles, I decided to try to develop methods prescribing ways to ensure conformity. So I evaluated the effects of viewing problems in different visual problem representations on conforming with the substitution and sure-thing principles (Keller [2]). Problems represented as decision matrices with columns proportional to their associated probabilities were found to lead to greater conformance with the principles than problems represented solely as minimally-structured written problem statements. Proportional decision matrices seemed *a priori* to have the potential of enhancing conformity with the principles since they make more transparent the fact that there are common consequences and common ratios across pairs of alternatives. The next step in this research stream would be to find or develop descriptive theories to explain how people process minimally-structured problem statements differently than they do visual problem representations, in order to explain the prescriptive results and guide further development of decision aids.

Decision problem structuring research

There is increased interest recently in prescribing methods to aid a decision maker in structuring a decision problem. Such research is fundamentally prescriptive, but it has descriptive and normative linkages. We need normative criteria by which alternative problem structures can be evaluated. Utility theory provides little guidance, other than to require an exhaustive set of mutually exclusive states of nature and a

complete set of alternative actions. However, given constraints on resources available to devote to problem structuring, more practical criteria can be identified. For example, one could continue adding additional states of nature to a model until the estimated probability of unmodeled "other" states is minimal. Further, we need descriptive theories of the way people structure decision problems. As part of such a descriptive theory, we need a model of a person's cognitive architecture. If we suppose that a person stores and processes knowledge in memory in the format of an associative network, we can prescribe strategies for searching the network that are likely to meet the practical criteria we identify (see Keller [3]).

References

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