

# GUEST EDITOR'S INTRODUCTION

## Giving Mathematical Psychology Away: Challenges and Promises

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The four articles in this Special Issue on *Practical Implications of Basic Research on Uncertainty and Utility* were solicited in an attempt to meet two goals. The first goal was to get active researchers in this field to think about the lessons that recent theoretical and empirical advances in basic research on utility theory might hold for practitioners, i.e., for those who use utility theory to facilitate better decision making in a broad range of applications. Many recent results in behavioral decision theory are not widely known to potential users of such information, because they are reported in a language and manner not readily accessible to practitioners and published in journals that are neither directed and nor read by them. A recent article (Cohen, 1996) on the normative status of expected utility (EU) theory in *Medical Decision Making*, for example, discussed the defensibility of violations of EU's independence axiom without any reference to the crucial distinction between violations of independence (or monotonicity) per se and violations of common probability accounting equivalences (see Luce, 1990). Some results may seem unimportant—from a theoretical perspective—to basic researchers, but may have important methodological implications and may raise the level of applications of utility theory significantly, if they were more widely known. The hope was that basic researchers would discuss their work from a fruitfully different perspective if challenged to consider its implications for decision making under uncertainty in areas such as risk analysis, strategic planning, and policy making, or its contributions to address problems in fields such as medicine or finance. They were asked to consider how recent research could improve or change the tools currently used to aid judgments or decisions in applied settings.

The second goal was to make decision researchers more aware of unsolved problems that are important to practitioners. Practitioners/researchers with content-specific interests were asked to describe pressing assessment or implementation problems in their field and to suggest basic research questions to which they would most like to see answers. In short, the Special Issue was conceived as a step toward narrowing the gap between the producers and potential users of new insights about decision making under risk and uncertainty.

Rising to George Miller's 1959 challenge to "give psychology away" has been particularly difficult for mathematical psychology. Mathematical formalization of theories of behavior has probably become less, rather than more, prevalent over the past 40 years. Mathematics—and its use in measurement and model development/testing—is considered an obscure foreign language not just by members of the general public, but also by large parts of the psychological, medical, legal, business, and public policy communities. The intelligent consumption of insights provided by mathematical psychology requires a considerable investment of preparation and mental effort from any user. Researchers who have lessons to impart would be well advised to (a) motivate potential users to expend such effort by advocating the benefits to be gained and (b) facilitate the transfer of knowledge by presenting their theories, results, and implications in an accessible fashion. This Special Issue is an attempt to highlight the importance of recent insights in utility theory and its extensions and to make them more accessible.

The contributions by Miyamoto and by Bleichrodt both address the topic of quality-adjusted life years (QALY) utility models, i.e., multiattribute utility models that incorporate both the quality and duration of survival into the evaluation of health outcomes. With patient-centered decision support emerging as one of the most important trends in American healthcare (Nease, 1998), these models are of immense interest and importance in both healthcare policy and clinical practice. An accurate, yet not unduly taxing method of assessing patients' utility for QALYs is crucial in supporting patients' decisions between alternative treatment regimens.

Miyamoto addresses the implication that descriptive failures of the basic EU model hold for the assessment of QALY utility. Operating under the assumption that health utilities should be based on a descriptive model of patient preferences, he contrasts the normative EU representation of preference to the rank-dependent utility (RDU) representation (Luce, 1988; Quiggin, 1982; Wakker, 1994), which has had far greater success in describing people's preferences (e.g., Birnbaum & Sutton, 1992; Weber & Kirsner, 1997). Miyamoto introduces several qualitatively different classes of QALY utility models for chronic health states and provides axiomatizations for them both within the EU framework and the RDU framework. His comparison of the axiomatic properties of preference judgments that are implied by these different representations of QALY utility is both a useful theoretical contribution and of practical benefit to those who need to assess patients' utility for health outcomes.

Bleichrodt, van Rijn, and Johannesson address the topic of QALY-based decision making with a focus on the elicitation of health state utilities. Their paper is motivated by their perception of the following problem in health utility measurement. Even though the standard gamble elicitation method is widely recognized as normatively more appropriate than other methods, its low descriptive validity when applied within the EU framework has undermined faith in the method. The authors show that use of the standard gamble elicitation method within the RDU framework greatly increases the consistency between assessed QALYs and patient preferences. They also show that the nonlinear probability weighting function of the RDU model (Wu & Gonzalez, 1996) does most of the work in improving the consistency between assessed QALYs and actual preferences for treatment alter-

natives, in the sense that the fit of the model is not significantly improved by assuming nonlinear utility for health outcomes.

Cho, Keller, and Cooper examine a somewhat different class of decisions, namely decisions to engage in risk-taking behavior that entails the possibility of adverse health outcomes. The authors show that health risk-taking is a complex and multifaceted decision that challenges attempts to predict it with EU-type models. By identifying the shortcomings of existing modeling attempts, Cho *et al.* provide a roadmap toward future progress in a decision domain that has important individual and societal implications.

Lopes and Oden are concerned with decisions in yet another domain, namely financial or investment decisions. They compare two models that both assume that people evaluate the utility of money in a rank-dependent fashion. Cumulative prospect theory (CPT) (Tversky & Kahneman, 1992) is also sign-dependent, i.e., assumes that the shape of people's nonlinear utility for money depends on whether the monetary outcomes are perceived to be gains or losses. SP/A (security-potential/aspiration) theory (Lopes, 1987) assumes that risky choice is a two-criterion process. In addition to the rank- and sign-dependent SP-evaluation of choice alternatives that is essentially equivalent to the CPT evaluation, the theory also assumes that people's aspirations (A) drive choice. In a spirit that is similar to the demonstration by Bleichrodt *et al.* that nonlinear probability weighting may play a greater role in the descriptive success of the RDU model than nonlinear utility functions, Lopes and Oden show that the aspiration-level part of the SP/A model is far more important for its descriptive success than the SP (CPT) component, in the sense that major qualitative features of preference data can be fit by the hypothesized aspiration-based processes alone.

In combination, the four contributions to this Special Issue are offered in support of my hypothesis that better communication between the producers and consumers of decision research will prove to be mutually beneficial. If you have comments or questions, as well as suggestions for similar special issues on other topics within mathematical psychology, please contact me by e-mail: weber.211@osu.edu.

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