A Proustian experience with an uncut gem

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Introduction

Before accepting the invitation of the editors of this special issue to comment on Howard Raiffa's "Preference for multi-attributed alternatives" (Raiffa, 1969, henceforth, HR 69), I much hesitated. Having to comment on an important text that is about forty years old and that has never been published is indeed a difficult exercise, unless you are aware of the story behind its writing and non-publication. I am not.

It would be extremely unfair to the author to be critical on a text that was not made widely available at the time it was written. Trying to summarize what has happened in the field since 1969 would be a formidable task requiring far more pages than what the editors have allotted me. Saying that "everything was already there" is not a viable position either. Indeed, if Howard Raiffa did not publish HR 69, we must accept the fact that he had good reasons for that. Furthermore, this would not be fair to the book he published, together with Ralph Keeney, on the same subject several years later (Keeney and Raiffa, 1976).

The main reason why I finally accepted the task was that this text reminds me of my early times as a student in a business school: a Proustian experience indeed.

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1 A Proustian experience...

I first met the work of Howard Raiffa in 1977 while I was a student at ESSEC (a French business school near Paris) attending a course entitled "Decision Analysis" given by Hervé Le Lous. This course used Howard Raiffa's classic "Decision under uncertainty" (Raiffa, 1968) as a textbook. At that time, I was so impressed by the elegance and power of Bayesian decision theory, together with the extraordinary pedagogical skills of Hervé Le Lous, that I quickly came to the conclusion that I should seriously work on this fascinating subject. At the end of the course, a three-hour class was devoted to "multiple criteria", using HR 69 as the main reference on the subject (it seems that back in 1977, Keeney and Raiffa, 1976, did not reach some parts of France yet).

The result of all this was that I finally decided to embark for a PhD in the area of multiple criteria decision-making after leaving the business school (and I found myself, several years later, recruited by that same business school, in which I taught the "Decision Analysis" course, still using Raiffa, 1968, as a textbook). Fortunately, I had access to Keeney and Raiffa (1976) by the time of my PhD and this book more or less replaced HR 69 in my library and thinking.

Many years later, reading through Keeney, Hammond, and Raiffa (1999) (a book that, together with Clemen, 1996, Keeney, 1992, and Russo and Schoemaker, 1989, I used as a textbook for an Executive MBA class on "Decision Modeling"), I felt that I had already read something about the "Even Swap" technique years before. Browsing through my files, I finally exhumed my old copy of HR 69 to discover that this text, that I had forgotten during more than 20 years, was really worth a second reading. I like to think of HR 69 as an uncut gem.

2 ... with an uncut gem

Raiffa (1968, chapter 9) contains a few pages (pp. 246–255) on the "multi-attribute problem". HR 69 appears as a development of these few pages. Alternatively, you may think of HR 69 as a first version of Keeney and Raiffa (1976). It would be very tedious to go through a detailed comparison of the respective contents of HR 69 and Keeney and Raiffa (1976). Most of the material in Keeney and Raiffa (1976) is already present in a highly condensed form in HR 69. Indeed HR 69 contains a detailed account of additive decompositions of utility functions, using the results in Fishburn (1965), (it seems that the work of Pollak, 1967, was unknown to Howard Raiffa when he wrote

HR 69) and a discussion of multiplicative utility functions for two attributes based on Keeney (1968). It also includes an introduction to the classical theory of conjoint measurement (that was available at that time through the work of Debreu, 1960, and Luce and Tukey, 1964). What is furthermore remarkable in this early text is that the most difficult questions, e.g., the structuring of attributes, tradeoffs involving life and death or consequences distributed over time, are recognized as such and discussed at length. Keeney and Raiffa (1976) will develop this material presenting results obtained after the writing of HR 69, adopting a more peaceful and detailed exposition and adding a wealth of examples and case-studies. HR 69 is a real gem... but since we are aware of Keeney and Raiffa (1976), it appears to be still uncut.

The reader familiar with Raiffa (1968) will recognize in HR 69 the unique writing style of Howard Raiffa. If you are looking for an example of excellent scientific writing, please do not miss the occasion to read it through. HR 69 contains very few formal definitions and results are rarely collected in frightening theorems. Yet, the reader is left with the extremely pleasant impression of being brighter at the end of these pages, having been exposed with lucidity and rigor to a systematic and attractive approach to think about problems involving several attributes. Reading a book or paper by Howard Raiffa can be dangerous though: as it happens with good novels (including, of course, *À la recherche du temps perdu*) once you have started reading them, it is almost impossible to stop... and when you have finished, you are not the same person any more [1].

The main point of HR 69, a point that will be developed at length in Keeney and Raiffa (1976), is that "decision with multiple attributes" should not be viewed as a separate question from "decision under risk and uncertainty". Indeed, paraphrasing the French Civil Code, it is clear that "*la décision ne dispose que pour l'avenir*" [2] and that, consequently, risk and uncertainty are always, more or less, present when analyzing decisions. HR 69 consequently embeds decision with multiple attributes into the broader framework of Bayesian decision theory.

The perspective taken in HR 69 on Bayesian decision theory is obviously

[1] I would like to offer here additional evidence about the quality of Howard Raiffa's style of writing. The library of the business school in which I was teaching the Decision Analysis course held many copies of the original version Raiffa (1968) as well as its French translation. Although almost all students of this course had, at this time, French as their mother language, most of them would nevertheless prefer to borrow the original version since the translation, although reasonable, could not render the extraordinary qualities of the original text.

[2] "*La loi ne dispose que pour l'avenir ; elle n'a point d'effet rétroactif*", Art. 2 of the French Civil Code (30 ventôse an XII, now more commonly known as 21 March 1804).

quite close to the one adopted in Raiffa (1968). It is prescriptive: if you are willing to structure your preferences according to a small number of very reasonable principles (mainly transitivity, substitution of indifferent lotteries and some form of continuity), then you should evaluate all lotteries by their expected utility, using subjective probabilities whenever necessary. The main question is therefore how to assess a utility function and subjective probabilities.

The central difference between HR 69 and Raiffa (1968) is that the assessment task of a utility function becomes formidably more complex when alternatives are multi-attributed, although the basic technique using BRLT (Basic Reference Lottery Ticket) could, in theory, be used. The driving force behind the line of research exposed in HR 69 is therefore to find ways to simplify the assessment task. The most obvious and simple way to do so is to investigate whether the multi-attributed utility function can be decomposed into components that would be simpler to assess.

In 1969, the theory underlying the decomposition of utility functions was still in its infancy and many other results were soon to come (see Farquhar, 1975, 1976, 1981, Farquhar and Fishburn, 1981, Fishburn and Farquhar, 1983, Fishburn and Keeney, 1974, 1975, Keeney, 1972, 1974; good early reviews include Farquhar, 1977, 1980, and Fishburn, 1973, 1977). Yet, HR 69 already contains much information and puts the reader in position to anticipate many of these future developments. Assessment strategies for the additive and multiplicative decompositions are discussed at length. Moreover, the text already suggests assessment techniques to cope with possible failures of some independence properties.

A note on terminology will perhaps be useful at this point. The property called "weak conditional utility independence" (*wcui*) in HR 69 will be called "preferential independence" in Keeney and Raiffa (1976). Similarly "strong conditional utility independence" (*scui*) will later become "utility independence". The simplified terminology of Keeney and Raiffa (1976) has hopefully now gained wide acceptance.

In a nutshell, HR 69 gives a unified rigorous exposition of the Bayesian perspective on decision problems with multiple attributes. I would still recommend it to anyone willing to get acquainted with the domain [3] (just as I would still recommend Raiffa, 1968, for an introduction to Bayesian decision theory), as an excellent introduction to Keeney and Raiffa (1976) (I would

[3] I have confessed earlier that I have been brought up "cutting my teeth on Raiffa (1968)", using the words of Machina (1989). I consider myself as an "unreconstructed Bayesian" (to paraphrase the expression used in Kreps, 1988, chapter 11). Therefore, I should warn the reader that this may be a biased judgment. An antidote to this Bayesian poison is Roy (1996).

also advise to keep French (1993) and von Winterfeldt and Edwards (1986) nearby).

In making this recommendation, I am aware of the fact that the Bayesian perspective is now gradually loosing strength in view of many experimental results contradicting it (see the pioneering work of Allais, 1953 and Ellsberg, 1961). Subjective expected utility has now many serious competitors, most notably Choquet expected utility as introduced in Schmeidler (1989), Quiggin (1982), and Yaari (1987). Nevertheless, I think that the interest of these new models can only be assessed by someone who is well familiar with the classical theory. Furthermore, these new models of decision under uncertainty have rarely been used to support decisions in the real world and realistic assessment techniques for their parameters are still under development (important results have nevertheless been obtained by Abdellaoui, 2000, Bleichrodt and Pinto, 2000, Bleichrodt et al., 2001, and Wakker and Deneffe, 1996). Furthermore there are only very few texts dealing with the decomposition of such functions that would allow applying them in a multi-attribute setting (they include Beaudouin et al., 1999, Dyckerhoff, 1994, Miyamoto and Wakker, 1996, and Zank, 2001).

3 Some pending questions

I would like to briefly discuss two questions that, in my view, are left open HR 69. I am taking the liberty to do so because, I have the feeling that these two questions are still somewhat open today.

In order to be as clear as possible, let me first repeat here that, when it comes to *personal decisions*, involving or not multiple attributes, I have always consciously tried to follow as closely as possible the advice of Bayesian decision theory. I am well aware of its limitations... but I find it a simple and powerful way to structure my thinking in my everyday life (for a beautiful exposition of how such a theory may be helpful in everyday life, the reader is obviously referred to Keeney, 1992, chapter 13).

My personal decisions nevertheless have two main characteristics: first I am more or less the only decision-maker (or, when I am not alone, the group of "decision-makers" remains very homogeneous consisting of family members, friends, etc.) and second, being an ordinary academic, I have seldom been in position to take decisions that would affect a very large number of persons (e.g., a city, a nation, etc.).

3.1 Decision analysis and applied economists

Although decision analysis is now forty years old, it seems that the market for aiding public decisions is still dominated by applied economists who more or less invariably use some form of cost-benefit analysis. Although decision analysis have always been rather critical on cost-benefit analysis (see, e.g., Dorfman, 1996 or Keeney and Raiffa, 1976, pp. 19–26), our approach and tools are still rather exotic in the field of public decision-making.

I consider this to be a very serious problem. On the practical side, the consequence of this situation is that the market for our methods is drastically reduced. On the theoretical side, it seems that we should not hide behind classical criticisms of cost-benefit analysis. Its pervasiveness may indeed also tell us something on our own tools.

Two basic tenets of cost-benefit analysis are the following. First, decisions are taken in an environment in which markets play a crucial rôle. Second, cost-benefit analysis emphasizes the need for being consistent across decisions: ideally, nobody would want to spend much more money saving lives in the nuclear industry than in car accidents. Markets (and, hence, prices) and consistency across decision processes are two elements that are far from being central in decision analysis: this may explain why, in spite of all its limitations, cost-benefit analysis is still the dominant method for the analysis of decisions in public organizations. Tackling such questions should be on our research agendas for the next few years.

3.2 Decision analysis and managers

The power of the Bayesian perspective is to consider a very general form of decision (e.g., the "basic problem" and its variants in Raiffa, 1968) and to analyze it in a systematic way. Yet, most important decisions are taken within organizations. Everyone who has taught a decision analysis class to executives (or, else, having read Mintzberg et al., 1976) is aware of the fact that our approach of decision problems often seems to be quite remote from the way most executives view their jobs. If they agree that they sometimes take difficult decisions, they also have to communicate, to coordinate, to give incentives, to imagine contracts, to organize, to control, etc. Most of them would not rate "deciding" as the most important part of their job.

Turning to the academic literature on management, it seems that our approach did not succeed to enter most of it. This should be no surprise: organizations still appear to be the *parent pauvre* of our field of research, although value-focused thinking, as introduced in Keeney (1992), gives quite useful clues. In this respect, it is instructive to compare our tools and meth-

ods with the ones that have been developed in the U.K. under the, unfortunate, name of "soft Operational Research" (for good overviews of these techniques, see Ackermann et al., 2005, Checkland, 1981, Checkland and Scholes, 1990, Eden and Ackermann, 1998, Eden et al., 1983, Mingers and Rosenhead, 2004, Rosenhead, 1989, and Rosenhead and Mingers, 2001). Groups, power, communication, meetings, compromises, crises, drama, stakeholders, ... (all things quite commonly observed in organizations) abound in the literature [4]. This may also explain why such methods were so successful, at least in the U.K., in order to support managers within organizations.

Recent research (see Bana e Costa et al., 1999, Belton et al., 1997, and Belton and Stewart, 2001) has shown how such methods could profitably be used together with our classical tools. This is a formidable opportunity to bring organizations back into our thinking and models. We should not miss it.

Conclusion

I would like to conclude with a perplexing question. Although Howard Raiffa has published several important papers in well established journals, it seems clear that his fame is mainly due to a series of outstanding books: Luce and Raiffa (1957), Raiffa and Schlaifer (1961), Pratt, Raiffa, and Schlaifer (1965), Raiffa (1968), Keeney and Raiffa (1976), Raiffa (1982), Raiffa (1996), Keeney, Hammond, and Raiffa (1999), and Raiffa, Richardson, and Metcalfe (2003) (if you have not yet read all of them, please consider doing so... this is an extremely rewarding experience).

Now forget everything you know about Howard Raiffa and ask yourself the following question: how would your institution evaluate the research performance of an academic whose publication record mainly includes books, many of them being expository in nature? If your institution has evaluation criteria that resemble the ones used by the institution I am working in, it is not unlikely that the following warning message would be issued: "Forget about books. You should mainly publish in international peer-reviewed journals". Well... it is all too obvious that this would indeed be an extremely silly message to send Howard Raiffa.

You might relax saying that Howard Raiffa is unique. I agree, of course. Yet, his outstanding contributions to the field of decision analysis may also give food for thought about the way research is or should be evaluated.

[4] A special issue of the *Journal of the Operational Research Society* (2006, **57**:7) has recently been devoted to these methods.

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