Decision Analysis

Remembering Howard Raiffa

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Howard Raiffa was the best man I have ever known. He had a brilliant mind and enormous personal charisma. Professionally he thought of himself as a decision scientist. Howard passed away peacefully in his sleep at home in Tucson, Arizona, on July 8, 2016, at the age of 92. I would like to summarize some of Howard's professional accomplishments and then describe the personal character of this remarkable man.

Howard was born in New York City on January 24, 1924, and grew up in the Bronx. He briefly attended the City College of New York and then joined the Army just before his nineteenth birthday. After training with the use of radar, he served in air traffic control in the Pacific. After the war, Howard returned to the United States and married Estelle, his high school sweetheart. Soon after, they went to the University of Michigan, where Howard received his PhD in mathematics in 1951. Their son Mark was born in 1952 and their daughter Judy was born in 1955. Howard and Estelle celebrated their seventieth wedding anniversary in 2015. Many interesting details of Howard's personal life are discussed in his memoir (Raiffa 2011).

Howard's intellectual and academic achievements are widely recognized. He had a profound influence on all aspects of the decision sciences and on the fields of systems analysis and operations research. His remarkable books on many aspects of the decision sciences have influenced countless individuals. He guided the introduction of the decision sciences into numerous fields such as business, medicine, public health, the environmental sciences, and law. Howard had approximately 90 doctoral students and helped thousands of students through his dedicated teaching and guidance. In addition, Howard was instrumental in founding and building world-recognized institutions such as the Kennedy School at Harvard and the International Institute for Applied Systems Analysis near Vienna, Austria.

Professional Contributions

Howard's main professional interest concerned the use of analysis to help an individual, organization, country, or group of countries make better decisions. He was concerned with both theory and practice, because if the theories are not useful and used, they can have no influence. In a thorough summary of Howard's academic contributions, Irv LaValle (1996, pp. 419–420) clearly described Howard's message, which I believe is a description that is wonderfully apt, as follows:

> Unless one is an exceptionally good holistic thinker, some systematic analysis can be of considerable help in making better decisions and in striking better bargains. Such analysis does not require superhuman rationality. It rests on certain principles of consistent behavior that most people find perfectly reasonable in the simple contexts in which they are asked to evaluate them. It calls upon them to constructively supply their own preferences and their own judgments, so that the resulting implications for action are ones that are good according their own lights. And Raiffa warns of the common cognitive traps, such as overconfidence in quantifying judgments (Alpert and Raiffa 1982) and too-hasty overweighting of anticipated feelings such as regret (Raiffa 1985). The analytical framework is broad enough to deliver on the claim that, if something matters to one, it can and it should be systematically taken into account. In the realm of negotiations, it implies that one should make a real effort to see things from the other parties' points and interests, one should seek ways to enlarge the pie at least as much as one strives

to attain a goodly share of it, one should never neglect the linkages of the present situation with other current and future situations (the reputation you save may be your own), and one should explore mutually benefi-cial ways of utilizing outside parties as mediators or arbitrators, all the while keeping in mind the observed realities of how people actually behave in negotiation settings.

Howard made substantial contributions in many areas of the decision sciences. His ideas, research, and clear communication has led to seminal contributions to game theory, statistical decision theory, decision analysis, decisions with multiple objectives, and nego-tiation analysis.

Howard's first faculty position was at Columbia University beginning in 1952. During that time, he and Duncan Luce wrote *Games and Decisions: Introduc-tion and Critical Survey* (Luce and Raiffa 1957), which organized and communicated the concepts, results, and relevance of game theory to a wide audience including social scientists and political analysts. This book is still in print and is the classic source for the basic concepts and results of game theory, as well as the original foundations for decisions under uncer-tainty. Although deep in substance, it is accessible for many readers. This is a common and valuable feature of all of Howard's authored and coauthored books and documents.

In 1957, Howard moved to Harvard University with his appointment in the Harvard Business School. Soon, Howard began working jointly with Robert Schlaifer and John Pratt in the area of statistical deci-sion theory. The resulting books, *Applied Statistical Decision Theory* (Raiffa and Schlaifer 1961) and *Intro-duction to Statistical Decision Theory* (Pratt et al. 1965), provide the foundations for Bayesian analysis of the standard statistical problems. This approach combines prior knowledge about problems with subsequent specific data gathered to lend operational insight for real decisions. *Applied Statistical Decision Theory* was reprinted in 2000 as a classic in mathematics and statistics.

With Pratt and Schlaifer, Howard authored a fun-damental paper that jointly axiomatized utility and subjective probability to provide a practical basis for a prescriptive theory to guide decision making (Pratt et al. 1964). In 1964, Howard began writing his book *Decision Analysis* (Raiffa 1968), which illustrates the

operational use of these ideas and introduces many advanced topics such as risk sharing, group decisions, and multiple objectives. This book was the first to lay out the foundations of decision analysis, and was the source for many students, academics, and lay persons becoming acquainted with the field.

In the mid-1960s, Howard's interest in classes of problems expanded from those focused on manage-ment and economics to problems relevant to the public domain. This included problems of govern-mental policy, science policy, public health, and clini-cal medicine. Such problems usually involve multiple objectives, and require, for their resolution, the con-sideration of value trade-offs among the objectives. Howard spent the summer of 1965 at the RAND Cor-poration developing a foundation for thinking about the analysis of problems with multiple objectives. His RAND report (Raiffa 1969) outlined how to address these problems using decision analysis. This entire report was republished as a classic in 2006.

In the fall of 1966, I began graduate school at the MIT Operations Research Center. In December, I saw an announcement stating that Professor Howard Raiffa of Harvard University would present an even-ing seminar at MIT on decision analysis sponsored by a professional organization. I attended and was engrossed. Afterward, I had a discussion with Profes-sor Raiffa about potential master's thesis topics. Of the topics that he mentioned, the one that most appealed to me concerned multiple objectives. He also told me about his course on decision analysis in the coming spring at Harvard. As an MIT student, I could enroll in the course, which I did. The text for the course was a complete draft of Raiffa's *Decision Analysis*, which was formally published in 1968. During that spring, I also worked on my master's thesis on two-objective util-ity functions, which was completed in the summer of 1967. Soon after, although Howard was a Harvard pro-fessor and I was an MIT student, he agreed to be my doctoral advisor, and MIT approved this arrangement. I completed my dissertation on the theory and appli-cation of multiple-objective utility functions in 1969.

After graduating in June 1969, I proposed to Howard that we write a book together on decision making involving multiple objectives. The process for writing the book was prolonged because of the key

role Howard had in creating and being the first director of the International Institute for Applied Systems Analysis (discussed later). In *Decisions with Multiple Objectives* (Keeney and Raiffa 1976), we extended the concepts and procedures of decision analysis to decisions involving multiple objectives. Specifically, the book focuses on the theory and practice of developing and assessing multiattribute utility functions and using them to resolve complex decisions involving multiple objectives. As LaValle (1996, p. 441) stated, this book "made a convincing case for the wide, practical applicability of structured multi-attribute utility in the real world," which was our joint purpose.

Howard's next book, *The Art and Science of Negotiation* (Raiffa 1982), founded the discipline of negotiation analysis. Prior to that time, much of the knowledge about negotiations was basically art and folklore, with essentially no systematic structure or science. Howard developed the concepts and procedures that created negotiation analysis as a field with substance relevant for serious study. This book brilliantly communicates and illustrates a simple message, namely, that the analysis of negotiations can provide very useful insights for negotiators. It also stresses the value of cooperative negotiations by indicating how all sides can better achieve their objectives by various cooperative strategies. It includes Howard's well-known asymmetric prescriptive/descriptive approach that probabilistically describes how your negotiating partner (or adversary) may behave, and then prescribes what decisions you should make to achieve your objectives for these potential partner behaviors. It was awarded the 1985 Melamed Prize of the University of Chicago Business School for the most significant published work by a faculty member in a school of business in the preceding two years. The book *Negotiation Analysis* (Raiffa 2002) integrates much of Howard's earlier work and includes developments in negotiation analysis since 1982.

Beginning in the 1980s, Howard and I would often discuss the need to spread the basic ideas of decision analysis to a much wider audience—decision makers rather than mainly analysts. Finally, in 1995, Howard, John Hammond, and I decided to write a book to synthesize the fundamental ideas and procedures of decision analysis and communicate them in a manner that anyone facing important decisions can understand and use. Our goal was to broaden the use of

the key tenets of good decision making. The result, *Smart Choices* (Hammond et al. 1999), has sold over 200,000 copies and has been translated into 19 different languages. It was awarded the annual book prize of the Institute for Conflict Prevention and Resolution in 1999 and the annual publication prize of the Decision Analysis Society in 2001.

Leadership Contributions

Even with his remarkable academic accomplishments, Howard's greatest interest was to improve the world that we live in and our lives. He recognized that helping individuals and organizations make better decisions, and groups make better negotiated choices, would make a positive difference. His ideas and work provided practical methods and procedures to indicate how better choices could be made.

From 1968 to 1972, Howard had a key role in the negotiations that created the first nongovernmental international research institute, the International Institute for Applied Systems Analysis (IIASA), located near Vienna, Austria. Initially it was sponsored by the National Academies of Science of 12 countries, including the United States and the former Soviet Union. IIASA came into existence on October 4, 1972, with Howard serving as its first director from 1972 to 1975.

The original motivation for its establishment was to enable scientists from east and west to work together on problems of common concern. Howard had always believed that international cooperation on problems common to different societies is critical. IIASA is still a vibrant intellectual research institution. It is now sponsored by 24 national organizations in countries from Africa, Asia, Europe, and North and South America. Its current focus is on interdisciplinary policy and scientific studies of environmental, economic, technological, and social issues to improve human and social well-being and protect the environment (IIASA 2016).

In addressing the numerous issues in creating and then guiding IIASA as its first director, Howard's interest in negotiations increased. When he returned to Harvard in 1975, he began pursuing teaching and research about negotiations in earnest. His elective course on negotiation analysis at the Harvard Business School was partially an experimental research laboratory. He included insights from this course and

analytical results developed over the next few years in his book *The Art and Science of Negotiation* (Raiffa 1982). During this time, Howard, along with Roger Fisher of the Harvard Law School, established Harvard's Program on Negotiation (PON).

Also, in the late 1960s, Howard played a key role in creating Harvard's Kennedy School of Government. His original suggestion included "a school with its own faculty, primarily stressing a professional master's program, with say 50% to 75% of its instruction by the case method, and with its own mini-campus" (Raiffa 2011, p. 76). He then became part of a committee of four who designed the Kennedy School and who are recognized as the school's four founding members. Howard firmly felt that it was important to educate leaders and future leaders about the significant contributions of thoughtful analysis to make better decisions.

The Educator

At Harvard, Raiffa held academic appointments in the Departments of Economics and Statistics, the Kennedy School of Government, and the Graduate School of Business. In addition, consistent with his often expressed interest in applying decision science, he developed and taught courses on decision making in the Schools of Law, Medicine, and Public Health, and for undergraduates in Harvard College. He retired from Harvard as professor emeritus in 1994.

Howard was the main dissertation advisor or committee member of approximately 90 doctoral students. This was one more area in which Howard excelled, as described by one of Howard's doctoral students:

> Raiffa has been exceptionally generous with his ideas and his time. Seeing him on short notice was never a problem, and he gave his complete attention and participation to his students' intellectual struggles. In due course, he assisted with good placements and, unlike most mentors, refused co-authorship of publications based on the dissertation. This generous and modest refusal, together with his insistence on alphabetical listing of his coauthors, makes it impossible ever to take a complete inventory of Raiffa's original ideas. Only glimpses appear, typically in footnotes, of his role in the work of others.   (LaValle 1996, p. 418)

It should be clear, however, that the value of Howard's contributions and intellectual influence is due to both his research publications and the research and leadership of his doctoral students such as Daniel Ellsberg, Harvey Fineberg, Victor Fung, C. Jackson Grayson, John Hammond, Gordon Kaufman, Jeff Kiesler, Joseph Pliskin, Patrick Noonan, James Sebenius, James Vaupel, Milton Weinstein, Robert Wilson, and Richard Zeckhauser. I also had the pleasure and benefit of having been one of Howard's doctoral students.

In addition to books, Howard was at least a decade ahead of others in producing another type of educational product. In the early 1970s, when Howard was traveling a great amount for meetings that eventually led to the creation of IIASA, he developed an audiographic course on decision analysis titled "Analysis for Decision Making." This material was used in his absence for distance learning by numerous students at Harvard in public health, education, economics, and the Kennedy School; it was also distributed by the Encyclopædia Britannica Educational Corporation. Subsequently, Howard developed additional audiographic lectures on topics such as auctions, game theory, and the foundations of statistical reasoning that were widely used as parts of courses at Harvard.

Honors and Awards

Howard was elected a member of the American Academy of Arts and Sciences in 1972, and in 2005 he was elected to the National Academy of Engineering. He has received recognition for exceptional contributions by several professional societies including the Distinguished Contribution Award of the Society of Risk Analysis in 1984, the Frank P. Ramsey medal for distinguished contributions in decision analysis of the Decision Analysis Society in 1984, the Gold Medal of the International Society for Multiple Criteria Decision Making in 1998, and the INFORMS Expository Writing Award in 2002. Howard and I shared the ORSA Lanchester Prize for the best OR publication for our book, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* (Keeney and Raiffa 1976).

In 2000, Howard received the Carnegie Mellon University Dickson Prize for Science, awarded annually

to individuals who have made outstanding contributions to science in the United States. He has received honorary doctorate degrees from Carnegie Mellon University, the University of Michigan, Northwestern University, Ben Gurion University of the Negev, and Harvard University.

Howard the Person

Howard's professional achievements were widely recognized during his lifetime, yet he had personal humility and was generous with his time and attentive to the ideas and issues facing others. Those who knew him well—and I have known him and worked with him for 50 years—know that he was clear-thinking, unwaveringly considerate, ethical, fair, loyal, often humorous, ever positive, and inspiring. I never heard Howard say anything bad about another individual.

In spite of all of Howard's contributions and accomplishments, he was never credit-seeking, nor was he particularly concerned about recognition. He was completely willing to share any credit with others whose contributions were less significant. Yet his impact and legacy can be seen today in economics, engineering, environmental science, business management, medicine, public policy, law, international relations, conflict management, risk analysis, and risk management.

Howard always defined himself first as a decision scientist, the term he uses to describe himself in his memoir titled *A Memoir: Analytical Roots of a Decision Scientist* (Raiffa 2011). It has always been a concern and hope of Howard's that decision sciences not become primarily a theoretical discipline, but continue to be used to analyze and contribute to the better resolution of real and complex problems in the world. At the 2015 IIASA Conference, dedicated to Howard, he stated the following in his opening videotaped remarks:

> Looking back on what has been accomplished in systems analysis over the past decades, it seems to me that there has been less progress than desirable with integrating methodology with real decision problems. I wish I were 20 years younger so I could be with you to work on this important task.

Howard firmly believed that applying the decision sciences in projects to provide insights to policy makers about the relative desirability of various alternatives to address specific problems would be a very effective way to enhance the impact of scientific analyses. So a wonderful way to honor Howard Raiffa's work would be to apply it to important decisions that we face.

Personally, my life has been profoundly and positively influenced by knowing Howard. During 50 years, he has held many roles in my life, including teacher, mentor, colleague, coauthor, and close friend. For the last 25 years, my family became Howard and Estelle Raiffa's honorary family members. Howard is the godfather of our son. Howard also wrote parts of his book *The Art and Science of Negotiation* (Raiffa 1982) on the front porch of our family cabin on a New Hampshire lake when they vacationed there.

Howard was a renowned researcher and author, a superb teacher, an excellent dissertation advisor, a caring mentor, and ideal coauthor, a wonderful colleague, and a loyal friend. I am very fortunate to have known him in all of these roles. At a large celebration of Howard's retirement from Harvard in 1994, I had the privilege to offer a few remarks about his career and contributions. Then, I concluded with "Howard, you did not leave room to exaggerate so I will grossly understate. You are simply the best." Anyone who knew Howard well would certainly agree.

References

Alpert M, Raiffa H (1982) A progress report on the training of probability assessors. Kahneman D, Slovic P, Tversky A, eds. *Judgment Under Uncertainty: Heuristics and Biases* (Cambridge University Press, New York), 294–305.

Hammond JS, Keeney RL, Raiffa H (1999) *Smart Choices* (Harvard Business School Press, Boston).

IIASA (2016) About IIASA. Accessed August 25, 2016, http://www.iiasa.ac.at.

Keeney RL (2011) Howard Raiffa. Assad AA, Gass SI, eds. *Profiles in Operations Research* (Springer, New York), 493–508.

Keeney RL, Raiffa H (1976) *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* (John Wiley & Sons, New York).

LaValle I (1996) The art and science of Howard Raiffa. Zeckhauser RJ, Keeney RL, Sebenius JK, eds. *Wise Choices* (Harvard Business School Press, Boston), 417–456.

Luce RD, Raiffa H (1957) *Games and Decisions: Introduction and Critical Survey* (John Wiley & Sons, New York).

Pratt JW, Raiffa H, Schlaifer R (1964) The foundations of decision under certainty: An elementary exposition. *J. Amer. Statistical Association* 59(306):353–375.

Pratt JW, Raiffa H, Schlaifer R (1965) *Introduction to Statistical Decision Theory*, 1st ed. (McGraw-Hill, New York). [Reprint 1995.]

Raiffa H (1968) *Decision Analysis: Introductory Lectures on Choices Under Uncertainty* (Addison-Wesley, Reading, MA).

Raiffa H (1969) Preferences for multi-attributed alternatives. RM-5868-DOT/RC, RAND Corporation, Santa Monica, CA. [Reprinted in 2006 in *Multi-Criteria Decision Anal.* 14(4–6):115–157.]

Raiffa H (1982) *The Art of Science and Negotiation* (Harvard University Press, Cambridge, MA).

Raiffa H (1985) Back from prospect theory to utility theory. Grauer M, Thompson M, Wierzbicki AP, eds. *Decision Processes* (Springer-Verlag, Heidelberg, Germany), 100–113.

Raiffa H (2002) *Negotiation Analysis* (Harvard University Press, Cambridge, MA).

Raiffa H (2011) *A Memoir: Analytical Roots of a Decision Scientist* (CreateSpace Independent Publishing Platform, Seattle).

Raiffa H, Schlaifer R (1961) *Applied Statistical Decision Theory* (Harvard Business School Press, Boston). [Reprint 2000.]