FOUNDATIONS OF TARGET-BASED DECISION THEORY

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Summary

Decision theoretic axioms are commonly interpreted in terms of utility functions, reflecting the philosophy of utilitarianism. But an alternate philosophy, suggested by Thomas Hobbes, leads to a target-based interpretation of the decision theoretic axioms. As we show, this target-based interpretation is more consistent with how people actually decide, and hence may be much easier to apply than the standard utility-focused decision analysis.

1. Bentham and Utility-Based Decision Analysis

Von Neumann and Morgenstern (1947) enunciated various axioms of rationality which implied that

1. For any rational individual, it was always possible to define the utility of a consequence as that probability p making the individual indifferent between receiving that consequence and receiving a lottery with a probability p chance of leading to the best possible consequence and a $(1-p)$ chance of leading to the worst possible consequence.

2. The rational individual, when choosing among several possible decisions, would always choose that decision whose possible consequences have the maximum expected utility.

How does one interpret utility? The word, "utility," as used by von Neumann and Morgenstern, is the same term which nineteenth-century utilitarianism used to describe a measure of pleasure. Hence by using the term "utility," von Neumann and Morgenstern were suggesting that there was some parallelism between their utility theory and utilitarianism.

The utilitarians argued that individuals all sought pleasure and that pleasure should be quantified in the form of a utility function. They developed a calculus of utility which allowed an individual to systematically calculate the utility or pleasure associated with any course of action and argued that individuals should choose those actions which achieve the maximum overall utility. Indeed a careful review of the elements of utilitarianism shows that it is remarkably analogous to modern utility theory. Thus the leading proponent of utilitarianism, Jeremy Bentham (1781), wrote:

> By the principle of utility is meant that principle which approves or disapproves of every action whatsoever according to the tendency which it appears to have to augment or diminish the happiness of the party whose interest is in question…Sum up all the values of all the pleasures on one side, and those of all the pains on the other. The balance, if it be on the side of pleasure, will give the good tendency of the act upon the whole.

As Sabine noted,

> Bentham … assumed, as had commonly been done by the hedonist moralists, that pleasure and pain are commensurable, a given amount of the one offsetting a like amount of the other, and also that they can be added so that a sum of pleasures may be calculated, which will define the greatest happiness.… Usually Bentham spoke as if he believed that human beings really do act in accordance with some such mental parallelogram of forces as this, though occasionally he acknowledged that the notion of adding pleasures, and especially the pleasures of different individuals, is fictitious. What is certainly true was that he considered the fiction to be "a postulation without the allowance of which all political reasoning is at a stand."

One could view much of economics, with its assumption of the insatiable utility-maximizing individual, as similarly reflecting this utilitarian vision.

But it has become widely recognized that von Neumann and Morgenstern's utility measure is not simply a measure of desirability; instead it is both a measure of desirability and a measure of the individual's attitude toward risk. Because it confounds these two effects, it is common to break up utility assessment into assessing two different measures:

1. A value function v which only measures the desirability of a consequence and

2. A utility function, expressed as a function of v, which describes how that value function is distorted by an individual's attitude toward risk.

But given this decomposition, von Neumann and Morgenstern's notion of utility no longer corresponds to the utility measure that the utilitarians used to quantify degrees of desirability. Instead the value function becomes analogous to the utilitarian measure of utility. And what von Neumann and Morgenstern call "utility" corresponds to something different than what the utilitarians meant by utility. (Given this semantic confusion, it is tempting to follow Howard in referring to u as a "preference probability" and not as "utility.")

If u is no longer a measure of desirability, then it is less clear how maximizing expected utility in the von Neumann/Morgenstern sense relates to utilitarianism. The next section explores this issue in more detail.

2. Hobbes and Decision Analysis

Bentham's "mathematics of hedonism" presumed that all individuals are, or should be, understood as seeking pleasure in some form. But Bentham's philosophy built on an earlier philosophic tradition started by Thomas Hobbes. As MacPherson writes in his review of political philosophy,

> the foundations of utilitarianism starts at least as far back as Hobbes … the utilitarian doctrine … is at bottom only a restatement of the individualist traditions which were worked out in the 17th century: Bentham built on Hobbes …

But even though Bentham built on Hobbes, he also appears to have significantly altered Hobbes's original argument. Thus Hobbes (1691) originally argued

> I put for a general inclination of all mankind, a perpetual and restless desire for power after power, that ceaseth only on death. And the cause of this is not always that a man hopes for a more intensive delight, than he has already attained to; or that he cannot be content with a more moderate power; but because he cannot assure the power and means to live well which he hath present, without the acquisition of more.

Hobbes also wrote:

> There be some, that taking pleasure in contemplating their own power in acts of conquest, which they pursue further than their security requires...others that otherwise would be glad to be at ease within modest bounds...those men who are moderate, and look for no more but equality of nature, shall be obnoxious to the force of others, that will attempt to subdue them. And from hence shall proceed a general diffidence in mankind and mutual fear of one another.

MacPherson summed up this Hobbesian perspective by saying that

> Some, not all, men innately desire ever more power and delight, while the rest desire only to continue at their present level.… Every man's innate desires are indeed incessant, but not every man's are for an increased level of satisfaction or power. All men in society … do seek ever more power, but not because they all have an innate desire for it. The innately moderate man in society must seek more power simply to protect his present level.…

In other words, Hobbes argued that there were two kinds of individuals:

1. An insatiable minority desiring ever more power and delight.
2. A majority of moderate but insecure individuals seeking enough to meet various needs. Because of uncertainty about is required to secure those needs, these moderate individuals constantly try to acquire as much as possible.

Bentham's formulation seems to have emphasized the insatiable minority. Hobbes's formulation indicates that both types of individuals exist. We will refer to the insatiable minority as Benthamite individuals and the moderate majority as Hobbesian individuals. Hobbes argued that most individuals—as opposed to being maximizers of pleasure—are actually oriented toward maximizing their chances of meeting certain well-defined needs. Thus Hobbes's philosophical perspective is fundamentally different than utilitarianism.

Is the Hobbesian perspective inconsistent with utility theory?

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Biographical Sketch

Robert F. Bordley is technical director at the corporate strategy and knowledge development group at General Motors Corporation. His work has focused on decision support, product and market segmentation, development of internet-based services, strategy development, in-vehicle navigation systems and product development. His past assignments at General Motors include being manager of research and development portfolio planning, manager of marketing and management sciences, manager

of decision support systems and manager of mission analysis in the Systems Engineering Center. He is also an adjunct professor at the University of Michigan at Dearborn and at Oakland University. He has previously worked as program director of decision, risk and management science in the National Science Foundation (where he was involved in helping created a directorate for the social sciences.) He has also worked at the Cooperative League where he was involved in helping pass the National Consumer Cooperative Bank Bill. He has a Ph.D. and Master's degree in industrial engineering and operations research from the University of California, Berkeley as well as an MBA in finance. He is a recipient of General Motor's Award of Excellence, its President's Council Award and a National Science Foundation Fellowship. His primary research area focuses on the development of prescriptive tools which are both easy to use and theoretical rigorous for the solution of problems in decision-making, strategy, operations management, marketing and finance. He has published more than sixty papers in such scientific journals as *Operations Research, Management Science, Review of Economics and Statistics, Theory and Decision, Journal of Business and Economic Statistics, American Political Science Review, Journal of Forecasting, Journal of the Operational Research Society, Journal of Economic Theory, Marketing Science, Journal of Service Research, Journal of Statistical Education, Physics Letters, Nous etc.* He has been an officer of the Production and Operations Management Society (as vice-president of publications and of finance), an officer of the risk section of the American Statistical Association (as chair, program-chair and representative to the council of sections), an officer of the Institute for Operations Research and Management Science, and member of the Management Sciences Roundtable.