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The Costs and Benefits of Calculation and Moral Rules

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Abstract
There has been a recent upsurge of research on moral judgment and decision making. One important issue with this body of work concerns the relative advantages of calculating costs and benefits versus adherence to moral rules. The general tenor of recent research suggests that adherence to moral rules is associated with systematic biases and that systematic cost-benefit analysis is a normatively superior decision strategy. This article queries both the merits of cost-benefit analyses and the shortcomings of moral rules. We argue that outside the very narrow domain in which consequences can be unambiguously anticipated, it is not at all clear that calculation processes optimize outcomes. In addition, there are good reasons to believe that following moral rules can lead to superior consequences in certain contexts. More generally, different modes of decision making can be seen as adaptations to particular environments.

Keywords
decision-making processes, cost-benefit analysis, moral rules, moral values, domain specificity

This article focuses on two of decision science's normative commitments. The first is that decisions should be assessed by how good or bad the expected outcome is given the decision maker's goals.[1] Nearly all decision science conforms to this commitment, and so will we.[2] The second concerns the processes by which those better expected outcomes should be sought. These processes involve engaging in some version of cost-benefit analysis (CBA). This second commitment is less universal than the first (for discussion of alternative approaches, see Dunwoody, 2009; Einhorn & Hogarth, 1981; Gigerenzer, Todd, & the ABC Research Group, 1999; Hogarth, 1981; Jungermann, 1983; March, 1978; Simon, 1955, 1957). Occasional dissenting voices notwithstanding, versions of CBA make up the dominant normative models of decision making in the social sciences (Amir & Ariely, 2007).[3]

This article examines whether CBA is necessarily the best tool for achieving better consequences and—if not—when and why it doesn't work. We discuss research and theory suggesting that there are a variety of alternative decision modes, each with its own unique costs and benefits, whose success depends on characteristics of the decision task and the decision maker. To constrain the discussion, we primarily focus on moral decision making and on adherence to moral rules of right and wrong. We argue that moral choices are often poorly suited to CBA and well-suited to some of the rules that are associated with the moral domain.

There has been an upsurge in interest concerning how people resolve dilemmas involving a conflict between a moral rule (commonly, "do no harm") and the dictates of CBA (e.g., Baron & Spranca, 1997; Bartels, 2008; Bartels & Medin, 2007; Connolly & Reb, 2003; Fiddick, Spampinato, & Grafman, 2005; Gigerenzer, 2007; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Haidt, 2001; Haidt, Koller, & Dias, 1993; Hauser, Cushman, Young, Jin, & Mikhail, 2007; Mikhail, 2007; Nichols & Mallon, 2006; Ritov & Baron, 1999; Sunstein, 2005). With few exceptions (e.g., Connolly & Reb, 2003), this research suggests that decision makers often adhere to moral rules instead of the dictates of CBA. Some researchers treat such behavior as implying suboptimal choices (Baron & Spranca, 1997; Ritov & Baron, 1999; Sunstein, 2005).

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One or two others take an opposing view (e.g., Gigerenzer, 2008), and many choose not to address the normative issue at all. Though there may be good reasons for avoiding the debate, failure to address normative questions may itself have normative implications. Given that systematic CBA has provided the normative backbone for decision science (e.g., Keeney & Raiffa, 1993), research that does not address normativity may implicitly endorse CBA.

For example, consider the following scenario from Ritov and Baron (1999):

> As a result of a dam on a river, 20 species of fish are threatened with extinction. By opening the dam a month each year, you can save those species, but 2 species downstream will become extinct because of the changing water level. Would you open the dam? What is the largest number of species made extinct by the opening at which you would open the dam? (p. 87)

Some participants said that they would not open the dam because they would not want to "cause the death" of a single species, even though not opening the dam leads to the loss of 20 species. Ritov and Baron (1999) also used a separate measure of people's willingness to consider the outcomes of these choices, and those who marked a response indicating that the action (causing the death of fish species) was wrong regardless of the benefits of doing so (those that held "protected values") were less willing to make tradeoffs to save fish species.[4] Because these participants focused more on action versus inaction than they did on outcomes (i.e., knowingly violating a rule like "do no harm" rather than deciding based on the total species lost; Baron, 1996), the researchers described participants with protected values as showing "omission bias."

Is this a clear case where the best decision would be to open the dam to save 20 fish species, even if doing so caused the extinction of 19 species? And are the people with protected values making worse decisions? We think the argument is compelling provided that closed-world assumptions are satisfied. By *closed-world assumptions*, we mean that the scenario is accepted as stated as complete and accurate with no other considerations or interpretations introduced. To satisfy closed-world assumptions, it is off limits to consider any alternative actions, to doubt that opening the dam will have the intended consequences, to suspect that it may have other unintended consequences, to wonder if the action sets a dangerous precedent for other circumstances where the information may be less reliable, or to assign utility or disutility to things besides the number of species saved.

Few of these assumptions hold for more real-world moral decisions. It is possible that the participants who care most about the issue involved in a given scenario—those with protected values—are the least likely to accept the implied closed-world assumptions Indeed, in analogous real-world circumstances, one can readily imagine faulting decision makers for accepting a "false dichotomy" and failing to consider other options (e.g., Bazerman & Moore, 2009, pp. 42–50). In short, it becomes more difficult to determine the best choice once unrealistic closed-world assumptions are dropped.

Critics may point out that participants who reject closed-world assumptions may nonetheless be engaging in CBA and that, even if they are not doing so, they should be. From this perspective, one requires a broader conception of "consequences" that takes into account the decision maker's values, goals, and beliefs rather than the rejection of CBA as a normative standard. We agree with two important aspects of this criticism. First, attempts to assess the quality of people's decisions require careful attention to individual and culture-specific values, goals, and beliefs—attention that is largely absent behavioral decision research. Second, in some cases in which it appears that participants are failing to weight costs and benefits, they may be weighing relevant costs and benefits that the researchers have inappropriately removed from consideration.

But one cannot have it both ways in this case. To adopt a sophisticated CBA is to concede that closed-world assumptions are not valid and (correctly, in our view) abandoning closed-world assumptions breaks the coupling between CBA and normative justifications for it. Therefore, a sophisticated CBA has no privileged status relative to other decision procedures and modes and must compete with these alternatives on an even playing field.

Here's our position in a nutshell. First, even if (and perhaps, especially if) one believes that the gold standard for choice is the quality of its expected consequences, there may be no privileged association between that standard and CBA. Second, the fact that CBA may be normative under closed-world assumptions does not justify the conclusion that people show bias by making decisions that deviate from CBA in the absence of compelling evidence that closed-world assumptions should apply. Third, when evaluating decision processes, it is important to consider the nature of decision environments, the information and other resources that people have available, and people's ability to make accurate cost-benefit calculations. Fourth, different environments and tasks may differentially support some decision modes over others. And finally, in the moral domain in particular, rules that are focused on behaviors rather than outcomes may often be more adaptive than CBA.

Before going further, some clarifications are in order. First, our focus on CBA versus moral rules might seem to belong in the frame of reference of normative ethics (e.g., consequentialism vs. deontology), and the fact that we focus on the topic of moral rules might lead one to think this article is rooted in Kohlbergian developmental theory. Instead, this article is primarily about decision-making processes, framed in the language of behavioral decision theory rather than moral philosophy or development. Further, our references to expected or anticipated consequences are not about consequentialism as an ethical doctrine, and unlike, for example, utilitarianism, decision science typically does not take a stance on what sorts of things ought to confer utility for the decision maker. Similarly, our normative assessment of moral rules is constrained to the framework of decision science's concern with better expected consequences rather than with a deontological framework whereby consequences can be ancillary to normative assessment. In short, our discussion is restricted to the

normative commitments of behavioral decision theory and the relevant behavioral science.

We should also clarify that our definition of *moral rules* is comprised of two components: (a) rules that do not calculate anticipated costs and benefits, and (b) rules that operate in the moral domain. Many rules that do not calculate costs and benefits are not moral. One of us, for example, has made the rule never to take on a commitment (e.g., agree to give a talk) over the phone. Just as nonconsequentialist rules are not necessarily moral, we also recognize that calculating costs and benefits is not necessarily nonmoral. Utilitarianism, for example, exhorts decision makers to calculate costs and benefits under the maxim, ''the greatest good for the greatest number.'' Nonetheless, in this article, we use ''moral rules'' to refer to rules that do not involve costs-benefit analysis, as these are the rules central to our argument.

What do we mean by *moral domain*? Although unambiguously separating the moral from the nonmoral may not be feasible, we suggest some serviceable guidelines. The moral domain tends to concern perceived duties, obligations, and prohibitions that bear on what a ''good'' person should do. Perceived moral duties or prohibitions vary across cultures, but there are some broad commonalities. Specifically, moral duties and prohibitions tend to concern (a) purity or balance, especially as related to relationships (with other people, with nature, or with the spiritual or divine), and (b) managing social conflict and cohesion, including prohibitions against harm, beliefs about individual rights and freedom, social contracts, hierarchy, and social roles (for good discussions of the moral domain and what it encompasses, see Haidt & Joseph, 2004; Shweder, Much, Mahapatra, & Park, 1997).

In the second section of this article, we review studies that examine people's willingness to make tradeoffs in moral decisions. It establishes our claim that commitments to moral rules of right and wrong motivate behavior independent of calculations of expected costs and benefits. Such responses are often characterized as errors by the prevailing consequentialist view in decision science.

In the third section, we review evidence and arguments that call into question whether people have the potential to apply CBA effectively and invite a reexamination of CBA's normative status. If CBA is often unreliable, where does this leave us? There are many ways of making decisions, and in the fourth section, we place our discussion of CBA and moral rules in the context of a larger set of decision modes, examining how expanding the space of approaches to decision making opens fruitful areas of investigation. We also suggest that decision procedures (whether CBA, adherence to moral rules, or something else altogether) may be adapted to specific ecologies and discuss how the different modes we use might be learned.

In the fifth section of the article, we examine ecological niches in more detail, bringing the discussion back to our emphasis on moral rules. We start by considering evidence that adherence to moral rules can outperform CBA by reviewing research on game theoretical resource allocation and end by considering when and why moral rules may be effective.

In the final sections, we draw conclusions concerning relationships between laboratory studies and closed-world assumptions on the one hand and real-world decision making and possibilities for improving moral judgment on the other. Along the way, we suggest several linkages with allied cognitive, behavioral, and biological sciences that can inform descriptive theories of moral judgment and decision making.

Tradeoffs and Moral Judgment and Decision Making

Many of the important decisions people make in their lives involve strong moral commitments. Although people presumably are trying to achieve good outcomes with these decisions, moral judgments appear to have nonconsequentialist properties that distinguish them from other decisions (Baron & Spranca, 1997; Fiske & Tetlock, 1997). First, consider symbolic or sentimental values. A patriotic U.S. citizen might well refuse to sell a U.S. flag to someone who intends to burn it, even for an amount several multiples of the retail price, because he or she feels it is wrong to burn the flag or do something that would facilitate that act. Similarly, a person may also decline to sell an antique vase passed down through the family over numerous generations because it has sentimental value to them. Although economic goods are fairly transferable (if you needed change and asked someone for five $1 bills in exchange for a $5 bill, they would likely agree), sentimental values are not (to the outsider, the antique vase is just worth the market value and nothing more). In addition, relational entities (e.g., loved ones) frequently consider very idea of mixing the sacred and the secular to be either inconceivable (e.g., you can't buy love or even friendship) or offensive (e.g., parents selling their children).

In these sorts of cases, it appears that values cannot be placed on a common scale, especially one that includes economic values. Under these circumstances, commitment to moral rules or reactions to perceived violations of moral rules may overwhelm purely consequentialist considerations. Our choices are often more a function of how we think goods ought to be treated than about estimated costs and benefits. That is to say, moral cognition is sometimes more concerned with adherence to duties and proscriptions (e.g., thou shalt not kill) than with consequences (e.g., even if it means saving more lives; no good can be accomplished through bad deeds).

Moral Judgment Elicited By Trolley Problems

We begin our survey with studies of ''trolley car problems'': a class of scenarios that have been used so often in studies of ethical dilemmas that one might refer to them as the fruit flies of moral judgment. In this area, the primary focus has been on how different kinds of actions leading to more or less the same outcome differ in their moral acceptability.

Consider the following two variants:

1. The bystander case (Foot, 1967): A runaway trolley is about to run over and kill five people, but a bystander can throw a switch that will turn the trolley onto a side track, where it will kill only one person. Is it permissible to throw the switch?
2. The footbridge case (Thomson, 1985): A runaway trolley is about to run over and kill five people, but a bystander is standing on a footbridge next to a large stranger. The bystander's body would be too light to stop the train, but he can push the stranger onto the tracks, killing him, but saving the five people. Is it permissible to shove the man?

Most people judge that flipping the switch is permissible but object to pushing the person off the footbridge. If only the closed-world consequences mattered (five survivors vs. only one), then both scenarios would be identical in terms of the appropriate choice (pull the switch and push the person, respectively), but clearly people are sensitive to other factors (such as the difference between throwing a switch and pushing a person to their death). Quite a few explanations for this divergence in judgments have been offered (Bartels, 2008; Cushman, Young, & Hauser, 2006; Fiddick et al., 2005; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene et al., 2001; Hauser et al., 2007; Mikhail, 2007; Moore, Clark, & Kane, 2008; Nichols & Mallon, 2006; Royzman & Baron, 2002; Waldmann & Dieterich, 2007). Although there are many differences in these explanations, three commonly recognized elements are (a) people do not simply maximize benefits relative to costs, (b) aversion to or prohibition against killing motivates behavior, and (c) more proximal, intentional, or direct killing has greater aversive force than more distant, less intentional, or less direct killing.

Sacred and Protected Values

As the trolley-dilemma research suggests, some decisions appear to be less driven by the consequences associated with an action than by moral rules concerning the ways that certain kinds of goods should be treated (Baron & Spranca, 1997; Fiske & Tetlock, 1997; Medin, Schwartz, Blok, & Birnbaum, 1999; Tenbrunsel & Messick, 1999). Baron and colleagues (Baron & Spranca, 1997; Ritov & Baron, 1999) and Tetlock and colleagues (Fiske & Tetlock, 1997; Tetlock, Kristel, Elson, Green, & Lerner, 2000) have independently described similar kinds of morally relevant values that they call protected (PVs) or sacred (SVs), respectively (unless specifically distinguishing between the two, we will use the term *sacred values* to refer to both frameworks). Tetlock defines SVs as values "that a moral community implicitly or explicitly treats as possessing infinite or transcendental significance that precludes comparisons, trade-offs, or indeed any other mingling with bounded or secular values" (Tetlock et al., 2000, p. 853). Baron defines them as those values that "resist trade-offs with other values, particularly economic values" (Baron & Spranca, 1997, p. 1) and that people "think of as absolute, not to be traded off for anything else" (Ritov & Baron, 1999, p. 79). Goods like human life and natural resources are often bestowed this sort of sacred or protected status, and people react strongly to proposed tradeoffs of these resources on moral grounds.

Choices that entail possible encroachment on or loss of a sacred value (as tradeoffs necessarily do) are enjoined by moral rules that proscribe any action that might sacrifice the value (e.g., do no harm). Violating these proscriptions—proposing tradeoffs of SVs for money, as in organ markets, pollution credits, and betting on terrorist acts—elicits moral outrage and an outright refusal to consider costs and benefits of such "taboo tradeoffs" (Tetlock, 2002, 2003; Tetlock et al., 2000). Even knowing that a third party merely contemplated such a tradeoff elicits contempt, disgust, and a desire to punish from participants. "[Taboo tradeoffs] are . . . morally corrosive: the longer one contemplates indecent proposals, the more irreparably one compromises one's moral identity. To compare is to destroy" (Tetlock et al., 2000, p. 854).

Baron and his colleagues explain that the refusal to trade off and the moral outrage are direct consequences of the moral prohibitions with which they are associated. It is the actions that harm a sacred value (e.g., killing an innocent person) that are absolutely prohibited, not the loss of an SV itself (e.g., the death of an innocent person), which, of course, cannot be prohibited (Baron & Spranca, 1997; Ritov & Baron, 1992, 1999; Spranca, Minsk, & Baron, 1991). As evidence for this claim, Ritov and Baron (1999) find that people with protected values show greater omission bias than do people who do not have a sacred value for the resource in question, suggesting that the moral prohibition, rather than just assessment of costs and benefits, drives participant's behavior.

However, this should not be interpreted to mean that costs and benefits matter less to people with protected values—rather, it appears that both actions and outcomes matter more. For example, Bartels and Medin (2007) examined tradeoffs like the opening of a dam to save species of fish, but they omitted the initial yes/no acceptability question and instead presented a range of tradeoff values (i.e., would you open the dam if it would kill 2 species as a result? would you . . . if it would kill 6/10/14/18 as a result?), which is a procedure derived from Connolly and Reb (2003). When focusing attention on outcomes, participants with protected values were more willing to make tradeoffs than were participants without protected values. Follow-up work conducted by Bartels (2008) showed that when participants with protected values were invited to compare omissions (with worse consequences) and harmful actions (with better consequences), they strongly preferred the actions that maximized the net benefit.

Even when attention is focused on means and not ends, omission bias is not always found. For some values and for some roles, no omission bias is found (Haidt & Baron, 1996) and/or an act bias is found (Patt & Zeckhauser, 2000; Tanner & Medin, 2004). The general picture appears to be that both means and ends matter more for people with SVs.

Closed-World Assumptions and the Problem of Distinguishing Adherence to Moral Rules From Sophisticated CBA

What we can learn from the study of either trolley dilemmas or sacred values should be strongly qualified by concerns about closed-world assumptions.[5] For example, with respect to the trolley dilemmas, wondering about whether the large man's body will, in fact, stop the trolley car, about whether this is the only option, about differences in the psychological or interpersonal consequences that might result from pushing a person to their death to save five people as compared to those that might result by diverting the train from killing five people so that it only kills one, or about the unspecified identities of the people whose lives are at stake violates closed-world assumptions transparently (note, for example, that Petrinovich, O'Neill, & Jorgenson, 1993, found that people wouldn't throw the switch to deflect the car away from Nazi officers).

Research on trolley dilemmas strongly suggests that decision makers do not care exclusively about expected costs and benefits but do give weight to other considerations, including judgments about the rightness or wrongness of moral acts distinct from their expected consequences. That is, decisions are influenced by moral rules distinct from CBA. Whether or not these demonstrations are compelling, given the problem of closed-world assumptions, the normative question of whether or not people should care about moral rules is yet to be tackled. It depends on both the relative shortcomings of CBA and he relative merits of adherence to moral rules. In the following section, we address the first of these issues and suggest that the challenge posed by CBA to mere mortals is a difficult one to meet.

The Challenges of CBA

For many decisions, people do not have access to the relevant information or tools that would allow them to reliably calculate expected costs and benefits. In these cases, the effectiveness of CBA is open to question. The theoretical basis for this analysis goes back to near the beginning of contemporary decision science and the concept of bounded rationality as put forth by Herbert Simon (1955, 1957). Simon criticized optimizing models of rational choice (such as expected utility theory) on descriptive grounds, arguing that these models could not describe human decision processes because people often do not have the time, cognitive capacity, or available information with which to effectively apply such processes. Instead, he suggested, people must do something else (he proposed the use of heuristics). How a decision maker ought to decide cannot be answered without consideration of the decision maker's available information, the importance of the decision, how much time the decision maker has, how difficult the decision task is, the cognitive capacities of the decision maker, and the structure of the decision task, including the task environment (Simon, 1955, 1956, 1957). Since that time, inspired in part by Simon, psychologists have amassed substantial evidence that people fail to weigh costs and benefits in a manner consistent with normative models of choice.

Of course, one can recognize that people fail to be good cost-benefit analysts without concluding that CBA is a bad idea. Perhaps through training or the development of tools, people can learn to be more effective cost-benefit analysts. As such, systematic failure at CBA is often seen as equivalent to systematic failure to make good decisions (for discussions of this standard and alternative views, see, for example, Einhorn & Hogarth, 1981; Gigerenzer, 2008; Jungermann, 1983; March, 1978; Thorngate, 1980). Although we readily concede that training and tools can improve the quality of CBA, it nonetheless cannot be taken for granted that CBA should be the de facto normative strategy. Whether CBA is the best strategy in a given real world context should represent a challenging empirical question rather than a theoretical presumption. Here, we will limit our discussion to cases that not only demonstrate descriptive shortcomings of CBA, but also suggest inherent shortcomings that call into question its normative status.[6]

The remainder of this section will consider three steps often required by calculation-based decision making: (a) assessing the range of outcomes that might result from each decision alternative, (b) translating those outcomes into anticipated costs and benefits given the decision makers' goals, and (c) assigning likelihoods or subjective probabilities that the various outcomes will occur.[7] For each step we will argue or present evidence for systematic shortcomings of CBA.

Assessing the Range of Outcomes That Might Result From Each Possible Decision

This first step requires knowledge of the range of available decisions and of the range of potential outcomes given each decision. These are typically given in lab studies of decision making, but outside the lab, there is often no reasonable limit to the number of options or outcomes one might consider. This is true of both critical and mundane decisions. What should Bill Gates wear today? Factorially combining all his pairs of socks, underwear, pants and shorts, shirts, jackets, and ties quickly pushes the number of possible choices into numbers that would be absurd to consider. But he could also drive to Goodwill to buy additional clothes. Or what about that lovely piece of parsley left over from the breakfast potatoes? Is it a candidate for his lapel? There is literally no limit to the number of choices he might consider. And what are the potential outcomes from each choice? Well, for all Gates knows, the parsley might have turned out to be the single most important positive choice he could have made. Perhaps the employees who see this will spread the word to other employees: ''He doesn't take himself so seriously. I love working for Microsoft.'' Even if there were enough time to consider all possible alternatives, he would have to essentially guess as to the range of possible outcomes associated with each alternative. Gates could even decide to sleep in that day, rendering the wardrobe question moot. He would also have to worry about ''opportunity costs.'' What

other decisions could he and should he be worrying about instead of contemplating his wardrobe?[8]

Translating Outcomes Into Anticipated Costs and Benefits Given the Decision Maker's Goals

This is another step that entails an enormous challenge. The assumption that the decision maker's goals are given, or that various outcomes have a calculable relationship to those goals, seems to presuppose an unlikely clarity not just concerning what one wants and does not want, but also of how much (i.e., of their utility), so that different costs and benefits can be coherently traded off with one another. Putting aside the question of how people could have reliable insight into the anticipated utility of the range of possible outcomes, the merits of such an approach would seem to depend critically on the empirical question of whether or not people in reality do have such insight. What research exists suggests that they do not.

People's choices are often forward-looking, and studies of intertemporal choice suggest that, even for not especially moral choices, people have a difficult time anticipating which consequences will best serve their preferences because not all things are weighted equally across time. Negatively valenced information is discounted at a steeper rate than positively valenced information is, meaning that positively valenced information is likely to exert a greater influence on preference for distant future consequences than for near future consequences (e.g., Lewin, 1951). Similarly, hedonic value is discounted at a greater rate than cognitive-based value is, meaning cognitive-based value exerts a greater influence on preferences for distant future consequences than for near future consequences (e.g., Read, Loewenstein, & Kalyanaraman, 1999). Finally, a third perspective suggests that so-called high-level features (abstract, goal-relevant features central to the meaning of a future event) are more likely to drive choice in the distant future because low-level features (concrete, contextualized, ancillary features) are not part of the distant future representation of a choice alternative (e.g., Day & Bartels, 2008; Trope & Liberman, 2003). Any of these differences in the salience of choice attributes over time can yield reversal in preferences across time.

Another line of research shows that people have great difficulty anticipating the experiential impact of their choices for themselves. Here are just a few examples. People exhibit an impact bias—they overanticipate just how bad or good a bad or good outcome (e.g., receiving or being denied tenure) will make them feel (e.g., Wilson & Gilbert, 2003), and they overpredict how long the negative or positive effect associated with an outcome (e.g., losing the use of one's limbs vs. winning the lottery) will last (e.g., Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). At the same time, people underanticipate the impact of their current emotional state on the value they assign to alternatives and how future emotional states will affect their consumption experiences (Loewenstein, 1996) and sometimes overweight features that will not affect their well-being while underweighting features that will affect their well-being (i.e., in contrast to the predictions of undergraduates, the nicer weather experienced by people living in California does not make them happier; Schkade & Kahneman, 1998).

In short, the empirical evidence suggests that people make mistakes in anticipating the utility that meeting their goals will provide once those goals are met, which suggests that decision makers decide in ways that do not best serve their goals (Hsee & Hastie, 2006). This is made worse by the fact that people are far from perfect at learning about future utility from past experience (Morewedge, Gilbert, & Wilson, 2005). Our point in reciting these examples is not to suggest that people are error-prone, irrational creatures, but rather to suggest that the second step in calculation-based decision making poses a huge challenge to decision makers.

There is an interesting caveat that is worth mentioning here. One might argue, for example, that the overanticipation of reactions to failure and success only appears to be a failure of CBA because of a narrow construal of outcomes (closed-world assumptions again). It may be that these anticipations trigger behaviors (e.g., developing new skills, flexible planning) that serve the decision maker well. Note, however, that this point only reinforces our overall thesis that closed-world assumptions and arbitrary limitations on what are deemed to be relevant outcomes get in the way of seeing the broader issue of whether a given modes of decision making has adaptive value and can compete with alternative decision strategies.

Assigning Subjective Confidence That the Various Outcomes Will Occur Given Each Available Decision

The third step in calculation involves assigning likelihoods to outcomes. Several excellent books have been written explaining the psychological basis of many of the biases that exert influence on subjective likelihood judgments (e.g., Baron, 2000; Gilovich, Griffin, & Kahneman, 2002; Hastie & Dawes, 2001). And, considering that many moral choices are likely to elicit strong emotions in the decision maker, recent research demonstrating how affect systematically skews the subjective likelihood function (Rottenstreich & Hsee, 2001) and produces a miscalibrated positive correlation between perceived risk and reward (Slovic, Finucane, Peters, & MacGregor, 2002), the problems apparently only get worse. Many of these studies derive from settings where objective probabilities are provided. Outside the lab, decision makers are often given only weak guidelines rather than precise probabilities (e.g., "the way the stock market behaves in January predicts how it does for the full year"). Even when precise data are available ("this has held for 87 of the last 120 years") there may be competing categorizations and conditionalizations (e.g., "but only 11 of the last 20 years" or "for presidential election years, the figure is 13 of the last 30 election years") that support different estimates.

In domains where we have extensive experience and the environment is particularly stable and where we receive

accurate, timely feedback, it may be possible to be well-calibrated with respect to probability, but in much of life, these features of the environment are not obtainable. Even when they are, we often have few if any means to assess this stability or to anticipate whether it is about to change (Taleb, 2007).

Our contention is that it simply is not possible to educe and weigh all the potential costs and benefits associated with some decision. Laboratory studies that enforce closed-world assumptions relieve CBA of much of the burden it must carry in real-world circumstances. CBA may prove to be a useful heuristic when the option generation process is effective and the set of potential outcomes educed captures important regularities, but, as we will argue, even in this case it must compete with a range of other decision strategies that have less demanding preconditions.

Modes of Decision Making

At this point, it is instructive to place our discussion of moral rules and CBA in the larger context of the range of strategies or decision modes by which people may make choices. In this section, we present an incomplete list of these modes and discuss how some of them might be learned. In the subsequent sections, we will return to the narrower distinction between CBA and adherence to moral rules and consider how they might be selected for by different choice environments.

Weber (1998; Weber, Ames, & Blais, 2005) distinguished the following decision modes:

1. Calculation-based decision making. This mode involves decomposition of choice alternatives, evaluation of outcome components, and integration of those components to determine the best value. Calculation-based decision making may include the use of mental shortcuts or heuristics that simplify the task (Shah & Oppenheimer, 2008).
2. Recognition-based decision making. This mode involves categorization and assimilation to previous learning and experience (e.g., Hertwig, Barron, Weber, & Erev, 2004; Klein, 1993, 1998). It includes the following distinct subtypes:
   a. The employment of rules, including moral rules.
   b. Case-based (precedent-based) decisions that may involve implicit rules or, in some cases, explicit reasoning to adjust for differences between the precedent and the current case.
   c. Role-based decisions in which the social role of the person dictates the rules and behaviors that are appropriate and that may conflict with individual self-interest.
3. Affect-based decision making. This mode is driven by immediate, holistic, affective reactions (typically approach and avoidance responses) to different choice alternatives (e.g., Frijda, 1988; Haidt & Joseph, 2004; Slovic et al., 2002; Wilson & LaFleur, 1995; Wilson & Schooler, 1991).

To Weber's modes, we propose adding the following:

1. Imitation-based decision making. This mode exploits the presumed expertise of others by following their actions (Atran, Medin, & Ross., 2005). This mode of decision making has mainly been studied by researchers interested in cultural evolution (e.g., Boyd & Richerson, 1985; Henrich & Gil-White, 2001; Richerson & Boyd, 2005).
2. Advice-seeking. This mode of decision making also involves deference to others who presumably have more experience and expertise for the relevant decision context (Bonaccio & Dalal, 2006). For moral decisions, this might involve seeking spiritual guidance from trusted people, spiritual texts, or forms of communication with spiritual entities.
3. Identity-based decision making. This mode is associated with evaluating the meaning or attributional implications of decisions in relation to one's self concept, idealized self, or identity. The idea is that decisions not only reveal preferences but convey information to both the individual and other people. In this mode, someone may reject an otherwise attractive option because "I couldn't live with myself if I did that" or "I'm not the kind of person that does that sort of thing" (e.g., Aquino & Reed, 2002; Beach & Mitchell, 1987; Gollwitzer & Kirchhof, 1998; Higgins, 1996; Medin et al., 1999; Messick, 1999; Shweder & Sullivan, 1990; Skitka, 2003). This decision mode may involve either individual identity or group identity. In the case of identification with some role, this mode becomes equivalent with Mode 2c.
4. Exploration-based decision making. It is often useful to conceptualize decisions as having a space of possibilities (e.g., types of occupations to pursue, restaurants to sample, places to vacation, places to live). If one thinks of the space as providing chances for improvements by "hill climbing" (switching when there is at least one surrounding option is better than the status quo), then one may also imagine being stuck in a local maximum (no better options in the surrounding environment but perhaps better options in another part of the space). Depending on the landscape, it may occasionally prove useful to explore another area of the conceptual space, even if there is little information available to evaluate novel options (Page & Hong, 2004).
5. Coherence-based decision making. This mode involves seeking out and choosing decision options (either implicitly or deliberatively) that fit more consistently with some standard of comparison (e.g., with an existing schema or model; Kahneman & Miller, 1986), with preexisting beliefs or choices (the extensive literature on cognitive dissonance—e.g., Aronson, 1992; Festinger, 1957—provides ample examples of how the drive for coherence between our choices or beliefs influences our decisions; see also Jungermann, 1983), with a narrative or story (Basso, 1996; Bruner, 1985), or with good reasons (Pennington & Hastie, 1988).

This list of modes is intended to provide context to our much narrower discussion of CBA and moral rules. Clearly,

adherence to moral rules is not the only alternative to CBA. Just which mode should be used—moral rules, CBA, or something else entirely—depends on the decision ecology—that is, on the relationship between the decision makers (their experience, goals, and ability) and the task environment.[9] Although we describe these modes as mutually exclusive, there is no reason to think that they are discrete, particularly in real-world contexts. Decision makers may use one mode or a range of modes for a given decision.

How do moral rules map on to this list of modes? Although they largely conflict with Mode 1 and explicitly fit with Mode 2a, some of the other modes are closely associated with them. For example, moral rules are often associated with case-based precedent (Mode 2b; e.g., "Remember the Alamo . . . "; for an excellent discussion of reference to the case-based mode, in the form of place and in moral reasoning, see Basso, 1996) and with role-based reasoning (Mode 2c; e.g., one might alternatively ask, what a good parent, child, scientist, or teacher would do in the same situation and arrive at different answers.). In addition, affect (Mode 3) is often a central component of moral rules, which—in turn—are often central to one's identity (Mode 6*)*.

Our purpose in reviewing decision modes is to reject a one-size-fits-all approach to decision making by placing CBA in a broad context. CBA may be a powerful strategy in some contexts but it must "earn its keep" against a background of other strategies that may also prove effective. Research on decision making has tended to favor studying situations in which calculation-based solutions are transparent. Such cases are ideally suited to CBA and often give the impression that any alternative would be necessarily nonnormative.

Which mode or modes we use and when we use them is subject to expertise effects and changes with learning (e.g., some people give better advice than others for a given domain or people may learn about circumstances in which they are imperfect at anticipating their future preferences), some (e.g., some affective judgments) may involve (innate) predispositions, and some naturally become more prominent with experience in a domain (e.g., recognition-based decision making). In short, learning may be important within each mode. But learning to select and coordinate across modes in different decision contexts is also critically important. It is easy to envision a range of environments that create an ecology favoring some strategies here and different strategies there (Bednar & Page, 2007).

We think that the question of how different decision modes are learned and applied in different settings is important both empirically and theoretically (see Rieskamp & Otto, 2006). Here, we make a broad distinction between decisions from experience (which involve learning) and decisions from description (Hertwig et al., 2004) and a more specific division on the experience side between individual/ontogenetic experience, social/cultural experience, and evolutionary/phylogenetic experience. We argue that although decisions from description often favor CBA, decisions from experience often favor adherence to rules not involving CBA. This is particularly true with respect to social/cultural and evolutionary/phylogenetic experience.

Decisions from description are those for which (presumably) all the relevant parameters to the decision are provided. Often this includes variables like the available choices, the outcomes that might result from those choices, and the probabilities of those outcomes. If the description provides all the relevant information, then decisions from description are ideally suited for CBA.

Decisions from experience are those for which the relevant parameters must be learned from repeated trials with the decision task. They provide difficulty for effective CBA. Decision makers have few ways of knowing whether or not their sampled experience of outcomes corresponds to the actual outcome distribution. This is particularly problematic when, as in the example from Hertwig et al. (2004), the distribution includes high-impact, low probability events.

An analogy with a lottery may help make this point. The vast majority of players never win the lottery, though they may have been purchasing tickets for years. If they were assessing their probability of winning from experience alone, they might reasonably conclude the expected value of playing the lottery is essentially zero, no matter how high the value of the prize. Does the person who finally wins the lottery get a reasonable estimate of the expected value? No, they are at a similar disadvantage, but this time from the opposite direction. The rare lucky individual who wins the lottery has almost certainly not played and lost the million or 30 million times that would represent the true likelihood of winning. If they use experience to estimate expected value, they will vastly overestimate it.

The situation is only more complicated for everyday experience because one rarely has accurate information for options not taken. Employers may learn about the productivity of the people they hire but little or nothing about the potential pool of talent that they chose not to hire (Einhorn & Hogarth, 1981). Experience often does not provide the representative distribution of information that would be necessary to be an effective cost-benefit analyst.

This problem is compounded by the fact that learning from experience often integrates decision-relevant information in powerful ways not accessible to the cost-benefit analyst. If we allow our concept of learning to be broad enough to include evolutionary/phylogenetic adaptation and social/cultural learning, the relevant information will likely be inaccessible to a decision maker wishing to deliberatively weigh costs and benefits. Evolution by natural selection, for example, in some sense takes into account the magnitudes and probability of costs and benefits by repeatedly experimenting with different genes and selecting those that work best given the particular environment. A similar kind of learning is possible through more proximal cultural evolutionary processes. A lifetime of experience playing chess will not result in knowledge of the range of powerful chess openings and their potential responses that any beginner can learn in a few weeks with a good book through the accumulated wisdom of generations of chess players.

This kind of learning is not well suited to CBA because the individual decision maker is not inheriting knowledge about

the range of possible choices, or the utilities or probabilities of their outcomes. Evolutionary/phylogenetic adaptation and social/cultural learning, often instantiated in imitation or advice seeking, may provide us only with rules of thumb and accepted practices rather than with the information needed for calculation. Yet these processes give other modes of decision making great potential power.

Ecologies of Moral Judgment and Decision Making

Even if we accept the limits of CBA, a reasonable counterpoint is that we do not know about the limitations of other decision modes. Returning to the more specific distinction between CBA and adherence to moral rules, is there empirical evidence that the latter can outperform the former? If so, when and why might this be the case?

There is surprisingly little research comparing the performance of alternative decision modes—including adherence to moral rules—to CBA. This likely reflects general difficulty of assessing the qualities of different decision modes when CBA no longer provides a straight-forward normative standard. Thus, in just the domains where alternative modes might be best suited to outperform CBA, it tends to be unclear how to assess expected consequences.

There have been some creative solutions to this challenge, however. Outside the moral domain, researchers have demonstrated that calculation shortcuts can outperform the most sophisticated CBA when generalizing from one set of data to another (e.g., "unit weighting" in Dawes, 1979; Gigerenzer & Brighton, 2009; Gigerenzer et al., 1999). Other researchers have looked at the relationship between adherence to cost-benefit analytic rules and success on other measures, including scores on intelligence tests, salary, and job performance (Larrick, Nisbett, & Morgan, 1993).[10] Inside the moral domain, Damasio (1994) provides compelling examples in which cold reason is used without the benefit of emotional learning associated with moral rules and has devastating consequences.

Social dilemmas and game theoretical resource allocation problems provides some of the more compelling evidence that adherence to moral rules can outperform CBA. After briefly reviewing this work, we consider characteristics of the moral decision ecology that we think help explain when and why moral decision making might be important.

Empirical Examples of Moral Rules Outperforming CBA: Social Dilemmas and Game-Theoretical Resource Allocation

In game-theoretical resource allocation problems participants often prefer what might be considered a fair distribution of resources to the distribution that would maximize their own—or even the group's—utility, such that they will often choose options that hurt everyone, including themselves, to punish those who do not share their inclinations. These examples differ from research on sacred values and on trolley dilemmas, however, in that they also offer compelling evidence that such adherence to and enforcement of moral rules sometimes makes everyone better off, including themselves.

Game theory concerns decisions for which the outcomes depend on choices made by other decision makers, choices that are unknown to each actor until after he or she makes a choice. Game theory has traditionally consisted of mathematical analyses to determine the optimal choice, given certain assumptions about the nature of the interacting agents. One such assumption has often been that of self-interest: the idea that agents seek to maximize their own utility without concern for the utility of other members of the group. Another assumption has been that decision-making agents are perfectly rational in that they act so as to maximize their own expected utility with the expectation that their opponents are doing the same. With these assumptions, game theory has developed mathematical models and theories that indicate how an agent ought to choose given different particular scenarios (i.e., different games).

For example, consider the prisoner's dilemma (Flood, 1958), which gets its name from the scenario that inspired it: Imagine two prisoners are suspected of participating in a crime, locked in separate rooms, and given the opportunity to confess or to maintain their innocence under the following conditions (of which both prisoners are informed): (a) if they both confess, they will each get 3 years in prison; (b) if they both maintain their innocence, they will each get 1 year in prison; (c) if one confesses and the other does not confess, the one who confessed will go free, but the one who did not confess will be incarcerated for 5 years. Given the structure of the one-shot prisoner's dilemma, regardless of what the other prisoner chooses to do, it will be better for the prisoner to confess: If the other prisoner has also confessed, then the first will be imprisoned for only 3 years instead of the 5 years he would have received by maintaining his innocence. If the other prisoner has not confessed, then the first will get off free.

The dilemma stems from the fact that if the two players behave as rational choice theory predicts they should, they will each get 3 years in prison instead of the 1 year they would have gotten if they had only both been dependably irrational. This discussion shows how, at least in theory, real-world decision makers might perform "better than rational," in the sense that both agents would be better off if something compelled them to cooperate.

Research using anonymous one-shot prisoners' dilemma games (Frank, Gilovich, & Regan, 1993) shows that people often choose to cooperate even though noncooperation ensures a gain that cooperating does not. Experimental conditions differed according to whether or not participants were allowed to make promises to cooperate before the games began among other things, though in all versions, the game was designed to ensure that players would have no way to know whether or not their opponent cooperated or kept their promises. Economics students were compared with noneconomics students to see if training in economics increased defection rates, given that the game theoretical assumptions of rational self-interest develop out of economic theory.

In the two conditions in which players were not given the opportunity to promise not to defect, economics majors cooperated 28.2% of the time whereas noneconomics majors cooperated 52.7% of the time, suggesting a strong effect of economics training. Of course, individual defectors would have been better off than cooperators regardless of the cooperation rates, but both defectors and cooperators are better off because they play the game among a population of players who tend to cooperate.

In the Free Rider game, participants have the option to contribute (from an initial endowment of money provided by the researchers) either to a private account that will go directly to them or to a public account that will be multiplied by some factor greater than one (but less than the total number of participants) and then redistributed. To maximize the utility of the group, individuals should allocate all money to the public account, but to maximize individual gain relative to others, it is best to allocate all money to the private account (since the individual will still get an equal share of the public account whether or not they donate to it).

In an experiment by Marwell and Ames (1981) participants contributed an average of 42% to the public account (noneconomics graduate students contributed 49%, and economics graduate students contributed an average of 20%). Note that students explicitly trained in CBA do worse as a community than they would if they were citizens of these more cooperative populations, even though defectors are still better off given no matter what group they are in. For additional relevant discussion, see Marglin's (2008) book, *The Dismal Science: How Thinking Like an Economist Undermines Community*.

The tragedy of the commons (Hardin, 1968) occurs in cases when people share resources with the greater population (say, grazing area for cattle or public land for pollution). Often the personal gain (for each head of cattle added or each piece of litter dropped on the ground) will be greater than the personal cost, and so one is rationally self-interested to use that resource. But if everyone thinks that way, the land will not support any cattle at all and their surroundings will be ridden with litter. A common viewpoint has been that the only way to avoid the tragedy is mutually agreed coercion: voluntary limits on individual freedom through laws and enforcement from above, echoing the argument for giving up individual rights to a state government originally proposed by Hobbes (1651/2008).

Elinor Ostrom and her colleagues have conducted a wide-ranging research program employing both lab and field studies on the tragedy of the commons (Ostrom, 1998, 2000; Ostrom, Gardner, & Walker, 1994; Ostrom & Hess, 2007) that suggest that the tragedy of the commons is not inevitable. They found that smaller scale societies and subgroups within larger societies often avoid the dilemma altogether through community bonds, social norms, and other mechanisms (including punishing defectors at a personal cost) that encourage cooperative behavior. In effect, members of these social groups do better than rational.

The above examples describe group success. In the following cases, such as the ultimatum game, we show that individual agents adhering to moral rules are better for it.

In the (one-shot) ultimatum game, there are two agents: an allocator and a receiver. The allocator has the power to allocate some fraction (anywhere from 0% to 100%) to the receiver. The receiver then has the option to accept or decline the allocation. If the receiver accepts, both agents keep their portion of the allocation. If the receiver declines, neither agent receives anything. This version of the game is played only once, so there is no reason to make choices in the hope of influencing future choices. From a game-theoretical perspective, the receiver should accept any amount greater than $0, as even $.01 is better than the alternative—nothing. Recognizing this, the allocator—also seeking to maximize net benefits—should offer that minimum amount. If on the other hand, the allocator has reason to believe that the receiver is not perfectly rational, then the allocator must consider both the utility of the allocation and the probability that it will be accepted. Here, the rationally self-interested choice for the allocator is an empirical rather than purely mathematical question: How are receivers likely to actually behave? If the allocator knows with certainty that the receiver will accept a 25% allocation (or even a 75% allocation) but will reject anything less, then the allocator would maximize personal net benefits by offering that minimum acceptable amount.

In actual practice, the most common offer is a 50-50 split, and most of the very unbalanced offers (in favor of the allocator) are rejected by the receiver (Guth, Schmittberger, & Schwarze, 1982; Kahneman, Knetsch, & Thaler, 1986). This does not necessarily indicate that the allocator is failing to weigh costs and benefits. He or she may simply have correctly recognized that receivers do not only weigh costs and benefits and that his or her offer will not be accepted if it is too one-sided. The fact that receivers usually refuse one-sided offers, however, shows that at least they care about something other than just net benefits—presumably "fairness." The fact that allocators anticipate this nonmaximizing response shows that they recognize that others are motivated by more than just the desire to maximize net benefits. Both sides do better as a result. The receivers do better by virtue of being the kind of creature that would "irrationally" refuse extremely unfair offers, and they are thus less likely to receive those unfair offers. The allocators do better by virtue of realizing this, and they are thus less likely to give unfair offers that would ultimately be refused.

Perhaps the best known example of the power of moral rules in game theoretical problems involves a computer programming competition organized by the political scientist Robert Axelrod (Axelrod & Hamilton, 1981). Each programmer's task was to write the code for one of the agents that would compete in an iterated prisoner's dilemma competition against the other algorithms entered in the competition. A key difference from the previously described prisoner's dilemma game is that agents played against the other agents repeatedly throughout the course of the competition. Agents were randomly pitted against other agents and were able to adjust their strategy depending on how the other agents had behaved with them in the past. This makes the game more realistic in that decision makers can learn about each other and in some sense develop reputations that influence future interactions.

The winning program across several iterations of the tournament was one of the simplest and came to be known as tit for tat. Submitted by Anatol Rapoport, an agent using the tit-for-tat program would cooperate on meeting another agent for the first time. If that agent cooperated too, the agent using tit for tat would again cooperate on the next meeting. If an agent defected, the agent using tit for tat would defect. The successfulness of one's strategy depends on the distribution of strategies of other agents in the competition: the optimal strategy cannot be calculated using CBA. For example, an even more cooperative program, tit for two tats (allowing other agents to defect twice before defecting) would have won the first competition if it had been entered (though not subsequent ones) and neither version of the program would have won if the opponents were all defectors. The key points are that an agent that chooses to cooperate by default can systematically outperform other agents and that this powerful strategy did not depend on CBA, but rather a simple rule to cooperate with ''strangers'' and with known cooperators and not to cooperate with known defectors.

Of course it is possible to formulate more sophisticated utility theories that focus on more than self-interest. In cases where people do ''better than rational,'' perhaps participants are seeking to maximize group utility instead of (or in addition to) self-interested utility. In that case, CBA might dictate cooperation. This consideration does not apply to the iterated prisoners' dilemma competition, as the standard of success was defined at the individual level. Similarly, it does not apply very clearly to the ultimatum game, as both individual and group utility are sacrificed by refusing an offer and, as long as the receiver accepts the offer, there is no greater pie to be divided when the allocator makes a larger offer. Nonetheless, in the ultimatum game, perhaps a broader conception of costs and benefits is sufficient to explain observed behavior: Maybe the virtue of dividing resources fairly has some utility for the allocator that is being weighed against money lost, or maybe the emotional desire to punish cheap allocators has similar utility that outweighs the sacrificed monetary utility.

As was noted earlier, we concede that it is possible and even desirable for CBA frameworks to incorporate a broader notion of what attributes or properties may be relevant and weighted by decisions makers. But this relaxation of assumptions comes at a considerable cost and creates something of a dilemma for CBA models. They can choose between simplistic assumptions that make the theory falsifiable and face data indicating that the theory is false, or they can incorporate a much broader and less constrained set of factors having utility and face the possibility that the theory is not falsifiable.

For example, Frisch and Clemen (1994) question the value of CBA as a process model and offer the following scenario:

> . . . [I]magine that a person has a $1,000 balance on his or her VISA card and pays 17% annual interest. Imagine that this person also has $2,000 in a savings account earning 4% interest. From the perspective of utility theory, one would conclude that the utility to this person from having money in a savings account (e.g., feeling of security) outweighed the cost of paying the high interest on the VISA bill. (p. 49)

Frisch and Clemen argue that whether this choice reflects the results of an explicit assessment of value or utility should be an empirical question, not a given. They suggest that it may reflect a habit of keeping the money in savings and, as Medin and Bazerman (1999) note, it is easy to think of other possibilities:

> 1) the person in the example may not have remembered that they had money in a savings account during times when they paid their bill, 2) the savings money may have been a gift from a relative and may be linked to a moral prohibition from using it to pay current expense bills or 3) the credit card bill may have been produced by some impulsive purchases and the person in question may have decided to punish himself or herself with the high interest payment (or they may be protecting themselves from future impulse buying by leaving a balance near their credit limit). (p. 538)

The point is that, when treated as a process model, CBA seems to either prejudge the basis for decisions or be relegated to formulating utilities in a post hoc manner that robs the theory of explanatory value.

Note also that the optimal strategy for the iterated prisoner's dilemma game won by tit for tat could not be calculated through CBA. The fact that cooperation in a one-shot prisoners' dilemma game, the free-rider game, or the tragedy of the commons results in everyone being better off (and not just the defectors) depends on the empirical fact of being part of a community primarily made up of cooperators, something that was notably not anticipated by the early best minds in the field of rational choice theory, so it would be surprising if it were being anticipated by the game participants themselves. Indeed, even when neither social nor individual utility seem to be maximized, decision makers show a commitment to moral right and wrong (as evidenced in the work on trolley dilemmas, sacred and protected values, the ultimatum game, and Haidt and colleagues' work on moral dumbfounding; Haidt, 2001; Haidt et al., 1993). The difficulty or impossibility of determining the best strategy through CBA in these situations is at least partly why explanations for these adaptive strategies tend to be given in the framework of cultural and biological evolutionary theory rather than CBA (e.g., Axelrod, 1984; Boyd & Richerson, 2001, 2002; Hamilton, 1964; Hammerstein, 2003; Trivers, 1971).

Why Might the Moral Domain Be Particularly Well Suited to Rules?

Recall that decisions in the moral domain are distinctive in that sometimes people seem not to care about consequences. Moral rules tend to concern the social: prohibitions against harm, duties to honor social contracts, beliefs about hierarchy and social roles (Haidt & Joseph, 2004), values about how to

manage the "commons" (i.e., the environment), and the like. Violations of moral rules are often associated with strong negative affect. Are there special characteristics of the moral domain such that rules requiring the decision maker not to weigh costs and benefits might be preferred (both descriptively and normatively)?

In this section, we consider three answers.[11] The first is directly related to the game theoretical resource allocation problems just discussed. Clearly, calculation-based strategies are often not ideal for achieving the best outcomes in the social sphere, because of the complexity of social interactions and the dependency of strategic success on the distribution of other agents' strategies. Instead, social/cultural learning and evolutionary/phylogenetic adaptations may promote moral rules concerning harm, rights, and cooperation that allow decision makers to perform "better than rational" but that also allow each individual to perform better than they would if they had been seeking to maximize net benefits.

A second reason goes back to the idea of high-impact, low-probability events. There are many important behavioral rules that are particularly hard to learn from individual experience, either because the consequences are so large that decision makers won't survive to learn from their mistakes or because the hazards of violating a moral rule rarely occur. We suggest that these high-impact, low-probability events are often in the moral domain and that this is no coincidence. Choices that could result in death, in loss of family and loved ones, or in family disgrace are often moralized by pure virtue of their transcendental importance. Furthermore, when these high-cost outcomes are particularly unlikely, moral prohibitions may insulate decision makers against motivated reasoning or simple lack of reliable information contributing to poor CBA. Thus, adherence to common moral rules like "keep your promises," or "remain faithful," may stop a generally good cost-benefit analyst from those rare, but particularly costly, mistakes.

A third reason for moral rules concerns the idea of *costly signaling*. Frank (1988) has used this theory to explain why people may have strong emotional responses to things that lead them to act in apparently irrational ways—ways that often lead to good outcomes. The ultimatum game discussed may be an example of this. By virtue of the receivers' willingness to sacrifice their own self-interest if they do not receive a fair offer (costly signaling), they are actually more likely to receive a fair offer.

Implications and Conclusions

Decision theorists often assume that some form of CBA is the right way to make both moral and nonmoral decisions. We have reviewed theory and evidence suggesting that there are serious limitations in the power of CBA to reliably assess expected consequences and that commitment to moral rules can be an effective tool for achieving good consequences.

Our review has been limited less by space limitations than by the straight-jacketing effect of a focus on the pluses and minuses of economic models of individual and social decision making. There have been few analyses of varying decision environments, and the lion's share of laboratory studies of decision making have relied on closed-world assumptions that exclude what may be critical decision-making skills (e.g., generating new options, anticipating unforeseen and unintended consequences, knowing when different strategies or modes are likely to be most effective). We can't learn about advice seeking and advice uptake if we exclude potential advisors from our studies, and we can't study changes with experience with one-shot studies.

We think the following claims and conclusions are well supported: (a) the use of anticipated costs and benefits to make decisions is strongly justified only when anticipated outcomes closely correspond with actual outcomes, (b) there is substantial evidence that anticipated utility often does not track experienced utility, (c) there is at least modest evidence from social dilemmas and coordination games that moral rules are often more effective than CBA, and (d) the straight-jacketing effect of the focus on CBA as a normative model has led to insufficient attention to questions about how alternative decision modes may compete or be coordinated in a range of decision contexts. Consequently, although we know that CBA has serious limitations, we know little about the strengths and limitations of alternative modes.

The monolithic approach to decision making in terms of a cost-benefit-maximizing decision procedure belies the multifaceted nature of human choice. Addressing this complexity is a significant challenge and will require considerable creativity. For the decision analyst seeking to evaluate others' decisions, part of the solution depends on more sophisticated CBA that takes into account the potential power of other modes of decision making. This calls for benchmarking the performance of alternative decision procedures before normative conclusions can be reached. These tests might take the form of computer simulations (e.g., like the tests of "fast and frugal" heuristics employed by the Adaptive Behavior and Cognition Group), agent-based modeling, or analytical analyses. Other ecological tests might start by sampling the procedures that people actually enact and the outcomes that ultimately result from these procedures (Larrick et al., 1993), as in experience sampling (Hogarth, Portell, & Cuxart, 2007; Larson & Csikszentmihaly, 1983).

The literature on judgment and decision making has benefited greatly from its interdisciplinary character. Nonetheless, because studies of decision making began with economic choices, there may be a "pioneering effect" that favors cost-benefit-driven choice procedures as "ground rules" for establishing cross-communicative research programs. We think that taking the perspective of different domains and different decision modes might allow for even greater cross-pollination with other branches of the social, biological, and cognitive sciences.

Notes

1. The emphasis on expected rather than actual outcomes points to decision science's common intent—which we share—to evaluate decisions independent from what results on any one particular

occasion, recognizing the probabilistic nature of outcomes. If a decision that would normally result in a bad outcome (e.g., spending all your retirement savings on lottery tickets), leads—by some fluke—to a good outcome (you win the lottery), decision scientists would generally not take that as indicative of a good decision.

2. Although we will largely adopt this standard for rhetorical purposes, we do not think it is the only defensible standard. Principled arguments can and have been made for nonconsequentialist commitments, such as Kant's categorical imperative to treat people as ends and not means.
3. Even among alternative perspectives, the debate is often between the relative merits of optimizing models of CBA and more limited forms of CBA that rely on heuristics (e.g., satisficing, Simon, 1957; elimination by aspects, Tversky, 1972; or anchoring and adjustment, Tversky & Kahneman, 1974). Although heuristics fail to take into account or integrate all available relevant information, they often still involve some simplified form of CBA.
4. Of course one might question whether protected values are being independently assessed given that the tradeoff or threshold question seems to be essentially the same as asking about the acceptability of CBA. As we shall see, however, these two measures do not always converge.
5. See the scathing comments about "playing trains" in Hare (1981) for relevant criticism of the trolley dilemmas.
6. A common distinction in decision theory is between normative, descriptive, and prescriptive models (Bell, Raiffa, & Tversky, 1988). This more or less proposes that prescriptive models refer to how people ought to choose taking into account bounded rationality, whereas normative models provide ideal standards by which to assess the effectiveness of both prescriptive and descriptive models. From this perspective, one might interpret us to be criticizing the prescriptive status of CBA while accepting it as normative. To remove any ambiguity, we are criticizing CBA on both prescriptive and normative grounds. CBA may systematically underperform other modes of decision making in certain contexts, and as such, it should not be taken to provide an ideal standard.
7. Many decisions are sufficiently constrained such that some of these steps are unnecessary. In games, for example, the set of choices and possible outcomes are often well constrained, and sometimes the probabilities can be calculated with precision. Alternatively, choices are often between certain outcomes rather than probabilistic ones ("Do I want the red car or the blue car?"). Experimental research often incorporates these kinds of constraints into the decision task, accepting the problem of closed-world assumptions in order to make the analysis manageable.
8. Herbert Simon (1991) reported having the same thing for lunch every day to avoid having to decide what to eat.
9. The above list should not be taken as comprehensive. We debated, for example, whether to include coherence-based or the narrower category of explanation-based decision making in the list of modes, and we are unsure how Tetlock's intuitive politician, theologian, and prosecutor (Tetlock, 2002) might map on to these modes, or whether instead they suggest a different organization altogether.
10. Unlike the other examples discussed here, this research supported the idea that systematic CBA is associated with better consequences. As the authors note, however, the choice of outcome measures favored adherence to cost-benefit rules. In the one study including scenarios involving commitment to humanitarian concerns, the results were more ambiguous.
11. This list should be seen as a starting point for the discussion rather than an exhaustive list of solutions. We might have discussed, for example, ideas about evolutionary processes related to kin selection (Hamilton, 1964) and reciprocal altruism (Trivers, 1971) that have been commonly associated with altruistic moral rules. Alternatively, there are good reasons to think that the reputation and reliability associated with an actor's commitment to moral rules might benefit that actor by making him or her the kind of person with whom other people want to "do business" (Milinski, Semmann, & Krambeck, 2002; Nowak & Sigmund, 1998).

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