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I would like to thank Professors Julia Driver, Don Loeb, and Cass Sunstein for their thoughtful comments. They correctly point out that I have not done justice to the complexity of moral philosophy, and, if I may add, the same can be said with respect to moral psychology. Rather, the question I tried to answer in my essay was this: What picture of morality emerges from the science of heuristics? Sunstein (2005) has written a pioneer article arguing that people often rely on “moral heuristics.” Here we are in agreement with each other, and Driver and Loeb also find it a promising proposition. Note that I prefer to speak of “fast and frugal heuristics” instead of “moral heuristics,” since one interesting feature is that the same heuristic can guide behavior in both moral and other domains.

Do Heuristics Lead to Moral Errors?

Sunstein also points to the imperfect reliability of heuristics. He emphasizes that his comment bears on the debate between those who emphasize cognitive errors (such as Kahneman and Tversky) and those who emphasize the frequent success of heuristics (such as myself). Here I would like to insert a clarification. Some philosophers have contended that the difference between the two programs was that one describes the dark side and the other the bright side of the mind (e.g., Samuels, Stich, & Bishop, 2002), although the distinctions are deeper and more interesting (e.g., Bishop, 2000). Cognitive errors have been measured against logical rationality as opposed to ecological rationality and explained by vague labels such as “availability” as opposed to precise models of heuristics. Let me illustrate these differences with reference to the term “sometimes” in Sunstein’s title. He is right; heuristics sometimes lead us astray, and sometimes they make us smart or good. However, we can do better and work on defining exactly what “sometimes” means. That is the goal of the program of ecological

rationality: to identify the structures of environments in which a given heuristic succeeds and fails. This goal can be achieved only with precise models of heuristics.

For instance, we know that “Imitate the majority” is successful in relatively stable environments but not in quickly changing ones (Boyd & Richerson, 2005), that “tit for tat” succeeds if others also use this heuristic but can fail otherwise, and that heuristics based on one good reason are as accurate as or better than consideration of many reasons when predictability is low and the variability of cue validities high (e.g., Hogarth & Karelaia, 2006; Martignon & Hoffrage, 2002). To the best of my knowledge, no such work has been undertaken in moral psychology and philosophy.

Thus, I agree with Sunstein that heuristics make errors, but I emphasize that there are already some quantitative models that predict the amount of error (e.g., Goldstein & Gigerenzer, 2002). Moreover, making errors is not specific to heuristics. All policies, even so-called optimal ones, make them. And there is a more challenging insight. We know today of situations where, in contrast to an “optimizing” strategy, a heuristic makes *fewer* errors (see below). In the real world, the equation “optimizing = best” and “heuristic = second best” does not always hold.

Institutions Shape Heuristics

Driver and Loeb find my suggestion unfair that English magistrates are more involved in trying to protect themselves than to ensure due process. My intention was not to issue a moral verdict against magistrates, who seemed to be unaware of the differences between what they think they do and in fact do, but to illustrate how institutions elicit heuristics. The study of the adaptive toolbox is not about the mind per se but about the mind–environment system. Features of the English legal institution, such as lack of feedback for magistrates’ errors, are part of the system, as is the “passing the buck” heuristic. The distinction between a moral theory that focuses on the individual mind versus one that focuses on the mind–environment system is an important one, which goes beyond magistrates’ bail decisions.

Consider medicine. Is it morally right that physicians make patients undergo tests that they themselves wouldn’t take? I once lectured to a group of 60 physicians, including presidents of physicians’ organizations and health insurance companies. Our discussion turned to breast cancer screening, in which some 75% percent of American women over 50 participate. A gynecologist remarked that after a mammogram, it is she, the

physician, who is reassured: "I fear not recommending a mammogram to a woman who may later come back with breast cancer and ask me 'Why didn't you do a mammogram?' So I recommend that each of my patients be screened. Yet I believe that mammography screening should not be recommended. But I have no choice. I think this medical system is perfidious, and it makes me nervous" (Gigerenzer, 2002, p. 93). Did she herself participate in mammography screening? "No," she said, "I don't." The organizer then asked all 60 physicians the same question (for men: "If you were a woman, would you participate?"). The result was an eye-opener: Not a single female doctor in this group participated in screening, and no male physician said he would do so if he were a woman. Nevertheless, almost all physicians in this group recommended screening to women.

Once again, my intention is not to pronounce a moral judgment on doctors or magistrates. A gynecologist who knows that there is still a debate in medical science as to whether mammography screening has a very small or zero effect on mortality reduction from breast cancer but has proven harms (e.g., biopsies and anxieties after frequent false positives, surgical removal and treatment of cancers that a woman would have never noticed during her lifetime) may or may not decide upon screening. Yet in an environment where doctors feel the need to protect themselves against being sued, they may—consciously or unconsciously—place self-protection first and recommend screening. At present, the United States in particular has created such environments for medical doctors and their patients. For many doctors, it is a no-win situation.

A physician who does not employ this double standard can be severely punished. A young Vermont family doctor and his residency were recently put to trial because the doctor, following national guidelines, explained the pros and cons of prostate-specific antigen (PSA) screening to a patient, after which the patient declined to have the test (and later died of an incurable form of prostate cancer). Note that the benefits of PSA testing are highly controversial, whereas the potential harms (such as impotence and incontinence after radical prostatectomy) in the aftermath of a positive PSA test result are well documented. The prosecution argued that the physician should have simply administered the test without informing the patient, as is established practice in Vermont and most other parts of the United States. A jury found the doctor's residency liable for \$1 million (Merenstein, 2004). After this experience, the family doctor said that he now has no choice but to overtreat patients, even at the risk of doing unnecessary harm, in order to protect himself.

These cases illustrate how institutions can create moral split brains, in which a person is supposed to do one thing, or even believes that he is doing it, but feels forced to do something else.

Maximization

It is interesting how economic theories resemble some moral theories: The common denominator is the ideal of maximization of a form of utility. One motivation for studying heuristics is the fact that maximization or, more generally, optimization is limited. The limits of optimization are no news to the departments of computer science where I have held talks, whereas during talks to economists and other social scientists, my pointing out these limits typically generates defensive rhetoric. In my chapter, I outlined some of these limits in consequentialist theories that rely on maximization. As my commentators correctly noted, these limits do not apply to all forms of consequentialism. For instance, if certain versions of consequentialism maintain that actions should be judged by their outcomes, and that one should choose a good-enough action (rather than the best one), the arguments I made do not apply.

Driver and Loeb defend maximization by introducing the distinction between the indeterminable and the indeterminate. Even if there is no procedure known to mind or machine to determine the best action, as long as a best action exists, consequentialism can still serve as a criterion of rightness. In economics, optimization is similarly defended. I must admit that I fail to understand the logic. Take the example of chess, where maximization is out of reach for mind and machine, but where a best strategy exists. Even if someone were to stumble over the best action by accident, we would not recognize it as such and be able to prove that it is indeed the best. How can maximization serve as a norm for rightness if we can neither determine nor, after the fact, recognize the best action?

Rethinking the Relation between Heuristics and Maximization

The ecological perspective also provides a new look on norms. It is a common belief that heuristics are always second best, except when there are time constraints. Yet that is not always so. Heuristics can also be “better than optimal.” It is important to understand what that phrase means. Driver and Loeb introduce the analogy of buying stocks. Nobody can know which stocks will produce the most returns, they argue; therefore, simple heuristics such as “Diversify one’s portfolio” would be practical. This does

not mean that one should reject maximization, they explain, because if one *could* know the future, one would pick the best portfolio. Let me outline my view on the matter, which I believe is systematically different.

First, I always use the term “maximization” for a process or, as Driver and Loeb call it, a “decision procedure,” whereas in this passage, it seems to refer to the outcome (knowing the stock results), not to the process of estimating their future performance. In economics, “maximization” refers to the (as-if) process.¹ For instance, the economist Harry Markowitz received a Noble Prize for his theoretical work on portfolios that maximize return and minimize risks. Nevertheless, for his own retirement investments, he relied on a simple heuristic, the 1/N rule, which simply allocates equal amounts of money to each option. He explicitly defended his decision to prefer a simple heuristic to his optimal theory (Zweig, 1998). How could he do that? The answer is that maximization (as a process) is not always better than a fast and frugal heuristic. For instance, a recent study compared a dozen “optimal” asset allocation policies (including Markowitz’s) with the 1/N rule in 7 allocation problems (DeMiguel, Garlappi, & Uppal, 2006). One problem consisted of allocating one’s money to the 10 portfolios tracking the sectors comprising the Standard & Poor’s 500 index, and another one to 10 American industry portfolios. What was the result? Despite its simplicity, the 1/N rule typically made higher gains than the complex policies did.

To understand this result, it is important to know that the complex policies base their estimates on existing data, such as the past performance of industry portfolios. The data fall into two categories, information that is useful for predicting the future and arbitrary information or error that is not. Since the future is unknown, it is impossible to distinguish between these, and the optimization strategies end up including arbitrary information. These strategies do best if they have data over a long time period and for a small number of assets. For instance, with 50 assets to allocate one’s wealth, the complex policies would need a window of 500 years to eventually outperform the 1/N rule. The simple rule, in contrast, ignores all previous information, which makes it immune to estimation errors. It bets on the wisdom of diversification by equal allocation. This is not a singular case; there are many cases known where some form of maximization leads to no better or even worse outcomes than heuristics—even when information is free (e.g., Hogarth, in press; Dawes, 1979; Gigerenzer, Todd, & the ABC Research Group, 1999).

Thus, it is important to distinguish clearly between maximization as a process and maximization as an outcome. Only in some situations does

the first imply the second; in others, maximization does not lead to the best outcome, or even to a good one. One can think of a two-by-two table with the process (optimization vs. heuristic) listed in the rows and the outcome (good or bad) in the columns. None of the table cells are empty; both optimization and heuristics entail good or bad outcomes. The challenging question is one of ecological rationality: When does a procedure succeed and when does it not?

Description and Prescription

My analysis of moral behavior concerns how the world *is*, rather than how it *should* be. As mentioned in my essay, although the study of moral intuitions will never replace the need for individual responsibility, it can help us to understand which environments influence moral behavior and find ways of making changes for the better. In this sense, the fields of moral psychology and moral philosophy are interdependent. A necessary condition of prescribing efficient ways to improve on a present state—on lives saved, due process, or transparency—is an understanding of how the system in question works. Sunstein suggests going further and trying to find heuristics that might be defensible or indefensible on the basis of any view or morality, or the least contentious one. This is a beautiful goal, and if he can find such universal heuristics, I would be truly impressed. Yet Sunstein's goal is not in the spirit of ecological rationality, where every strategy has its limits and potential, and there is no single best one for all situations. My proposal is to study the combinations of heuristics and institutions that shape our moral behavior. The idea of an adaptive toolbox may prove fruitful for moral psychology, and moral philosophy as well.

Note

1. The distinction between process and outcome is also important for understanding the term “as-if model,” which refers to the process, not the outcome. Driver and Loeb suggest that the as-if model refers to a player “who behaves as if he intends to catch the ball” (the decision outcome). The as-if model I describe, however, refers to a player who behaves as if he were calculating the ball's trajectory (the decision process).