

Do Legal Rules Rule Behavior?

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ABSTRACT

Economic analyses of law share an implicit or explicit belief in unbounded rationality. Here two boundedly rational psychological principles are discussed that together provide an alternative explanation for why most people behave in accordance with legal rules most of the time. These principles are the capacity for social learning and the impact of environmental cues and constraints. The ability to observe others' behavior and its consequences helps people conform to behavioral norms without memorizing the legal canon or Miss Manners's rules of etiquette. Environmental and institutional constraints help winnow down the set of actions available to people, and environmental cues suggest which of the available actions are desirable. If people who aspire to live by legal rules, standards, and institutions are to have a chance of doing so, lawmakers must recognize the psychological realities of boundedly rational decision making.

INTRODUCTION

Do racially segregated neighborhoods in big cities prove the existence of entrenched racism? In his book *Micromotives and Macrobehavior*, Thomas Schelling (1978) concluded no. Using a checkerboard to represent a city, he randomly distributed equal numbers of two kinds of "agents"—pennies and dimes—on the board while leaving some cells vacant. Schelling assumed that the agents were not highly prejudiced: Each was content to live in an integrated, "penny-and-dime" neighborhood as long as at least three of the eight adjacent agents were like itself. Thus, agents moved to a randomly selected vacant place only when half or more of their neighbors were unlike themselves. Updating the agents' locations on the basis of this simple rule, Schelling found that the originally integrated neighborhoods became highly segregated within just a few rounds. Schelling's simulations thus elegantly demonstrated that even people who prefer fairly integrated neighborhoods might wind up living in segregated ones. More generally, Schelling's (1978) analysis suggests that macrobehavior—that is, behavior at the aggregate level—does not necessarily equal the sum of individual micromotives. Even seemingly straightforward inferences about micromotives made on the basis of macrobehavior may be wrong.

This insight inspired the current chapter. Just as inferences from macro-behavior to micromotives can be deceptive, so can inferences from macromotives to microbehavior. In the present context, the macromotives are legal rules, and the microbehavior is the actions of individual people. The question is: Do legal rules rule individual behavior, and if so, how? I suggest that the answer offered in classical economic analyses of legally relevant behavior—namely, that laws shape behavior by setting costs and benefits that individuals consider when choosing the optimal course of action—is probably wrong under most circumstances. The problem is that the classical approach makes assumptions about people's knowledge and reasoning power that do not hold in most real-world contexts, as I will discuss shortly. But if the causal arrow does not go from law to behavior, why do most people nevertheless conform to legal norms and regulations most of the time? My thesis is that legally relevant behavior is governed by psychological rather than legal principles. Chief among them are *social learning* and *environmental constraints*.

Before I turn to these psychological principles, I use a recent change in German tax legislation to illustrate how the impact of law on individual behavior has been explained in economic analyses.

TO COMPLY OR NOT TO COMPLY WITH THE LAW: A DECISION REQUIRING UNBOUNDED RATIONALITY

Germany's dismal economic performance, high unemployment rate, and skyrocketing budget deficits have left state coffers empty (*The Economist*, Feb. 19, 2004). It was therefore no surprise when the Minister of Finance offered amnesty to German citizens who, wishing to evade the capital gains tax hikes of the early 1990s, shifted their assets to tax havens such as Switzerland, Liechtenstein, and Luxembourg. Swiss banks alone are said to be holding many billion Swiss Francs of private German investment. Until now, the dilemma faced by repentant tax sinners was that there was no legal way to bring the money back to Germany without paying penalties of up to 60% of its worth. The new tax amnesty, which went into effect in January 2004, exempts from penalties all undeclared tax on income received after Dec. 31, 1992, and before Jan. 1, 2003. Under the new scheme, investors face a tax rate of 25% or 35%, depending on the assets' worth, on assets repatriated by the end of 2004—a deal the government argues is attractive compared with the 48% tax rate that otherwise would have applied. How will the new law affect the behavior of tax evaders?

In an economic analysis, the individual is believed to act rationally on the basis of the costs and benefits associated with legal and illegal choices. Thus, the tax sinner is assumed to compute his subjective expected utility of accepting the amnesty deal and of choosing alternative courses of action (e.g., keeping his money abroad). If the expected utility of accepting the deal exceeds that of the alternatives, he will repatriate the money; otherwise, he will select the

alternative with the highest expected utility. More generally, this view stipulates that legal rules put implicit or explicit prices on different behaviors, and people adjust their behavior to those prices in much the same way as they adjust to relative prices in economic markets (see Ulen 2000).

One of the most prominent examples of an economic analysis of legal and illegal behavior is that of Gary Becker (1968; for a critique, see Wilson and Abrahamse 1992). In his paper "Crime and punishment: An economic approach," Becker (1968, p.170) argued, "A useful theory of criminal behavior can dispense with special theories of anomie, psychological inadequacies, or inheritance of special traits and simply extend the economist's usual analysis of choice." In other words, criminals, like everyone else, are rational utility maximizers. They decide whether to comply with the law by comparing the expected costs and benefits of committing a crime and of obeying the law, respectively. The expected costs of a crime are calculated by multiplying the subjective probabilities of the crime's being detected and of the perpetrator's being apprehended and convicted by the negative utility of any monetary sanction and any nonmonetary losses he might suffer (e.g., reputational damage, jail time). The expected benefits of the crime are calculated by multiplying the subjective probability of getting away with it by the value of the monetary and nonmonetary utility it would bring (e.g., being known in one's community as someone to be reckoned with). The maximizer will then choose whichever option promises the higher subjective expected utility. In this view, there is a direct route, henceforth called the *rational choice pathway*, between the law and the individual mind: The law divides the world into legal and illicit actions and defines some of the consequences of these actions (e.g., in terms of "legal costs and benefits"; Kornhauser 2001); the individual responds by applying the expected utility calculus.

Will German citizens who stashed their fortunes abroad decide whether to cut a deal with the German revenue service by using the expected utility calculus? Although we do not know (because people rarely discuss their Swiss bank accounts with researchers), we can gain some insight into tax sinners' decision making by examining the publicly available advice of their lawyers. Not long after the amnesty was announced, tax lawyers began to offer advice on how to respond to the amnesty. In the on-line journal *manager-magazin.de*, for instance, Busse and Fischer-Zernin (2004) published a "Guide for Tax Sinners" outlining the kinds of information that a rational utility maximizer would require: (a) how much money in taxes one would have to pay if one returned the money, (b) what alternative courses of action are available, (c) how high the risk of being detected is, (d) what kind of legal sanctions a tax evader who is caught faces, and so on. But when they got to the heart of the matter (Should one strike a deal with the government or not?), Busse and Fischer-Zernin seemed to abandon the rational choice approach. Instead of instructing readers to feed all the listed information into the expected utility calculus, they appealed to intuition: "We have presented

the crucial rational decision parameters; yet in the end much is a question of your gut feeling.”

Of course, Busse and Fischer-Zernin’s (2004) apparent reluctance to counsel expected utility maximization when it comes to obeying tax laws cannot be taken to reflect the psychological plausibility or implausibility of the rational choice pathway. The more interesting lesson from this episode is that treading the rational choice pathway from the law to an individual’s decision about whether to follow the law is bewilderingly difficult. Imagine a tax sinner who aims to choose whether to take advantage of the amnesty on the basis of a subjective expected utility analysis. Although Busse and Fischer-Zernin have given her a head start, much work that cannot be delegated remains to be done. To compute subjective expected utility for accepting the government’s deal, she would have to list all the possible consequences of doing so (e.g., having more resources legally available for consumption or investment, being subject to additional taxation in the future), attach a quantitative probability and subjective utility to each one, multiply each utility by its associated probability, and add up all these products to estimate the subjective expected utility of accepting the deal. She would have to go through the same procedure to estimate the subjective expected utility of not accepting the deal, which encompasses all alternative courses of action. Finally, she would have to compare the subjective expected utilities and choose the alternative with the higher one.

Completing all these steps requires knowing the law in detail, identifying the different courses of action, and gathering reliable information about the actions’ consequences and the consequences’ probabilities and utilities. Even assuming that the possible consequences of a course of action are finite and knowable, a person might have to invest days, weeks, or perhaps months and years of effort into this analysis, leaving her little time for activities other than managing her taxes. Just learning the relevant tax laws is a daunting task. One prominent commentary on the German income tax code, for example, consists of 2,262 pages (Kirchhof 2002), and the American tax code is estimated to include more than 50,000 pages (*The Economist*, Sept. 23, 2004). To suppose that a person can respond to all or some of the laws that make up the social and economic order of a community by applying the maximization calculus is tantamount to assuming that humans have unlimited cognitive abilities, knowledge, and time. This vision of *unbounded rationality* paints humans in God’s omniscient image (Gigerenzer et al. 1999).

ECONOMIC ANALYSIS OF LAW: AS-IF MODELS AND CONSTRAINED OPTIMIZATION

One may fault the above depiction of economic analyses of law for outlining a view that perhaps was common early in the evolution of the field but that very few contemporary law and economics scholars would endorse. Today, many

would interpret the economic models in an “as-if” sense. Others would agree that cognitive resources, time, and money are limited and would assert that economic models explicitly take such limits into account. Let us consider each of these views in detail.

Unboundedly Rational in an As-if Sense

When proponents of an economic analysis of law acknowledge that their models assume unrealistic mental abilities, they often argue that this is merely an as-if assumption. On this interpretation, economic analyses of criminal acts, for example, do not describe underlying reasoning processes but rather behavioral outcomes on the aggregate level. In that case, the fact that the processes on the level of the individual actor are psychologically implausible is beside the point. But do contemporary proponents of an economic analysis of law hew to this as-if interpretation? Let us consider, for example, Robert Cooter and Thomas Ulen’s (2004) best-selling textbook *Law and Economics*, now in its fourth edition, which offers students an introduction to the economic analysis of law. How do these authors portray economic models of law?

In an analysis of embezzlement, Cooter and Ulen (2004) describe how someone might go about deciding whether to commit this crime. Specifically, they “assume an informed criminal, who knows the costs, benefits, and probabilities associated with the crime” (p. 462). The “rational embezzler calculates an expected value for the crime, which equals the gain minus the punishment multiplied by the probability of being caught and convicted” (pp. 456–457). Thus, in their view, “the economic model may be understood as an account of the *deliberations* of a rational, amoral person when deciding in advance whether to commit a crime” (p. 463, emphasis added).

These excerpts from Cooter and Ulen’s (2004) influential textbook suggest that at least two contemporary proponents of an economic analysis of law do not consider their models of, for instance, rational crime to be mute on the subject of psychological processes. It is therefore reasonable to ask to what extent their analysis includes deliberative steps that rest on unrealistic assumptions about the human mind.

Constrained Optimization

Many contemporary economic models explicitly aim to take bounded rationality into account by, for instance, assuming limited rather than unlimited search for information. Limited search requires a stopping rule, that is, a way to decide when to stop looking for more information. Often put under the rubric of “optimization under constraints,” one class of economic models assumes that the stopping rule *optimizes* search with respect to the constraints of time, computation, money, and other resources being spent. In this view, the mind should

calculate the marginal benefits and the marginal costs of searching for further information and stop search as soon as the costs outweigh the benefits (e.g., Sargent 1993; Stigler 1961). Although the rule “stop search when costs outweigh benefits” sounds plausible at first glance, optimization under constraints can demand even more knowledge and computation than classic models of unbounded rationality. This is because they assume that the decision maker takes into account not only cost-benefit calculations but also opportunity costs and second-order costs for making those calculations (Conlisk 1996; see also Gigerenzer et al. 1999).

To summarize the argument up to this point, the rational choice pathway from legal rules to the human mind suggested by economic analyses of law rests on assumptions that are unworkable under most circumstances. Moreover, this argument cannot be simply dismissed by claiming that contemporary economic analyses of law represent as-if models or constrained optimization models. How, then, do macromotives affect microbehavior? My thesis is that they generally do not. Specifically, there is no direct causal pathway from legal rules to individual behavior, and legal norms are often unknown to those subject to them.¹ Why do most people nevertheless act in accordance with legal rules most of the time?

Perhaps the most radical answer is that the causal arrow from legal rules to behavior actually points in the opposite direction. In other words, social practices may be a source rather than a product of the law. In that case, laws are not created but rather deduced through observation of evolved social norms (Parisi 2000). Because custom is only one source of law, however, it can provide only a partial explanation for people’s adherence to legal norms that they do not know. In what follows, I discuss two other mechanisms that could help account for this phenomenon. I focus on these mechanisms not to suggest that they alone can explain law-abiding behavior but to highlight contributors that I believe to be particularly relevant (for others see, e.g., Ellickson 1991).

HOW BOUNDEDLY RATIONAL PEOPLE FOLLOW LEGAL RULES: SOCIAL LEARNING

Last year I moved to Basel, an experience that has taught me that Switzerland is indeed a special case. The oldest continuous democracy in the world, it has a widely envied political system; it remains fiercely independent; it has four official languages; and it is home to so many ethnic and religious groups that, in a recent survey of the country, *The Economist* (Feb. 12, 2004) wondered how it has

¹ After writing this chapter, I discovered that Robert Ellickson, a fellow participant at this Dahlem Workshop, has put forth a similar view. He pointed me to his excellent book *Order without Law: How Neighbors Settle Disputes* (1991), where readers can find a thought-provoking explanation for how order can emerge in the absence of legal knowledge as well as a summary of empirical studies that document the paucity of legal knowledge among laypeople (pp. 144–145).

managed to stick together for so long. Switzerland is also special when it comes to the informal laws that govern its social life. For instance, when you greet someone you know fairly well, you are expected to kiss the person lightly on the cheek three times in this order: right, left, right; importantly, however, men usually shake hands with one another instead. When you clink glasses with someone, it is important to look the person in the eye as you make a toast. During a meal, you should keep your hands above the table rather than in your lap. At work, the afternoon coffee break is a ritual observed by nearly everyone regardless of how busy they are. Although my German upbringing exposed me to variants of some of these rules, my lack of familiarity with their nuances has brought me into a few awkward situations.

When in Rome ... For the most part, however, I have been able to avoid making gaffes in my country of residence. Why? I propose that the capacity for social learning helps people to act in accordance with both legal and social rules without necessarily having explicit knowledge of them. Very generally put, social learning occurs when a person or an animal learns a behavioral pattern or acquires a preference as a result of observing or interacting with conspecifics (see Laland 2001). In humans, perhaps the best-known mechanism of social learning is what I will call the *imitation heuristic*, the purposeful copying of others' behavior. Indeed, imitation is the mechanism by which I learned how to greet people at a Swiss party. After observing a colleague who shook hands and either greeted by name or introduced himself to everyone present, I followed suit. Judging from my reception, this was the right thing to do.

Imitation can help one behave in accord with other social rules as well—for instance, to decide whether and how to queue in a store (e.g., if one sees other customers take a number, elbow others out of the way, or stands in line, one can simply do the same) and whether and for whom to hold the door. Copying other people can also help one avoid violating legal rules of which one is uncertain or ignorant. Take traffic laws, which vary greatly from place to place. Unless there is a sign to the contrary, making a right turn on a red light is legal in Los Angeles; it is illegal in New York. In deciding whether to turn right on red, make a U-turn, or drive on the left or the right side of the road, intentionally copying others' behavior is generally an efficient strategy for staying on the right side of the law. Similarly, imitation can help one determine the legal boundaries on drinking alcohol (e.g., whether one is permitted to drink in public), smoking cigarettes or marijuana (the latter is legal in the Netherlands and illegal almost everywhere else in Europe), and waste disposal (e.g., when and where to put out one's trash).

Social imitation is not a surefire way to stay on the right side of the law; that is, it will not *invariably* produce behavior consistent with legal rules. For example, a driver cannot necessarily infer that car traffic flow always falls within the legal speed limit, and smoking marijuana may be illegal even if most of one's peers do it. The claim here is simply that, by watching and copying others' behavior, an observer can learn to act in accordance with the practices in his social

environment. When these social practices are in step with legal rules, as they generally are, the observer will behave consistently with the law (for more on the link between social learning and legal rules, see Engel 2004). By the same argument, however, when social practices and legal rules diverge from one another, observing and copying others' behavior will result in rule violations.²

The Bounded Rationality of the Imitation Heuristic

As Laland (2001) pointed out, social learning—of which imitation is an example—allows individuals to learn about their environment without engaging in potentially hazardous learning trials or wasting a large amount of time and energy on exploration, information search, and deliberation (see also Henrich and McElreath 2003). The imitation heuristic is particularly versatile in that it can be more nuanced than an unconditional “do-what-others-do” strategy. Studies of social learning in species as diverse as rats, pigeons, and guppies, for instance, suggest that these animals sometimes adopt a “do-what-the-majority-of-others-do” strategy (Laland et al. 1996). In such contexts, the probability that an individual learns a behavior from others depends on the number of other individuals exhibiting the behavior. Moreover, humans and animals can learn from the outcomes of others' actions (*inadvertent social information*, Danchin et al. 2004). For example, bats that fail to locate food alone seem to use a “do-what-the-most-successful-individuals-do” strategy, following bats that have previously found food to feeding sites (Wilkinson 1992).

To conclude, imitation is not a monolithic strategy. Probably depending on situational cues and opportunities, the behavior copied may be that exhibited by the majority, by the most successful individuals, or by the nearest individual; and whether a behavior is copied or avoided can also depend on feedback regarding its consequences, when such is available. The crucial point is that using any variant of the imitation heuristic (or even simpler forms of social learning; see Noble and Todd 2002) can speed up decision making by reducing the need for direct experience and information gathering. The imitation heuristic is a prime example of a *boundedly rational* decision strategy (Simon 1990; Gigerenzer et al. 1999).

Did Adam Maximize His Utility?

Under the present view, there is no causal pathway from legal rules to individual behavior. Instead, macrobehavior that appears to be regulated by macromotives is actually driven by other means, such as the use of simple heuristics by individuals whose knowledge of social rules and legal standards is nil or only tacit. One

² Of course, there are myriad other reasons why people violate legal rules, but social learning mechanisms can help explain when and why people do so.

may fault this argument for skirting the problem of how the individuals whose behavior is copied learned to behave. Presumably, they too imitated others, but somebody must have shown a given behavior for the first time. Could it be that the rational choice model is descriptively appropriate for the first human actors, Adam and Eve?

Although one may doubt the soundness of Adam's decision to eat the forbidden fruit, he may have indeed performed the kind of rational calculations posited by classical economic theory and concluded that, given his utility function, eating the fruit had a higher expected utility than refraining from doing so.³ Alternatively, there may have been a single noncompensatory reason for his decision; for instance, he may simply have been hungry or wished to impress Eve with his sangfroid. There are many routes by which an individual might arrive at a behavior that for whatever reason becomes an example for others, among them trial and error, coordination between agents, application of a boundedly rational heuristic, and deduction from first principles. There is no need to assume that Adam's choice was based on expected utility calculations. Even when a threatened punishment such as prison time or banishment from the Garden of Eden influences a decision maker (Eide 2000), his behavior can be explained not only by rational utility maximization but also by simple, boundedly rational choice heuristics (e.g., the priority heuristic; Brandstätter et al. 2006).

HOW BOUNDEDLY RATIONAL PEOPLE FOLLOW LEGAL RULES: ENVIRONMENTAL CUES AND CONSTRAINTS

Many textbooks and articles on human decision making begin with the premise that people constantly make decisions. In the classic theory of utility maximization, this premise is typically interpreted to mean that people are constantly deliberating about the costs and benefits of possible actions (see Camerer et al. 2005). Several reasons make this fiction intuitive to researchers. As Camerer et al. (2005) suggested, as self-observers we may have a bias to interpret our own behavior as the outcome of a deliberate decision process because the neural activity that is associated with other processes (such as automatic ones) is inaccessible to consciousness. In addition, we students of human decision making may fall prey to the correspondence bias or fundamental attribution error—a phenomenon that we see in our subjects—which is the tendency to draw strong inferences about a person's disposition from his behavior even when his behavior is highly constrained by situational factors (Ross and Nisbett 1991). Efforts to understand legally relevant choices mostly or exclusively in terms of careful

³ Going back even further, one may ask why Eve ever suggested eating the fruit and whether she did so on the basis of the expected utility calculus.

deliberation recall the correspondence bias in that they overlook the potential of the environment to make decisions for us or at least to winnow down the set of decision options.

As Norman (1988) observed, the environment puts myriad physical, semantic, cultural, and logical constraints on what we can do and how we can do it. Focusing on everyday things such as doors, water faucets, and light switches, he argued that well-designed objects exploit those constraints, making objects easy to understand and operate by restricting the set of possible actions. To understand the role of constraints better, consider the task of building a toy alien using nine pieces found in an *Überraschungsei* (“surprise egg”) (Figure 18.1, top). Theoretically, there are 9—or more than 350,000—orders in which the 9 pieces could be assembled, only a few of which would result in success. Chances are, however, that even without instructions, you could put the pieces together correctly in a couple of minutes (Figure 18.1, bottom). How is this possible?

The role of each part of the alien, like each part of many other objects, is unambiguously determined by a set of constraints. Physical properties constrain the ways in which an object can be moved, placed in relation to other objects, put together, and so on. For instance, the alien’s arms have sockets, indicating that something needs to be inserted into them. Semantic and cultural constraints further narrow the set of possible actions. For instance, knowing what an arm is, one can infer that the arms connect with the torso at the sockets. And knowing that most tools are manipulated by hand, one would guess that the stick belongs in the alien’s grip.

The alien example (inspired by Norman 1988) illustrates that environmental constraints can aid decision making even in novel situations by limiting what can be done and by making desired actions obvious. Environmental constraints guide people’s behavior not only in the assembly of children’s toys and the operation of water faucets. I argue that they also signal what behavior is legal and desired. As in the case of social learning, environmental cues and constraints can influence behavior without there being a causal pathway from legal norms to the human mind. They can shape behavior directly. Consider laws against taking things owned by other people. Even if one did not know about property laws, there are environmental constraints on what can be taken. For instance, fences, walls, barbed wire, and locked doors all restrict one’s access to other people’s things and also provide cues regarding desired behavior.

Take traffic behavior as another example. The physical environment confronts the driver with curbs, speed bumps, median strips, guardrails, barricades, trees, houses, pedestrians, and other vehicles. All of these objects limit what the driver can do. Moreover, crosswalks, traffic lights, street signs, and traffic circles serve to signal what the driver may do. Finally, the physical environment of the car itself can be designed to prevent behavior that conflicts with legal rules. In some new car models, for instance, the engine can be started only after the seat belts have been fastened.

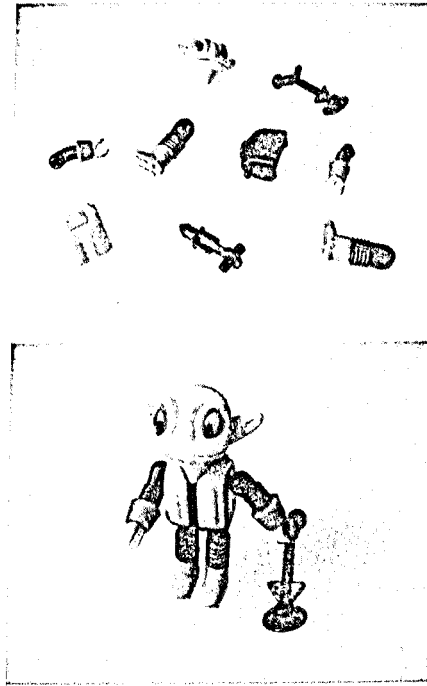


Figure 18.1 A nine-piece toy alien from an *Überraschungsei* (surprise egg) before (top) and after (bottom) construction.

In other domains, it is often institutional constraints that narrow the range of possible behaviors. For example, evading income taxes is not only illegal; it is difficult. For instance, for the large majority of workers in the United States and Germany, federal income taxes are deducted from gross wages before paychecks are even cut. Although a worker may try to reduce his tax burden by omitting or misrepresenting his other income or the number of his dependents, he will have to pay at least some income tax simply by dint of being on a payroll.

To conclude, explaining the behavioral effects of a legal norm in economic terms perpetuates the idea that people are round-the-clock decision makers. This fiction ignores that some and perhaps much of the work of making decisions is done not in the mind but in and through the external environment. Natural as well as artificial environmental constraints help restrict the set of actions to those that are lawful, and environmental cues signal actions that are desirable. Although some environmental constraints and cues are direct expressions of legal norms (e.g., speed bumps), many others are not. Of course, environmental constraints and cues are not the only reason why people generally adhere to the law, but any analysis of why people follow rules of which they have no explicit knowledge needs to take account of the structure of the environment.

LEGAL STANDARDS: HOW AN UNREALISTIC VIEW OF THE HUMAN MIND MAKES ADHERENCE TO LEGAL STANDARDS LESS LIKELY

The rational choice framework assumes that legal rules are known to those who are subject to them (Kornhauser 2001). Although I have argued that this assumption often does not hold, it holds in at least some contexts, for instance, in the courtroom.⁴ Turning from the effects of legal standards on individuals to their effects on behavior within legal institutions such as the courtroom, I devote this final section to the argument that here, too, understanding actual behavior requires making realistic assumptions about how people make decisions.

When the Representation of Uncertainty Determines the Degree of Doubt

The “beyond-a-reasonable-doubt” standard has been a pillar of the Anglo-American criminal justice system for more than 200 years (Shapiro 1991). In the United States, judges explicitly instruct jurors to vote for criminal conviction only if they believe the defendant to be guilty beyond a reasonable doubt. Determining whether this criterion is met can be a daunting task. But advances in forensic methods over the last decade, especially DNA analysis, which has revolutionized criminal investigation, can make the task more manageable. Scheck et al. (2000, p. xv) went so far as to suggest “DNA testing is to justice what the telescope is for the stars: not a lesson in biochemistry, nor a display of the wonders of magnifying optical glass, but a way to see things as they really are. It is a revelation machine.”

Indeed, DNA fingerprinting was initially received as a nearly foolproof means of identifying a criminal who left biological traces at the crime scene. There is no doubt that DNA analysis has enormous potential not only for identifying criminals but also for preventing false convictions (Scheck et al. 2000). But the value of DNA fingerprinting, like that of all diagnostic tools, depends on people’s ability to interpret the results. The benefits of even the most valuable diagnostic tool can be offset by a lack of understanding of the uncertainties associated with the data gathered with it (Gigerenzer 2002; Hertwig and Hoffrage 2002). In an economic analysis of the behavioral effects of legal standards, people’s ability to understand and process information about uncertainties does not warrant attention because the theory of expected utility maximization

⁴ In fact, some legal scholars at the Dahlem Workshop thought this assumption much too optimistic. Referring to the situation in the courtroom, one legal scholar argued: “There is reason to believe that much law is not known to lawyers, or to judges, even there. For example, new legislation, which introduces significant conceptual change in a legal system may be unknown, or known and not applied although applicable. In a study on sexual harassment law, we found that many judges hardly know new law in certain areas.”

presupposes that people reason in accord with laws of probability and statistics such as Bayes's rule. As Cooter and Ulen (2004, p. 433) put it: "An economically rational decision maker begins with some prior beliefs and updates them in light of new evidence by conforming to certain rules of inference." Ignoring, however, how people actually reason about uncertainty can interfere with due process.

Although a criminal suspect is unlikely to share a DNA profile with a piece of incriminating evidence by coincidence, how unlikely that coincidence is depends on the frequency of a specific combination of genetic features in a specific reference population. *Random match probability* is the frequency with which that genetic combination, or profile, occurs in a reference population such as American males or residents of a particular city. This statistic, which is typically provided to judges and jurors in the courtroom, may be fairly interpreted as the chance that someone selected at random would have the profile in question. In the courtroom, however, the random match probability seems to be widely misunderstood by judges, jurors, and even DNA experts. One misinterpretation is to take the low frequency of a DNA profile in a given population to be the likelihood that the defendant is innocent (for this and similar examples, see Koehler 1993).

Confusion about the meaning of DNA evidence suggests that judges, jurors, and sometimes even DNA experts do not spontaneously understand uncertainties that are expressed in terms of conditional probabilities. Adopting a more realistic conception of the human mind can facilitate the development of ways to communicate evidence such that people are able to interpret the results of forensic scientific analyses correctly. For most of the time over which the human mind evolved, information about uncertainties was experienced in the form of natural frequencies, that is, event counts that are not normalized with respect to base rates; mathematical probability representations, of which the random match probability is an example, were not devised until the seventeenth century (Gigerenzer et al. 1989). Gigerenzer and Hoffrage (1995) argued that, although natural frequencies and probabilities are mathematically equivalent, representation matters because Bayesian updating is simpler with natural frequencies relative to conditional probabilities.

To investigate whether natural frequencies foster insight into the uncertainties associated with DNA evidence, Lindsey et al. (2003; Hoffrage et al. 2000) asked 127 advanced law students and 27 legal professionals to evaluate two criminal case files. The files were nearly identical to those in two real cases in Germany, one a rape and the other a murder. In both cases, a match was reported between the DNA of the defendant and a DNA trace found on the victim. Aside from the DNA match, there was little reason to suspect that the defendant was the perpetrator. Lindsey et al. (2003) focused on the following questions: Do lawyers understand the uncertainties involved in DNA fingerprinting better when they are represented in terms of natural frequencies than conditional

Table 18.1 Text for the conditional probability version and the natural frequency version of one of the two tasks involving forensic DNA evidence used by Lindsey et al. (2003).

Conditional Probabilities

In a country the size of Germany there are as many as 10 million men who fit the description of the perpetrator. The probability of a randomly selected person having a DNA profile that matches the trace recovered from the crime scene is .0001%. If someone has this DNA profile it is practically certain that this kind of DNA analysis would show a match. The probability that someone who does not have this DNA profile would match in this type of DNA analysis is .003%. In this case, the DNA profile of the sample from the defendant matches the DNA profile of the trace recovered from the crime scene.

Natural Frequencies

In a country the size of Germany, there are as many as 10 million men who fit the description of the perpetrator. Approximately 10 of these men would have a DNA profile that matches the trace recovered from the crime scene. If someone has this DNA profile it is practically certain that this kind of DNA analysis would show a match. Of the some 9,999,990 people who do not have this DNA profile, approximately 100 would be shown to match in this type of DNA analysis. In this case, the DNA profile of the sample from the defendant matches the DNA profile of the trace recovered from the crime scene.

probabilities, and does the type of representation affect their judgments regarding the defendant's guilt?

Half the law students and the legal professionals received the uncertainty information in conditional probabilities; the other half received it in natural frequencies. Table 18.1 summarizes the relevant passages from the file for one of the two cases. Participants were asked to estimate two probabilities: (a) the probability that the reported match is true, that is, that the defendant actually has the same DNA profile as the forensic trace (true match probability); and (b) the probability that the defendant is the source of the trace (the source probability).

When the information was presented in probabilities, the students and the professionals alike were hopelessly bad at computing the requested probabilities. For example, as Figure 18.2 shows, only about 1% of the students and 10% of the professionals determined the true match probability correctly. When the information was presented in natural frequencies, these percentages increased to about 40% and 74%, respectively. Why did the representation make such a big difference?

To estimate the true match probability, one must take false positives—that is, “untrue” matches between the defendant's DNA and the forensic trace—into account. False positives can occur because current DNA technology is not perfect and because of human error (e.g., contamination of the sample in the laboratory). Bayes's rule is required to combine the false positive rate with the base rate of the DNA profile in the relevant population:

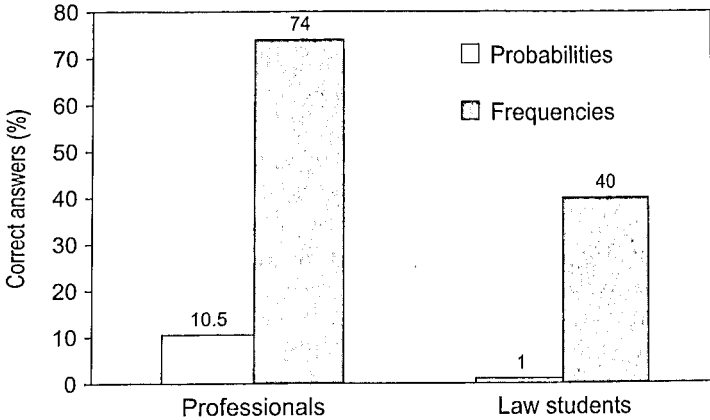


Figure 18.2 How a natural frequency representation improves probabilistic reasoning in law students and legal professionals. Percentages of correct Bayesian inferences in the probability and natural frequency representations are taken from Lindsey et al. (2003).

$$p(\text{profile}|\text{match}) = \frac{p(\text{profile}) p(\text{match}|\text{profile})}{p(\text{profile}) p(\text{match}|\text{profile}) + p(\neg\text{profile}) p(\neg\text{match}|\text{profile})}$$

Inserting the statistical information displayed in Table 18.1 into Bayes’s rule results in a true match probability of 0.09:

$$p(\text{profile}|\text{match}) = \frac{(0.00001)(1.0)}{(0.00001)(1.0) + (0.99999)(0.0001)} = 0.09.$$

The relatively complex probability computations above can be drastically simplified by representing the information in natural frequencies. To compute the probability of a person having a particular DNA profile given a match using natural frequencies, one needs merely to know the number of people who actually have the profile out of all the people who match the profile. The natural frequency computations amount to solving the following equation:

$$p(\text{profile}|\text{match}) = \frac{\text{match \& profile}}{\text{match \& profile} + \text{match \& } \neg\text{profile}} = \frac{10}{10 + 100} = 0.09.$$

Natural frequencies facilitate Bayesian computations by obviating the need to take base rates into account directly. With frequencies, one recognizes immediately that there are 10 men in the population with the same DNA profile as the defendant and another 100 men for whom a match will be reported although

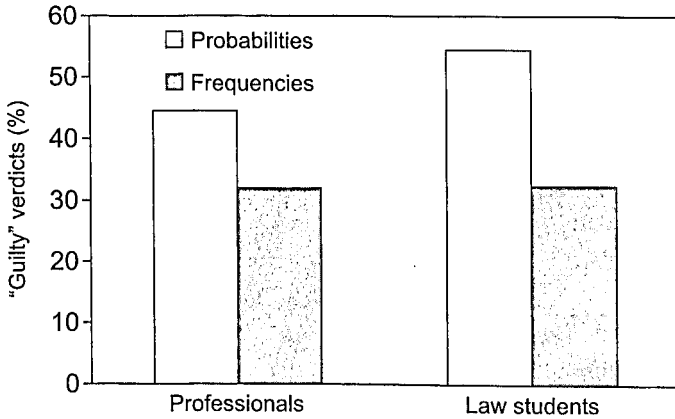


Figure 18.3 How the representation of information about uncertainties influences verdicts made by law students and legal professionals. Percentages of guilty verdicts as a function of representation are taken from Lindsey et al. (2003).

there is no true match. In other words, it is easy to see that, out of 110 men for whom a match is reported, only 10—or 9%—actually have the DNA profile.

The final decision in a criminal trial is about the defendant's guilt or innocence, and it is cast in yes-no terms. Did the representation of the DNA evidence affect the verdicts of the law students and the legal scholars in Lindsey et al.'s (2003) study? Yes. As Figure 18.3 shows, more students and more professionals judged the defendant to be guilty when the evidence was presented in terms of probabilities—that is, when the large majority of them had performed the wrong calculation—than when it was expressed in natural frequencies. In both groups, the proportion of guilty verdicts increased substantially when the DNA evidence was couched in terms of conditional probabilities.

To conclude, the representation of DNA evidence can mean the difference between freedom and imprisonment or even life and death. With conditional probabilities, essentially none of the law students or legal professionals in Lindsey et al.'s (2003) study estimated the true match probabilities in accord with Bayes's theorem, but they were much more likely than with natural frequencies to conclude that the DNA evidence proved the defendant's guilt beyond a reasonable doubt. This result by no means implies that the lawyers to whom the DNA evidence was presented in probabilities did not evaluate the evidence conscientiously. In fact, the authentic nature of the case files was so motivating that they spent an average of more than an hour and a half reading and deliberating about the two cases. To blame their poor estimates of the true match probability on negligence would be to miss the key point: How uncertain evidence and legal standards such as "beyond a reasonable doubt" combine in the minds of jurors and judges can be understood only if one takes account of psychological knowledge, for instance, about how information representation influences reasoning.

Heuristics Evoked by Law

In the DNA example, confusing representations of uncertain evidence produced an apparently inflated sense of certainty regarding the guilt of the defendant. In the next and final example, I will show how a law can require people to do things that exceed their cognitive abilities, thus evoking the (implicit) use of heuristics that, in turn, appear to violate the principles of due process. One of the most common decisions that must be made in the legal system is whether to release a person on unconditional bail, release the person on conditional bail, or keep the person in custody (the first decision is nonpunitive, whereas the latter two are punitive). In the English system, bailing decisions are made by magistrates, nearly all of whom belong to the local community and have no formal legal training. According to the Bail Act of 1976 and revisions thereof, when making a bail decision magistrates should pay attention to the nature and seriousness of the offense; the defendant's character, community ties, and bail record; the strength of the prosecution's case; the likely sentence in the event of conviction; and any other factor that appears to be relevant (see Dhami and Ayton 2001). The law gives no guidance, however, on how much attention magistrates should pay to each factor or how they should integrate the pieces of information into the final decision; nor does the law offer feedback on the appropriateness of past decisions.

Left to their own devices but exhorted to consider all the available evidence, how do magistrates actually make their bail decisions? Based on an analysis of several hundred bail decisions made by magistrates in two London courts, Dhami (2003) found that a simple decision tree accounted for about 95% of all bail decisions. The decision tree in the first court was as follows. If the prosecution requests a punitive decision, then concur. If the prosecution does not request a punitive decision or no information regarding its request is available, go to the next branch: If a previous court has already imposed conditions on bail or remand in custody, then follow suit. If not or no information is available, then make the same bail decision as the police. Dhami (2003) captured the second court's bail decisions using a decision tree identical to the first one with the exception of one branch. The trees accounted for 96% of the first court's decisions and 95% of the second court's decisions.

In this case, the decision makers knew the relevant law and the legal standard involved, and yet they seem to have implemented a "pass-the-buck" policy. That is, they appear to have copied others' behavior, basing their decisions on those previously made by the prosecution, past benches, or the police. Although this approach deviates from the ideal of due process, it is impossible to find out how accurate the decision tree is. Judging from the good performance of other "fast and frugal" decision-making heuristics, however, it may not result in less accurate judgments than due process (see Gigerenzer, this volume).

Dhami's (2003) analysis of bail decisions points to another possible pathway from legal rules and standards to individual behavior. To the extent that a legal

norm requires people to do things that are beyond their limited processing abilities, people may respond by evolving “approximate methods” to handle the task (Simon 1990, p. 6). In other words, laws that rest on ideals that real people cannot live up to, might influence people’s behavior through their use of simple heuristics that could have developed for the express purpose of implementing the law or could have been co-opted from other contexts. What these heuristics are and whether they lead to the kind of behavior that the law aims to promote are two exciting questions that a psychological analysis of the law’s behavioral effects can address.

MACROMOTIVES AND MICROBEHAVIOR

In this chapter, I questioned economic analyses of the behavioral effects of legal rules, which often assume that the rule is known to those who are subject to it and that individuals respond to the rule as if they maximized their utility (e.g., Cooter and Ulen 2004; see also Cooter, this volume). I argued that any analysis of the pathway from macromotives to microbehavior is doomed to fail unless it rests on a psychologically plausible conception of individual actors. Specifically, I speculated that people have no explicit knowledge of most of the laws that make up the political and social systems of which they are a part. Yet most people behave in accordance with the law most of the time. Various psychological principles help explain this puzzle. The ones I discussed are the capacity for social learning and environmental cues and constraints. Specifically, the ability to observe others’ behavior and the consequences thereof allows people to conform to behavioral norms without memorizing the legal canon or Miss Manners’s rules of etiquette. Natural and artificial constraints in the environment help winnow down the set of actions available to the individual, and environmental cues suggest what actions are desirable. Using the interpretation of DNA evidence and bail decisions as examples, I demonstrated that not even within legal institutions such as the courtroom can one presuppose that the law governs people’s behavior as it was intended to. If lawmakers aim to design legal rules, standards, and institutions such that people who aspire to live by them have a chance of doing so, the psychological realities of boundedly rational human decision making must be appreciated.

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