

To: FSU Law Faculty
From: Bob Cooter
Re: faculty seminar

I will use the following paper to compare cognitive psychology and the traditional economic analysis of law to the procedural law concerning the standard of proof in civil cases. I look forward to the discussion.

--bob

Adapt or Optimize the Law?

by

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Abstract:

In civil disputes, the plaintiff must prove his case by the preponderance of the evidence. To reach this standard, the plaintiff accumulates evidence by combining facts. I compare two models of this process. Decision makers can adapt their behavior for improved results, as assumed in some psychological models. Adaptive models predict that court practice will allow the plaintiff to combine facts according to relatively simple rules. Alternatively, decision makers can optimize their behavior for best results, as assumed in most economic models. Optimization models predict that court practice will require the plaintiff to combine facts according in ways that conform to the laws of probability theory. The two predictions are distinct when simple, adaptive rules violate the laws of probability theory. I show that actual practice in a California court allows the plaintiff to combine facts according to relatively simple rules that sometimes violate the laws of probability theory. Adaptation is, consequently, a better descriptive theory than optimization. Procedures that violate the laws of probability theory, however, are vulnerable to withering criticism. Given that trials proceed with deliberate speed under expert guidance, suboptimal adaptations are irrational. Optimization, consequently, is a better normative theory than adaptation.

Adapt Or Optimize the Law?

Introduction

Decision makers can adapt their behavior for improved results, as assumed in some psychological models of behavior. Adaptation relies on adjusting relatively simple rules called “heuristics” that are effective in most circumstances. Alternatively, decision makers can optimize their behavior for best results, as assumed in most economic models of behavior. Optimization often requires deliberation and calculation. I distinguish between these two models of behavior and apply them to civil litigation.

In civil litigation, the plaintiff must prove his case by the preponderance of the evidence. To reach this standard, the plaintiff accumulates evidence by combining facts. Combining facts sometimes requires combining probabilities. To be rational, the combination of probabilities should obey the laws of probability theory as developed by statisticians. Courts that combine probabilities in ways that violate these laws are irrational, which results in bad decisions. Most members of courts, however, lack the technical training required to apply the laws of probability theory directly to cases. Instead, courts should follow rules of evidence developed by experts. Rules of evidence that require knowledge of probability theory are inappropriate for courts.

Adaptive models predict that court practice will allow the plaintiff to combine facts according to simple rules that violate the laws of probability theory in some circumstances. Because these rules mostly succeed and occasionally fail, they are called “heuristics.” In contrast, optimization models predict that court practice will require the plaintiff to combine facts according to rules that do

* For comments and suggestions, I would like to thank the faculty at Tel Aviv Law School, especially Ariel Porat and Omri Yadlin, and participants in the Dahlem conference.

not violate the laws of probability theory. Relative to the optimum, heuristics are approximations that sometimes do an injustice by failing to give the best result.

I will show that actual practice in a California court allows the plaintiff to combine facts according to relatively simple rules that sometimes violate the laws of probability theory. Adaptation is, consequently, a better descriptive theory of court behavior than optimization. Heuristics that violate the laws of probability theory, however, are vulnerable to withering criticism -- they are irrational. Optimization, consequently, is a better normative theory of the court's aspiration than adaptation.

I. Deliberate and Calculated Versus Fast and Frugal

To contrast optimization and adaptation, I begin with an example. To get to the top of a mountain, a climber can deliberate and calculate the best path for the ascent. I call the best path "optimal," and I call the process of calculating it "optimization." Alternatively, the climber can follow a simple rule that does not require calculating the best path. For example, the climber can follow the rule, "Always go up from where you stand in the direction with the steepest angle that you can climb." I call this rule a "heuristic," and I call the process of applying it "adaptation."

A good heuristic yields the optimal result in most circumstances. For example, following the steepest feasible contour line gets the climber to the top of any mountain with a single peak. (This is also the way that some computer programs search for the maximum of a concave function.) Sometimes, however, optimization and adaptation lead to different results. To illustrate, following the steepest feasible contour line will not necessarily get the climber to the top of a mountain with two peaks.

Although the heuristic sometime errs, it has potentially offsetting advantages. To illustrate with the preceding example, assume that you enter a competitive race to climb to the top of an unfamiliar, uncharted mountain. If time and circumstances permit, you should study the mountain with a telescope before the race starts and calculate the best route for the ascent. Time and circumstances, however, may not permit these calculations. Perhaps the race

starts before anyone has time to calculate, or perhaps the peak is shrouded in fog that your telescope cannot penetrate. In these circumstances, you may increase your probability of winning by making your best guess concerning the path to take and acting immediately.

In general, an adaptive heuristic may perform better than optimization in three circumstances. First, if time is scarce, then adaptation is often quicker than optimization. Second, if information is scarce, then adaptation may be feasible and optimization may be infeasible. Gigerenzer emphasizes that quick decisions require a rule that is “fast” in the sense that its application takes little time, and scarce information demands a decision rule that is “frugal” in the sense that its application requires little information. Third, if decision makers are likely to make large calculation errors, then applying a simple heuristic correctly may yield better results than solving a complex optimization problem incorrectly.

Conversely, when time and information are plentiful, and errors can be corrected before they cause harm, then optimization yields better results than adaptation.

II. Legal Obligation for Deliberate and Timely Decisions

I have explained that optimization and adaptation are best under different circumstances. When time and information are plentiful, careful calculations usually get closer to the best result with fewer mistakes. In view of this fact, law sometimes imposes a duty to collect the relevant facts and deliberate before taking actions that affect others. Professionals often have a duty of “due diligence” before making decisions that affect clients. To illustrate, assume that the board of directors of a public corporation must make an important decision. If the board collects the facts and deliberates with care, the “business judgment rule” shields the board from liability for making a bad decision. If, however, the board fails to collect the facts and makes a hasty decision, it may breach its fiduciary duty to stockholders. Breach of fiduciary duty makes the board members liable to stockholders for losses resulting from a bad decision.

Conversely, when circumstances require a quick decision, law sometimes imposes a duty for timely action. To illustrate, the board of directors of a

company has a duty to review large payments that the company makes to its officers. If the chief executive pays a large sum of the company's money to one of its officers and the board the board of directors fails to conduct a timely review, the board members may be liable for "sustained inattention." The wrong consists in failing to take timely action, not in taking the wrong action.

III. A Case of Alleged Medical Malpractice

I turn to a case of alleged medical malpractice that I will use to contrast adaptation and optimization, especially as applied to the rules of evidence in civil trials. The case was tried in 2003 in the Superior Court of Alameda County, State of California. The doctor made two critical decisions, one of which was leisurely and the other was an emergency. The account that follows is based on observations during the two weeks that I spent as a juror in the case,¹ and on my subsequent research concerning rules that I observed the court applying.

A. The Facts

A man went to the hospital for a hernia operation. Before the operation, the anesthesiologist gave the patient a medical exam. Having passed the exam, the anesthesiologist put the patient to "sleep." In an ordinary case, the anesthesiologist would keep the patient "sleeping" until the surgeon repaired the hernia, the patient would wake up, and the patient would leave the hospital and go home the same evening. In this case, however, the patient had trouble breathing early in the operation, stopped breathing, suffered cardiac arrest, and died. An autopsy revealed that the victim's heart muscles were excessively thick and scarred, which is a condition commonly called a "heavy heart." Until the autopsy after his death, no one knew that the patient had a heavy heart, which makes a person susceptible to a heart attack. The strain of the operation, which would cause no problem for a normal heart, caused cardiac arrest in this patient.

¹ According to applicable rules of procedure, the attorneys on each side can challenge candidates for the jury and remove a certain number of them without giving any reason for doing so. Consequently, law professors are often removed from juries by one of the attorneys. Unlike the past, neither attorney challenged me in the case, so I was seated on the jury.

When the patient died, his descendants sued the anesthesiologist. Before the operation, the anesthesiologist was responsible for examining the patient and deciding whether or not to proceed. During the operation, the anesthesiologist also administered the drugs that put the patient to sleep and maintained the patient's breathing and other vital functions while the patient was asleep. Plaintiff made two accusations of wrongdoing by the anesthesiologist. First, plaintiff alleged that the anesthesiologist had not given adequate tests before the operation to determine if the patient had a condition such as a heavy heart. In brief, plaintiff alleged negligence in the pre-operation screening. Second, plaintiff alleged that when the patient began to have trouble breathing during the operation, the anesthesiologist responded too slowly and incorrectly. In brief, the plaintiff alleged negligence in the operating procedure.

I will compare the legal standard of care to optimization and adaptation. The question is, "Did the anesthesiologist have a legal obligation to optimize or adapt? Or is the legal standard of care something different?" Next, I turn to a question of evidence. "In weighing evidence, did the legal procedure require the jury to combine facts consistently with the laws of probability theory?" Combining facts consistently with the laws of probability theory is necessary for optimization.

B. Pre-operation Screening

For pre-operation screening, the anesthesiologist followed this simple rule:

Check the patient's age and blood pressure, and ask the patient if he had any history of heart problems. If the patient meets the cutoff for age and blood pressure, and if he reports no history of heart problems, and if there are no other obvious medical problems, then proceed with the operation without further tests. Otherwise conduct further tests.

The rule can be applied quickly (fast) based on little information (frugal). It does not require deliberation or calculation. It can be adapted in light of experience. Thus the anesthesiologist's pre-operation screening looks like adaptive behavior.

The plaintiff alleged in effect that the actual rule based on three factors – age, blood pressure, and previous history – was too simple for the

circumstances. Specifically, the plaintiff was grossly overweight. (He weighed more than 400 pounds.) A better rule, according to the plaintiff, would include a fourth factor, specifically the patient's weight. According to the plaintiff, further tests should be performed before anesthetizing a grossly overweight patient. The defendant, however, denied that further tests are required before anesthetizing an obese patient. According to the defendant, the screening criteria did not need changing, partly because there is no relationship between obesity and a heavy heart. If additional tests had been done in response to patient's obesity, the defendant asserted, the results would not have revealed the heavy heart or otherwise reversed the decision to operate on this patient.²

The jury had to decide whether the anesthesiologist's pre-operation screening was negligent or non-negligent. In general, non-negligent behavior is "reasonable in the circumstances". I will ask whether this vague legal standard should be understood as requiring optimization or adaptation. First, consider a recognized legal standard that explicitly requires optimization. The Hand Rule, which is named after Judge Hand who first formulated it, applies a cost-benefit standard: If the benefits of precaution exceed the costs, then an actor who fails to take the precaution is negligent. More specifically, an actor is negligent under the Hand Rule who fails to take precautions that cost less than the resulting reduction in expected harm.³ Applied to this case, the anesthesiologist is negligent if the cost of administering additional tests to obese people before the operation is less than the reduction in the expected harm from fewer accidents. If the anesthesiologist were obligated to obey the Hand Rule, then a jury who believes that adding a fourth factor (weight) would improve the test should find the anesthesiologist negligent.

Instead of requiring the anesthesiologist to optimize, the standard of care might require him to adapt. In this case, "adapting" means improving the criteria

² Technically, defendant denied negligence and causation. According to defendant, pre-operation screening was not negligent and, if it were negligent, it did not cause the patient's death.

³ The reduction in the expected harm equals the reduction in the probability of an accident times the liability created by an accident.

for screening patients based on experience and new information. Applying an adaptive standard, the jury should consider whether the screening criteria used by the anesthesiologist developed over time and responded to experience. If so, the anesthesiologist satisfied the adaptive standard in the pre-operative procedure and his use of simple screening criteria did not make him liable for the patient's death.

This tragedy was the occasion for the anesthesiologist to reconsider the problem of patients with undetected heart problems and the risks of operating on obese patients. Adaptation requires reconsidering and modifying a practice in light of new evidence. If adding a fourth factor (weight) to the criteria would improve the pre-operation screening, then the anesthesiologist should do so for the next patient, or face liability for a repetition of this accident.

Did the law impose a duty on the anesthesiologist to optimize or adapt the criteria for screening patients? Decisive evidence that this court required the defendant to optimize would exist if the judge and attorneys asked the jury to apply the Hand Rule to pre-operation screening as a test of negligence. In this case, the judge and attorneys did not ask the jury to apply the Hand Rule test for negligence. In spite of its prominent place in scholarly writing, a recent survey of cases concluded that the Hand Rule is seldom invoked in trials.⁴ Indeed, experimental evidence suggests that courts react with hostility to cost-benefit calculations in cases involving injury or death.⁵ These studies conclude that the negligent defendant who did not deliberate fares better in court than one who attempted to optimize. (Unlike courts, regulators recognize that cost-benefit calculations are a necessary part of formulating and applying safety standards for cars, medicinal drugs, environmental hazards, and other risks. Reconciling the practice of courts and regulators remains an unsolved problem.⁶)

Instead of optimizing, the court might have required the anesthesiologist to adapt. Adaptation requires the anesthesiologist to follow a simple rule that works

⁴ Cite Allen.

⁵ Cite viscusi

⁶ cite Cooter.

in most cases and adjust it in light of experience. In this case, the rule that the anesthesiologist followed in pre-operation screening was undoubtedly simple, it works in most cases, and was adjusted to past experience. Consequently, if the legal standard were adaptive behavior, then the anesthesiologist was not negligent in pre-operation screening. However, no one argued in court for such a weak standard. Even the defendant's lawyer did not argue that adaptation is sufficient for non-negligence.

I have explained that the court in this case apparently thought that the legal standard requires more than adaptive screening, and that cost-benefit optimum was not relevant. The next section discusses a different legal standard of negligence – the “community standard of care.”

C. Operating Procedure

After the patient passed the pre-operation screening, the anesthesiologist proceeded to put the patient to “sleep”. The second alleged wrongdoing concerned the anesthesiologist's response when the sleeping patient began to have trouble breathing. When the patient struggled to breathe, the anesthesiologist had to decide when to intervene, and, in addition, the anesthesiologist had to choose between two possible interventions. The plaintiff alleged that the anesthesiologist delayed too long in deciding to intervene and then chose the wrong intervention.

According to the plaintiff, the anesthesiologist's decisions did not conform to the level of skill expected of anesthesiologists. The level of skill expected of anesthesiologists is the “community standard of care,” which courts often use to determine negligence. This legal standard presumes that members of the community (here, the “community” of anesthesiologists) usually do what is “reasonable” in the circumstances. What members of the community usually do is taken as an indication of what they are legally required to do.

A community standard is often formulated as a simple rule, such as “signal before making a turn in a car.” In this case, no one argued in court that the anesthesiologist responded to the medical emergency, or should have

responded to it, by applying a rule. The arguments in court presumed that medical emergencies like this one require expert judgment that is fast but not frugal. The legal question was whether other competent anesthesiologists would have performed differently from the defendant. The court thought that the relevant legal standard of care was expert judgment, not an adaptive heuristic. Perhaps experts over-rate their powers of judgment compared to the power of simple rules, as some cognitive psychologists claim, but no such arguments were made in this case.

If the anesthesiologist had possessed complete information about the patient's heavy heart, he would have known not to operate. Once the emergency began, complete information about the patient's heavy heart would have prompted the anesthesiologist to intervene more quickly and perhaps to choose a different intervention. The law, however, did not require the anesthesiologist to make the same decision in the actual operation that he would have made with full information. The legal standard of care is not the full-information optimum. In other words, the legal standard of care does not require the best decision in light of the actual facts. It would be unreasonable to hold actors with incomplete information to the same standard of performance as actors with complete information.

To summarize this discussion, the law required the anesthesiologist to respond to the emergency that developed in the operation by conforming to the "community standard" of care. In these circumstances, the community standard apparently refers to expert judgment, not an adaptive heuristic. However, the community standard did not require the anesthesiologist to do what would have been best if he had possessed full information. In these circumstances, the community standard is apparently more complex than a heuristic and less demanding.

D. Combining Facts

So far I have discussed the standard of care applied to the defendant's behavior. Now I turn to the rules of evidence the court used to weigh the facts. The plaintiff had to prove that the preponderance of the evidence favors the

conclusion that the victim's death was caused by the defendant's negligence. I will focus on the legal rules for combining evidence to construct such a proof.

In discussing the facts, I described two points in time where defendant's negligence might have caused the victim's death. If pre-operation screening had detected the heavy heart, the operation would never have occurred and the patient would not have died. Negligence could have occurred in the pre-operating screen. Once the operation began, if the anesthesiologist had responded more quickly to the emergency and chosen a different intervention, the patient's life might have been saved. Negligence could have occurred in the operating procedure.

The plaintiff argued for negligence at both points in time. How should the court apply the standard of proof – the preponderance of the evidence – to the two points in time? The simplest approach is to apply the standard of proof independently to the acts. By this approach the court decides whether the preponderance of the evidence about the pre-operation screening indicates fatal negligence. Entirely independently, the court decides whether the preponderance of the evidence about the operation indicates fatal negligence. An affirmation answer to either inquiry implies liability, and a negative answer to both inquiries implies no liability.

To implement independent decisions, the judge might instruct the jury as follows:

If the preponderance of the evidence indicates that the defendant was negligent in conducting the pre-operation screening and his negligence caused the patient's death, then you should find him liable for the resulting loss and end your deliberations. Otherwise, you should consider the operating procedure. If you find that the preponderance of the evidence indicates that the defendant was negligent in the operating procedure and his negligence caused the patient's death, then you should find him liable for the resulting loss. Otherwise you should find him not liable and end your deliberations.

The independent, sequential decision-making prescribed by these instructions is simple and usually produces a good result. Cognitive psychologists who favor adaptive heuristics sometimes commend independent,

sequential decision-making.⁷ The alternative, which I will now describe, is more complicated and more strictly correct. Instead of applying the legal standard of proof independently at the two points in time, the evidence could be combined into an overall judgment. Combining evidence into an overall judgment allows for the possibility that evidence about negligence at one point in time affects the believability of evidence about negligence at another point in time. To illustrate by this case, a temporary cause of inattention (e.g. a hangover), or a permanent cause of bad judgment (e.g. bad training), could cause negligence at both points in time.

To implement combining evidence in an overall judgment, the judge might instruct the jury as follows:

If you find that the preponderance of the evidence indicates that the defendant's negligence in the pre-operation screening or the operation caused the patient's death, then you should find him liable for the resulting loss. To find liability, it is sufficient that the preponderance of the evidence indicates that defendant's negligence caused the patient's death one way or the other. If you find that the preponderance of the evidence indicates that the defendant was not negligent in the pre-operation screening and the operating procedure, then you should find him not liable and end your deliberations.

Combining evidence into an overall judgment might cause the court to conclude that the preponderance of the evidence favors the conclusion that the defendant was negligent in screening or the operation, even though applying the standard independently reaches the opposite conclusion. The next section demonstrates this fact by using probabilities.

E. Probabilistic Representation

When applying the legal standard of proof in a civil case, courts do not normally reduce evidence to probabilities. Probabilities suggest a precision that is usually absent and often unattainable in the court's reasoning about evidence. However, modeling the facts of this case in terms of probabilities clarifies my

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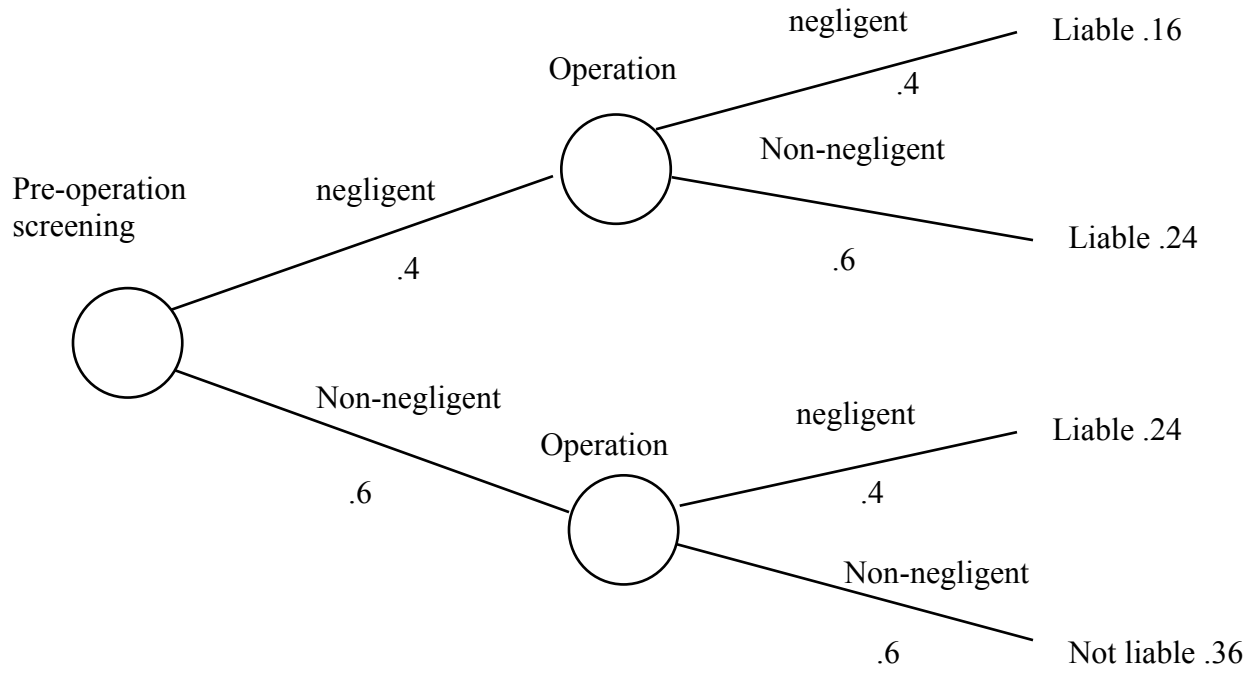
argument by increasing its precision. For this reason, I will represent the problem of proof in terms of probabilities. The reader should bear in mind that I do not think that jurors in this case actually reasoned in terms of precise probabilities or should have done so. In assigning probabilities, I will depart from my practice so far of presenting the facts in the actual case as accurately as possible.

Figure 1 depicts the court's problem as a decision tree. For now, focus on its branches, not the probabilities. The first branch indicates that the anesthesiologist may have been negligent or non-negligent in the pre-operation screening. If the preponderance of the evidence indicates that he was negligent in the pre-operation screening, and non-negligent behavior would have prevented patient's death, then the jury should find the defendant liable. If, however, the preponderance of the evidence indicates that he was non-negligent in pre-operation screening, then the jury must go on to the next branch in the decision tree and consider the operating procedure. In the second branch of the tree, the anesthesiologist may have been negligent or non-negligent in the operation. If the preponderance of the evidence indicates that he was negligent in the operation, and non-negligent behavior would have prevented patient's death, then the jury can find the defendant liable. If, however, preponderance of the evidence indicates that the anesthesiologist was not negligent in screening or operating, then the jury should find the defendant not liable.

Assume that the "preponderance of the evidence" means that the event is more probable than not. "Preponderance of the evidence" will be interpreted as a probability of .5 or greater. According to Figure 1, the evidence indicates that the probability is .4 that negligence in pre-operation screening caused the patient's death. Consequently, the plaintiff has not proved negligence in the pre-operation screening by the preponderance of the evidence. So the jury must go on to the next branch in the decision tree.

Proceeding to the next branch, if the preponderance of the evidence indicates that the anesthesiologist was negligent in the operating procedure, and non-negligent behavior would have prevented patient's death, then the jury can

find the defendant liable. According to Figure 1, the evidence indicates that the probability is .4 that negligence in the operating procedure caused the patient's death. Consequently, the plaintiff has not proved negligence in the operating procedure by the preponderance of the evidence. Using the probabilities in Figure 1, independent and sequential application of the standard of the preponderance of the evidence leads to the conclusion that the anesthesiologist was not negligent.



What about combining probabilities to reach an overall judgment? If the probabilities on each branch of the tree are independent,⁸ the laws of probability theory prescribe a simple rule to combine them: the multiplication rule. Applying this rule to Figure 1, the probability that the anesthesiologist was not negligent in the pre-operation screening and also not negligent in the operating procedure is .36. Equivalently, the probability that the anesthesiologist was negligent in the pre-operation screening or in the operating procedure is .64. Thus the preponderance of the evidence indicates that the defendant's negligence caused the patient's death one way or the other.

The decision tree clarifies the fact that independent and sequential application of the preponderance of the evidence standard sometimes gets the wrong result. Specifically, the result is wrong when the preponderance of the evidence indicates that defendant's negligence caused the patient's death one way or the other, but does not indicate which way it was caused. To reach this conclusion, I have made some simplifying assumptions in my decision tree.⁹ A full consideration of the complexities, however, should not change my conclusions.

When evidence can be represented as probabilities, independent and sequential application of the preponderance of the evidence standard violates the laws of probabilities theory. Independent and sequential application of the preponderance of the evidence standard is a heuristic that is easy to understand,

⁸ The theory of negligence presented by the plaintiff in this case is consistent with the assumption of independent probabilities. The plaintiff did present any argument that linked negligence in the two acts. For example, the plaintiff did not argue that the anesthesiologist suffered from a temporary cause of inattention (e.g. a hangover), or a permanent cause of bad judgment (e.g. bad training). From the plaintiff's argument, it seems that the alleged negligence was the result of a lapse in judgment by a generally sound physician.

⁹ If the probabilities on each branch of the tree are dependent, the laws of probability theory prescribe a more complex way to combine them than the multiplicative rule. Also, note that I do not discuss whether or not the probabilities in the tree should be understood as subjective uncertainty or objective frequencies.

and it works most of the time, but not all of the time. Combining the facts to reach an overall judgment is strictly more correct, but also more complicated. A rule of evidence that is not strictly correct is vulnerable to criticism in court, especially by the side whom it disadvantages. In special cases where evidence can be reduced to probabilities, a rule of evidence that violates the laws of probability theory is vulnerable to the withering accusation of irrationality.

F. Judge's Instruction to the Jury

How did the judge instruct the jury in this case? The judge read the jury a form that said what we were supposed to decide and then he gave the form to the jury foreman (me). The form was not entirely clear about whether we were to make sequential and independent decisions about the evidence, or whether we were to reach an overall judgment. Trying to parse the ambiguity, my best interpretation of the form favored sequential and independent weighing of the evidence. The jury in this case decided that the plaintiff had not carried the burden of proof, so our decision was "no liability." If the jury had received clear instructions to reach an overall judgment, the case would have been a closer call and the decision might have gone differently.

In my opinion, part of the reason why we did not receive clear instructions on this point concerned the plaintiff's attorney. At the beginning and end of the trial, the plaintiff's attorney gave his summary of what we were to decide. He should have explained to us on both occasions that we were to determine whether it was more likely than not that the defendant's negligence in the pre-operation screening or the operation caused the patient's death. He should have added that we should find the defendant liable if the evidence indicates that defendant's negligence caused the patient's death one way or the other, even if we are unsure which was the cause. The defendant's attorney would no doubt have challenged the plaintiff's attorney on this point. The exchange between attorneys would have forced the judge to focus on whether the jury was to make sequential, independent decisions, or combine information to reach an overall judgment

Since the best interpretation of the jury instructions favors independent and sequential decision making, I conclude that adaptation is a good descriptive model for how this court required the jury to apply the standard of the preponderance of the evidence. However, the fact that the court did not ask the jury to reach an overall judgment is a serious criticism of these evidentiary procedures. If the facts were interpretable as probabilities, the fact that these evidentiary procedures violate the laws of probability theory is a withering criticism. Optimization provides a powerful normative theory for critiquing the evidentiary procedures.

IV. Conclusion

The common law often imposes an obligation on people to act “reasonably.” In some circumstances, fast and frugal rules give better results than deliberation and calculation. In these circumstances, fast and frugal decisions rules may be the only reasonable way to decide. When fast and frugal rules are the only reasonable way to make decisions that affect others, the common law may allow or require fast and frugal decisions, which preclude deliberate and calculated decisions.

Conversely, deliberation and calculation give better results in some circumstances than fast and frugal rules. In these circumstances, deliberation and calculation may be the only reasonable way to decide. When deliberation and calculation are the only reasonable way to make decisions that affect others, the common law may require deliberate and calculated decisions, and forbid fast and frugal decisions.

I applied this contrast to a medical malpractice case. The physician, who was the defendant, used a fast and frugal test to screen the patient before proceeding with the operation. The screening did not detect a serious heart disorder, and ignorance about this condition caused the physician to proceed with an operation that proved fatal. The plaintiff argued that the screening criteria were too frugal and a better screen would use at least one more criterion. Furthermore, the plaintiff argued that the physician should have used the better

test in this case, not merely learn from experience and improve the test for future cases.

When an emergency developed during the operation, the physician made quick decisions about alternative interventions. The choice of interventions was a matter of judgment based on many factors, not a simple rule. Arguments about whether or not the plaintiff was negligent especially focused on the standard of care in the relevant community of physicians. This standard seems more demanding than merely using adaptive criteria, and less demanding than the best decision of a physician who knows everything about the patient.

A further comparison between adapting and optimizing in this case concerns the rules of evidence. The plaintiff had to prove that the preponderance of the evidence favors the conclusion that defendant's negligence caused the patient's death. The simplest way to interpret this rule is to apply it sequentially and independently to the pre-operation screening and to the operating procedures. That is what the jury thought the judge instructed it to do. A more complicated way requires an overall judgment about whether the combined evidence on pre-operation screening and the operating procedure satisfies the legal standard of the preponderance of the evidence.

Reducing evidence to probabilities, which juries do not ordinarily do, clarifies the difference between adaptation and optimization. Sequential and independent consideration of evidence is inconsistent with the laws of probability theory. To be consistent with probability theory, the jury should ask whether the preponderance of evidence favors the conclusion that the physician's negligence caused the patient's death one way or the other. This instruction invites the jury to cumulate the weight of evidence concerning negligent screening and the weight of evidence concerning negligent operating. Such an instruction is consistent with the way a statistician would combine cumulate evidence if it were reduced to probabilities. Although adaptation is a better descriptive theory in this case, optimization is a better normative theory.

Besides adaptation, cognitive psychologists have studied bias and identified forms to which people are susceptible. Reasonable behavior presumably avoids bias. Much argument in this case concerned whether or not the anesthesiologist's judgment was biased or reasonable. If the jury had found bias in the anesthesiologist's judgment, it would assuredly have concluded that he was negligent.

To be added.

Footnote

1. Gigerenzer
2. Mel and Board's action