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Adapt or Optimize? The Psychology and Economics of Rules of Evidence

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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 in ways that conform to the laws of probability theory. The two predictions contradict each other 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.

Robert Cooter[*]

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. Optimization models predict that court practice will require the plaintiff to combine facts according to rules that do not violate the laws of probability theory. In contrast, adaptive models predict that court practice will allow the plaintiff to combine facts according to rules that violate the laws of probability theory in some circumstances.

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. This conclusion is unsurprising since most members of courts lack the technical training required to apply the laws of

probability theory directly to cases. Rules of evidence whose use requires knowledge of probability theory are inappropriate for courts. These arguments respond to a puzzle recently posed by Saul Levmore: Why does the law avoid the issue of conjunctive probability?[1]

However, courts may seek the advice of statistical experts when making judgments or creating rules. Heuristics that violate the laws of probability theory, however, are vulnerable to withering criticism -- they are irrational. Unlike the optimum, heuristics are approximations that sometimes fail to give the best result and cause injustice. Courts should use experts to help develop rules that lead courts to behave consistently with probability theory. Optimization, consequently, is a better normative theory of the court's aspiration than adaptation. 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.

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[1] Saul Levmore, S. (2001). "Conjunction and Aggregation." <u>Michigan Law Rev</u> 99 (No. 4): 723-756. Levmore's solution to the puzzle focuses on aggregating the judgments of different jurors. I focus on the psychology of a single decision maker.

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 emphases 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.[2] Third, if decision makers are likely to make large calculation errors, then correctly applying a simple heuristic may yield better results than solving incorrectly a complex optimization problem. Conversely, when time and information are plentiful, and errors can be corrected before they cause harm, optimization yields better results than adaptation.

I. 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 fiduciary duty or a duty of "due diligence" to prepare themselves carefully before making a

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[2] cite

decisions.[3] 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. [4] 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 of directors fails to conduct a timely review, the board members may be liable for "sustained inattention."[5] The wrong consists in failing to take timely action, not in taking the wrong action.

II. 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,

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[3]In the context of corporations and securities, "due diligence" refers to a prospective buyer's investigation of a target company, a piece of property, or a newly issued security, especially before recommending a security for purchase. More generally, the phrase refers to reasonable care in discharging a legal obligation. See Black's Law Dictionary.

[4] The two leading cases that hold that directors are liable for insufficient preparation are Smith v. Van Gorkom, 488 A.2d 858 (Del. 1985) and Cede v. Technicolor, Inc., 634 A.2d 345 (Del. 1993) . The former case was settled by the directors after the Delaware. Supreme Court decision. The latter case was remanded, and the trial court found that no injury had resulted.

[5] The business-judgment rule requires that a judgment -- a decision -- be made. A new and important leading lower-court case holding that inattention (as opposed to bad preparation to make a decision) gives rise to liability is In re the Walt Disney Company Derivative Litigation, 825 A.2d 275 (Del. Chancery 2003).

State of California. The account that follows is based on observations during the two weeks that I spent as a juror in the case,[6] 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." This condition makes a person susceptible to a heart attack. Until the autopsy after his death, no one knew that the patient had a heavy heart. The strain of the operation, which is unproblematic for a normal heart, caused cardiac arrest in this patient.

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

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[6] 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.

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.

In this paper, I will not consider the legal standard of care. (Elsewhere I ask whether the standard of care more closely resembles optimizing or adapting.[7]) I ask the question, "In weighing evidence, did the legal procedure require the jury to combine facts consistently with adaptation or optimization?" Reducing the evidence to probabilities sharpens the contrast because combining facts consistently with the laws of probability theory is necessary for optimization and unnecessary for adaptation. Consequently, in some circumstances, the laws of probability theory are consistent with optimization and inconsistent with adaptation. As an illustration of my argument, I will consider the special case where uncertainty can be represented by probabilities.

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 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

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[7] Cooter…

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.[8]   The jury had to decide whether the anesthesiologist's pre-operation screening was negligent or non-negligent.

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.

C. Combining Facts

So far I have discussed the facts about the two alleged acts of negligence. 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.

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[8] 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.

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 negligence. Entirely independently, the court decides whether the preponderance of the evidence about the operation indicates 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 patients 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.[9] 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, assume that plaintiff alleges that defendant was drunk. If defendant was drunk, then he is likely to have behaved negligently in screening and operating. Consequently, if the court concluded that screening was not

negligent, it is less likely that he was in fact drunk, and hence it is less likely that he operated negligently. In general, if plaintiff alleges that negligence was caused by some factor that operated at both critical points in time, then strength of evidence at one point in time affects the strength of evidence at the other point 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.[10] The next section demonstrates this fact by using probabilities.

D. 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
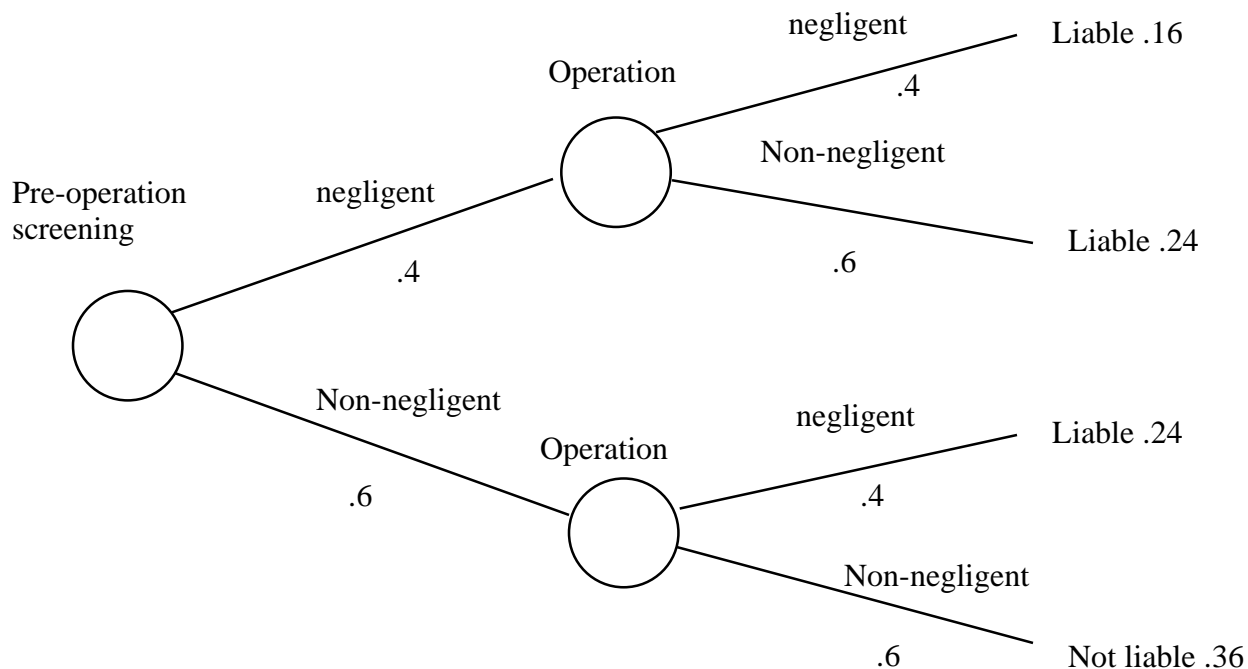
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[9] Gigerenzer

[10] Others have discussed the difference between deciding a case as a whole or decomposing it into its component issues and deciding them seriatim. The fact that the two approaches yield different results when courts consist of panels of several judges is called the "paradox of decision." See L. Kornhauser L. Sager (1993), "The One and the Many: Adjudication in Collegial Courts." California Law Rev. 81: 1, and "The Many as One: Integrity and Group Choice in Paradoxical Cases." Philosophy and Public Affairs 32. Also see   List, C. and P. Pettit (2005). "On the Many as One." Philosophy and Public Affairs(33).

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 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.

Figure 1: Uncertainty as Probability

Figure 1 tree diagram:

- Pre-operation screening
  - negligent .4 → Operation
    - negligent .4 → Liable .16
    - Non-negligent .6 → Liable .24
  - Non-negligent .6 → Operation
    - negligent .4 → Liable .24
    - Non-negligent .6 → Not liable .36

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.

Proceeding to the jury's next decision, 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.

I have shown that 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

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independent,[11] 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.[12] A full consideration of the complexities, however, would 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, and it works most of the time, but not all of the time. Combining the facts to reach an overall judgment is more correct and more complicated.

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[11] 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.

[12] 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.

E. 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 in this case. In general, optimization provides a powerful normative theory for critiquing the evidentiary procedures.

III. Decomposition

I have contrasted two to apply the standard of proof to the elements of the proof. One interpretation applies the standard independently to each element, and the other interpretation combines the elements into an overall judgment. In this section I consider whether one party can gain an advantage by making more distinctions and decomposing a single argument into several arguments.

To illustrate this possibility, assume contrary to fact that the anesthesiologist examined the patient in this case several weeks before the operation and then decided to schedule the operation. In these circumstances, the plaintiff might want to argue that the defendant was negligent in the scheduling examination. Will this additional argument increase the likelihood that the plaintiff satisfies the standard of proof required for liability?

I offer an answer for each of the two interpretations of the standard of proof. If there is some likelihood of negligence in scheduling the operation, and if the court applies the standard to this additional claim independently of the other claims, then the plaintiff's likelihood of winning increase in some circumstance. Specifically, the plaintiff's case is helped if there is a positive probability that the court will find that the probability of negligent scheduling exceeds .5. Otherwise, this additional allegation does not strengthen the plaintiff's case.

The situation is somewhat different if the court applies the standard of proof to the overall evidence. Even a small possibility of negligent scheduling would normally increase certainty that negligence caused the death in one way or another. In probabilistic terms, if the probability of negligent scheduling is positive, then, under the usual conditions,[13] the overall probability that defendant's negligence caused victim's death in one way or another's must increase. Thus the ability to decompose a factual situation into more elements appears to help the plaintiff, especially when the court makes an overall judgment about the preponderance of the evidence.

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[13] As before, this argument requires probabilities or particular forms of dependent probabilities. The proposition is untrue under some unusual forms of dependent probabilities

This conclusion, however, is misleading. To strengthen the plaintiff's case, the facts must be decomposed into additional conditions that are *sufficient* for liability. In the preceding example, negligence at any of the three points – scheduling, screening, and operating – is allegedly sufficient to cause the victim's death. Conversely, decomposing the facts into additional conditions that are *necessary* .for liability weakens the plaintiff's case.

To illustrate, liability requires that defendant's negligence caused the victim's death. ""Cause" and "negligence" are both necessary to liability. I have explained that defendant argued that more intensive screening of obese patients would not increase the likelihood of detecting a heavy heart. To decompose the facts, defendant might argue that detecting a heavy heart would have been insufficient to cancel this patient's operation. Thus defendant might argue that heavy hearts come in two types: "very dangerous" that require canceling such operations, and "not so dangerous" that allow proceeding with such operations. Defendant could then argue that screening might have discovered a not so dangerous condition. In probabilistic terms, as the probability of detecting a very dangerous heavy heart falls, the overall probability that defendant's negligence caused victim's death also falls,

I have explained that applying the standard of the preponderance the evidence to the overall facts might cause plaintiff to decompose the case into more sufficient conditions for liability and might cause defendant to decompose the case into more necessary conditions for liability. Consequently, this interpretation of the standard of proof does not systematically favor either party. In any case, before decomposing the case into more parts, either side must weigh the advantage gained against the disadvantage of distracting the court from its central argument by introducing a relatively unimportant argument.

IV. Conclusion

Applying the legal standard of proof independently to the elements of a case is simplest. The simple approach is consistent with adaptive heuristics. That is what the jury thought the judge instructed it to do in the case in question. Reducing evidence to probabilities, which juries do not ordinarily do, clarifies a

problem with this approach: Independent consideration of evidence is inconsistent with the laws of probability theory. In a case like this, the plaintiff could reasonably object to being disadvantaged by the court interpreting the rules of evidence to contradict probability theory. To be consistent with probability theory, the court should ask whether the preponderance of evidence favors the conclusion that defendant's negligence caused the victim's harm in one way or another. Although adaptation is a better descriptive theory in this case, optimization is a better normative theory.