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Citation: 81 U. Chi. L. Rev. 131 2014

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Expert Mining and Required Disclosure

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INTRODUCTION

In the social sciences, “data mining” sometimes refers pejoratively to the repetitive use of classical statistical methods to find “evidence” that results from only random variation.¹ Various aspects of evidence and civil-procedure law disincentivize data mining by expert witnesses in federal civil litigation. But as many authors have noted through the years, resourceful attorneys can do data mining’s dirty work by hiring multiple experts, asking each to provide an expert report on the same issue, and then put on the stand only the one who provides the most favorable report.² This practice is often referred to as “expert shopping” or “witness shopping.”³ To emphasize its analogousness to data mining, though, I will use the term “expert mining.”

Nothing in the Federal Rules of Evidence or the Federal Rules of Civil Procedure (jointly, “the Rules”) prevents expert

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¹ For example, one might run many statistical models on the same data set, varying the included explanatory variables to find the greatest possible value of conventional test statistics, as Stata’s built-in “stepwise” command does automatically. See *Stata 13 Help for Stepwise*, Stata (StataCorp LP 2013), online at <http://www.stata.com/help.cgi?stepwise> (visited Mar 2, 2014). The term “data mining” has a more neutral meaning in other fields, especially computer science. See, for example, Wikipedia, *Data Mining*, online at http://en.wikipedia.org/wiki/Data_mining (visited Mar 2, 2014). Other terms sometimes used to distinguish the pejorative version include “data snooping,” see Halbert White, *A Reality Check for Data Snooping*, 68 *Econometrica* 1097, 1098 (2000), and “data dredging,” see Wikipedia, *Data Dredging*, online at http://en.wikipedia.org/wiki/Data_dredging (visited Mar 2, 2014).

² See Samuel R. Gross, *Expert Evidence*, 1991 *Wis L Rev* 1113, 1143; Richard A. Posner, *An Economic Approach to the Law of Evidence*, 51 *Stan L Rev* 1477, 1541–42 (1999); Richard A. Posner, *The Law and Economics of the Economic Expert Witness*, 13 *J Econ Persp* 91, 98 (Spring 1999); Christopher Tarver Robertson, *Blind Expertise*, 85 *NYU L Rev* 174, 211 (2010).

³ See, for example, Posner, 51 *Stan L Rev* at 1541–42 (cited in note 2) (referring to “witness shopping”); Andrew MacGregor Smith, Note, *Using Impartial Experts in Valuations: A Forum-Specific Approach*, 35 *Wm & Mary L Rev* 1241, 1247 (1994) (explaining “expert shopping”).

mining; what little case law exists is mixed.⁴ It is often observed that our adversarial system induces situations in which both sides predictably hire fancy experts who predictably testify to opposite effect.⁵ In part because of the tendency of trials to devolve into such a battle of the experts, many have argued that our system should at least make more use of court-appointed (and thus putatively neutral) experts, if not use them exclusively.⁶ However, there has been little use of Federal Rule of Evidence 706, which allows courts to use such experts, and there seems little likelihood of change on the horizon.⁷

Judge Richard Posner has suggested a less sweeping solution to the specific problem of expert mining. Posner advocated requiring lawyers who call an expert witness “to disclose the name of all the experts whom they approached as possible witnesses before settling on the one testifying. This would alert the jury to the problem of ‘witness shopping.’”⁸ Posner suggested that if one party’s testifying expert were the only one it hired, while the other party’s testifying expert were, say, its twentieth, then fact finders would be able to draw the “reasonable inference” that the latter’s case must be weaker (otherwise why hire so many experts?).⁹ Professor Christopher Robertson has proposed a more substantial reform. His proposal is based on the double-blind matching of experts to litigants, but for my purposes

⁴ See discussion in notes 21–22 and accompanying text.

⁵ See, for example, Gross, 1991 Wis L Rev at 1126–36 (cited in note 2).

⁶ This reform has a long record of support in the civil-procedure literature, especially among comparative-law scholars. See, for example, John H. Langbein, *The German Advantage in Civil Procedure*, 52 U Chi L Rev 823, 835 (1985) (“In the Continental tradition experts are selected and commissioned by the court, although with great attention to safeguarding party interests. In the German system, experts are not even called witnesses. They are thought of as ‘judges’ aides.”). See also Amalia D. Kessler, *Our Inquisitorial Tradition: Equity Procedure, Due Process, and the Search for an Alternative to the Adversarial*, 90 Cornell L Rev 1181, 1215 (2005) (“[T]here is good reason to think that procedures relying exclusively on the parties to identify, present, and interpret the relevant facts may be the least likely to arrive at the truth—certainly less likely than inquisitorial procedures that rely more on the court.”).

⁷ See, for example, Joe S. Cecil and Thomas E. Willging, *Court-Appointed Experts: Defining the Role of Experts Appointed under Federal Rule of Evidence 706* *3 (Federal Judicial Center 1993), online at [http://www.fjc.gov/public/pdf.nsf/lookup/experts.pdf/\\$file/experts.pdf](http://www.fjc.gov/public/pdf.nsf/lookup/experts.pdf/$file/experts.pdf) (visited Mar 2, 2014).

⁸ Posner, 51 Stan L Rev at 1541 (cited in note 2).

⁹ *Id.*

its key feature is that it, too, relies on disclosure of the number of experts retained to eliminate expert mining.¹⁰

My primary objective here is to assess disclosure's ability to realize the promise of (i) inducing parties to acquire expert evidence, while (ii) eliminating parties' ability to obscure the informative value of that evidence via expert mining. I argue that while required disclosure surely reduces the allure of expert mining, it generally does not eliminate the use of multiple experts. I then point out that if we can count on parties to disclose truthfully, then a party's use of expert mining is observable, so that a combined policy of required disclosure and exclusion of evidence obtained through expert mining would be feasible and would eliminate the incentive to use expert mining. But it is not obvious that such a combined disclosure-exclusion policy is desirable.¹¹ When coupled with required disclosure, "expert mining" is really just the reporting of evidence gathered from multiple experts. To the extent that additional *fully disclosed* expert testimony increases the fact finder's information, we can expect a beneficial increase in accuracy. On the other hand, expert evidence is costly; in addition, changes in its use could also change the pattern of settlement and litigation, with potentially unpredictable effects on both the extent of litigation and primary behavior. Thus, I conclude that it is *ex ante* unclear whether disclosure-exclusion or just disclosure would be a better policy reform.¹²

In Part I, I briefly discuss how the current Rules handle expert discovery and testimony. In Part II, I discuss the efficacy of required disclosure in a stylized example, showing that it does not generally eliminate incentives to expert mine. To eliminate expert mining requires that courts go further, excluding expert-mined

¹⁰ See Robertson, 85 NYU L Rev at 179–80 (cited in note 2). While Robertson's objective is to provide a broader fix to more problems than just expert mining, I will focus on that aspect of his work.

¹¹ This observation helps show how the Article links, at least heuristically, to the revelation-mechanism literature. We can think of parties' "types," as this term is used in the mechanism-design literature, see Jean-Jacques Laffont and David Martimort, *Mechanism Design with Collusion and Correlation*, 68 *Econometrica* 309, 312 (2000), as being given by the information they receive from the first-hired expert. A party that uses expert mining does so deliberately to obscure this type. We could prevent the parties from hiding their types by refusing to admit *any* expert evidence, but that approach would throw the baby out with the bathwater. The combined disclosure-exclusion policy both eliminates expert mining and induces parties to reveal their types.

¹² On the possibility that increased accuracy might not be worth its costs, see Louis Kaplow, *The Value of Accuracy in Adjudication: An Economic Analysis*, 23 *J Legal Stud* 307, 336 (1994).

testimony. In Part III, I discuss some Rules-based policy options that could be used to deter expert mining. I discuss some further considerations in Part IV, and then I conclude.

I. EXPERT WITNESSES AND THE FEDERAL RULES OF CIVIL PROCEDURE

The Federal Rules of Civil Procedure require parties to disclose the identities of any experts they expect to testify at trial.¹³ Testifying expert witnesses generally must compose a written report that will also be disclosed and that must include, inter alia, the expert's opinions and their bases, as well as the facts and data that the expert considered.¹⁴ All of these disclosures must be made at least ninety days before the trial date (or such other date as the court determines),¹⁵ except that disclosures related to experts expected to testify to rebut the testimony of another party's disclosed testifying expert can be made within thirty days of receiving that party's disclosures.¹⁶ In addition, parties may take the deposition of opponents' testifying experts.¹⁷

Nontestifying experts are subject to almost no discovery. Rule 26(b)(4)(D) states: "Ordinarily, a party may not, by interrogatories or deposition, discover facts known or opinions held by an expert who has been retained or specially employed by another party . . . and who is not expected to be called as a witness at trial."¹⁸ One exception involves medical examinations under Rule 35(b).¹⁹ A second requires "showing exceptional circumstances under which it is impracticable for the party to obtain facts or opinions on the same subject by other means."²⁰ Courts have debated what constitutes exceptional circumstances²¹ and also whether Rule 26(b)(4)(D)'s "facts known or opinions held" language shields identities of nontestifying experts.²² These issues

¹³ See FRCP 26(a)(2)(A).

¹⁴ See FRCP 26(a)(2)(B).

¹⁵ See FRCP 26(a)(2)(D)(i).

¹⁶ See FRCP 26(a)(2)(D)(ii).

¹⁷ See FRCP 26(b)(4)(A).

¹⁸ FRCP 26(b)(4)(D).

¹⁹ See FRCP 26(b)(4)(D) (stating that a party may take a deposition of a nontestifying expert "(i) as provided in Rule 35(b)").

²⁰ FRCP 26(b)(4)(D)(ii).

²¹ Contrast *Coates v AC & S, Inc*, 133 FRD 109, 110 (ED La 1990) (holding that expert shopping constitutes exceptional circumstances), with *Pickett v IBP, Inc*, 2000 US Dist LEXIS 19500, *7-9 (MD Ala) (rejecting *Coates*).

²² See, for example, *Ager v Jane C. Stormont Hospital & Training School for Nurses*, 622 F2d 496, 503-04 (10th Cir 1980); *Hoover v United States Department of the Interior*,

have not been addressed by the Supreme Court, and only a couple of courts of appeals have addressed them, so it is an open question whether the Rules as written allow discovery of nontestifying experts' identities.

The policy basis for access to testifying experts is simple and deeply rooted in federal civil procedure: not only fair trials, but also just and accurate results, require that parties be informed of the key facts before trial commences.²³ The policy rationale for shielding nontestifying experts from discovery—a shield that is now based in Rule 26(b)(4)—mirrors the two policy concerns that underlie *Hickman v Taylor's*²⁴ work-product doctrine.²⁵ First, fairness and efficiency warrant extensive discovery rights for testifying experts. Second, allowing too much discovery of work product disincentivizes an attorney's own diligent case preparation, with baleful effects on clients.²⁶

II. INDIVIDUAL AND EXPERT MINING

A. Individual Data Mining

Individual data mining would involve an expert witness's conducting whatever number of tests turned out to be necessary to obtain a result that supported the party hiring her, and then testifying regarding only the supportive test. Several features of the Rules discourage data mining. Testifying experts can be questioned during both deposition and trial testimony. If an adversary discovers a party's expert engaged in data mining, she could use the Federal Rules of Evidence to exclude the data-mined testimony. Data mining is not a "reliable . . . method[.]" of testing for the level of a contaminant, so it fails Rule 702(c).²⁷ An expert who repeatedly conducts a reliable and probabilistic test until she gets the desired result is not "reliably

611 F2d 1132, 1146 (5th Cir 1980); *Sea Colony, Inc v Continental Insurance Co*, 63 FRD 113, 114 (D Del 1974); *Baki v B.F. Diamond Construction Co*, 71 FRD 179, 182 (D Md 1976).

²³ See, for example, Charles Alan Wright, Arthur R. Miller, and Edward H. Cooper, 8A *Federal Practice and Procedure* § 2032 at 93 (West 3d ed 2013) ("Automatic access to at least some discovery regarding [testifying] experts was viewed as essential to enable the adverse party to prepare for effective cross-examination and rebuttal, as the Advisory Committee pointed out in its [1970] Note."). See also *Hickman v Taylor*, 329 US 495, 507 (1947) ("Mutual knowledge of all the relevant facts gathered by both parties is essential to proper litigation.").

²⁴ 329 US 495 (1947).

²⁵ See *id* at 509–10.

²⁶ See *id* at 510–11.

²⁷ FRE 702(c).

appl[ying] [] principles and methods,” violating Rule 702(d).²⁸ And repeatedly conducting a probabilistic test until one gets a desired result will generate that result with probability arbitrarily close to one, so testimony that the desired result did occur cannot meaningfully “help the trier of fact to understand the evidence or to determine a fact in issue,” violating Rule 702(a).²⁹ Finally, data-mined expert testimony surely fails *Daubert v Merrell Dow Pharmaceuticals, Inc.*³⁰ Thus, the Federal Rules of Civil Procedure and of Evidence work together to enable a well-prepared party to punish an adversary for its expert’s use of data mining.

B. Expert Mining: Just like Individual Data Mining

Hiring experts and directing each to conduct a single test until one turns up a helpful result has exactly the same statistical properties concerning test results as would an individual expert’s data mining. Suppose the question at issue is whether soil is contaminated; if it is, the defendant will be liable, and if it is not, then the defendant will not be liable. Table 1 concerns the repeated running of a soil test on uncontaminated soil. I calculated the table’s figures under the assumption that when the null hypothesis that the soil is uncontaminated is true, the test has probability 0.05 of finding that the soil is contaminated. This type of mistake is interchangeably known as a false positive or a Type I error, and the rate at which it occurs is known as the test’s significance level, typically denoted by α .³¹ The table’s first column shows the number of independent trials of the test, ranging from 1 to 100. The second column reports the probability that at least one trial would reject the null hypothesis of

²⁸ FRE 702(d).

²⁹ FRE 702(a).

³⁰ 509 US 579 (1993). For example, there is nothing falsifiable about using a method that will always generate a particular result regardless of the underlying facts. See *Falsifiability* (Princeton University), online at <http://www.princeton.edu/~achaney/tmvel/wiki100k/docs/Falsifiability.html> (visited Mar 2, 2014).

³¹ There is nothing necessary to my argument about the value $\alpha = 0.05$, though it is commonly used. See David H. Kaye and David A. Freedman, *Reference Guide on Statistics*, in Federal Judicial Center, *Reference Manual on Scientific Evidence* 211, 251–52 (National Academies 3d ed 2011) (stating that significance “levels of 5% and 1% have become icons of science and the legal process”). Contrast Posner, 51 Stan L Rev at 1510–11 (cited in note 2) (arguing that such a low significance level is too demanding in practice), with *ATA Airlines, Inc v Federal Express Corp*, 665 F3d 882, 896 (7th Cir 2011) (Posner), cert denied, 133 S Ct 162, 184 (2012) (rejecting a jury’s damage award (in dicta) because the plaintiff expert’s damages estimate was not significant at the 5 percent level).

uncontaminated soil. With just 15 repetitions, the probability of observing a positive test exceeds one-half; with 25 repetitions, it is nearly three-fourths; and with 100 repeated tests, it is nearly certain.

TABLE 1. MULTIPLE DRAWS FROM THE TEST DISTRIBUTION WHEN THE SOIL IS UNCONTAMINATED AND $\alpha = 0.05$

Number of Independent Repetitions of Soil Test	Probability of Rejecting Null Hypothesis in <i>at Least One</i> Experimental Repetition
1	0.0500
5	0.2262
15	0.5367
25	0.7226
50	0.9231
100	0.9941

Now consider the implications of repeated testing from the defendant's point of view. She would like to obtain a negative test even when the soil truly is contaminated. Suppose the test is sensitive enough to detect true contamination 75 percent of the time. This means the test's power is $\beta = 0.75$, and its Type II error rate—the probability that it will incorrectly fail to reject a *false* null hypothesis, also known as its false-negative rate—is $1 - \beta = 0.25$. Table 2 shows that the probability of obtaining at least one negative test result when the soil actually is contaminated rises from 0.25 with one test, to 0.5781 with three tests, to greater than 0.9 with ten tests, and to a nearly certain 0.99 with just sixteen tests.

TABLE 2. MULTIPLE DRAWS FROM THE TEST DISTRIBUTION WHEN THE SOIL IS CONTAMINATED AND THE TEST HAS POWER EQUAL TO 0.75

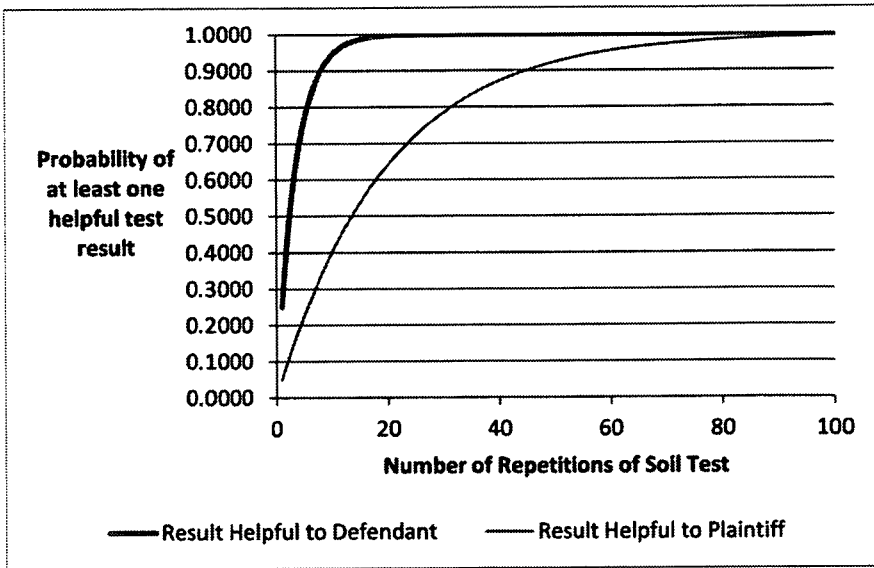
Number of Independent Repetitions of Soil Test	Probability of <i>Failing to Reject</i> Null Hypothesis in <i>at Least One Test</i>
1	0.2500
3	0.5781
5	0.7627
10	0.9437
16	0.9900

Statistical tests' significance levels and Type II error rates—for example α and $1 - \beta$ —often differ substantially. Figure 1 provides a dramatic visual perspective on the importance of this fact. In the figure, I use the same parameter values I used to construct the two tables above to plot the probability of obtaining incorrectly helpful results. As the number of hired experts increases, this probability rises much more slowly for the party with the burden of proof, reflecting the fact that $\alpha = 0.05$ is considerably below $1 - \beta = 0.25$. Test power is typically well below one for conventional significance levels like $\alpha = 0.05$,³² in which case the Type II error rate will exceed α substantially. Thus, expert mining is likely to be cheaper for the party not carrying the burden of proof, which frequently will mean the defendant.³³

³² Without delving into technical statistical details, I note that a test's power, and thus its Type II error rate, usually depends on the significance level, α , that a researcher uses. See Kaye and Freedman, *Reference Guide on Statistics* at 254 n 106 (cited in note 31).

³³ Whether the defense case is more likely than the plaintiff's case to rest on expert mining in actually observed trials is difficult to determine, because it depends on the share of actually tried cases in which the true state of the world is such that an informed fact finder would find the defendant liable. This share is difficult to observe or predict in the presence of party selection in litigation. See the discussion of party selection in note 43.

FIGURE 1. EACH PARTY'S PROBABILITIES OF OBTAINING AT LEAST ONE HELPFUL TEST RESULT WHEN THE TRUTH IS UNHELPFUL TO THAT PARTY



C. Incentives to Use Expert Mining and the Effects of Required Disclosure

In Appendix A, I provide a stylized model of expert mining in the absence of required disclosure. The model shows that when the stakes are great enough, each party will have a dominant strategy to expert mine: each will (i) sequentially hire as many experts as it takes to generate a single helpful result and then (ii) introduce testimony from the expert who generated it. Such an expert miner will always find a helpful result, so the parties will have spent a lot of resources hiring experts who provide zero informational content at trial.³⁴ In this Section, I will address arguments related to expert mining in two scholarly articles, one by Richard Posner and the other by Chris Robertson.³⁵

³⁴ As Robertson puts it, if all cases involved a single expert on both sides of an issue, then there is probability one-half that one of these experts, chosen randomly from among actually testifying experts, would be correct, regardless of the true rate of error among experts in the population. See Robertson, 85 NYU L Rev at 189 n 63 (cited in note 2).

³⁵ For additional discussion of issues related to parties' ability to introduce experts of their choosing, see Gross, 1991 Wis L Rev at 1126-36 (cited in note 2). For models of the performance of jury decision making when parties control evidence generally, see Luke M. Froeb and Bruce H. Kobayashi, *Naive, Biased, Yet Bayesian: Can Juries Interpret Selectively Produced Evidence?*, 12 J L, Econ & Org 257, 270-71 (1996) (finding that

Posner has suggested that this problem can be mitigated via required disclosure: “[L]awyers who call an expert witness could be required to disclose the name of all the experts whom they approached as possible witnesses before settling on the one testifying. This would alert the jury to the problem of ‘witness shopping,’” leading to the “reasonable inference” that a party interviewing multiple experts has a weaker case than one using only a single expert.³⁶

Next, consider Christopher Robertson’s clever suggestion to use double-blind expert assignment in order to attack expert partisanship in general.³⁷ One can regard Robertson’s basic scheme as a way to operationalize my assumption that any given expert testifies sincerely as to empirical findings. If Robertson stopped there, then, his proposal would not prevent expert mining. Mindful of this point, he proposes that each blinded expert’s report disclose the number of times a party has sought a blinded expert as to the issue in question. This report would be discoverable if the (subsequently revealed) blinded expert testified.³⁸

parties will engage in evidence mining generally but that juries might still decide accurately); Amy Farmer and Paul Pecorino, *Does Jury Bias Matter?*, 20 *Intl Rev L & Econ* 315, 327 (2000) (finding that jury accuracy is a fragile result); Andrew F. Daughety and Jennifer F. Reinganum, *On the Economics of Trials: Adversarial Process, Evidence, and Equilibrium Bias*, 16 *J L, Econ & Org* 365, 388–89 (2000); Luke M. Froeb and Bruce H. Kobayashi, *Evidence Production in Adversarial vs. Inquisitorial Regimes*, 70 *Econ Letters* 267, 268–71 (2001).

³⁶ Posner, 51 *Stan L Rev* at 1541 (cited in note 2).

³⁷ Under Robertson’s scheme, litigation parties would contact an intermediary to request an expert report. The parties would provide the empirical question together with all information they wanted the expert to use, as well as an amount they were willing to pay per hour. The intermediary then would choose an expert from a pool of eligible experts willing to work at the offered billing rate. The expert would write a report answering the proffered question with the provided data. The value added of this procedure is that the intermediary would match experts to parties in a double-blind fashion, in principle eliminating the basis for concern about partisanship of hired gun experts. Parties could choose to use the expert report or not; if they did, then the intermediary would reveal the expert’s identity so that the party and the expert could contract for testimony. Parties would still be able to use hired-gun experts if they chose to, including when any contracted blinded expert’s report was unhelpful. But juries would be instructed concerning the difference between blinded and hired-gun experts, presumably providing a credibility advantage to parties using blinded experts. Robertson, 85 *NYU L Rev* at 206–14 (cited in note 2).

³⁸ Robertson’s proposal differs from Posner’s in that it does not require disclosure for nonblinded experts. In fact, Robertson argues that required disclosure of the number of hired blind experts is consistent with existing Rule 26(b) only because of the extraordinariness of using blinded experts. See *id.* at 211–13.

While Robertson suggests that, in general, required disclosure would be sufficient to eliminate mining of blinded experts,³⁹ this is too strong a claim. To understand why, observe that even when results from multiple repetitions of a particular type of test conflict, the collection of all test results together might be informative as to the true state of the world. The informational content of conflicting test results depends not only on the number of results pointing in each direction, but also on the test's false-positive and false-negative rates. Even two test results pointing in opposite directions can be very informative, if the probabilities of false negatives and false positives are sufficiently different.

As a simple example, consider a test with a false-positive rate of 5 percent ($\alpha = 0.05$) and a false-negative rate of 20 percent ($1 - \beta = 0.2$). Assume we use Bayes's Law to update beliefs, placing prior probability $1/2$ on the event of correctness of both the null hypothesis and its complement.⁴⁰ Now suppose we observe two independently drawn results from this test, one rejecting the null hypothesis and one not rejecting. One of these results must be incorrect, but which is the more likely one? Ex ante, false negatives are four times more likely than false positives. It stands to reason, then, that the negative test result is more likely to be incorrect than the positive one, and so our posterior belief after observing conflicting test results should be that the null hypothesis is likely to be false. Indeed, in this example, the posterior probability of the null hypothesis is 0.23—less than half the prior probability.⁴¹ Thus Robertson is mistaken

³⁹ Id at 212.

Ex ante knowledge of this disclosure rule would generally deter litigants from iterative use of the blind procedure. For a litigant, there is little value in bringing a favorable blind opinion if he also must disclose the existence of one or more unfavorable blind opinions; he would be better off resorting to traditional unblind experts or settling the case.

⁴⁰ Treating the defendant's case as the negation of the plaintiff's has its critics. See, for example, Ronald J. Allen, *A Reconceptualization of Civil Trials*, 66 BU L Rev 401, 425 (1986). I take this approach here only for simplicity of exposition.

⁴¹ Using Bayes's Law, the posterior probability that the null hypothesis is true here is

$$P(\text{Null}|\text{Data}) = \frac{P(\text{Data}|\text{Null})P(\text{Null})}{P(\text{Data})}.$$

Using the laws of probability, this is equivalent to

$$P(\text{Null}|\text{Data}) = \frac{P(\text{Data}|\text{Null})P(\text{Null})}{P(\text{Data}|\text{Null})P(\text{Null}) + P(\text{Data}|\text{Not - Null})P(\text{Not - Null})}.$$

in suggesting that there is “No Signal” sent to the fact finder when each party introduces blinded-expert evidence in its favor.⁴² At least for a Bayesian fact finder with a prior belief that the null hypothesis and its complement are equally likely, this claim would be correct only if $\alpha = 1 - \beta$.

This observation is relevant for expert mining with required disclosure. Would a party who has hired a first expert and received unhelpful evidence still find it worth hiring a second expert when there is required disclosure? Possibly. A necessary condition is that the fact finder will update its beliefs toward the party’s position when the fact finder observes two test results, one of which helps the party and the other of which doesn’t. For example, consider a plaintiff who thought the fact finder (i) placed prior probability 1/2 on the event of defendant’s liability and (ii) would use $\alpha = 0.05$ and $\beta = 0.8$, as in the example just above. Other things equal, this plaintiff would expect evidence from a second-hired expert to cause the fact finder to update its beliefs toward the plaintiff’s case (where the null hypothesis is the absence of defendant liability). Thus, expert mining could still make sense even in the presence of required disclosure.

Whether such a plaintiff would actually use expert mining depends on more than just the direction in which the fact finder would update, though. Most notably, it also depends on the plaintiff’s beliefs about how many experts the defendant would use. Similarly, the defendant’s willingness to use expert mining depends on her own beliefs about whether the plaintiff will do so. And of course, each party’s incentives will depend on the cost of hiring experts, the cost of trial, and the stakes of the case. Finally, the parties will both engage in expert mining only if they have sufficiently different beliefs concerning the likelihood that

With a prior belief that $P(\text{Null}) = P(\text{Not-Null}) = 1/2$, we thus have

$$P(\text{Null}|\text{Data}) = \frac{P(\text{Data}|\text{Null})}{P(\text{Data}|\text{Null}) + P(\text{Data}|\text{Not-Null})}.$$

In our example, $P(\text{Data}|\text{Null})$ can be shown to equal $\alpha \times (1 - \alpha)$, while $P(\text{Data}|\text{Not-Null})$ equals $\beta \times (1 - \beta)$. Given $\alpha = 0.05$ and $\beta = 0.8$, it follows that

$$P(\text{Null}|\text{Data}) = \frac{0.05 \times 0.95}{0.05 \times 0.95 + 0.8 \times 0.2} = 0.23,$$

so the null hypothesis is much less likely given the data than it was before we saw the data.

⁴² Robertson, 85 NYU L Rev at 217 table 1 (cited in note 2).

each would win at trial, given the profile of expert evidence they presented to the fact finder.⁴³

In Appendix B, I present another model, in which it is a Nash equilibrium for each party to do at least some expert mining even when there is required disclosure. This result reflects the fact that required disclosure is generally insufficient to eliminate expert mining (at least when the fact finder is Bayesian, as in the model). But it is easy to show that even in this model, required disclosure together with a policy of excluding evidence obtained from an expert other than the first one *does* eliminate expert mining. If this proposition sounds trivial, that's because it is: a party can't benefit from the fruits of a second- or later-hired expert if a court will not admit that expert's findings. So no party would bother hiring more than one expert in a regime that combined required disclosure and exclusion of later-hired experts. Of course, it would be impossible to exclude later-hired experts without required disclosure of the number of experts consulted on an issue; adversaries would not know which experts to challenge, and judges would not know which challenges to sustain. Thus, required disclosure is a necessary part of a combined mechanism to eliminate expert mining.

One problem with the combined disclosure-exclusion policy is enforceability. Suppose a party did hire two experts and introduced the second one's results. If the party did not disclose the fact that it had hired another expert first, it might not be caught; so what's to stop this sort of behavior? One answer is that the norms of legal culture might be sufficient to induce ex post disclosure compliance, so that few parties decide to engage the second expert in the first place. A second answer is that parties would get caught *sometimes*; provided that penalties are sufficiently severe and targeted at lawyers, who are repeat players in the courts, compliance might be incentive compatible.⁴⁴ Without taking a stand on the empirics of these issues, I will point out that much of the discovery system operates on the honor system. An observer who is comfortable with the existing system's

⁴³ This is just the usual point that litigation happens in economic models only when some form of disagreement or informational asymmetry exists among parties; otherwise the parties would settle and avoid spending money on experts, lawyers, and trial preparation. See Kathryn E. Spier, *Litigation*, in A. Mitchell Polinsky and Steven Shavell, eds, 1 *Handbook of Law and Economics* 259, 326 (Elsevier 2007), for an excellent and comprehensive review of the literature on litigation and selection.

⁴⁴ See Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 *J Polit Econ* 169, 176–79 (1968).

performance should not be less comfortable with applying it to the disclosure-exclusion policy I propose.⁴⁵

In sum, assuming that parties and their attorneys would comply with it, the disclosure-exclusion policy would have several key features if implemented in a world similar to the one I model. First, the policy would preserve the incentive to hire the first expert when it exists now. Second, it would eliminate the incentive to engage in expert mining. Third, litigation would be less expensive, since parties would never hire more than one expert on any issue. Fourth, when parties did introduce expert evidence, fact finders informed of the disclosure-exclusion policy would be justified in treating that evidence as truly informative. While parties would not introduce unhelpful expert evidence at trial, fact finders would rationally infer that an expert-silent party had hired a single expert who provided unhelpful evidence. By comparison to the no-disclosure baseline, the disclosure-exclusion policy converts a system in which two experts might provide uninformative evidence into one in which fact finders would be justified in treating both expert testimony and its absence as providing real information about empirical facts.

There remains the interesting question of whether it is desirable to eliminate expert mining, given disclosure. I will assume for now that it is. I address this question directly in Part IV.C.

III. POLICY OPTIONS TO DEAL WITH EXPERT MINING

In the real world, there are legitimate reasons why a party might hire multiple experts to address a single issue. For example, the first retained expert might have either delivered a poorly written report or demonstrated that she is no good at articulating her opinions orally. Excluding expert evidence in such a situation would undermine parties' ability to prepare their own case, while serving no useful mining-prevention purpose. Thus in practice, any change in the Rules would have to be more refined than simply excluding any expert evidence when more than one expert has delivered a report concerning a test. It is easy to imagine widespread opposition—in the bar, on the bench, and among rule makers—to a firm policy of exclusion of later-hired

⁴⁵ One nice feature of Robertson's approach is that reporting of the number of blind experts hired would be done by the intermediary, so there would be no way to avoid disclosure compliance when a party used blind experts. Robertson, 85 *NYU L Rev* at 211 (cited in note 2).

experts' testimony. Moreover, as I discuss in Part IV.C, it is not clear that it would be desirable to adopt such a policy. Thus, I begin this Part by discussing how we might effect a policy centered on required disclosure; only subsequently do I turn to the issue of excluding later-hired experts' testimony.

New Rules language would be necessary to effect required disclosure. The most straightforward approach would be to simply add Rules language to require parties to disclose, via standard discovery, the number of experts who were hired as to an issue. A party could introduce her adversary's disclosure of this number directly as an exhibit, or she could raise it when cross-examining whichever expert does testify.⁴⁶ In line with Posner and Robertson's arguments, a well-crafted cross-examination would undermine the credibility of the adversary's expert evidence when many experts are consulted. This would at least reduce the incentive to use expert mining. If all of a party's experts (whether testifying or not) came to the same conclusion, then the Rules could allow the court to grant pretrial motions to exclude such cross-examination. To effect this or a similar policy, courts could allow parties to provide documents sealed for in camera review.⁴⁷

Another possible reform would require disclosure not just of the number of experts hired, but also of the contents of reports provided by a party's nontestifying experts (including the contents of any oral report). Such reports could be made admissible in cross-examination of a party's testifying expert. Parties would know that the full range of expert opinions they had received could come before the fact finder. To the extent that attorneys are skilled in using language from unhelpful expert reports against the unfortunate party who received such a report, this policy could do more than a policy of requiring disclosure only of the number of hired experts. To address work-product concerns, parts of nontestifying experts' reports other than the ones relevant to expert mining could be redacted, and parties would always have the ability to seek protective orders pursuant to Rule 26(c). And once again, additional provisions for in camera examination of nontestifying experts' reports could be added if need be.

While these reforms would discourage—and likely reduce—the extent of expert mining, I have argued above that eliminating

⁴⁶ There would be no hearsay problem because under Federal Rule of Evidence 801(d)(2), the disclosure would qualify as an opposing party's statement.

⁴⁷ FRCP 26(c)(1)(H) allows for sealed filing of designated documents.

rather than simply reducing expert mining requires excluding testimony from later-hired experts. If such elimination is considered a desirable policy, then perhaps the best way to effect it would be to require disclosure and to exclude expert testimony when an adversary both moves to do so and provides good cause to believe that there is no nonmining explanation for a party's having hired multiple experts. Alternatively, the Rules could direct courts to presume that expert mining has occurred when multiple experts have been hired, with a later-hired expert's proponent given the opportunity to rebut this presumption.⁴⁸ If preventing expert mining is a desired policy, then perhaps the best approach would be to expand judges' discretionary gate-keeping powers, however controversial these powers may be.

IV. FURTHER CONSIDERATIONS

In this final Part, I discuss several further issues related to expert mining. First, is expert mining really a problem under status quo rules? Second, does my analysis apply in expert-relevant contexts that do not quite fit the random-test result framework I have considered so far? Third, would it be better to eliminate expert mining or to allow parties to introduce whatever evidence they wish as to an issue, provided that they disclose the number of experts they consulted as to that issue?

A. Is Expert Mining Really a Problem under Status Quo Rules?

An optimist might look at the paucity of cases in which there are accusations of expert mining and ask whether there's any basis for concern. There are two good reasons why the answer is yes.

First, the incentive to expert mine is obvious. If the stakes are high enough, it will make economic sense for parties to spend what it takes to find an expert who is able to testify truthfully to a helpful test result. Perhaps one might argue that expert mining is unethical inasmuch as its general practice vitiates the informational value of expert testimony. But it would be a strain to read the ABA's Model Rules of Professional Conduct,

⁴⁸ Note that when the question of whether a witness's testimony was procured as a result of expert mining is murky, Federal Rule of Evidence 104 would allow the court discretion to decide these issues.

for example, to prohibit expert mining,⁴⁹ and it doesn't take Holmes's *Bad Man*⁵⁰ to believe that a client's zealous advocate might find expert mining within bounds.

Second, it is entirely possible that the absence of judicial outcry over expert mining is a result of its very protection from discovery. Expert-mining parties do not have to disclose the facts that indicate mining; even those opponents who are wise to the scheme can't get the discovery they would need to unmask and counteract it. So there is no reason to think that courts, or even rule makers for that matter, should be aware of the scope of whatever problem does exist.

B. Other Contexts in Which Expert Testimony Is Used

I have deliberately restricted attention thus far to situations in which expert testimony involves conducting tests whose random aspect can be repeated during litigation. There are, of course, many other important contexts in which expert testimony is used. Far away from the context on which I've focused, for example, is the testimony found inadmissible in *Kumho Tire Co v Carmichael*.⁵¹ Closer to my context, we find expert testimony by economists in, say, antitrust cases, where all experts might have access to the same industry data concerning pricing, production, or product quality. These data are fixed at the time of litigation, so there is no way to data or expert mine in the way I discuss.⁵² But that doesn't mean that data or expert mining is impossible in the antitrust setting. Experts will typically use statistical techniques in these cases, and the nature of the models they estimate will be susceptible to individual data mining via sample selection or model-specification searching. Further, qualified experts differ as to not only the most appropriate statistical methods, but also the underlying economic models whose parameters should be estimated. So there will be plenty of scope for parties to engage in expert mining by hiring multiple experts to write reports and then picking the most favorable one. What

⁴⁹ Model Rules of Professional Conduct (MRPC) Rule 3.3(a)(3) (ABA 2011). This rule prohibits offering evidence that an attorney knows to be false. But the evidence actually offered as a result of expert mining—that the testifying expert recorded a helpful result—is true.

⁵⁰ Oliver Wendell Holmes Jr, *The Path of the Law*, 10 Harv L Rev 457, 459 (1897).

⁵¹ 526 US 137, 153–58 (1999) (involving a defective-design expert who based conclusions on the technological features of the allegedly defective tire).

⁵² See Part II.

drives the expert-mining process here is not random test-result variation, but variation in experts' good-faith opinions regarding subjective matters. Similar considerations arise in the medical-malpractice context that Robertson considers.⁵³

My analysis would need to be altered to accommodate contexts like these. But the basic points might carry through, because we can expect parties to hire as many experts as it takes to get a sufficiently helpful opinion; this is especially likely to be true in antitrust cases, in which the financial stakes can be humongous. Requiring disclosure of the number of experts hired might tend to reduce the egregiousness of expert mining in such situations, though disclosure might be less effective than in the repeatable-test cases. For one thing, parties could first determine experts' publicly expressed views on, say, the competitive benefits and deadweight costs related to more aggressive antitrust enforcements, and only then hire the one who appears most likely to provide helpful testimony. That said, experts chosen through such sorting will be vulnerable to a line of cross-examination that focuses on their precase attachment to the opinion—in other words, an expert who appears to have made up her mind before seeing the facts of the given case might be less effective at persuading the trier of fact. A complete analysis of this modified expert-witness situation is beyond the scope of this Article.

C. Would It Be Better to Allow Expert Mining, given Required Disclosure?

Given required disclosure, it is not at all clear that expert mining is a bad thing. The more expert opinions that the fact finder knows about, the more accurate her decision will be, provided that the fact finder correctly assesses the implications of the evidence she receives. Suppose a fact finder knows that two experts of equal ability have considered a question and are split. Under certain assumptions, the fact finder will on average be more likely to be correct if it can base its decision on the opinion of a similarly capable third expert.⁵⁴ The informational problem

⁵³ See Robertson, 85 *NYU L Rev* at 219–30 (cited in note 2).

⁵⁴ I believe the following assumptions would be sufficient: the fact finder interprets each expert opinion correctly, knows the true rates of false negatives and false positives, and uses Bayes's rule. To the extent that the fact finder does not satisfy these assumptions, more information conceivably could reduce the accuracy of its decisions. That issue is far beyond the scope of this Article.

with expert mining under status quo rules is not that the parties consult too many experts, but rather that the fact finder does not have the ability to take account of *how many* experts the parties have consulted. Given required disclosure, preventing expert mining via exclusion of later-hired experts is not an unambiguously good idea, then. But it is also not necessarily a *bad* idea, either. Expert reports are costly to create, and it is possible that the marginal increase in the fact finder's accuracy isn't worth the added cost of the expert reports that will be written if expert mining is allowed.

A further set of interesting but quite difficult questions concerns how exclusion affects rational parties' litigation behavior. Adding an exclusion policy to one of required disclosure will affect the distribution of expert evidence across cases by eliminating what expert mining would exist under the policy of only required disclosure. That means the exclusion policy generally will affect which cases settle and which go to trial. It is not obvious whether this is a good thing or a bad thing. These observations indicate that a full normative assessment of the disclosure rules for nontestifying experts would require a comprehensive model. But the takeaway point is clear: it might well be better to rely only on required disclosure, rather than on exclusion together with required disclosure.

CONCLUSION

The probability of obtaining a helpful result rises quickly as parties increase the number of draws they take from the test-result distribution. For that reason, parties can virtually assure themselves of obtaining helpful test-result evidence by hiring enough experts. Consequently, the expert evidence presented at trials conducted under status quo rules may have no informational value. As they stand, the Federal Rules of Civil Procedure and the Federal Rules of Evidence neither prevent nor even facilitate the ferreting out of expert mining. Proposals to require parties to disclose the number of experts hired would reduce the incentive to use expert mining but not necessarily eliminate it totally. To do that, one would have to marry required disclosure to a policy of excluding evidence obtained from later-hired experts. Since additional expert evidence is costly but also increases the information available to the fact finder, provided that the number of experts hired is disclosed, it is an interesting open

question whether disclosure-exclusion or just disclosure is the better policy.