Patent Damages Heuristics

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Abstract. In many domains, including law, decision makers often resort to heuristics, which others have aptly described as "shortcuts that simplify and speed up decision making" by, for example, "ignor[ing] some of the available information" to arrive at "adequate, though often imperfect, answers to difficult questions." In this paper, I argue that a patent system that more readily accepts the use of damages heuristics may better serve public policy than one that requires patent owners to substantiate every aspect of their claimed damages with rigorous proof. More specifically, policymakers confronted with the choice between a

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proposed heuristic and an open-ended, nonheuristic standard (or an alternative heuristic) ideally should choose the proposed heuristic when the sum of the administrative and error costs associated with its use is lower than the sum of the administrative and error costs resulting from the use of the nonheuristic (or alternative heuristic). To be sure, there often may be no easy way to evaluate whether this condition is satisfied—due both to the paucity of the evidence and to the fact that the cost one attributes to error depends in part on the value one places on the importance of accurate damages calculations to patent policy. Nevertheless, I will argue that, at least in some recurring situations, policymakers can reach a reasoned conclusion whether or not use of a particular heuristic is likely to improve social welfare; and that, more generally, the patent system would benefit if courts were more mindful of both the necessary tradeoffs to be made in calculating damages and where the gaps in our knowledge lie.

I. Introduction

In law, as in everyday life, when people make decisions they often resort to *heuristics*: "shortcuts that simplify and speed up decision making"[1] by, for example,

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[1] Callia Piperides et al., *Group Report: What Is the Role of Heuristics in Litigation?*, *in* HEURISTICS AND THE LAW, 344, 374 (Gerd Gigerenzer & Christoph Engel eds., 2006). For other discussions of heuristics in various fields, *see, e.g.*, JOSEPH HENRICH, THE SECRET OF OUR SUCCESS: HOW CULTURE IS DRIVING HUMAN EVOLUTION, DOMESTICATING OUR SPECIES, AND MAKING US SMARTER 189 (2015) (discussing, *inter alia*, how the internalization of social norms "may provide a quick and efficient heuristic that saves the cost of running the mental calculations that consider all the potential short- and long-term benefits and probabilistic penalties of an action"); DANIEL KAHNEMAN, THINKING, FAST AND SLOW 98 (2011) (defining a heuristic as "a simple procedure that helps find adequate, though often imperfect, answers to difficult questions"); HUGO MERCIER & DAN SPERBER, THE ENIGMA OF REASON 166, 207-09, 218-21 (2017) (arguing, *inter alia*, that logic itself can be viewed as a type of "heuristic tool that clarifies questions and suggests answers"); GEORGE PÓLYA, HOW TO SOLVE IT: A NEW ASPECT OF MATHEMATICAL METHOD 113, 129 (2d ed. 1957) (stating that "[h]euristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only"); PHILIP E. TETLOCK & DAN GARDNER, SUPERFORECASTING: THE ART AND SCIENCE OF PREDICTION 40 (2015) (noting that "when faced with a hard question, we often surrepticiously replace with it with an easy one," that is, we employ a heuristic); Christoph Engel & Gerd Gigerenzer, *Law and Heuristics: An Interdisciplinary Venture*, *in* HEURISTICS AND THE LAW, *supra*, at 1, 2-4 (tracing the origin and development of the term "heuristic," and arguing that "[f]rom an ecological (and evolutionary) point of view, " simple heuristics can be "highly robust in an uncertain world, whereas complex strategies tend to *overfit* . . . . Less can be more."); Gerd Gigerenzer & Peter M. Todd, *Fast and Frugal Heuristics: The Adaptive Toolbox*, *in* SIMPLE HEURISTICS THAT MAKE US SMART 1, 14 (Gerd Gigerenzer, Peter M. Todd, & ABC Res. Group eds. 1999) (stating that "[f]ast and frugal heuristics employ a minimum of time, knowledge, and computation to make adaptive choices in real environments," and thus "represent bounded rationality in its purest form"); Jonathan Haidt et al., *Group Report: What Is the Role of Heuristics in Making Law?*, *in* HEURISTICS AND THE LAW, *supra*, at 239, 240-41 (defining a heuristic as "a simple decision or action procedure that ignores some of the available information"); Peter Lee, *Patent Law and the Two Cultures*, 120 YALE L.J. 2, 22-23 (2010) (describing heuristics as "cognitive shortcuts that economize the selection and processing of information," and arguing that certain formalist doctrines in patent law might be viewed as having served a heuristic function); Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCIENCE 1124 (1974) (discussing three common cognitive heuristics); Gerhard Wagner, *Heuristics in Procedural Law*, *in* HEURISTICS AND THE LAW, *supra*, at 281. Engineers and computer scientists

"ignor[ing] some of the available information"[2] to enable one to attain "adequate, though often imperfect, answers to difficult questions."[3] Common examples of legal heuristics include not only certain substantive rules—for example, bright-line rules that narrow the scope of a liability determination in comparison with an open-ended, totality-of-the-circumstances standard—but also many procedural rules, including those that govern the admissibility of evidence; the allocation of burdens of production and persuasion; and presumptions, that is, evidentiary devices that either permit or require the trier of fact to draw certain inferences upon proof of some *other*, more readily demonstrated, fact.[4] In principle, legal heuristics such as presumptions can serve a variety of purposes—among them to economize on the cost of adjudication, to allocate the burden of producing evidence to the party who probably has better access to it, or to facilitate desired substantive ends[5]—though if left unchecked legal heuristics (like cognitive and other heuristics) also can generate a variety of errors.

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sometimes further distinguish ordinary (low-level) heuristics from higher-level "metaheuristics" or "hyperheuristics" for selecting *among* lower-level heuristics (or generating new ones). *See, e.g.*, Edmund K. Burke et al., *Hyper-heuristics: A Survey of the State of the Art*, 64 J. OPERATIONAL RES. SOC'Y 1695 (2013) (defining a "hyper-heuristic" as "a method or learning mechanism for selecting or generating heuristics to solve computational search problems").

2 Haidt et al., *supra* note 1, at 240-41.

3 KAHNEMAN, *supra* note 1, at 98.

4 *See, e.g.*, CHRISTOPHER B. MUELLER & LAIRD C. KIRKPATRICK, EVIDENCE § 3.4 (1995) (discussing presumptions); Douglas A. Kysar et al., *Group Report: Are Heuristics a Problem or a Solution*, *in* HEURISTICS AND THE LAW, *supra* note 1, at 103, 129-35 (discussing, among other things, bright-line rules of substantive law as heuristics); Joachim Schulz, *Rules of Evidence as Heuristics—Heuristics as Rules of Evidence*, *in* HEURISTICS AND THE LAW, *supra* note 1, at 327, 335 (stating that "shifting the burden of proof could be a concept equivalent to applying heuristics"); Wagner, *supra* note 1, at 285, 300 (stating that "procedural law is replete with rules and institutions to enable the court to enter into a decision without having investigated the case to the fullest extent possible," and that certain "presumptions allow the court to generalize the most familiar fact patterns as long as these are not challenged by" the opposing party). As discussed herein, even multifactor standards may be heuristic to the extent they limit the decision maker's attention to certain factors only; and, of course, as the rules versus standards literature makes clear, in addition to stereotypically simple rules and complex standards there are complex rules and simple standards. *See, e.g.*, Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 566, 588 (1992).

To be sure, as Lisa Ouellette pointed out in her comments on an earlier draft of this paper, at some level *all* legal rules are heuristics in the sense that we don't simply have one generic cause of action whereby one person can sue another and ask the court to come to a decision that maximizes social welfare. *Cf.* Antonin Scalia, *The Rule of Law as a Law of Rules*, 56 U. CHI. L. REV. 1175, 1175-76 (1989) (describing an account of how the medieval King Louis IX of France—St. Louis—allegedly conducted justice in a manner along these lines). Instead, in every body of law (patent law being no exception) the state grants or recognizes and enforces certain rights upon the fulfillment of certain conditions to achieve certain goals. For convenience, however, when I refer to legal heuristics in this paper, I generally will be referring to lower-level heuristics intended to simplify the determination of some specific fact or to attain some (more or less specific) policy end.

5 *See* MUELLER & KIRKPATRICK, *supra* note 4, § 3.5, at 138; *see also* John M. Golden, *Principles for Patent Remedies*, 88 TEX. L. REV. 505, 562, 570, 579-82 (2010); David McGowan, *Irreparable Harm*, 14 LEWIS & CLARK L. REV. 577, 582 (2010); Richard A. Posner, *An Economic Approach to the Law of Evidence*, 51 STAN. L. REV. 1477, 1503-04 (1999).

Like other bodies of law, the law of intellectual property (IP) employs a variety of heuristics, including procedural rules,[6] substantive rules,[7] and presumptions[8]—

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[6] Statutes of limitations, for example, are sometimes justified on grounds (among others) that on balance they reduce the risk of inaccurate fact-finding (despite extinguishing some meritorious claims) and economize on adjudication costs. *See, e.g.*, Tyler T. Ochoa & Andrew J. Wistrich, *The Puzzling Purposes of Statutes of Limitation*, 28 PAC. L.J. 453 (1997) (noting that, from the standpoint of accuracy, statutes of limitations are "a blunt instrument"). As such, statutes of limitations like those embodied in the Patent Act, *see* 35 U.S.C. § 286, and the Copyright Act, *see* 17 U.S.C. § 507(b), can be viewed as a type of heuristic. Patent law's so-called grace period or statutory bar, which cuts off the inventor's ability to patent her invention if she has publicly exploited it for more than one year, is another. *See* 35 U.S.C. § 102(b). For a discussion of how some other recent procedural (and substantive) developments in patent law can be viewed as heuristics, see Paul Gugliuzza, *Quick Decisions in Patent Cases*, 106 GEO. L.J. (forthcoming 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2987289.

[7] An example from trademark law would be the rule that secondary meaning may be inferred from evidence of five years' continuous and substantially exclusive use of a mark, *see* 15 U.S.C. § 1052(f). Patent law traditionally has made use of certain rules and standards that conserve on the administrative cost of determining whether a particular prior art reference was sufficiently "public" as of the critical date. *See, e.g.*, Egbert v. Lippmann, 104 U.S. 333, 336 (1881) (prior use of an invention was public, where the inventor gave it over to another with no "injunction of secrecy," even if knowledge was confined to that single recipient); *In re* Hall, 781 F.2d 897 (Fed. Cir. 1986) (prior publication of a dissertation was sufficiently public as long as it was publicly accessible and indexed); Rosaire v. Baroid Sales Div'n, 218 F.2d 72, 74-75 (5th Cir. 1955) (prior use of an invention was sufficiently public as long as the invention was practiced openly and in the ordinary course of business, even if it was unknown to the general public). Some commentators have called into question the status of the preceding patent cases, however, following enactment of the America Invents Act in 2011.

[8] An obvious example under U.S. law is that patents, registered copyrights, and registered trademarks are all presumed valid, meaning that in litigation the person challenging validity bears the burden of coming forward with evidence that the right at issue is invalid. *See* Microsoft Corp. v. i4i Ltd. P'ship, 564 U.S. 91 (2011) (holding that, in patent infringement litigation, the alleged infringer bears the burden of proving invalidity by clear and convincing evidence). Curiously, U.S. patent law imposes a higher standard of proof on the person challenging validity than does patent law in other countries—or U.S. copyright and trademark law, for that matter. *See, e.g.*, Medforms, Inc. v. Healthcare Mgt. Solutions, Inc., 290 F.3d 98, 114 (2d Cir. 2002) (holding that a defendant can rebut the presumption of validity of a registered copyright by a preponderance of the evidence); Theodore H. Davis, Jr. & John H. Welch, *Introduction to United States Annual Review: The Sixty-Seventh Year of Administration of the Lanham Act of 1946*, 105 TRADEMARK REP. 14 n.18 (2015) (noting the division of authority on the question of whether a person challenging the validity of a registered U.S. trademark bears only a burden of production or the burden of persuasion by a preponderance of the evidence). In U.S. administrative challenges to patent validity, the standard of proof is preponderance of the evidence. *See* 35 U.S.C. §§ 316(e), 326(e).

Presumptions also have sometimes played a role in determining whether the IP owner is entitled to injunctive relief. Until recently, courts in the U.S. applied a rebuttable presumption of irreparable harm in deciding whether to grant preliminary injunctive relief in cases alleging patent, copyright, and trademark infringement. *See, e.g.*, Ranbaxy Pharms., Inc. v. Apotex, Inc., 350 F.3d 1235, 1239 (Fed. Cir. 2003) (patents); Apple Comput., Inv. v. Franklin Comput. Corp., 714 F.2d 1240, 1254 nn.11 & 13 (3d Cir. 1983) (copyright); Church of Scientology Int'l v. Elmira Mission of the Church of Scientology, 794 F.2d 38, 43 (2d Cir. 1986) (trademarks). Since the U.S. Supreme Court's decisions in eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388 (2006) and Winter v. Nat. Res. Def. Council, Inc., 129 S. Ct. 365 (2008), however, the lower courts have concluded that this presumption no longer applies. *See, e.g.*, Herb Reed Enters., LLC v. Florida Enter. Mgt. Ltd., 736 F.3d 1239, 1242, 1248-49 (9th Cir. 2013) (trademarks); Robert Bosch LLC v. Pylon

though in recent years both the United States Supreme Court and the Court of Appeals for the Federal Circuit also have rejected some such devices for being overly rigid or insufficiently tied to the facts of a given case.[9] To date, however, scholars have given little consideration to the topic of how the practices courts use (or have rejected) for determining monetary compensation for patent infringement might be viewed as heuristics intended to speed up and simplify decision making, and whether greater reliance on damages heuristics would improve the working of the patent system.

As I will show, for purposes of awarding damages, courts in fact *have* employed certain heuristics while rejecting others, and on occasion even have responded to perceived heuristic biases on the part of fact-finders—though often without recognizing *their own* arguable susceptibility to heuristic biases or, more generally, that the choice facing them is often between or among *competing* heuristics. My principal argument therefore is that a patent system that more consciously considered the advantages and disadvantages of competing heuristics would better serve public policy than one that glosses over that choice—or that, in certain contexts, requires patent owners to substantiate every aspect of their claimed damages with rigorous proof. More specifically, policymakers confronted with the choice between a proposed heuristic and an open-ended, nonheuristic standard or alternative heuristic ideally should choose the proposed heuristic when the sum of the administrative and error costs associated with its use is lower than the sum of the administrative and error costs resulting from the use of the nonheuristic (or alternative heuristic).[10]

Mfg. Corp., 659 F.3d 1142, 1148-49 (Fed. Cir. 2011) (patent); Salinger v. Colting, 607 F.3d 68, 74-75 (2d Cir. 2010) (copyright). *eBay* expressly held that the decision whether to grant a permanent injunction is a matter of equitable discretion, thus reversing the Federal Circuit's rule—itself a rebuttable presumption—that prevailing patent owners were entitled to permanent injunctions absent extraordinary circumstances. Most other countries nevertheless continue to award the prevailing patent owner a permanent injunction as a matter of course. *See* THOMAS F. COTTER, COMPARATIVE PATENT REMEDIES: A LEGAL AND ECONOMIC ANALYSIS 182, 245-46, 305, 348-49 (2013); *see also* Titan Tire Corp. v. Case New Holland, Inc., 566 F.3d 1372, 1375-76 (Fed. Cir. 2009) (discussing how the presumption of patent validity affects the court's evaluation of the likelihood of success on the merits, one of the conditions for granting a preliminary injunction); Lee, *supra* note 1, at 39-40, 56-59 (discussing the standards for granting injunctions in terms of heuristics) .

9 *See, e.g.*, Bilski v. Kappos, 561 U.S. 593, 604 (2010) (rejecting "exclusive" use of the machine-or-transformation test to determine patent eligibility); KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 419 (2007) (rejecting the "rigid and mandatory" application of the teaching-suggestion-motivation test for determining nonobviousness); *see also infra* notes 80-81, 98, 144-50 and accompanying text.

10 Consistent with Ouellette's insight that all legal rules are in some sense heuristic, *see supra* note 4, perhaps it is a misnomer to characterize *any* legal decision or judgment as "nonheuristic" to the extent legal decision making presents "practical problems . . . for which computational algorithms simply are not available," Herbert A. Simon & Allen Newell, *Heuristic Problem Solving: The Next Advance in Operations Research*, 6 OPERATIONS RES. 1, 5 (1958). Indeed, in other work I have discussed how legal decision making necessarily involves the exercise of practical reason—"a method that emphasizes the need for choice, deliberation, and communication in the face of radical uncertainty . . . a way of simultaneously affirming and mediating among our conflicting

To be sure, there often may be no easy way to evaluate whether this condition is satisfied—due both to the paucity of the evidence and to the fact that the cost one attributes to error depends in part on the value one places on the importance of accurate damages calculations to patent policy.[11] I have three general responses to this point. First, I will argue that policymakers often can reach a reasoned conclusion whether use of a proposed cost-reducing heuristic is likely to improve social welfare—particularly where there is reason to believe that the evidence on which courts will rely absent the heuristic is unlikely to generate a substantially more accurate result than the heuristic.[12] (The courts' preference for the use of comparable licenses over the Nash Bargaining Solution may be one salient example.)[13] Second, and relatedly, I will argue that the patent system would benefit if courts were more mindful of both the necessary tradeoffs to be made in calculating damages and where the gaps in our (and their) knowledge lie. This means, among other things, that courts should be aware of their own potential susceptibility to cognitive heuristics (such as "representativeness" and "anchoring"), not just the possible presence of such biases among jurors.[14]

Third, and following from the preceding points, because we often lack good empirical evidence that would assist in more accurate fact-finding—for example, on questions such as the compensation the parties would have agreed to, had the defendant not infringed—an ideal system would be one that is both receptive to new empirical findings and that encourages both the parties themselves and third parties to invest in developing *better* empirical evidence. To draw an analogy from a radically different field of study, one of the most pressing tasks today in artificial intelligence is the development of "hyperheuristics" that enable machines to engage in dynamic learning—that is, to adjust their lower-level heuristics based on feedback.[15] What I am calling for in the field of patent damages is something similar: for courts to embrace the concept of dynamic learning by (for example) adopting presumptions or starting points based on existing empirical evidence, assuming it meets some minimal standard of adequacy; encouraging the parties and others to develop better evidence over time; and when necessary to adjust these initial presumptions or starting points in the light of the newly developed evidence.[16] Put another way, an imperfect heuristic may be not only preferable in

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norms," Thomas F. Cotter, *Pragmatism, Economics, and the Droit Moral*, 76 N.C. L. REV. 1, 30 (1997), and thus could be viewed as the antithesis of deciding matters by means of a "computational algorithm." In any event, and as suggested above, for purposes of legal decision making the choice often will be between competing heuristics.

11 *Cf.* Pierre Schlag, *Rules and Standards*, 33 UCLA L. REV. 379, 407 (1985) ("Whether a rule exhibits certainty when applied in a given context depends upon whether the context is described in a way that is hospitable to rule-like treatment.").

12 For a compatible view, see Golden, *supra* note 5, at 563 (observing that "a commitment to optimizing patent remedies might generate futile and wasteful efforts to achieve perfect tailoring of remedies across a wide spectrum of situations").

13 *See infra* Part III. D.2.b.

14 *See id.*

15 *See* Burke et al., *supra* note 1, at 1698.

16 *See* Golden, *supra* note 5, at 561 (advocating the principle of "learning," that is, "fashioning a

the short run when compared to the existing alternatives, but also over time may improve the law by encouraging the development of more reliable empirical evidence.[17]

Part II presents a theoretical framework for choosing among competing heuristics, based on a comparison of administrative and error costs. Part III. poses the question of how important accuracy (that is, avoiding error) is in the context of patent damages law—as well as, perhaps more importantly, the competing meanings of accuracy in the present context. Part IV. applies the methodology sketched out in Parts II. and III. to various issues surrounding the availability and calculation of patent damages. Part V. concludes.

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regime of patent remedies that encourages the production of information that can be used to improve the regime itself"); Lisa Larrimore Ouellette, *Patent Experimentalism*, 101 VA. L. REV. 65 (2014) (generally calling for more policy experiments to elicit better empirical evidence on the effects of patents). The concept is in no way foreign to U.S. law. In the antitrust context, for example, courts over time have come to conclude that certain conduct is nearly always anticompetitive and thus deserving of summary condemnation, *see* FTC v. Actavis, Inc. 133 S. Ct. 2223, 2238 (2013), or alternatively that conduct once deemed anticompetitive may offer some procompetitive virtues after all and therefore should *not* be per se illegal, *see* Leegin Creative Leather Prods., Inc. v. PSKS, Inc., 551 U.S. 877, 886-87 (2007) ("[T]he per se rule is appropriate only after courts have had considerable experience with the type of restraint at issue . . . and only if courts can predict with confidence that it would be invalidated in all or almost all instances under the rule of reason."). Similarly, as Willem Boshoff argues in a recent paper, the presumptions (based on pre- and post-merger market shares) that courts and the enforcement agencies in the U.S. apply in determining whether a particular merger is likely to suppress competition have evolved, based not only on the courts' and agencies' adjustment of their Bayesian "priors" as the result of learning from past experience but also on their increased sensitivity to the cost of measurement and other errors (as well as institutional differences between the enforcers themselves). *See* Willem Boshoff, Presumptions in Merger Control (Jan. 10, 2016) (unpublished paper, on file with author).

[17] There may well be many other ways to generate empirical evidence on how patent damages law could be improved: for example, by conducting lab experiments in which researchers judge how close participants come to determining a predetermined correct amount of compensation when certain evidence is disclosed or omitted; or perhaps by randomly assigning different rules to a selection of patents (e.g., subjecting all even-numbered patents granted during a given year to a regime of mandatory fee shifting and later assessing the aggregate costs incurred in litigating these patents in comparison with a control group subject to the traditional rule). The courts and Congress also could encourage greater experimentation on the part of district courts with respect to matters such as early discovery on damages; routine bifurcation of liability and damages determinations; greater use of court-appointed experts or of expert "hot tubbing," *see* Thomas F. Cotter, *Expert Testimony and Patent Damages: Could "Hot-Tubbing" Be the Answer?* COMP. PAT. REMEDIES BLOG, July 14, 2014, *available at* http://comparativepatentremedies.blogspot.com/2014/07/expert-testimony-and-patent-damages.html (discussing a procedure, referred to as "hot tubbing," for vetting expert testimony in Australia and the U.K.); greater experimentation regarding jury instructions; and, for damages determinations, greater use of general verdicts accompanied by special interrogatories. Although such experimentation wouldn't necessarily enable researchers to draw firm conclusions regarding which procedures lead to more accurate results, some of them might generate useful information on the impact of potential reforms on both the cost of litigation and the variation among expert opinions under alternative regimes. I thank Lisa Ouellette for stimulating thought in this direction, though for purposes of the present paper the principal learning tool I advocate is, as stated above, the greater of use of presumptions and other starting points concerning matters such as profit splits and royalty allocation.

II. Legal Heuristics

As discussed above, researchers within many disciplines use the term "heuristics" to refer to shortcuts or "rules of thumb" for reducing the time and effort needed to reach a solution or decision.[18] Computer scientists and engineers, for example, have developed heuristic algorithms for solving optimization problems, while behavioral psychologists have uncovered various cognitive heuristics by which human beings navigate their way through the world. (Among the latter are the "representativeness" heuristic, which predisposes human actors to evaluate the probability that A is a member of class B by the extent to which A resembles B;[19] the "availability" heuristic, by which we "assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind";[20] and the "anchoring" heuristic, whereby our estimates often are biased in favor of by an initial value with which we are presented.[21] We'll return to all three at one point or another below.) In many settings, the use of heuristics is desirable, as long as the solution arrived at is "good enough" in view of the potential stakes and the cost of employing more rigorous methodologies.[22] At the same time, however, heuristics are hardly foolproof in guiding us to accurate or optimal decisions. Indeed, some applications of common cognitive heuristics—such as the predisposition to stereotype, which is a manifestation of the representativeness heuristic—can impose substantial costs on both the user and (unfairly) third parties. Application of a heuristic to a given situation therefore must be judged on the basis of whether it solves the problem at hand well enough in comparison with other, costlier, alternatives—or alternatively, is the heuristic itself the costlier alternative, in light of its potential flaws?

More relevant to present purposes, law too makes extensive use of heuristics in establishing substantive and procedural rules for adjudicating disputes. To illustrate, suppose that a legal system is choosing between two possible procedures, P1 and P2, for resolving a particular type of dispute. P1 requires the decision maker to consider all potentially relevant facts[23] in order to arrive at the most accurate

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18 *See generally* sources cited *supra* note 1.

19 *See* Tversky & Kahneman, *supra* note 1, at 1124.

20 *Id.* at 1127.

21 *See id.* at 1128. To the extent that reliance on these heuristics is a heritable human trait, heuristics may have tended to confer a selective advantage on our remote ancestors by increasing the probability of survival over a range of common experiences and environments. *See, e.g.*, EDWARD O. WILSON, CONSILIENCE: THE UNITY OF KNOWLEDGE 207-08 (1998) (proposing an evolutionary explanation for cognitive heuristics).

22 *See, e.g.*, Engel & Gigerenzer, *supra* note 1, at 4.

23 *Cf.* Cass Sunstein, *Problems with Rules*, 83 CAL. L. REV. 952, 1000 (1995) (noting that factor-based standards cannot be "attentive to all aspects of the situation," because "[h]uman and legal perception are inevitably selective"; "a system based on factors attends to much of the whole situation but certainly not all of it"). The fact that simple rules can be over- and under-inclusive in comparison with open-ended standards is of course a commonplace in the rules versus standards literature, *see, e.g.*, *id.* at 992-93; *cf.* Kaplow, *supra* note 4, at 589 (noting that standards can be over- and under-inclusive too, depending on how they are applied). Apropos of this latter point, and as others have pointed out, some of my discussion above may seem to mirror the familiar

result possible, while P2 is a heuristic. Since a heuristic is intended to exclude some potentially relevant information, the administrative cost of applying P1 (call it a_1) should exceed the administrative cost of applying P2 (call this a_2).[24] In addition, each procedure may generate some erroneous results—for example, a judgment for the defendant in a case in which a factually accurate reconstruction of events would have resulted in a judgment for the plaintiff. These erroneous results in turn produce error costs (e_1 and e_2, respectively). The magnitude of these error costs depends on two factors: how frequently errors occur, and the importance of accurate decision making.[25]

This second factor—the importance of accurate decision making—depends on several additional considerations. First, while one might expect accurate decision making always to be important, the *degree* to which it is important may vary from one setting to another. When the private stakes of the disputes are low, for example, accuracy necessarily will be less important than when the private stakes are high; absent substantial third-party effects, society might think twice about incurring administrative costs of $1 million to resolve a dispute that is worth only $100 to the parties. Relatedly, however, the *public* stakes of the dispute may be high or low as well. To illustrate, suppose that the body of law regulating the dispute at issue is intended to promote policy *X*, but that the policymaker has reason to believe that policy *X* will be adequately served by a rule that is only approximately accurate. As with the small private stakes dispute, at some point additional investments in accuracy will not be worth the cost. A second consideration is that the *direction* of expected errors might be relevant. In criminal cases, for example, conventional wisdom holds that it's better to free nine[26] (or some other comparatively large number of[27]) guilty defendants than to convict one innocent. Put another way, in the criminal context, society has decided that the cost

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rules/standards debate—though with respect to patent damages in particular, as we shall see, the choice courts often have to make is between competing rules (or competing standards or competing presumptions or starting points), rather than simply between rules and standards. Thus, for example, as discussed *infra* at Part IV. .D, courts could improve the patent system by accepting the use of certain presumptions or starting points for calculating damages, and by reconsidering some of the presumptions and other heuristics (such as the widespread use of comparable licenses as evidence of royalties) that they *do* employ.

24 Of course, if the heuristic is a rule, a full comparison would need to take into account the cost of ex ante promulgation of the rule as against the ex post cost of applying the standard, the cost of providing advice regarding compliance, and the potential effects on settlement. With regard to this last point, more predictable rules might seem, on the one hand, to make settlement more likely, but also may reduce the cost of litigation and thus make litigation comparatively more attractive. *See* Kaplow, *supra* note 4, at 562-63, 573 n.35, 574.

25 *Cf.* Neil Komesar, *A Job for the Judges: The Judiciary and the Constitution in a Massive and Complex Society*, 86 MICH. L. REV. 657, 691 (1988) (stating, in a discussion of standards of judicial review, that "clear tests mean fewer cases brought, litigated, and appealed, and therefore a smaller burden on the judiciary," but that "[s]uch clarity . . . involves a degree of arbitrariness . . . which risks invalidating good legislation or accepting bad. The chances as well as the costs of such an error vary with the subject matter and the legislation under review.").

26 4 WILLIAM BLACKSTONE, COMMENTARIES ON THE LAW OF ENGLAND *358 (1769).

27 *See* Alexander Volokh, *n Guilty Men*, 146 U. PA. L. REV. 173 (1997).

of a false positive (a false conviction) is immensely greater than the cost of a false negative (a false acquittal). On the other hand, in the civil context, the policymaker may care less about errors that skew against the party deemed to be at fault, perhaps on the normative ground that a conscious wrongdoer assumes (some) risk of error (and thus suggesting that fault itself may be a relevant consideration in evaluating the importance of accuracy). Yet another consideration is the *range* of possible error. All other things being equal, the greater the range of possible outcomes (that is, the greater the variance around the expected mean), the smaller the probability that the parties will settle their dispute (thus raising administrative costs), and the greater the likelihood that the more risk-averse party will be willing to settle on unfavorable terms.[28] Moreover, when the bargaining range is enormous, parties may dissipate much of the potential gains from trade in negotiation and strategic behavior.[29]

In many settings, one would expect e_2 to exceed e_1. For example, suppose that the percentage of cases going to trial that plaintiffs "deserve" to win, based on an accurate assessment of the facts, is 50%; and that P2 is the procedure employed by Rabelais's Judge Bridlegoose to adjudicate disputes: by throwing dice.[30] Assuming that the dice are fair, one would expect the court to reach the correct outcome 50% of the time: plaintiffs and defendants each will win half the cases they deserve to win, and half they deserve to lose. By contrast, even if P1 is highly imperfect, one would expect it to perform better than this; otherwise we *may as well* just flip a coin to resolve the dispute and pocket a_1. More generally, the choice of P1 over P2 depends on whether $a_1 + e_1 < a_2 + e_2$, that is, whether the sum of administrative and error costs resulting from P1 exceeds the sum of administrative and error costs from P2. In the fanciful cases adjudicated by Judge Bridlegoose, one would assume that $a_1 + e_1 < a_2 + e_2$ even if a_2 is 0 or close to it—though one might imagine *some* real-world contexts in which dice-rolling actually would appear to be a rational way of choosing among two outcomes, such as to resolve contested election results like that in *Bush v. Gore*[31] where the margin of victory lay within the margin of error.[32] But

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[28] A risk-averse applicant, "when faced with a choice between two gambles with the same expected value, will usually choose the one with a smaller variability of return." WALTER NICHOLSON, MICROECONOMIC THEORY: BASIC PRINCIPLES AND EXTENSIONS 538 (9th ed. 2004); *see also* ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 158 (5th ed. 2001).

[29] *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW, § 3.6, at 66-69 (9th ed. 2014).

[30] In most English-language translations, the judge's name (*Bridoye*) is translated into its English equivalent, "Bridlegoose." *See* FRANÇOIS RABELAIS, GARGANTUA AND PANTAGRUEL 202-14 (J.M. Cohen tr. 1955) [1546]; Joseph C. Hutcheson, Jr., Lawyer's Law, and the Little, Small Dice, 7 TUL. L. REV. 1, 12 (1932). More recent translations and scholarship retain the original French name. *See, e.g.*, FRANÇOIS RABELAIS, GARGANTUA AND PANTAGRUEL 558-80 (Michael A. Screech tr. 2006) [1546]. *Cf.* Kaplow, *supra* note 4, at 587-88 (noting that a rule that decided disputes by flipping a coin would result in inconsistencies).

[31] Bush v. Gore, 531 U.S. 98, 103, 127 (2000).

[32] A practical problem in such a case is that decisions rendered by arbitrary means may appear to lack legitimacy. More generally, the observation that people often are subject to overconfidence bias—whereby we think we are more competent at evaluating evidence and making good predictions than we really are, *see* KAHNEMAN, *supra* note 1, at 261-63; MERCEIER & SPERBER, *supra* note 1, at

even in less unusual circumstances, the use of a simple heuristic in lieu of a multidimensional standard will sometimes improve social welfare—for example, if a_1 is substantially higher than a_2, and the error costs are comparable because (due perhaps to the inherent limitations of eyewitness testimony and the technology used to reconstruct historic facts) much of the evidence that would be helpful to an accurate reconstruction is simply not available.[33] In such a case, the additional investment in accuracy attendant on the use of P1 may be wasted.

Perhaps more commonly, the choice the policymaker faces will be between two or more heuristics. To illustrate by way of bringing the discussion back to patent damages, consider a dispute where the hypothetically accurate damages award is *d*. (More on exactly what this might mean in the next part.) Suppose further that directly calculating *d* is not feasible, and that the policymaker therefore must choose from among two heuristics, H1 and H2, to estimate *d*. We could imagine both H1 and H2 as generating a distribution function with a mean and a variance; the closer the mean generated by either H1 or H2 is to *d*, the more accurate H1 or H2 is. For example, suppose (again for illustrative purposes) that the use of H1 results in a damages award of *d* with a probability of 0.5, a damages award of 1.25*d* with a probability of 0.25, and a damages award of 0.75*d* with a probability of 0.25. The mean damages award using method H1 is *d*, the variance is approximately 0.03*d*, and the standard deviation is 0.18*d*. By contrast, suppose that method H2 results in a damages award of *d* with a probability of 0.5, a damages award of 1.1*d* with a probability of 0.25, and a damages award of 0.75*d* with a probability of 0.25. The mean damages award generated with the use of H2 is approximately 0.96*d*, its variance is 0.02*d*, and its standard deviation is 0.13*d*.

Because the mean associated with H2 is slightly lower than the mean associated with H1, accuracy considerations alone would incline the policymaker to choose H1 over H2. As discussed above, however, there may be other considerations of equal or greater relevance. If a_1 is substantially greater than a_2,

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241-44; TETLOCK & GARDNER, *supra* note 1, at 181—conceivably could lead decision makers to favor what passes for rigorous analysis (or multifactor balancing tests), even when such analysis is objectively *more* likely to lead us astray than would an arbitrary rule. *See also* Greg Reilly, *Rethinking the PHOSITA in Patent Litigation*, 48 LOYOLA UNIV. L.J. 501 (2016) (arguing that tailoring the law of nonobviousness to the abilities of lay decision makers, "including more legalistic and objective doctrines that reduce the role of the PHOSITA . . . may be optimal in practice, even if second-best in theory"). *Cf.* HENRICH, *supra* note 1, at 104-06 (discussing how in some cultures divination randomizes certain decisions and therefore serves as an effective counterbalance to cognitive biases that would undermine a group's aggregate self-interest).

[33] *See* Sunstein, *supra* note 23, at 1012 (1995) ("Often a legal system should make the choice between rules and rulelessness on the basis of a contextual inquiry into the aggregate level of likely errors and abuses . . . . Even a poor fit, in the form of overinclusive and underinclusive rules, can be tolerated when individualized decisions would result in a similar level of inaccuracy. . . ."); *see also* Kaplow, *supra* note 4, at 586-88 (noting that both rules and standards may be applied inconsistently). Another analogous situation is that faced by a small-to-medium investor, who is often better off investing in a stock market fund than retaining a financial advisor who, despite her vaunted expertise, in the long run is unlikely to outperform the market. *See, e.g.*, KAHNEMAN, *supra* note 1, at 212-16; TETLOCK & GARDNER, *supra* note 1, at 316 n.10.

for example, the relatively small increase in accuracy associated with H1 may not be worth the additional increment in cost, particularly if the private or public stakes of the dispute are small. The more the mean award calculated using H2 deviates from *d*, however, the more problematic the use of H2 may appear—though again, one would need to consider the administrative costs of the heuristics, as well as the direction and range of potential error. Thus, in an industry in which patents are unlikely to play a major role in stimulating invention or other desirable public ends (as discussed below), a substantial deviation downwards from *d* would be more tolerable than in an industry in which patents have a more significant effect, whereas a substantial deviation upwards might risk generating a net surplus of social costs over benefits. (On the other hand, if the defendant is an intentional infringer, a mean above *d* might seem less troubling.[34]) Similarly, if H2 is associated with a much greater variance than H1, the use of H2 will tend to disadvantage the more risk-averse party, while rendering settlement marginally more difficult as well.[35]

To be sure, if we knew what *d* was, we wouldn't have to go through this exercise at all; and surely no sane person would imagine that we *can* estimate and compare the means and variances associated with competing heuristics. Indeed, one might argue that most of the relevant considerations are simply too opaque or disputatious for the above analysis to promise any payoff at all in the real world. But maybe not—after all, if we really have *no* basis for choosing a heuristic over a complex standard, or for choosing one heuristic over another, we may as well take a page from Judge Bridlegoose and simply roll the dice (or flip a coin, or whatever random process comes to mind). In particular, two of the considerations I discussed above arguably could serve as "free-floating" heuristics applicable in a wide range of disputes. First, if the defendant is at fault (again, under whatever definition of "fault" seems appropriate in light of the policies underlying the relevant body of law), it might be sensible to tolerate a degree of error that is believed to favor the plaintiff. As John Golden has noted, contract law applies an analogous heuristic[36]

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[34] Of course, much may depend on how we define "intentional." Exposing someone who knowingly uses a patented technology in the objectively good-faith (but perhaps incorrect) belief that the patent is invalid or noninfringed to a risk of greater damages liability could reduce social welfare by chilling some potential challenges to weak patents. I return to this point in Part IV. .B.

[35] The range of possible outcomes may be a very pressing problem in contemporary patent damages law. *See, e.g.*, John C. Jarosz & Michael J. Chapman, *The Hypothetical Negotiation and Reasonable Royalty Damages*, 16 STAN. TECH. L. REV. 769, 809 (2013) (stating that "for opinions issued since 1978 in which a suggested royalty rate was reported for both the patent holder and the infringer, the range has been as high as three hundred to one," and that "[i]n many cases, the difference has been more than twenty to one. And the range has not declined over time.").

[36] *See* John M. Golden, *Reasonable Certainty in Contract and Patent Damages*, 30 HARV. J.L. & TECH. 257, 258 (2017) (arguing that patent damages law should, like contract law, apply "a standard of reasonableness [that] allows courts, in addressing the admissibility or sufficiency of evidence, to take into account context-specific factors . . . including the size of claimed damages amounts, the relative innocence or blameworthiness of the parties, and the potential availability or non-availability of better methods or evidence for developing a damages calculus."); *see also* Carl Shapiro, *Property Rules v. Liability Rules for Patent Infringement* (May 4, 2016), *available at*

(as does, I would note, antitrust law).[37] Second, as noted above (and as Golden notes as well)[38] all else equal it doesn't make sense to require the parties and the court to incur adjudication costs that exceed the value of the dispute—a factor that may be quite relevant when the private stakes are small.

Even aside from these examples, for reasons discussed below I doubt that a radical skepticism is universally warranted; in many instances, at least a rough estimate of comparative administrative costs and accuracy may be feasible enough to enable a rational, if not infallible, choice among heuristics and standards. Nevertheless, to make such a (rational) choice requires a closer look at the policies served by accurate damages calculations, and of the various sources of possible errors resulting from competing heuristics. The next portion of this paper addresses these issues.

III. Is Accuracy Important?

To think clearly about what an "accurate" damages award would include requires some preliminary analysis of the purposes served by awarding patent damages in the first place. In this regard, I start from the premise that the ultimate, albeit abstract, goal of any patent system—and, presumably, of its constituent parts including the law of patent damages—is to maximize the surplus of the social value generated by the system over the social costs.[39] Depending on one's point of view, the social benefits may include not only the creation, disclosure, and commercialization of new inventions, but also the role patents (may) play in facilitating technology transfer and attracting venture capital.[40] Social costs include

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http://papers.ssrn.com/abstract_id=2775307 (manuscript at 24) ("Arguably, in a more balanced system an independent inventor would face less liability.").

To be sure, in some respects a context-specific approach might seem the antithesis of a heuristic—which, after all, is intended to limit consideration of some relevant evidence. My response is that, although *some* heuristics may take the form of simple bright-line rules, applicable under all or most circumstances, one could justifiably consider context *before* deciding whether a simplifying heuristic is appropriate. Perhaps a set of metaheuristics designed to assist in choosing among heuristics (e.g., in a small-stakes case choose P1 over P2), would be useful in this regard. *See* Burke, *supra* note 1.

37 *See, e.g.*, Story Parchment Co. v. Paterson Parchment Paper Co., 282 U.S. 555 (1931) (holding that, once the antitrust plaintiff proves the fact of injury, it faces a lesser burden of proving the amount).

38 *See* Golden, *supra* note 36.

39 *See, e.g.*, Thomas F. Cotter, *Innovation and Antitrust Policy*, *in* 2 OXFORD HANDBOOK OF ANTITRUST ECONOMICS 132, 136 (Roger D. Blair & D. Daniel Sokol eds. 2014) [hereinafter Cotter, *Innovation*]; Thomas F. Cotter, *Misuse*, 44 HOUS. L. REV. 901, 940 (2007).

40 *See, e.g.*, Thomas F. Cotter, *Patent Remedies and Practical Reason*, 88 TEX. L. REV. SEE ALSO 125, 126 (2010). On the venture capital point in particular, *see* Joan Farre-Mensa et al., *The Bright Side of Patents*, USPTO ECON. WORKING PAPER SERIES NO. 2015-5 (Jan. 2016), *available at* http://www.uspto.gov/sites/default/files/documents/Patents%20030216%20USPTO%20Cover.pdf, which reports the results of a study of 45,819 first-time patent applications filed by U.S. startups since 2001 and posits a causal relationship between approval of the application and a startup's subsequent ability to "create jobs, enjoy faster sales growth, innovate more," and to go public or be acquired. The effect was more pronounced in the IT sector than in biotech, given that startups in the latter field "tend to be founded by experienced scientists, the quality of whose research can be

the omnipresent administrative and transaction costs, the potential monopoly costs, and (to the extent they are distinct from transaction costs) other costs associated with restricting access, including holdup costs.[41] Unsurprisingly, no one knows how to craft a system of patent rights that perfectly achieves this hypothetical ideal: even if there were consensus on exactly what counted as a social benefit and what counted as a cost, a social planner intent on implementing such a system would need a common metric for comparing costs and benefits; perfect information about how the magnitude and distribution of costs and benefits under varying configurations of patent rights; and the political capital to carry out the system's execution. That's a tall order.[42]

Instead of aiming directly to achieve the maximum surplus of costs over benefits, then, we make (at best) educated guesses about the optimal design of patent rights through the construction and enforcement of the various rules and standards that make up patent law. By most accounts, the law of patent damages takes these (mostly substantive) rules as a given and (ideally) restores the patent owner to the position she would have occupied—that is, to the position that substantive patent law entitled her—but for the infringement.[43] In this way, patent damages law (again, ideally) indirectly serves patent law's ultimate goal of maximizing the surplus of benefits over costs. Seen in this light, the compensatory goal of patent damages law can *itself* be viewed as a heuristic, because the goal of restoring the patent owner to the position she would have enjoyed absent the infringement is a shortcut of sorts for approximating the reward that would be granted under the ideal patent system.

On the other hand, compensation is not the only possible goal that might be consistent with the ideal. An alternative approach would be to award damages with an eye to deterring rather than compensating for infringement, since perfect deterrence, like perfect compensation, would leave the patent owner no worse off as a result of the infringement.[44] (Indeed, perfect deterrence might seem preferable to perfect compensation, because perfect deterrence would conserve on the cost of adjudicating disputes.) In theory, a costless and perfectly-enforced system that awarded restitutionary damages would achieve perfect deterrence by rendering all acts of infringement unprofitable. Under such a system, an implementer who could make a more efficient use of the patented invention, than could the patent owner, would negotiate a license with the latter, while a less-efficient would-be user would avoid use altogether. (A system under which injunctions were awarded just prior to

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evaluated using a variety of sources such as academic publications and . . . grants."

41 *See* Cotter, *Innovation*, *supra* note 39, at 136.

42 Indeed, a state that had the informational and political capability to create and manage such a system probably wouldn't need to do so, since presumably it could induce the optimal quantity of innovation though a centralized system of grants and prizes—though as Ouellette suggests, in theory greater use of policy experiments could assist in generating useful information about the effects of patents in specific contexts. *See* Ouellette, *supra* note 16.

43 *See* Cotter, *supra* note 40, at 130-31.

44 A third possible goal would be punishment. *See infra* text accompanying note 81.

the commencement of infringement would achieve the same result.) In the real world, however, where costs are nontrivial and enforcement imperfect and subject to error—a problem that might result in *over*deterrence of lawful conduct—the issue of whether compensation or restitution better aligns with the goals of the patent system is not so easy to resolve. For what it's worth, I've argued elsewhere that the best practice is probably for courts to view compensatory damages as the default remedy, and to award damages enhancements only when needed to attain further deterrence.[45] As discussed below, however, the distinction between compensation and restitution is sometimes illusory;[46] moreover, to the extent the two *do* differ, a preference for compensatory over restitutionary damages (or vice versa) may hinge on the heuristics deployed to estimate what compensatory or restitutionary damages *are* in a given setting.

Furthermore, some scholars have argued that the optimal patent damages regime would *not* make compensation (or deterrence) the touchstone but rather would try to calibrate the patent owner's reward with its R&D costs. On this view, an invention that resulted from huge R&D expenditures ex ante would garner a larger damages award ex post than would one that required only a smaller investment.[47] Such a system would be similar to a system of ex post prizes, except that the reward would be payable primarily by private actors rather than by government. For a court to accurately calibrate the reward, however, would require very good ex post information, and it is questionable (to say the least) whether the judiciary would be up to such a formidable task. (Practical problems also might arise in apportioning the resulting damages among several defendants or potential defendants.)[48] Further, unless courts tempered such awards by taking into account social benefits along with R&D costs (as Sichelman recommends),[49] such a proposal might encourage courts to award high damages to compensate for large R&D costs even when the value of the resulting invention, in terms of the economic advantages it bestows in comparison with alternatives, is slight. (Of course, such a system also would avoid awarding large damages in cases in which the patent

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45 *See, e.g.*, COTTER, *supra* note 8, at 63-65.

46 *See infra* note 56.

47 *See* Ted Sichelman, *Purging Patent Law of "Private Law" Remedies*, 92 TEX. L. REV. 516 (2014) (proposing, as a theoretical ideal, a system in which courts would calibrate damages, some of which might be payable by the government rather than by the defendant, in light of R&D costs and social benefits).

48 *See* Mark A. Lemley, *Taking the Regulatory Nature of IP Seriously*, 92 TEX. L. REV. SEE ALSO 107, 113 (2014), http://www.texaslrev.com/wp-content/uploads/2015/08/Lemley-92-SeeAlso.pdf.

49 *See id.* at 116. In a somewhat similar vein, Zhang and Hylton argue that, under present law, some patents confer social value that exceeds the private value the patent owner is able to capture (an observation that others have made as well), and that as a result aggregate investment in invention is likely socially suboptimal. To remedy this perceived problem, they would authorize courts to grant additurs or enhanced damages in a wider variety of cases than at present. *See* Mengxi Zhang & Keith Hylton, *Optimal Remedies for Patent Infringement Hylton and Zheng*, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2698413. I'm inclined to think this would give rise to many problems, though, including difficulties in estimating social value and chilling effects on downstream innovation.

incentive played little or no role in generating the invention, and this would seem to be a plus. But perhaps the better response to such cases is to exercise greater vigilance ex ante, by granting fewer or weaker patents in fields that do not rely heavily on the patent incentive.) Put another way, if we want the patent system to induce the invention of economically valuable inventions, the better policy for both practical and economic reasons is to reward results, not effort, though presumably the two will often run in sync. In this regard, compensatory damages at least have the virtue of promising a greater reward for substantial contributions to the art than for modest or trivial ones. At bottom, though, it's important to recognize that awarding compensatory damages is merely a heuristic device that, like other heuristics, screens out some information that in theory would be relevant but the consideration of which might prove too costly, time-consuming, and error-prone.

Moreover, even if compensation is the appropriate general (or meta-) heuristic for awarding damages, in theory its importance might vary from one setting to another. As discussed above, for example, if the private stakes of the dispute are low, it may not make much sense for courts to overinvest in getting damages awards "just right." More controversially, perhaps there also are identifiable cases in which (regardless of the private stakes at issue) the *public* stakes of the dispute might justify the use of some cost-reducing heuristic to estimate damages, rather than devoting too much effort to ensuring that patent owners are fully compensated. The empirical evidence, after all, suggests that patents probably play a lesser role in encouraging invention, disclosure, and commercialization in fields such as information technology, where simultaneous invention and inadvertent infringement appear to be commonplace,[50] than in fields such as pharmaceuticals and industrial chemicals.[51] On the other hand, such a principle might be viewed as undermining

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[50] *See, e.g.*, Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19; Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421 (2008). On the other hand, the "signaling" function may be more important for some of these latter technologies, *see supra* note 40 and accompanying text, though perhaps the goal of accurate compensation is *less* important in litigation involving these patents if it is their mere existence, rather than their specific content, that conveys the signal to VCs.

[51] *See, e.g.*, Wesley M. Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)*, NBER WORKING PAPER NO. 7552 (Feb. 2000), *available at* http://www.nber.org/papers/w7552 (based on a survey administered to 1,478 R&D laboratories in the United States in 1994, concluding that while patents "are still not one of the major mechanisms in most industries when the views of all firms are considered . . . they can be counted among the major mechanisms of appropriation in a more sizeable minority of industries," including drugs, medical equipment, and chemicals); Joseph A. DiMasi & Henry G. Grabowski, *The Cost of Biopharmaceutical R&D: Is Biotech Different?* 28 MANAGERIAL & DECISION ECON. 469, 476-77 (2007) (estimating the price of bringing a new drug to market at $1.3 billion in 2005 dollars); Bronwyn H. Hall & Dietmar Harhoff, *Recent Research on the Economics of Patents*, NBER WORKING PAPER 1773, at 16-18 (Jan. 2012), *available at* http://www.nber.org/papers/w17773 (noting that the (rather limited) empirical evidence on the effect of patent disclosure suggests that it is most useful with respect to pharmaceuticals and chemicals). *But see* Golden, *supra* note 5, at 555-56 (counseling against discrimination on the basis of business models, and warning "against the danger that . . . efforts to 'reform' patent law will become overly subject to social prejudice or special interests."); Lisa Larrimore Ouellette, *Do*

rule-of-law values; and even if not, to apply such a principle a policymaker would need some basis for predicting the direction of likely errors resulting from the use of a proposed cost-reducing heuristic, since errors that favored plaintiffs would likely *reduce* social welfare. Then again, it may be (as some have argued) that application of the standard methodologies courts already use tends to induce defendant-favoring errors, though I remain skeptical.[52]

Yet another matter to consider is exactly what the goal of compensation should be understood to mean. At the most literal level, achieving compensation would require ensuring that the owner is restored to precisely the financial position it would have held had the infringer not infringed. In a case in which the infringement deprived the patent owner of sales of articles incorporating the patented invention, this would mean, at a minimum, awarding the owner her lost profits on those lost sales, which is what the typical lost profits award is intended to do. Note, however, that there are several other possible losses which the patent system may, or may not, choose to compensate, among them attorneys' fees and costs; interest; lost profits on sales of unpatented but nonduplicable articles that

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Patents Disclose Useful Information?, 25 HARV. J.L. & TECH. 545, 548 (2012) (reporting that, in a more recent survey of nanotechnology researchers, 64% of respondents claimed to read patents; of these, 70% did so in search of technical information; and "[o]f those reading patents for scientific (rather than legal) reasons, 60% found useful technical information.").

[52] Einer Elhauge, for example, argues that in general damages are likely to be undercompensatory due to factors such as hindsight bias, difficulties that patent owners may face in communicating value to juries, and damages estimation techniques that shortchange accuracy for administrative ease. *See* Einer Elhauge, *Do Patent Holdup and Royalty Stacking Lead to Systematically Excessive Royalties?*, 4 J. COMP. L. & ECON. 535, 557 (2008). (Hindsight bias, by the way, is itself sometimes viewed as a cognitive heuristic. *See, e.g.*, Ulrich Hoffrage & Ralph Hertwig, *Hindsight Bias: A Price Worth Paying for Fast and Frugal Memory*, *in* SIMPLE HEURISTICS THAT MAKE US SMART, *supra* note 1, at 191.) What Elhauge refers to as hindsight bias, however, would seem to cut in favor of high awards where use of the invention has resulted in higher-than-expected benefits and low awards where it has resulted in lower-than-expected benefits. Even if this is properly characterized as bias (which I think is doubtful, for reasons discussed below), it would seem that the errors would cancel out. As for difficulty in communicating value to jurors, notwithstanding a few multimillion or billion dollar awards, median patent damages awards are relatively low. *See* Thomas F. Cotter & John M. Golden, *Empirical Studies Relating to Patents—Remedies*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW (Peter Menell et al., eds., Edward Elgar Publishing forthcoming 2016) (reviewing the literature). Whether or not this fact supports Elhauge, however, depends on whether he is right in claiming that damages estimation techniques shortchange accuracy, an assertion for which he cites no specific examples—though to the extent such methods exist, as I argue in the text above, they sometimes may be justified. Finally, Elhauge argues that, even if errors in calculating damages are symmetrically distributed around a mean of actual patent value, there will be systematic undercompensation because infringers will opt for litigation when patent value is expected to be higher than the average award, and will negotiate for a license when it is lower, thus on average depressing both awarded damages and negotiated royalty rates. *See* Elhauge, *supra*, at 557-59; *see also* Golden, *supra* note 5, at 568-69; Norman V. Siebrasse, *Accuracy of Damages Awards* (citing other sources making the same or an analogous argument) (unpublished manuscript, on file with author). Such a strategy would require a good deal of foresight on the part of infringers, however, as well as willingness to ignore the high cost of litigation and (in the U.S. and some other countries) the risk of enhanced damages if the defendant knowingly infringes.

compete with the infringing article;[53] lost profits on lost sales of convoyed goods;[54] other losses caused in fact but possibly excluded under the doctrine of proximate cause; net opportunity costs; future losses due to unrecoverable market share; and loss of chance.[55] I will return to some of these matters in Part IV. below.

Alternatively, if the infringement didn't deprive the patent owner of a sale (either because the owner doesn't sell any products covered by or competing with the patented invention, or because absent the infringement the defendant would have licensed the invention or employed a noninfringing alternative) one could imagine compensation taking the form of a "lost royalty"[56] in the sense of the royalty the trier of fact believes the parties actually would have negotiated had they been inclined to do so. Unless the patent owner offers everyone a uniform established royalty,[57] however, calculating the amount of such a lost royalty necessarily would involve a degree of hypothetical reconstruction. Moreover, the reasonable royalties that courts actually *do* award are not intended *literally* to duplicate the award the parties actually would have negotiated, but rather are said to reflect the amount the parties would have agreed to, ex ante, with knowledge that the patent was valid and infringed.[58] In the real world, by contrast, negotiated royalties would be discounted to reflect the parties' perceptions that the patent might be invalid or not infringed. Conventionally, the assumption of validity and

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[53] *See* Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1548-49 (Fed. Cir. 1995) (en banc) (affirming a lost profits award on lost sales of goods covered by another patent, not in suit, which Rite-Hite sold in competition with defendant's infringing product).

[54] *See id.* at 1550-51 (reversing an award for lost sales of convoyed goods that merely "as a matter of convenience or business advantage" were sold together with the principal good that competed against the infringing product).

[55] U.S. courts, unlike the counterparts in other countries, do not award damages for "loss of chance," that is, for the actuarial value of profits that would have been earned on certain sales, unless there is a greater-than-fifty-percent likelihood that such sales would have been made. *See* Thomas F. Cotter, *Bobst v. Heidelberg: A Recent French Case on Lost Profits*, COMP. PAT. REMEDIES BLOG (Jan. 24, 2014 3:53AM), http://comparativepatentremedies.blogspot.com/2014/01/bobst-v-heidelberg-recent-french-case.html. Unlike their counterparts elsewhere, U.S. courts also do not compensate a defendant who is subsequently found to have been wrongfully enjoined, beyond the amount of the plaintiff's bond. *See* Thomas F. Cotter, *Damages for a Wrongly Issued Injunction*, COMP. PAT. REMEDIES BLOG (Apr. 4, 2014 7:48AM), http://comparativepatentremedies.blogspot.com/2014/04/damages-for-wrongly-issued-injunction.html.

[56] Alternatively, one could imagine the "lost royalty" as a restitutionary reward of the royalty the defendant otherwise would have paid the plaintiff. *See* Thomas F. Cotter, *Reining in Remedies in Patent Litigation: Three (Increasingly Immodest) Proposals*, 30 SANTA CLARA HIGH TECH. L.J. 1, 25-26 (2013) (discussing some observers' characterization of reasonable royalties as restitutionary). On this reasoning, the distinction between compensation and restitution is, as I suggested above, sometimes more illusory than real. To the extent patent law requires the disgorgement of the infringer's entire profit resulting from the use of the invention, however, as opposed to merely the royalty it should have paid for that use, the distinction between compensation and restitution can be substantial.

[57] *See, e.g.*, Nickson Indus. v. Rol Mfg. Co., 847 F.2d 795, 798 (Fed. Cir. 1988); Roger D. Blair & Thomas F. Cotter, *Rethinking Patent Damages*, 10 TEX. INTELL. PROP. L.J. 1, 7-8 (2001) (discussing established royalties).

[58] *See, e.g.*, Lucent Tech., Inc. v. Gateway, Inc., 580 F.3d 1301, 1325 (Fed. Cir. 2009).

infringement is justified in order to avoid a double-discounting problem that otherwise would arise.[59] In other recent work, however, Norman Siebrasse and I have argued that the assumption also reflects a deeper principle that patent damages are best viewed as a means to the end of providing patent owners with a reward that is commensurate with—though not equal to the full social value of—their contribution to the art, rather than (exclusively) as a historical reconstruction of the state of the world that would have existed, but for the infringement.[60] On this view, the conventional framework for awarding reasonable royalties is nothing more than a legal fiction and therefore should be evaluated (and where necessary, modified) based on its utility for achieving the desired substantive end, rather than for its faithfulness to an illusory reality.[61] Under our approach, a court should aspire to award the royalty the parties would have agreed to ex ante based on all relevant information that is available ex post (that is, at the time of trial). Whether one agrees or not, the point to be made here is simply that both the conventional approach to reasonable royalties and our proposed tweak depart from a purely compensatory model, since neither is intended literally to replicate the award the parties actually would have negotiated ex ante.[62]

In contrast to these approaches, Omri Ben-Shahar has argued that patent law errs by according the prevailing patent owner the greater of either its *actual* (ex post) lost profit or its *expected* (ex ante) royalty.[63] I've argued elsewhere that Ben-Shahar's analysis fails to distinguish the circumstances under which a patent owner would *prefer* lost profits to a reasonable royalty, i.e., when the owner makes rather than licenses the patented invention.[64] For present purposes, however, I will note only that in theory one could construe the goal of compensating the patent owner as requiring—contrary to the suggestion floated in the preceding paragraph, and even in the context of lost profits awards—an award for the owner's expected rather than actual loss. An award of expected lost profits would be administratively very

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59 *See, e.g.*, Stephen H. Kalos & Jonathan D. Putnam, *On the Incomparability of "Comparable": An Economic Interpretation of "Infringer's Royalties"*, 9 NO. 4 J. PROPRIETARY RTS. 2 (1997); Norman V. Siebrasse & Thomas F. Cotter, *A New Framework for Determining Reasonable Royalties in Patent Litigation*, 68 FLA. L. REV. 929, 937 (2016).

60 *See* Siebrasse & Cotter, *supra* note 59, at 936, 946-47; Norman V. Siebrasse & Thomas F. Cotter, *The Value of the Standard*, 101 MINN. L. REV. 1159, 1177 (2016) [hereinafter Siebrasse & Cotter, *Value*]. I therefore argue that courts should depart from the conventional ideal of awarding the estimated royalty a willing licensor and licensee would have agreed to ex ante (before the infringement), by taking into consideration ex post evidence of patent validity and infringement, the amount of use, or other relevant matters—which may result in an award that is higher or lower than the parties would have expected ex ante.

61 *See* Siebrasse & Cotter, *supra* note 59, at 945-46.

62 Both approaches are also distinct from a "pure" ex post model, under which the royalty would be the one the parties would negotiate ex post—a framework which would enable the patent owner to extract a royalty that reflects holdup value—and from a disgorgement model, under which the defendant is required to give up the entire profit actually earned from the infringement.

63 *See* Omri Ben-Shahar, *Damages for Unlicensed Use*, 78 U. CHI. L. REV. 7, 13-23 (2011).

64 *See* COTTER, *supra* note 8, at 71-72.

complex, however, and if my critique of Ben-Shahar's analysis is correct would offer no countervailing benefit to the standard approach.[65]

IV. Specific Applications of Patent Damages Heuristics

Having presented the general concept of heuristics and the problems toward which patent damages heuristics in particular may be directed, I turn my attention in this part to the specific heuristics that courts either have applied or considered applying in this latter context. Section A provides a brief description of the *forms* of legal heuristics (such as presumptions) that are available to courts in this context. Section B then presents a more detailed discussion of three specific purposes for which heuristics are or may be employed: first, to determine a patent owner's *eligibility* for a *type* of damages award ("eligibility heuristics"); second, to provide a rough-and-ready estimate of the amount of such an award by equating it with some other more easily determined amount ("equating heuristics"); and third, to regulate the methodologies used for more granular calculations of damages amounts ("methodology heuristics"). This third class is further subdivided into heuristics relating to lost profits or awards of defendant's profits; heuristics relating to reasonable royalties; and heuristics relating to "fair, reasonable, and nondiscriminatory" (FRAND) royalties. As we shall see, although courts sometimes have applied heuristics in a defensible manner, in other instances they either have used inappropriate heuristics or rejected what might have been productive applications of heuristic approaches. Interestingly, in engaging these matters courts sometimes have purported to take factfinders' cognitive biases into account, though in others they may have fallen victim to such biases themselves.

A. Types of Heuristics

As noted in the Introduction, legal heuristics generally can take the form of substantive rules or standards, procedural rules, and presumptions; and as we shall see, patent damages law makes use of all three. Among the relevant substantive rules and standards that courts in the U.S. or elsewhere have applied in this field and which might be viewed as heuristic in nature are those relating to the relevance (or not) of noninfringing alternatives to lost profit calculations,[66] as well as those establishing the factors upon which expert witnesses may base their royalty estimates.[67] As for procedural rules, the most important are those relating to the admissibility of expert testimony under the Federal Rules of Evidence, as applied to the specific context of damages calculation.[68] Of arguably greater interest to the present discussion, however, are presumptions, which straddle the border between

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65 *See id.* at 71 n.62.

66 *See infra* notes 115-32 and accompanying text.

67 *See infra* notes 133-34 and accompanying text.

68 *See, e.g.*, *infra* notes 151-58 and accompanying text (discussing the admissibility of testimony based on Nash Bargaining). More generally, rules limiting the admissibility of potentially relevant evidence function as heuristics to the extent they are intended to conserve on adjudication costs or to preclude the trier of fact from basing its decision on possibly unreliable or substantively improper factors.

procedure and substance by requiring or permitting the factfinder to infer Fact X upon production of evidence of some more readily accessible Fact Y. Presumptions generally come in different varieties, ranging from so-called conclusive presumptions (which really are just substantive rules of law), to rebuttable (burden-shifting) presumptions, such as the presumption of validity, to permissive presumptions (which when applicable permit, but do not require, the trier of fact to draw certain conclusions).[69] As others have noted, presumptions may function to reduce adjudication costs; relatedly, to allocate the burden of production on Fact X to the party with better access to it; or to increase the probability of attaining a desired substantive goal.[70] Many of the damages heuristics discussed below can be viewed as presumptions of one type or another.[71]

In addition, many damages-related heuristics are not really presumptions at all but rather starting points, background assumptions, or priors which courts in certain contexts have approved, and in other instances rejected, for use in awarding damages. In 2011, for example, the Federal Circuit laid to rest one such heuristic, the so-called "Rule of Thumb," under which an expert could take as a starting assumption the premise that patent licensors generally expect to share 25% of the profit derived from the sale of a product embodying the patented invention.[72] As we shall see, however, some of these types of heuristics still remain in play, while others (like the Rule of Thumb itself) have been rejected.

B. Eligibility Heuristics

Courts sometimes have employed heuristics to help determine if the claimant is eligible to recover a certain class of damages at all. Section 284 of the U.S. Patent Act, for example, states that "[u]pon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, *but in no event less than a reasonable royalty* for the use made of the invention by the infringer" (emphasis added).[73] In *Apple, Inc. v. Motorola, Inc.*,[74] the Federal Circuit interpreted the italicized language to mean that, even when the patent owner fails to introduce admissible evidence quantifying the amount of its loss, the court still has an obligation to "determine what constitutes a reasonable royalty from the record evidence"[75]—in effect, creating a rebuttable presumption that the patent owner is

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69 *See* MUELLER & KIRKPATRICK, *supra* note 4, § 3.4, at 136-37.

70 *See supra* note 5 and accompanying text.

71 *See, e.g.*, *infra* notes 73-77 and accompanying test (discussing the presumption of harm).

72 *See* Uniloc USA, Inc. v. Microsoft Corp., 632 F.3d 1292, 1315 (Fed. Cir. 2011) (characterizing the 25% rule as "a fundamentally flawed tool for determining a baseline royalty rate in a hypothetical negotiation" and holding that "[e]vidence relying on the 25 percent rule of thumb is thus inadmissible under *Daubert* and the Federal Rules of Evidence, because it fails to tie a reasonable royalty base to the facts of the case at issue.").

73 35 U.S.C. § 284.

74 Apple, Inc. v. Motorola, Inc., 757 F.3d 1286 (Fed. Cir. 2014).

75 *Id.* at 1328. Further:

> . . . if the patentee's proof is weak, the court is free to award a low, perhaps nominal, royalty, as long as that royalty is supported by the record . . . .

entitled to *something* as a consequence of the infringement. The rule is consistent with practice in some other countries,[76] but it provides no guidance on how to calculate the royalty due when the parties' evidence is deficient. One might imagine, though, that in such cases courts will have to take it upon themselves to apply methodology heuristics akin to those I discuss in a subsequent section below, based on whatever record evidence there may be concerning the amount of the use, comparable license rates, and the advantages of the technology over alternatives. For now, however, this appears to be an area in which U.S. patent damages law remains largely underdeveloped.[77]

> Thus, a fact finder may award no damages only when the record supports a zero royalty award. For example, in a case completely lacking any evidence on which to base a damages award, the record may well support a zero royalty award. Also, a record could demonstrate that, at the time of infringement, the defendant considered the patent valueless and the patentee would have accepted no payment for the defendant's infringement. Of course, it seems unlikely that a willing licensor and willing licensee would agree to a zero royalty payment in a hypothetical negotiation, where both infringement and validity are assumed.
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> At summary judgment, as is the case here, a judge may only award a zero royalty for infringement if there is no genuine issue of material fact that zero is the only reasonable royalty. Thus, if a patentee raises a factual issue regarding whether it is due any non-zero royalty, summary judgment must be denied. In any event, simply because a patentee fails to show that its royalty estimate is correct does not, by itself, justify awarding a royalty of zero at summary judgment, as the district court did here . . . .

Id.

[76] *See, e.g.*, Markus Schönknecht, *Determination of Patent Damages in Germany*, 43 IIC 309, 311-13 (2012) (discussing the German courts' "free discretion" (*nach freier Überzeugung*) to estimate patent damages under § 287 of the Code of Civil Procedure); *see also* Charlotte Scott, *Damages Inquiries and Accounts of Profits in the IPEC*, 38 E.I.P.R. 273, 273 (2016) (asserting that the procedural rules employed in the Intellectual Property Enterprise Court of England and Wales—a sort of smallish-claims court in which damages are capped at £500,000—"enable a rough and ready determination with more limited disclosure"). According to Schönknecht, in Germany "[t]he injured party is not required to prove the exact amount of its damage; rather, it is sufficient if it presents a factual basis on which the court can establish 'at least a rough estimate' of the damage." Schönknecht, *supra*, at 312 (citing Federal Supreme Court (Tolbutamid), 1980 GRUR 841, 842, *translated in* 11 IIC 763, 764 (1980)). Statutory damages, which are (by far) the dominant form of damages award for IP infringement in China, arguably are intended to play a similar role of allowing the court to provide compensation when the evidence on lost profits, royalties, and defendant's profits is lacking, though critics argue that awards of statutory damages are not closely correlated with actual losses or gains. For discussion, see Jingjing Hu, *Determining Damages for Patent Infringement in China*, 47 IIC 5 (2016).

[77] Although, as I have noted elsewhere, one of the recent FRAND cases—Microsoft Corp. v. Motorola, Inc., Case No. C10-1823JLR, 2013 WL 2111217, at *39-49 (W.D. Wash. Apr. 25, 2013), *aff'd*, 795 F.3d 1024 (9th Cir. 2015)—arguably provides some insight into how judges can determine damages without relying too closely on either side's damages calculation. *See* Thomas F. Cotter, *Comparative Law and Economics of Standard-Essential Patents and FRAND Royalties*, 22 TEX. INTELL. PROP. L.J. 311, 360 (2014); *see also In re* Marriage of Abu-Hashim, 14 N.E.3d 524, 531 (Ill. App. 2014) (affirming a trial judge's methodology for valuing a daycare business in a divorce proceeding, on the ground that "where a party does not offer evidence of an asset's value,

The other principal examples of eligibility heuristics under U.S. patent law relate to awards of enhanced damages and attorneys' fees.[78] With respect to enhanced damages, the Patent Act states only that courts "may increase the damages up to three times the amount found or assessed,"[79] though traditionally courts have held that such enhanced damages are available only for "willful" or "egregious" (or some equally sinister-sounding adjective) infringement—an interpretation the Supreme Court reaffirmed this past term in *Halo Electronics, Inc. v. Pulse Electronics, Inc*.[80] In this regard, the Court held that "although there is 'no precise rule or formula' for awarding damages under § 284, a district court's 'discretion should be exercised in light of the considerations' underlying the grant of that discretion," which the Court described as "punitive" or "vindictive."[81] (Deterrence arguably remains a statutory purpose as well, as the Federal Circuit had previously stated,[82] though the Supreme Court didn't expressly mention deterrence in *Halo*.) In so ruling, the Court overruled *In re Seagate Tech. LLC*[83]—a case in which the Federal Circuit held that to recover enhanced damages a patentee had to "show by clear and convincing evidence that the infringer acted despite an objectively high likelihood that its actions constituted infringement of a valid patent" and that "this objectively-defined risk (determined by the record developed in the infringement proceeding) was either known or so obvious that it should have been known to the accused infringer"[84]—as well as subsequent case law holding that willfulness was a question of law to be reviewed de novo on appeal.[85] Presumably still intact, however, is Federal Circuit case law holding that once a court has found an act of infringement to be willful, it may consider a variety of factors in deciding how much (if at all) to enhance the actual damages up to the statutory maximum.[86]

Taken together, the combination of a discretionary willfulness standard with a list of potentially relevant factors to consider in determining the amount of an

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the party cannot complain as to the disposition of that asset by the court").

78 There is, also, a presumption that the prevailing patentee be awarded prejudgment interest. *See* General Motors Corp. v. Devex Corp., 461 U.S. 648, 657 (1983) (holding that, under 35 U.S.C. § 284, courts should award prejudgment interest absent a justification for not doing so); *id.* at 658 (Stevens, J., concurring) (referring to "a presumption favoring the award of prejudgment interest in the ordinary case"). The presumption arguably functions as a heuristic by not requiring the plaintiff routinely to demonstrate an entitlement to interest, and thus by relegating to the defendant the task of demonstrating such unusual circumstances as would counsel against such an award.

79 35 U.S.C. § 284 (2012).

80 Halo Elec., Inc. v. Pulse Elec., Inc., 136 S. Ct. 1923, 1934 (2016).

81 *Id.* at 1929, 1932.

82 *See* SRI Int'l, Inc. v. Advanced Tech. Labs., Inc., 127 F.3d 1462, 1468 (Fed. Cir. 1997) (referring to deterrent and punitive purposes).

83 *In re* Seagate Tech. LLC, 497 F.3d 1360 (Fed. Cir. 2007) (en banc).

84 *Id.* at 1371.

85 *See* Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., 682 F.3d 1003, 1007 (Fed. Cir. 2012).

86 *See* Read Corp. v. Portec, Inc., 970 F.2d 816, 816, 827 (Fed. Cir. 1992) (listing the relevant factors as including (1) "Defendant's size and financial condition"; (2) "Closeness of the case"; (3) "Duration of defendant's misconduct"; (4) "Remedial action by the defendant"; (5) "Defendant's motivation for harm"; and (6) "Whether defendant attempted to conceal its misconduct").

enhancement doesn't sound very heuristic[87] (though it remains to be seen how the lower courts will adapt to their new-found discretion). And to be fair, it's difficult to articulate what an appropriate heuristic *would* be, absent some idea of the sort of conduct courts *should* be trying to deter or punish—and what sort they shouldn't. On this latter issue, however, it seems reasonably clear that we *don't* want to deter firms from engaging in lawful conduct, such as permitting their employees to read patents or attempting lawfully to design around patented technologies.[88] This would suggest that courts probably shouldn't penalize infringers who had a good-faith belief that the patent in suit was invalid or not infringed, and relatedly that they shouldn't infer that an infringement was deliberate just because the defendant (or one of its employees) was aware of the patent. On the other hand, I've suggested elsewhere[89] that enhancements may serve a legitimate purpose when compensatory damages alone (1) would leave the plaintiff worse off than it would have been but for the infringement (perhaps because certain harms are not susceptible to quantification); or (2) would leave the defendant in a better position than a willing licensee (perhaps because the infringer avoids certain risks that a licensee normally would shoulder); or (3) would be necessary to achieve adequate deterrence (perhaps because the infringing act was of a type that often would go undetected, or the defendant has deliberately driven up litigation costs to discourage an impecunious patentee from filing suit). A heuristic that screened for the likely presence of these factors as a precondition for awarding enhanced damages would both reduce the cost of administration—precisely because it wouldn't be an open-ended, totality of

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87 As also noted by Gugliuzza, *supra* note 6, (manuscript at 62).

88 *See, e.g.*, Thomas F. Cotter *An Economic Analysis of Enhanced Damages and Attorneys' Fees for Willful Patent Infringement*, 14 FED. CIR. B.J. 291, 323-36 (2004); Mark A. Lemley & Ragesh K. Tangri, *Ending Patent Law's Willfulness Game* , 18 BERKELEY TECH. L.J. 1085 (2003); Lisa Larrimore Ouellette, Halo v. Pulse *and the Increased Risks of Reading Patents*, WRITTEN DESCRIPTION BLOG (June 16, 2016, 4:55 PM), http://writtendescription.blogspot.com/2016/06/halo-v-pulse-and-increased-risks-of.html; *see also Halo*, 136 S. Ct. at 1935 2016 WL at *11 (noting that "[r]espondents and their amici are concerned that allowing district courts unlimited discretion to award upto treble damages in infringement cases will impede innovation as companies steer well clear of any possible interference with patent rights."); *id.* at 1937-38 (Breyer, J., concurring) ("The more that businesses, laboratories, hospitals, and individuals adopt this approach [of settling or abandoning challenged conduct to avoid litigation], the more often a patent will reach beyond its lawful scope to discourage lawful activity, and the more often patent-related demands will frustrate, rather than 'promote,' the 'Progress of Science and useful Arts.'").

89 *See* Thomas F. Cotter, *Complete Set of Briefs Filed Thus Far in* Halo *and* Stryker *Enhanced Damages Cases*, COMP. PAT. REMEDIES BLOG (Dec. 18, 2015, 1:15 PM), http://comparativepatentremedies.blogspot.com/2015/12/complete-set-of-briefs-filed-thus-far.html. Malani and Masur have argued that courts should award enhanced damages (payable from the public fisc or by means of term extensions) in cases in which defendants *unsuccessfully* challenge patent validity, in order to compensate for the risk of a wrongful invalidation. *See* Anup Malani & Jonathan S. Masur, *Raising the Stakes in Patent Cases*, 101 GEO. L.J. 637 (2013), a proposal that Ouellette supports as well, *see* Ouellette, *supra* note 88. The amount of the appropriate enhancement would depend on the probability of an erroneous invalidation, however, and I am skeptical that courts or other policymakers could make such a determination with any degree of confidence.

the circumstances inquiry—and would be less susceptible to errors resulting from the overdeterrence of lawful, socially beneficial conduct.

Seen in this light, the Federal Circuit's now-defunct willfulness case law (including but not limited to *Seagate*) may not have been too far off the mark when viewed as a heuristic designed to discourage behavior on the part of defendants that is objectively welfare-reducing.[90] As noted above,[91] exposing someone who knowingly uses a patented technology in the objectively good-faith (but perhaps incorrect) belief that the patent is invalid or noninfringed to a risk of greater damages liability could reduce social welfare by chilling some potential challenges to weak patents. (Focusing on whether the infringer had such a good-faith belief at the time it began infringement, as the Supreme Court now appears to direct,[92] also reduces this risk but as suggested above poses a risk that firms will discourage their employees from reading patents, out of fear that any infringement occurring thereafter may be viewed as deliberate.) Moreover, by focusing only on objectively reckless conduct, *Seagate* also reduced the circumstances under which enhanced damages were available,[93] thus reducing the risk of overdeterrence, and it certainly narrowed the range of possible outcomes in comparison with an open-ended standard.

A second example of an eligibility heuristic is the standard for awarding the prevailing party its attorneys' fees. A patent damages system that focused exclusively on compensation would favor awarding fees to the prevailing party, plaintiff or defendant, as a matter of course; and in fact many countries purport to follow this practice, though in reality the fees they award often are only a fraction of the fees litigants actually incur.[94] Such mandatory fee-shifting nevertheless would

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[90] Assuming, that is, that the enforcement of valid and infringed patents promotes social welfare, and that the nonenforcement of invalid and noninfringed patents doesn't. *See supra* text accompanying notes 4, 34.

[91] *See supra* note 34.

[92] *See* Halo Elec., Inc. v. Pulse Elec., Inc., 136 S. Ct. 1923, 1933 (2016).

> The Seagate test . . . mak[es] dispositive the ability of the infringer to muster a reasonable (even though unsuccessful) defense at the infringement trial. The existence of such a defense insulates the infringer from enhanced damages, even if he did not act on the basis of the defense or was even aware of it. Under that standard, someone who plunders a patent—infringing it without any reason to suppose his conduct is arguably defensible—can nevertheless escape any comeuppance under § 284 solely on the strength of his attorney's ingenuity.
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> But culpability is generally measured against the knowledge of the actor at the time of the challenged conduct.

[93] *See* Christopher B. Seaman, *Willful Patent Infringement and Enhanced Damages After In re Seagate: An Empirical Study*, 97 IOWA L. REV. 417, 420, 444 (2012) (reporting that, after *Knorr-Bremse Systeme fuer Nutzfahrzeuge GmbH v. Dana Corp*., 383 F.3d 1337, 1347 (Fed. Cir. 2004) (en banc), first tightened the willfulness standard, findings of willfulness declined from 63.8% in cases in which the issue was decided from 1983-99 to 48.2%, and that after *Seagate* they declined further to 37.2%).

[94] *See* COTTER, *supra* note 8, at 209, 276, 328. In comparison with a system in which fees are

run counter to the general American Rule that each side bears its own fees; and in theory such awards risk chilling some legitimate claimants from asserting their rights as well as possibly threatening to drive up litigation costs and deter settlement.[95]

In any event, whether these theoretical objections are sound or not, U.S. patent law permits fee awards only in "exceptional" cases,[96] which according to the Supreme Court means that courts should award fees only "to address 'unfairness or bad faith in the conduct of the losing party, or some other equitable consideration of similar force,' which made a case so unusual as to warrant fee-shifting."[97] For present purposes the relevant question is whether a totality-of-the-circumstances standard or a heuristic would be preferable for evaluating exceptionality. Until recently, the Federal Circuit's practice was to award fees only when the losing party engaged in independently sanctionable misconduct or (shades of *Seagate*) when the action was both objectively baseless and in subjective bad faith.[98] In 2014, however, in two companion cases that that foreshadowed its 2016 decision on

awarded only under some conditions, the presence or absence of which may be contested by the parties, mandatory fee-shifting also may conserve on adjudication costs—though some theorists argue that fee shifting encourages parties to invest more in litigation. *See id.* at 148. Moreover, additional costs may be incurred to evaluate the reasonableness and amount of the proposed fee, though in some systems the prevailing party usually is awarded a fee set by statute or (for plaintiffs) a fee equal to some arbitrary percentage of its actual damages. *See id.* at 276, 328.

95 *See id*. at 148-49 (reviewing economic literature on fee shifting).

96 *See* 35 U.S.C. § 285.

97 Octane Fitness, LLC v. ICON Health & Fitness, Inc., 134 S. Ct. 1749, 1753 (2014); *see also id.* at 1756 (stating that "an 'exceptional' case is simply one that stands out from others with respect to the substantive strength of a party's litigating position (considering both the governing law and the facts of the case) or the unreasonable manner in which the case was litigated").

98 *See id.* at 1754 (summarizing the Federal Circuit's approach as holding that "a case is 'exceptional' . . . 'when there has been some material inappropriate conduct related to the matter in litigation, such as willful infringement, fraud or inequitable conduct in procuring the patent, misconduct during litigation, vexatious or unjustified litigation, conduct that violates FED.R.CIV.P. 11, or like infractions'" and that "'[a]bsent misconduct in conduct of the litigation or in securing the patent,' . . . fees 'may be imposed against the patentee only if both (1) the litigation is brought in subjective bad faith, and (2) the litigation is objectively baseless'" in the sense that 'no reasonable litigant could believe it would succeed'") (citations omitted). In view of this approach, the Federal Circuit at one time spoke of a "presumption that an assertion of infringement of a duly granted patent is made in good faith," Highmark, Inc. v. Allcare Health Management Systems, Inc., 687 F.3d 1300, 1310 (Fed. Cir. 2012) (in the context of fee awards, quoting *Medtronic Navigation, Inc. v. BrainLAB Medizinische Computersysteme GmbH*, 603 F.3d 943, 954 (Fed. Cir. 2010), as authority for a "presumption that an assertion of infringement of a duly granted patent is made in good faith"), *rev'd on other grounds*, 134 S. Ct. 1749 (2014), though a later Federal Circuit panel backed away from the characterization. *See* Kilopass Tech., Inc. v. Sidense Corp., 738 F.3d 1302, 1314-15 (Fed. Cir. 2013), *overruled on other grounds in* Highmark Inc. v. Allcare Health Mgt. Sys., Inc., 134 S. Ct. 1744 (2014). Patent reform legislation proposed in the last few years would introduce the opposite presumption by requiring the court to award fees unless it "finds that the position and conduct of the nonprevailing party or parties were reasonably justified in law and fact or that special circumstances (such as severe economic hardship to a named inventor) make an award unjust." *See* Innovation Act, H.R. 9, Rep. No. 114-235, 114th Cong., 1st Sess., § 3(b) (reported July 29, 2015), *available at* https://www.congress.gov/bill/114th-congress/house-bill/9/text#toc-H7E6F9EAE8263402492511BD54A562B0B.

willfulness, the Supreme Court held that courts instead should apply a totality-of-the-circumstances approach and should review decisions on fee petitions under the deferential abuse of discretion standard.[99] As a result, fee awards now appear to be somewhat more common[100]—arguably a desirable outcome if one thinks that fee awards *should* be more common, in order to compensate and to deter frivolous litigation—though hardly routine, in view of the extant "exceptionality" requirement.

As with the willfulness standard, the question of whether it is preferable to have a totality-of-the-circumstances or a brightish-line rule for evaluating eligibility depends on the underlying purpose of permitting the type of relief at issue. The supposed purpose stated above ("to address 'unfairness or bad faith in the conduct of the losing party, or some other equitable consideration of similar force'") is, unfortunately, vague, though the Court may well have been correct in construing it to mean that Congress intended for fees to be awarded in at least a slightly greater proportion of cases than would be possible under other bodies of law[101] or the common-law exception to the American Rule.[102] Viewed in this light, the Federal Circuit's more stringent test probably did generate higher error costs, by excluding too many deserving fee petitions. On the other hand, the new standard will likely raise adjudication costs, not only because fee petitions will become more common but also because the range of possibly relevant considerations is greater than before. This cost nevertheless may be worth incurring if greater resort to fee awards deters a substantial number of frivolous claims or defenses, though a more permissive standard for awarding fees would likely have even more impact.

C. Equating Heuristics

A second category of damages heuristics *equates* the damages due the plaintiff with some other, more readily determined amount. These heuristics are at best only very rough proxies for the harm suffered by the plaintiff or benefit enjoyed by the defendant, and for the most part are now absent from U.S. practice. At one time, however, courts sometimes inferred that the amount of the defendant's profit attributable to the infringement was an appropriate "surrogate for the profits the plaintiff would have earned but for the defendant's improper use," or that a loss of

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99 *See Octane Fitness*, 134 S. Ct. at 1756; *Highmark*, 134 S. Ct. 1744, 1748 (2014).

100 For review of the empirical studies to date, see Cotter & Golden, *supra* note 52 (manuscript at 15-16).

101 *See Octane Fitness*, 134 S. Ct. at 1756-57 ("the first category of cases in which the Federal Circuit allows fee awards—those involving litigation misconduct or certain other misconduct—appears to extend largely to independently sanctionable conduct . . . . But sanctionable conduct is not the appropriate benchmark. Under the standard announced today, a district court may award fees in the rare case in which a party's unreasonable conduct—while not necessarily independently sanctionable—is nonetheless so "exceptional" as to justify an award of fees").

102 *See id.* at 1758 (characterizing the Federal Circuit's test as "so demanding that it would appear to render § 285 largely superfluous. We have long recognized a common-law exception to the general 'American rule' against fee-shifting—an exception, 'inherent' in the 'power [of] the courts' that applies for 'willful disobedience of a court order' or 'when the losing party has 'acted in bad faith, vexatiously, wantonly, or for oppressive reasons . . . .'") (citation omitted).

sales (and hence the profits lost on those sales) during the period of the infringement were attributable to the infringement.[103] From the standpoint of accuracy *however* defined, such heuristics arguably leave something to be desired: a reduction in the plaintiff's profits often will be attributable to many factors, and due to differences in costs and other factors the amount of the defendant's profits may bear little relation to what the plaintiff would have earned even if the two happen to be direct competitors. Indeed, such heuristics might seem suspect even if they served merely as rebuttable presumptions, since (all other things being equal) one would expect the plaintiff, not the defendant, to be in a better position to produce evidence substantiating and explaining its own losses.

Nevertheless, until recently courts in the U.S. did follow one patent damages rule that functioned quite similarly to such otherwise discarded heuristics: namely, that the prevailing *design patent* owner was entitled to recover the entire profit the defendant earned from the sales of an infringing end product, regardless of whether or to what extent those profits were attributable to the infringing design.[104] The rule was based on a literal reading of 35 U.S.C. § 289, which in relevant part states that whoever without authorization sells an "article of manufacture" to which a patented design "has been applied shall be liable to the owner to the extent of his *total profit* . . . " (emphasis added).[105] Given that complex products such as smartphones can incorporate literally thousands of features, some patented and some not, a rule requiring the disgorgement of the entire profit earned from sales of a device bearing even a single infringing design seems like overkill (to say the least)—though for present purposes it might be worth considering whether such a rule *could* be justified as a simplifying heuristic that avoids the administrative cost of having to apportion profits. The obvious problem, though, is that it would accomplish this goal only at the risk of imposing enormous (and probably unnecessary, given contemporary methods for quantifying damages) pro-plaintiff error costs. On balance, it's hard to imagine that any rational patent damages regime would consciously adopt such a rule today.[106]

In any event, in late 2016 the U.S. Supreme Court overruled this interpretation of § 289, holding instead that the statutory language requires the disgorgement only

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[103] Blair & Cotter, *supra* note 57, at 11-12 (citing sources). Courts in some countries still are authorized to consider the defendant's profit as evidence of the plaintiff's lost profit. *See* COTTER, *supra* note 8, at 323-24 (quoting Japan Patent Act art. 102(2)).

[104] *See* Apple Inc. v. Samsung Elecs. Co., 786 F.3d 983 (Fed. Cir. 2015), *rev'd*, 137 S. Ct. 429 (2016) (No 15-777).

[105] 35 U.S.C. § 289. Congress enacted in 1888 to eliminate a perceived burden faced by design patent owners in quantifying their damages (which burden sometimes resulted, under the standards of the time, in juries awarding only nominal damages). *See* Samsung Elecs. Co. v. Apple Inc., 137 S. Ct. 429, 432-33 (2016).

[106] On the other hand, many countries that permit awards of infringer's profits, under one doctrinal theory or another, employ a rebuttable presumption that the profit derived from the infringement equals the defendant's gross profit; the burden, in other words, is on the defendant to come forward with evidence concerning what expenses should be deducted to arrive at the net profit derived from the infringement. *See* COTTER, *supra* note 8, at 206, 325.

of the entire profit attributable to the article of manufacture bearing the infringing design, not necessarily the entire profit earned from sales of the end product.[107] Thus in the case of a smartphone, it's conceivable that the relevant article of manufacture could be (for example) only the phone's case or its graphical user interface, rather than the entire device. This reduces the risk of overdeterrence somewhat—though not entirely, given that the relevant article of manufacture still could incorporate many features (albeit fewer than the entire device), only one of which is infringed. Moreover, the Court declined to provide any guidance on how to define the article of manufacture in cases involving complex products, or how to apportion the profit attributable to such an article.[108] In the near term, at least, the cost of adjudicating design patent infringement cases in the U.S. therefore is likely to increase, as the lower courts grapple with resolving these issues and litigants with presenting relevant evidence, presumably by means of expert testimony.

A second practice that appears (for reasons below) to reflect a substantive economic error, but is worth evaluating for its possible merits as a heuristic, is that when courts deny prevailing patent owners permanent injunctions they typically impose a postjudgment royalty the rate of which exceeds the prejudgment rate.[109] Mark Lemley has aptly characterized this practice as a presumption of sorts—namely that the postjudgment rates should be greater than the prejudgment rate, though not necessarily by how much[110]—that shifts the burden to the defendant to demonstrate why the rate should not change. As presumptions go, however, this one is difficult to justify on the merits, since it both raises the cost of litigation and reduces accuracy in comparison with a rule that the pre- and post-judgment rates should equate. The reason for this latter observation is that, as Lemley has argued, the prejudgment rate is supposed to be calculated on the assumption that the parties knew the patent to be valid and infringed. Accordingly, there is no additional relevant knowledge to be taken into account on that ground, and the pre- and post-judgment rates should equate.[111] Moreover, if (as I have argued) ongoing royalties are preferable to injunctions in some cases because injunctions sometimes enable defendants to extract royalties reflecting holdup value, increasing the postjudgment rate seems to replicate the very risk that denying an injunction was supposed to

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[107] *See Samsung*, 137 S. Ct. at 434-35.

[108] *See id.* at 436.

[109] *See* Christopher B. Seaman, *Ongoing Royalties in Patent Cases After eBay: An Empirical Assessment and Proposed Framework*, 23 TEX. INTELL. PROP. L.J. 203, 239 (2015) (reporting that, from the date of the *eBay* decision through January 2015, district courts awarded mean and median post judgment royalty rates that were 1.84 and 1.34 times the mean and median prejudgment royalty rates, respectively).

[110] *See* Mark A. Lemley, *The Ongoing Confusion over Ongoing Royalties*, 76 MO. L. REV. 695, 706 (2011) (stating that "[o]n occasion, the Federal Circuit has found that changed circumstances compel different royalty rates. The fact that circumstances can change provides a reason to make the past damages measure a presumptive rather than a required basis for the ongoing royalty.") (citing Applied Med. Res. Corp. v. U.S. Surgical Corp., 435 F.3d 1356, 1361-63 (Fed. Cir. 2006)).

[111] *See supra* text accompanying notes 58-59.

avoid.[112] Perversely, then, in the one setting in which an equating heuristic would make sense the courts have rejected it.

D. Methodology Heuristics

The practices I referred to above as "equating heuristics" might be viewed as a subset of a broader category of what I will refer to here as "methodology heuristics"—that is, shortcuts used to estimate the profit or royalty due to the plaintiff—with the main difference being that the heuristics I discuss in this section are at least somewhat more narrowly focused than the ones discussed above. Subsection 1 below discusses the methodology heuristics courts sometimes have used to estimate the plaintiff's lost profit (or, in countries where such awards are still available, the infringer's profit). Subsection 2 discusses and critiques the various methodology heuristics used for calculating reasonable royalties, while subsection 3 focuses on a specific category of royalties, namely the "fair, reasonable, and nondiscriminatory" (FRAND) royalties that may be awarded for the unauthorized use of certain standard-essential patents (SEPs).[113] As we shall see, courts and commentators around the world are continuing their efforts to develop appropriate FRAND heuristics.

1. Lost Profits and Defendant's Profits

Economists largely agree that an accurate measure of the profit the plaintiff lost (or the defendant gained) as a result of the infringement cannot be gauged absent a consideration of the infringer's next-best available noninfringing alternative. To illustrate, suppose that a company that manufactures and sells bicycles includes a bicycle suspension system that infringes a rival manufacturer's Patent X. Had the company not infringed, however, it would have used an alternative Y that is in the public domain.[114] If the company would have sold just as many bikes using alternative Y as it made using Patent X—perhaps because

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[112] *See* COTTER, *supra* note 8, at 127. In an analogous vein, in a recent paper Carl Shapiro presents a mathematical analysis leading to "rules of thumb" that when "switching costs are small relative to the value of the patented technology, an injunction is likely to be the better remedy," whereas "if the court believes it can measure the harm to the patent holder caused by infringement and the benefits to the downstream firm from infringement with a high degree of accuracy, then ongoing royalties are likely to be the better remedy." Shapiro, *supra* note 36 (manuscript at 24). Shapiro's proposal strikes me as both analytically correct and administratively feasible.

[113] Standard-setting organizations (SSOs) often recommend or require that their members declare which of their patents are or may be essential to a standard that the SSO is considering or has adopted, and to commit to license any such patents on FRAND terms. SSOs usually leave these terms undefined, however, and in some recent cases courts have had to determine FRAND royalties for specific SEPs.

[114] Additional complications, not germane to the present discussion, may arise if the next-best alternative to the infringed technology was also subject to (someone's) patent. On one view, damages should be calculated based on the value of the infringed technology over the next-best public domain technology only; on another, damages should reflect only the net advantage of the infringed technology over the advantage that would have resulted from using (and, if necessary, licensing) the next-best alternative, patented or not. For discussion, *see* Siebrasse & Cotter, *Value*, *supra* note 60, at 1191-92, 1222-24.

consumers perceive no functional advantage of X over Y—its infringement has cost the patent owner no sales, and hence no lost profit on those sales.[115] At most, the patent owner would be entitled to a royalty based on whatever advantage (a reduction in cost of production, maybe) that accrued to the defendant as a result of the infringement.[116] What we shouldn't do, if our goal is to accurately measure the loss *caused by* the infringement, is to assume that every infringing sale by the defendant deprived its patent-owning competitor of a sale. Put another way, in a case in which the defendant could have resorted to a noninfringing alternative, which consumers would have found indistinguishable from the patented invention, the patent owner's position would have been precisely the same absent the infringement, and there is nothing to compensate (other than the royalty, if any, a noninfringing defendant would have paid for the privilege of using X over Y). Put yet another way, if (as I have argued elsewhere) the value of the patented invention is the profit or cost advantage it enables a user to derive over the next-best alternative, the value of our hypothetical invention X is (at most) the cost advantage it enabled the defendant to accrue over public-domain technology Y. To award anything more than that value overcompensates the patent owner for an invention that may be functionally no better than the prior art.[117]

U.S. courts have long understood and applied this reasoning in calculating lost profits—and, until such awards were abolished in 1946, awards of infringer's profits for non-design patents—though disputes sometimes arise over whether a proposed alternative really was "available" to the defendant during the time period at issue,[118] or whether only unpatented alternatives should count.[119] In the United Kingdom and some other countries, by contrast, courts routinely disregard the availability of noninfringing alternatives when calculating lost profits and awards of the infringer's profits.[120] For the most part, these non-U.S. decisions seem (with all

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[115] In most countries, including the United States, an invention is sufficiently *useful* to satisfy patent law's utility requirement as long as it works; it doesn't have to work *better* than other alternatives.

[116] Alternatively, if the infringement enabled the defendant to make (say) fifty more sales (to consumers who prize the patented invention X over alternative Y) than it would have made using alternative Y, the patent owner should recover its lost profits on those fifty sales, assuming it can show that it had sufficient capacity to meet that additional demand. Analogously, if the patent owner is entitled under the patent-granting country's domestic law to recover the defendant's profit attributable to the infringement, that profit should be only the net profit the defendant earned using the infringing technology over and above what it would have earned using the next-best available noninfringing alternative.

[117] For discussion, see, for example, COTTER, *supra* note 8, at 68. *See also* Siebrasse & Cotter, *Value*, *supra* note 60, at 1189 ("If the patentee can extract some part of the user's sunk costs, in addition to the cost saving or profit increase provided by the patented technology, the incentive to invent will be greater than the costs saving or profit advantage provided by the invention, and the patent incentive will be too great.").

[118] *See, e.g.*, Grain Processing Corp. v. Am. Maize-Prods. Co., 185 F.3d 1341, 1349-50 (Fed. Cir. 1999).

[119] *See* Cotter & Siebrasse, *Value*, *supra* note 60, at 1191-92.

[120] The leading case in the U.K. is *United Horse-Shoe & Nail Co. v. John Stewart & Co.*, (1888) L.R. 13 App. Cas. 401 (appeal taken from Scot.). For discussion of other cases within the Commonwealth (mostly) following *United Horse-Shoe*, see COTTER, *supra* note 8, at 187-93.

due respect) simply not to grasp the economic logic as I've tried to express it above.[121] As with the U.S. rule on disgorgement of profits for design infringement, however, it's at least worth considering whether the U.K. rule could be justified as a heuristic. Refusing to consider evidence on the existence of noninfringing alternatives certainly simplifies matters and (presumably) reduces the cost of litigation. The obvious drawback is that this cost-reduction potentially comes at a very steep price in terms of accuracy—though I've speculated in other work that perhaps it hasn't mattered too much in practice, given the relatively small number of cases in the U.K. (and other jurisdictions that follow *United Horse-Shoe*) in which an award of lost profits or infringer's profits is actually litigated all the way through to judgment (though one would expect it to have some impact on settlement).[122] It's also possible that in some cases courts have applied other practices that tend to favor defendants and thus cancel out the overcompensatory effect of ignoring alternatives.[123] Be that as it may, I doubt that many sober economists would advocate disregarding noninfringing alternatives solely for the cost-reducing effect of such a rule.

On the other hand, in some lost profits cases U.S. courts have applied presumptions that seem almost as questionable (though perhaps with less potential systemic impact). In *Rite-Hite Corp. v. Kelley Co.*,[124] for example, the court affirmed a lost profits award on lost sales of goods that competed with the defendant's infringing products, based on the assumption that the plaintiff's goods were covered by another valid patent or patents and thus that there were no noninfringing alternatives available to the defendant.[125] Since the majority of patents litigated to judgment are either invalid or not infringed, however, as an empirical matter the opposite presumption might seem more apt—though, on the other hand, all issued patents are *presumed* valid and thus arguably the burden of establishing the invalidity of these other patents should rest (if anywhere) on the defendant.[126]

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[121] For discussion, see, for example, COTTER, *supra* note 8, at 68, 111-12. *See also* Norman V. Siebrasse, *"I Could Have Gone Down Metcalf Street Instead"*, SUFFICIENT DESCRIPTION BLOG, Feb. 1, 2015, *available at* http://www.sufficientdescription.com/2015/02/i-could-have-gone-down-metcalfe-street.html (persuasively arguing that a recent Canadian case adhering to *United Horse-Shoe* "turns on a failure to distinguish between the liability and damages determinations").

[122] According to practitioners, for example, the vast majority of patent cases in the U.K. and Germany are bifurcated, and most damages disputes settle prior to trial on damages—though the pace seems to be picking up in the U.K. *See* Scott, *supra* note 76, at 273.

[123] *See* COTTER, *supra* note 8, at 200-03 (discussing how in *Celanese Int'l Corp. v. BP Chemicals Ltd.*, [1999] R.P.C. 203 (Pat. Ct.) (Eng.), the court ultimately concluded that the infringing process contributed very little to the profit earned on the defendant's products, and awarded only about 0.3% of what the plaintiff initially sought).

[124] Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538 (Fed. Cir. 1995) (en banc).

[125] *See id.* at 1548; *see also id.* at 1573 (Nies, J., dissenting in part) (noting that these patents "were never asserted against Kelley, and the validity of those patents is untested").

[126] The issue is somewhat analogous to that faced by courts in reverse-payment antitrust disputes, where there is a widespread concern over not having to incur the cost of holding a patent validity trial-within-a-trial. *See* FTC v. Actavis, Inc., 133 S. Ct. 2223, 2236-37 (2013).

Second, in *State Industries., Inc. v. Mor-Flo Industries., Inc.*, the court awarded lost profits on a "market share" theory.[127] More specifically, the damages award was premised on the assumption, that, but for the infringement, the defendant would have exited the market and that the plaintiff and other competing firms would have retained their relative market shares vis-à-vis one another.[128] One would expect such a presumption often to be inaccurate. First, if the competitors' products were noninfringing and not covered by other patents or intellectual property rights, the defendant might have been able to retain all or most of its market share by copying those products (thus suggesting that the plaintiff may have been entitled to a lower award). Second, if on the other hand the defendant would have exited the market absent the infringement, the plaintiff and its competitors would have seen their relative shares of the remaining market go up, all other things being equal (suggesting that the plaintiff may have been entitled to a higher award). Third, however, if all other things *weren't* equal, the plaintiff's market share vis-à-vis the competitive fringe might have been either higher or lower than during the period of the infringement.[129] Given the possibly high cost of resolving these indeterminacies, though, perhaps the court was right not to require a more detailed inquiry, particularly since the (possibly defendant-favoring) methodology the court employed was suggested by the plaintiff itself.[130]

Third, the Federal Circuit has held that, in a market characterized by only two suppliers, the trier of fact *may* infer that any sales made by the defendant would have been made by the plaintiff;[131] and in *Integrated Technology Corp. v. Rudolph Technologies, Inc.* it extended this rule by permitting an inference of lost sales notwithstanding evidence that the defendant could have competed by means of a noninfringing alternative.[132] This latter extension, at least, seems hard to justify as long as noninfringing alternatives generally are not excluded for reasons of cost reduction. As discussed above, if there *was* a noninfringing alternative, the plaintiff's actual lost profit may have been zero.

2. Reasonable Royalties

a. The Georgia-Pacific factors

Courts also make extensive use of heuristics in calculating reasonable royalties. In the United States, opinions commonly cite to the *Georgia-Pacific* factors[133] as guides for calculating reasonable royalties. One could conceive of the

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127 State Indus., Inc. v. Mor-Flo Indus., Inc., 883 F.2d 1573 (Fed. Cir. 1989).

128 *See id.* at 1575-76.

129 *See* COTTER, *supra* note 8, at 112-13.

130 *See State Indus.*, 883 F.2d at 1577-78.

131 For cases, see Blair & Cotter, *supra* note 57, at 12 n.47.

132 Integrated Tech. Corp. v. Rudolph Techs., Inc., 734 F.3d 1352 at 1360 (Fed. Cir. 2013). In the interest of full disclosure, I should note that I consulted on Rudolph Technology's petition for certiorari in the cited case.

133 I could list all fifteen factors here, but anyone reading this paper probably already is more familiar with them than he or she would care to admit, so why take up space? Of the fifteen, the most important *Georgia*-Pacific factors, in my view, are factor 2, "the rates paid by the licensee for the

fifteen *Georgia-Pacific* factors in their entirety as a sort of heuristic for tabulating an appropriate royalty—or alternatively, of the first fourteen factors as a heuristic for deciding the overarching issue embodied in factor fifteen, namely the "hypothetical bargain" that a willing licensor and licensee would have struck prior to the date on which the infringement began. Either way, however, an obvious problem with allowing testimony on such a wide range of evidence is that, unless the judge exerts very tight control over the presentation of evidence, a clever expert could manipulate the factors to find support for virtually any damages amount. The risk and range of potential error therefore would appear to be substantial, and the potentially wide-ranging nature of the inquiry seems poorly constructed to control costs. Thus, as a heuristic, the *Georgia-Pacific* factors leave much to be desired—though some recent proposals to collapse the relevant inquiry into a smaller number of economically relevant factors appear to have promise.[134]

b. Comparable licenses

Of the various *Georgia-Pacific* heuristics, one that often is the focal point of disputes is the consideration of "comparable" licenses.[135] Logically, the terms of

use of other patents comparable to the patent in suit"; factors 8 through 10, all of which relate to the value of the patented technology, in terms of its effect on the implementer's profit or cost, in comparison with alternatives; factor 13, "the portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer"; and factor 15, "the amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee—who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license." For readers who nonetheless feel compelled to access the complete list, the case that compiled them and from which the preceding quotes are taken is *Georgia-Pacific Co. v. U.S. Plywood Co*., 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *modified*, 446 F.2d 295 (2d Cir. 1971).

134 *See, e.g.*, FED. CIRCUIT BAR ASS'N, MODEL PATENT JURY INSTRUCTIONS (Jan. 2016) (proposing that courts instruct juries that they "should consider all the facts known and available to the parties at the time the infringement began," but that "[s]ome of the kinds of factors that you may consider in making your determination are: (1) The value that the claimed invention contributes to the accused product. (2) The value that factors other than the claimed invention contribute to [the accused product]. (3) Comparable license agreements, such as those covering the use of the claimed invention or similar technology"); Daralyn J. Durie & Mark A. Lemley, *A Structured Approach to Calculating Reasonable Royalties*, 14 LEWIS & CLARK L. REV. 627 (2010) (arguing that the *Georgia-Pacific* mostly "boil down to three fundamental questions: (1) what is the marginal contribution of the patented invention over the prior art?; (2) how many other inputs were necessary to achieve that contribution, and what is their relative value?; and (3) is there some concrete evidence suggesting that the market has chosen a number different than the product of (1) and (2)?"); *cf.* Kysar et al., *supra* note 4, at 134 (observing that, "in light of . . . process values, we may be forced as a practical matter to keep legal tests that employ cumbersome amalgams of factors, while relying on the heuristics research methodology to 'excavate' the real factors and weights that end up being used by judicial actors within the seemingly unpredictable balancing tests").

135 Somewhat analogous is the use in other countries of what are perceived to be industry norms for licensing rates for various technologies. As I have noted previously, "courts in Germany

other licenses offered by the patent owner for the patent in suit (or by the patent owner or others for closely similar technology) might be helpful for reconstructing the terms of the license to which the owner and the accused infringer would have agreed, but for the infringement, as well as for estimating the objective value of the technology in suit. Nevertheless, there are some obvious limits to comparable licenses as accurate guides to adjudicated royalties. First, although U.S. law would generally require a patent plaintiff to disclose to the other party any relevant licenses it previously has granted, other patent licenses generally are confidential and thus not publicly accessible—which poses risks that the "comparable" licenses on which experts base their opinions may not be representative of the whole.[136] Second, the terms the patentee negotiated with one party may not be similar to the terms it would have negotiated with the infringer, but for the infringement—and thus to the extent that the trier of fact is susceptible to the "representativeness heuristic," it may accord these existing licenses undue weight. Unless the patent owner is subject to an obligation to offer the patent on identical terms to everyone, for example—which is one, but not the only, interpretation of the "nondiscriminatory" portion of the FRAND commitment that encumbers some SEPs—there is no particular reason to expect the patent owner to agree to similar terms with licensees whose expected uses of the technology may be very different.[137] Two recurring settings in which courts recognize this potential for diverging rates are when the proposed comparables are in settlement of litigation, in which case courts often have excluded them,[138] or are licenses offered by patent

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sometimes consult awards made in arbitration decisions involving employee inventor compensation for guidance in determining royalty rates, and courts in Japan sometimes consult standard rates for various technologies as reported by surveys conducted by the Japanese Institute of Inventors and Innovation (*Hatsumei Kyokai*)." Cotter & Golden, *supra* note 52 (manuscript at 23 n.34) (citing COTTER, *supra* note 8, at 269, 311 & n.100, 328). Just how accurate these heuristics are in estimating the bargain the parties themselves would have reached, if that is the intended goal, is not clear to me.

136 *See* Jorge L. Contreras et al., *Study Proposal—Commercial Patent Licensing Data* (Univ. of Utah Coll. of Law, Research Paper No. 164; Minn. Legal Studies, Research Paper No. 16-25, 2016), http://papers.ssrn.com/abstract_id=2755706.

137 *See, e.g.*, Erik Hovenkamp & Jonathan Masur, *Reliable Problems from Unreliable Patent Damages* (unpublished manuscript) (on file with author) (manuscript at 7-14). Moreover, where the patent owner has voluntarily granted only exclusive licenses, logically the appropriate monetary recovery is the exclusive licensees' lost profits. *See* Mark A. Lemley, *Distinguishing Lost Profits from Reasonable Royalties*, 51 WM. & MARY L. REV. 655, 673 & n.82 (2009).

138 *See, e.g.*, Wordtech Sys., Inc. v. Integrated Networks Sols., Inc., 609 F.3d 1308, 1320-21 (Fed. Cir. 2010). One rationale for treating licenses negotiated in settlement of litigation with suspicion is that these licenses will reflect (to some degree) the defendant's willingness to pay in order to avoid not only further litigation costs but also the additional holdup costs that may result from having to switch technologies. *See, e.g.*, William F. Lee & A. Douglas Melamed, *Breaking the Vicious Cycle of Patent Damages*, 101 CORNELL L. REV. 385, 418 (2016). On the other hand, as Jonathan Masur argues, settlement licenses may be more likely to reflect a high probability of validity and infringement, which (for reasons discussed *infra* at notes 144-50 and accompanying text) would tend to make such licenses more accurate as guideposts for estimating a reasonable royalty. *See* Jonathan S. Masur, *The Use and Misuse of Patent Licenses*, 110 NW. U.L. REV. 115, 145-48 (2015). Durie and Lemley have also noted that some settlement licenses could show that the patented technology was worth less than what the patentee is demanding. *See* Durie & Lemley,

pools (which may have to be adjusted, as discussed below).[139] A related problem arises in connection with the use of portfolio licenses as comparables, since portfolio licenses by definition encompass many patents, while the reasonable royalty to be determined in litigation by definition encompasses only the single patent or small number of patents in suit. I return to this problem below in the context of SEPs, though the problem is not limited to that context.

A third potential problem with the use of comparables to determine reasonable royalties is circularity, since comparables themselves presumably are negotiated based on the parties' sense of what the parties expect a court would award if the matter proceeded to litigation.[140] Whether this circularity problem systematically over- or under-rewards patent owners is a matter of some debate, however. On one view, even if jury awards are on average correct, patent owners will be systematically undercompensated because infringers will opt for litigation when patent value is higher than the average award and for licensing when it is lower.[141] By contrast, Erik Hovenkamp has argued that comparables often may be overcompensatory, because patent owners may be reluctant to license for an (accurately low) royalty that later could be used against them in litigation.[142] For what it's worth, there is some evidence that this is what happened with regard to Motorola's license with VTech, as discussed in *Microsoft Corp. v. Motorola, Inc*.[143]

Fourth, according to Jonathan Masur, despite the fact that the hypothetical ex ante bargain presumes (as it should) that the parties bargained in the belief that the patent in suit was valid and infringed,[144] courts generally are "resistant to using a standard multiplier on the ground that it lacks a connection to the case at bar."[145] Given the empirical evidence that U.S. patent owners prevail in somewhere between

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supra note 134, at 642-43. And in one recent case, the Federal Circuit *has* expressed a greater willingness to allow damages awards to be based on settlement agreements, under appropriate circumstances. *See* Prism Techs. LLC v. Sprint Spectrum L.P., 849 F.3d 1360 (Fed. Cir. 2017)

139 *See infra* text accompanying notes 189-91.

140 *See, e.g.*, Lee & Melamed, *supra* note 138, at 418-20; Masur, *supra* note 138, at 121; Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 2021 (2007).

141 *But see supra* note 52 (critiquing this argument).

142 *See* Erik Hovenkamp, *How Reasonable Royalties Suppress Patent Licensing* (May 18, 2015), *available at* http://papers.ssrn.com/abstract_id=2607678; *see also* Lee & Melamed, *supra* note 138, at 418 (stating that "[p]atent holders, knowing that their licenses will influence royalty awards in future litigation, have an incentive to structure their agreements in ways that exaggerate the apparent cost of the licenses to the licensees.").

143 Microsoft Corp. v. Motorola, Inc., Case No. C10-1823JLR, 2013 WL 2111217, at *67 (W.D. Wash. Apr. 25, 2013), *aff'd*, 795 F.3d 1024 (9th Cir. 2015). I thank Norman Siebrasse for calling this specific matter to my attention.

144 *See supra* text accompanying note 59.

145 Masur, *supra* note 138, at 152 (citing Avocent Redmond Corp. v. Rose Elecs., No. C06-1711RSL, 2013 WL 8844098, at *4-5 (W.D. Wash. Mar. 11, 2013)). *But see* St. Lawrence Comm'ns LLC v. ZTE Corp., Case No. 2:15-cv-349-JRG (E.D. Tex. Feb. 21 2017) (permitting an expert to offer an opinion that the royalty rate the plaintiff had negotiated with Samsung for the use of the patents in suit should be increased by 50% to reflect a "settlement discount" and 18% to account for an "invalidity discount").

a quarter and a third of all infringement actions resulting in a final judgment,[146] such resistance might seem misplaced (though understandable in light of recent Federal Circuit case law, discussed below, precluding experts from using certain general assumptions absent evidence of a close fit between those assumptions and the specific facts of the case).[147] Applying a standard (three- or four-time) multiplier to the royalty rate negotiated in a comparable license therefore might appear on average to improve accuracy, whereas *not* permitting any increase in effect amounts to a presumption that the comparable was negotiated with knowledge that the patent was valid and infringed by the other party to the comparable.[148] Notice, however, that whichever way the court decides it is effectively applying a presumption—either that the parties to the comparable negotiated under conditions of uncertainty with regard to validity and infringement, or that they did not—and that either way the presumption is likely to go unrebutted. Under the current approach as described by Masur, the burden would be on the patent owner to offer evidence of the perceived pre-litigation vulnerability of its own patent, while if we presume that the comparable reflects (say) a 75% discount the burden would be on the infringer to show that both parties to the comparable believed the patent very likely was valid and infringed.[149] In either case, the risk of introducing such evidence to the party bearing the burden of production may well outweigh the benefit, and the presumption will go unrebutted. This suggests that, from the standpoint of accuracy alone, a standard increase of three to four times the negotiated rate might be worth considering—unless, pace Hovenkamp, comparables are already likely to be inflated due to strategic bargaining.[150]

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[146] *See* CHRIS BARRY ET AL., PWC 2016 PATENT LITIGATION STUDY: ARE WE AT AN INFLECTION POINT? 14-15 (reporting patent owners' overall success rate from 1995-2016 as "approximately 33%"); John R. Allison et al., *Understanding the Realities of Modern Patent Litigation*, 92 TEX. L. REV. 1769, 1793-94 (2014) (reporting that, for 2008-2009, patentees won 26% of suits overall and 61% of cases that went to trial).

[147] *See infra* notes 153-60 and accompanying text.

[148] On the other hand, as several coauthors and I have cautioned in another recent paper, the use of such a standard multiplier might give rise to a circularity problem, because

> [a] standard multiplier will overcompensate patentees with strong patents. Anticipating this, parties bargaining in the shadow of the expected trial outcome will negotiate a royalty based on the inflated damages value, and that inflated royalty will feed back into future awards, and so on. This would result in effect in a new source of holdup which would allow a patentee with a strong patent to extract more than the value of its invention. The same spiral would happen in the other direction with patents that are weaker than average.

Thomas F. Cotter et al., *Reasonable Royalty Damages for Complex Products* (manuscript at 37-38) (unpublished paper, on file with author).

[149] *See* Masur, *supra* note 138, at 150-51.

[150] *See supra* text accompanying note 142; *see also* Masur, *supra* note 138, at 152-56 (showing how standard multipliers might exacerbate the circularity effect).

c. Profit splits

One class of heuristics that the Federal Circuit has come to disfavor in recent years involves assumptions about how the bargaining parties would have agreed to split the benefits the implementer derived or expected to derive from the use of the patented technology. Most notable was the court's rejection, noted above, of the "Rule of Thumb" permitting experts to base their damages estimates on the premise that patent licensors generally expect to share 25% of the profit derived from the sale of a product embodying the patented invention.[151] As I've discussed before (and as others have explained in much greater depth) this 25% Rule was based on a small, unrepresentative sample of firms. Moreover, by taking as its starting assumption that the parties would agree to split 25% of the profit from sales of the infringing product—*not* 25% of the profits *derived from the use of the patent*—the rule didn't make much economic sense for products embodying more than just a couple of patents.[152]

But the intuition that rational parties might agree *in some fashion* to split the expected or actual benefits from the use isn't crazy. Indeed, it's a central assumption of most economic bargaining models—including the famous Nash Bargaining construct, under which (to simplify a bit) the expert begins with the assumption that bargaining parties generally would agree to a 50-50 split of the profits attributable to the use of the invention at issue. Nevertheless, in *VirnetX, Inc. v. Cisco Systems*, the Federal Circuit disapproved of the use of the Nash Bargaining construct on the ground that using a 50-50 split as the proposed starting point for a damages calculation was "insufficiently tied to the facts of the case."[153] The court had expressed the same misgiving about methodology not being "tied" to the facts in *Uniloc*,[154] but the two cases arguably are quite different. The principal problem with the 25% Rule of Thumb as applied prior to *Uniloc* was that the

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[151] *See* Uniloc USA, Inc. v. Microsoft Corp., 632 F.3d 1292 (Fed. Cir. 2011). Courts in some other parts of the world have continued to use versions of the Rule of Thumb. *See* COTTER, *supra* note 8, at 195, 269 n.185; Thomas F. Cotter, *Nestler and Hellebrand Square Off on Rules of Thumb*, COMP. PAT. REMEDIES BLOG Jan. 12, 2015 4:23AM), http://comparativepatentremedies.blogspot.com/2015/01/nestler-and-hellebrandt-square-off-on.html; Thomas F. Cotter, *French Court Applies 25% Rule of Thumb, Multiplier to Arrive at 3% Royalty*, COMP. PAT. REMEDIES BLOG, (Apr. 23, 2015 9:22AM), http://comparativepatentremedies.blogspot.com/2015/04/french-court-applies-25-rule-of-thumb_23.html. The Federal Circuit's rejection of the 25% Rule is a counterexample to the trend noted in the Introduction of that court's embrace of bright (or brightish) line rules in other contexts—which rules the Supreme Court has proven apt to strike down as being unduly rigid, as in the willfulness and attorneys' fees contexts. *See supra* text accompanying notes 80-81, 98.

[152] *See* COTTER, *supra* note 8, at 137-39 (discussing critiques); Thomas F. Cotter, *Four Principles for Calculating Reasonable Royalties in Patent Infringement Litigation*, 27 SANTA CLARA COMPUTER & HIGH TECH. L.J. 725, 754-57 (2011) (same).

[153] VirnetX, Inc. v. Cisco Systems, 767 F.3d 1308, 1314-34 (Fed. Cir. 2014).

[154] *See Uniloc*, 632 F.3d at 1315 (characterizing the 25% rule as "a fundamentally flawed tool for determining a baseline royalty rate in a hypothetical negotiation" and holding that "[e]vidence relying on the 25 percent rule of thumb is thus inadmissible under *Daubert* and the Federal Rules of Evidence, because it fails to tie a reasonable royalty base to the facts of the case at issue.").

assumption of a 25% split *of the entire profit* had little empirical or theoretical support and predictably would lead to inflated royalties, particularly if juries (subject, as they may be, to anchoring bias) were aware that the entire profit was enormous. Nash Bargaining, by contrast, is a standard methodological tool within game theory—as well as being, at an abstract level at least, consistent with common sense and experience—and would be less susceptible to misuse as long as the relevant profit to be split is the profit attributable to the use of the patented invention, not the entire profit derived from sales of what is often a multipatented device.[155]

Doctrinally, the court's "tying" objection is based on its reading of the Federal Rules of Evidence and governing Supreme Court case law on the admissibility of expert testimony.[156] But the text of Federal Rule of Evidence 702 doesn't necessarily require, in the present context, proof that the parties themselves would have agreed to a 50% split; all it states is that "A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case."[157] Moreover, the three Supreme Court cases on which the current text of the rule is based, which the Federal Circuit cited in *Uniloc*, all involved questionable applications of specialized expertise to determine whether the plaintiffs' injuries were *caused* by the defendants. Because these applications were not closely tied to the facts surrounding the genesis of those specific injuries, the testimony was not "helpful" to the trier of fact.[158]

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[155] The use of a rebuttable presumption that the parties would have agreed to split the profit attributable to the defendant's use of the patented invention (over and above what it would have earned from the next-best available noninfringing alternative) also would seem consistent with experimental evidence suggesting that people in Western societies generally find an even division of benefits to be fair. *See, e.g.*, HENRICH, *supra* note 1, at 358-59 (discussing the ultimatum game); LYNN STOUT, CULTIVATING CONSCIENCE: HOW GOOD LAWS MAKE GOOD PEOPLE 86-88 (2011) (similar).

[156] This is more apparent from *Uniloc* than from *VirnetX*, which merely cites to *Uniloc* for the proposition that the proposed methodology must be sufficiently "tied" to the facts. *See VirnetX*, 767 F.3d at 1333-34. *Uniloc* cites to the Supreme Court case law that is now reflected in FED. R. EVID. 702.

[157] FED. R. EVID. 702.

[158] *See* Daubert v. Merrell Dow Pharm. Inc., 509 U.S. 579, 591 (1993) (citing United States v. Downing, 753 F.2d 1224, 1242 (3d Cir. 1985), for the proposition that it is an "aspect of relevancy . . . whether expert testimony proffered in the case is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute."); Kumho Tire Co. v. Carmichael, 526 U.S. 137, 153-54 (1999); Gen. Elec. Co. v. Joiner, 522 U.S. 136, 142-47 (1997) (affirming exclusion of expert testimony on causation given the "analytical gap between the data and the opinion proffered").

In the present context, by contrast, as we have seen the issue is not whether the plaintiff suffered any injury caused by the defendant's conduct—that much, rightly or wrongly, is presumed—but rather the quantification of that injury; and the premise that the parties would have agreed to quantify that loss by dividing the surplus in some fashion, had the defendant not infringed, seems unremarkable. The only remaining question is whether the expert may assume a 50-50 split as the starting point of her analysis, to be adjusted up or down based on other relevant factors; or whether instead she must substantiate the 50-50 (or other) split with party-specific evidence. But since the parties *didn't* actually negotiate anything—the defendant infringed, after all—any such effort at substantiation may be equally speculative. Indeed, the outcome of cases like *VirnetX* might be to exclude testimony that (on average) not only would be less costly to obtain, but also would be more likely to increase accuracy, than other alternatives such as comparables—the latter often being an unappetizing choice, given their many potential defects as described above.

Put another way, once we accept that dividing the surplus between the parties would be a rational way to calculate a royalty, the question is whether one should start with *no* assumption regarding the split to which the parties would have agreed, or alternatively with a prior assumption that can, in Bayesian fashion, subsequently be altered in light of additional evidence. Under the current rule, the burden is on the proponent to come forward with evidence as to the specific split the parties would have agreed to; but while such evidence may be available in some cases,[159] if it is not a 50-50 split would seem as reasonable an assumption as any. Moreover, as long as a 50-50 split is used only as a starting point, either party would still be able to refute the presumption if it has access to competent counterevidence that the parties would have agreed to a different division. Precluding the use of a 50-50 presumption thus seems, at best, to undervalue the potential benefits of the presumption as a heuristic, and at worst to risk reducing (rather than improving) the odds of accurate calculation.[160]

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[159] *See* Christof Binder & Anke Nestler, *Valuation Of Intangibles And Trademarks—A Rehabilitation Of The Profit-Split Method After* Uniloc, LES NOUVELLES *(May 2016* https://www.lesi.org/les-nouvelles/les-nouvelles-article-of-the-month (arguing that data from purchase accounting, "the process of classifying, valuing and accounting for all of the assets and liabilities that are included in the acquisition of a business," can be useful in inferring typical profit splits in specific industries); Scott, *supra* note 76, at 276 (stating that in the absence of comparable licenses English courts will consider how much profit the defendant actually made, on the assumption "that the parties would have accurately predicted this figure and based their negotiations on determining the split of those available profits," with the actual split "likely to depend upon how profits tend to be split in that industry and the division of work between the licensee and licensor."); *see also supra* note 135 (noting the use of industry norms in Germany and Japan). Further empirical study of typical splits or royalty rates in specific industries would be helpful.

[160] For a related critique of the *Uniloc* court's rejection of the 25% Rule, see 5 DAVID L. FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 43:9, at 885 (2015-16 ed.):

> While the *Uniloc* court's reasoning appears merely to mirror longstanding *Daubert*

d. Royalty bases

Heuristics also play a role when, rather than awarding a lump-sum reasonable royalty, a court awards a "running" royalty consisting of a royalty rate multiplied by a royalty base. Typically, the base is (some portion of) the revenue the infringer earned from sales of products incorporating the patented invention. In a series of recent decisions, the Federal Circuit has held that, as a general matter, the base should *not* be the "entire market value"—that is, 100%, of the revenue earned from sales of infringing products—unless "the patented feature drives the demand for an entire multi-component product."[161] Instead, the expert should begin with the assumption that the correct base is the "smallest salable patent-practicing unit" (SSPPU),[162] and then if necessary make further adjustments to account for the fact that the patent in suit may be only one of several patents or features embodied in that unit.[163] The rationale for the SSPPU rule is twofold: first, as a "substantive legal rule" that "the ultimate combination of royalty base and royalty rate must reflect the value attributable to the infringing features of the product, and no more";[164] and second, as an "evidentiary principle" intended to avoid "skew[ing] the damages horizon for the jury" by "mak[ing] a patentee's proffered damages amount appear modest by comparison."[165] The SSPPU rule therefore functions as a legal heuristic, by imposing a (rebuttable) presumption against the use of the entire market value (EMV) as the base, and also reflects the court's concern over juries' improper use of the anchoring heuristic.

Whether the SSPPU rule actually improves the accuracy of damages calculations is debatable. Multiplication is commutative, after all, so (as the Federal Circuit itself has recognized) one could arrive at the same royalty by multiplying a large base by a minute rate or by multiplying a small base by a correspondingly

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> principles about the fit between expert testimony and the facts of the case, the realities are more complicated. For one thing, the court took a rather extreme position that the expert's use of the 25 percent rule as a *starting point* was illegitimate, even though he might then depart using case-specific facts. Since the royalty calculations are based on a hypothetical negotiation, an expert needs to start somewhere.

For reasons stated in the text above, although I agree with the court's rejection of the 25% Rule, Faigman et al.'s point about needing a starting point rings true, and to my mind suggests that the court's further extension of *Uniloc* to the Nash Bargaining framework goes too far.

161 LaserDynamics, Inc. v. Quanta Comp., Inc., 694 F.3d 51, 67 (Fed. Cir. 2012) (quoting Cornell Univ. v. Hewlett-Packard Co., 609 F. Supp. 2d 279, 283 (N.D.N.Y. 2009)).

162 *Id.*

163 *See* VirnetX, Inc. v. Cisco Sys., Inc., 767 F.3d 1308, 1327-28 (Fed. Cir. 2014).

164 Ericsson, Inc. v. D-Link Sys., Inc., 773 F.3d 1201, 1226 (Fed. Cir. 2014) (citing *VirnetX*, 767 F.3d at 1326). For an argument against placing too strict a burden on the patent owner on the issue of apportionment, however, see Golden, *supra* note 5, at 585 (arguing that the "infringer seems likely to be the best potential source of knowledge about how the value of a patented invention compares to the overall value of the infringer's product or process," and that "to the extent courts demand information on apportionment, they should not place too stringent a burden on the patentee as opposed to the adjudged infringer.").

165 *Ericsson*, 773 F.3d at 1226-27 (quoting *LaserDynamics*, 694 F.3d at 68).

large rate.[166] Moreover, experience suggests that (for convenience or other reasons) parties to real-world licensing transactions often *do* use the EMV as the royalty base.[167] This could pose a quandary if a negotiated license using the EMV happened to be the most directly relevant comparable, since excluding it from consideration might deprive the trier of fact of the best available evidence from which to estimate the royalty due the patent owner. In recognition of this potential problem, the court in *Ericsson, Inc. v. D-Link Systems, Inc.* held that an expert may rely on such licenses as comparables as long as she "explains to the jury the need to discount reliance on a given license to account only for the value attributed to the licensed technology," and that the district court should provide a cautionary instruction upon request.[168] In addition, in the subsequent *CSIRO* decision the court approved an expert's use of the EMV as the royalty base where this mirrored the parties' own (ultimately unsuccessful) licensing negotiations.[169] *CSIRO* also happened to be a bench trial; and while this matter did not explicitly factor in to the court's analysis perhaps there need be fewer concerns over potential misuse of the anchoring heuristic in a case tried to a professional judge, rather than to a lay jury.[170] (For what it's worth, judges often do use the EMV as the royalty base in Japan, Germany, and other countries where juries are never called upon to decide patent cases.[171]) On the other hand, some commentators have questioned whether it makes sense to assume, as the SSPPU rule arguably does, that juries are less likely to heed a cautionary instruction on apportioning royalties than they are in following

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166 *See Ericsson*, 773 F.3d at 1226; Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1333-39 (Fed. Cir. 2009).

167 *See, e.g.*, *Lucent*, 580 F.3d at 1339; Colleen Chien & Eric Shulman, *Patent Semi-comparables*, 25 TEX. INTELL. PROP. L.J. 215, 220 (2018); Thomas F. Cotter, *Patent Holdup, Patent Remedies, and Antitrust Responses*, 34 J. CORP. L. 1151, 1186 n.164 (2009) (citing additional sources).

168 *See Ericsson*, 773 F.3d at 1228.

169 *See* Commonwealth Sci. & Indus. Research Org. v. Cisco Sys., Inc., 809 F.3d 1295, 1301-04 (Fed. Cir. 2015) [hereinafter *CSIRO*].

170 Though perhaps not: according to some studies, judges too sometimes are unconsciously motivated by irrelevant factors. In what is perhaps the most prominent recent example, Danziger et al. reported that in a study of 1,112 judicial rulings by Israeli judges, the likelihood of a favorable parole ruling was "greater at the very beginning of the work day or after a food break than later in the sequence of cases." Shai Danziger et al., *Extraneous Factors in Judicial Decisions*, 108 PROC. NAT'L ACAD. SCI. 6889, 6890 (2011). And there's no obvious reason why one should expect judges, any more than the rest of us, to be immune to overconfidence bias, *see supra* note 32, which in turn may explain why some courts prefer the use of multifactor tests which (in theory, if not in practice) promise greater accuracy than do relatively simple rules. *See also* MERCIER & SPERBER, *supra* note 1, at 271 (stating that "judges, however competent, have a myside bias, using their erudition to defend preconceived opinions rather than arrive at an impartial verdict," whereas jury "deliberation has the potential to compensate for each juror's biases").

171 *See* Schönknecht, *supra* note 76, at 322-24 (discussing German law); Thomas F. Cotter, *A Study of Reasonable Royalty Awards in Japan*, COMP. PAT. REMEDIES BLOG (Mar. 23, 2016 4:26AM), http://comparativepatentremedies.blogspot.com/2015/03/a-study-of-reasonable-royalty-awards-in.html (discussing Second Subcommittee of the Second Patent Committee, *Predictability of Monetary Damages under Article 102(3) of the Japanese Patent Law*, 64 INTELL. PROP. MGT. 219 (2014)).

instructions regarding other complex matters which, for better or worse, our legal system entrusts them to adjudicate.[172]

Be that as it may, the IEEE last year adopted a policy requiring members to use the SSPPU as the base for FRAND royalties.[173] Although the next section of this paper discusses FRAND royalties in more depth, I note the matter here because adoption of this new policy has provoked considerable academic discussion of the question whether, even aside from possible anchoring concerns, the SSPPU rule is likely to increase or decrease the accuracy of royalty and damages calculations. Resolution of the issue depends in part on how one defines "accuracy." As many observers (including me) have observed, a patent's value to the user increases when that patent is integrated with other complementary technologies;[174] and if one believes (as I do,[175] though there are many who would disagree) that the owner should capture some portion of this increased value, then use of the SSPPU can be problematic. To illustrate, in a recent article Nicolas Petit discusses a hypothetical aircraft manufacturer that replaces most of its aircraft's electrical wiring with wireless technology, which is compliant with the Wireless Avionics IntraCommunications (WAIC) standard and which uses a portfolio of patents owned by a single patent owner. In his example, although the SSPPU consists of "Radio Frequency ('RF') equipment, ie antennas, transmitters, and receivers" costing about $1,000, the cost savings attributable to the replacement amounts to $3.02 million per aircraft.[176] Using the SSPPU as the base, however, the royalty rate the patent owner would demand to capture even half of the projected cost savings from the use of its patents would be 1510%, which seems unrealistic.[177] If

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[172] *See* J. Gregory Sidak, *The Proper Royalty Base for Patent Damages*, 10 J. COMP. L. & ECON. 989, 1022-24 (2014) (arguing that because "individuals are typically averse to extreme results," it is "equally plausible that juries would adopt a cautious approach when awarding damages for patent infringement and thus undercompensate the patent holder.").

[173] *See* Institute of Electric and Electronics Engineers Standards Association (IEEE-SA) Standards Board Bylaws 6.1 [hereinafter IEEE Bylaws], *available at* http://standards.ieee.org/develop/policies/bylaws/sb_bylaws.pdf (stating that the determination of a "reasonable rate" "should include, but need not be limited to, the consideration of: The value that the functionality of the claimed invention or inventive feature within the Essential Patent Claim contributes to the value of the relevant functionality of the smallest saleable Compliant Implementation that practices the Essential Patent Claim[;] The value that the Essential Patent Claim contributes to the smallest saleable Compliant Implementation that practices that claim, in light of the value contributed by all Essential Patent Claims for the same IEEE Standard practiced in that Compliant Implementation . . . .").

[174] *See, e.g.*, Siebrasse & Cotter, *Value*, *supra* note 60.

[175] *See id.*

[176] *See* Nicolas Petit, *The Smallest Salable Patent-Practicing Unit ("SSPPU") Experiment, General Purpose Technologies and the Coase Theorem*, SSRN at 3 (Feb. 18, 2016), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2734245. *See also* Anne Layne-Farrar, *The Patent Damages Gap: An Economist's Review of U.S. Patent Damages Apportionment Rules*, http://papers.ssrn.com/abstract_id=2911289 (Apr. 8, 2017) (arguing that courts should focus on the value of the use to the defendant, rather than on the location of the technology within a particular component).

[177] Petit proposes a rate of 3020%, *id.* at 4, but this assumes (unrealistically, in my view) that the patent owner would extract the entire surplus.

the base was instead the cost of an aircraft ($414.4 million in Petit's hypothetical), the royalty would be only 0.36%, but this would run afoul of the SSPPU. Of course, in the real world it's unlikely that one single patent owner would own all of the relevant patents reading on a standard, so perhaps one could employ the SSPPU rule and still come up with a per-patent royalty that would not exceed the value of the SSPPU itself—though in Petit's example, there would have to be 30,200 patents for the per-patent rate to amount to only 5% of the value of the SSPPU. Based on this analysis, Petit argues that SSPPU "is likely to reduce investment in socially beneficial activities, including" general purpose "enabling" technologies that "yield countless positive production externalities."[178] Again, though, if one starts from the premise that innovation policy requires that the patent owner *not* benefit from the increased value to the user resulting from complementarity, the SSPPU corrects for what otherwise might be a serious risk of overcompensation.[179]

On the other hand, and in addition to the above considerations, Richard Stern has argued that use of a larger base necessarily entails a greater risk of error for yet another reason rooted in people's cognitive limitations:

> [C]onsider a $1 chip in a $500 smartphone. Suppose the invention contributes 10% of the value of the chip and that the reasonable royalty is half of that or 5 cents, ie., 5% of the $1 chip price. In principle, the reasonable royalty based on the smartphone price would be the same 5 cents or 0.02% of $500. But how is a jury or judge to determine the difference between a royalty of 0.02% and 0.01% or even 0.1%? Yet the cash value of the error is multiplied greatly by starting out with an inflated royalty base. Choosing between infinitesimals is an inherently error-prone exercise.[180]

Actually, if the royalty in Stern's example is supposed to come to $0.05 per chip or per phone, the per-phone royalty would be 0.01%, not 0.02%, though this doesn't affect Stern's broader point: perhaps the trier of fact is more likely to confuse 0.01% with 0.02% than to confuse 5% with 10%, so that errors will be more common when the EMV is used as the base. Worse yet, the errors may be more likely to favor patent owners (than to cancel out), if as the Federal Circuit assumes revealing the EMV to the jury will "skew" its "damages horizon" upwards rather than down.

On balance, though, although the cognitive biases that advocates of the SSPPU invoke may be well-documented in many settings, whether they are likely to affect the calculation of damages within the formal setting of a trial remains a hypothesis, not a proven fact.[181] Moreover, the fact that many real-world transactions employ

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[178] *Id.* at 5, 8.

[179] Petit argues, however, that even aside from points discussed above the SSPPU may raise transaction costs for a variety of reasons, *see id.* at 5-7, an observation that would appear to explain why in the real world parties often use the end value of the product as the base.

[180] Richard H. Stern, *What Are Reasonable and Non-Discriminatory Terms for Licensing a Standard-Essential Patent?*, 37 EUR. INTELL. PROP. REV. 549, 554 n.26 (2015).

[181] So here's an example where a lab experiment, *see supra* note 17, might be quite helpful. *Cf.* John Campbell et al., *Countering the Plaintiff's Anchor: Jury Simulations to Evaluate Damages Arguments*, 101 IOWA L. REV. 543 (2016) (citing studies concluding that, in personal injury cases, juries *are* influenced by the damages figure proposed by plaintiffs' counsel, independent of the evidence presented, and discussing experiments designed to test the effect of defense responses).

the EMV as a base would incline me to permit its use in litigation as well until there is stronger evidence tying the general cognitive biases identified above to the specific context of damages calculations at trial. That said, if one believes that patent owners are not entitled to recover any portion of the value attributable to complementarity, abandoning the SSPPU would pose a serious risk of overcompensation. Ultimately, then, the resolution of this particular issue may depend more on one's view of what value the patent owner should be able to recover, than on the various ways in which cognitive heuristics may affect damages calculation.

3. FRAND Royalties

A final setting in which courts have begun to consider various heuristics involves the calculation of FRAND royalties. As noted above, in recent years courts in the U.S. and elsewhere have sometimes had to determine whether a particular licensing offer or counteroffer was on FRAND terms, and what the actual amount of FRAND royalty would be;[182] and as one might imagine, these questions can be quite difficult to answer. At a theoretical level, courts and commentators have expressed differing views on such matters as whether a FRAND royalty should be equal to or lower than the reasonable royalty that would be due for the infringement of the same patent absent the FRAND commitment; whether, as alluded to above,[183] the owner should derive any portion of the value attributable to complementarity or network effects; and (relatedly) whether the ideal royalty should reflect the value of the patent ex ante in light of both unpatented and patented alternatives. Further, even if one could put these areas of contention aside, the fact that many complex products embody hundreds or thousands of patented features means that any patent infringement case (not just FRAND cases) in which the trier of fact is called upon to calculate the damages owed for the infringement of just one or a small number of these patents will encounter many complicated practical questions, among them how to apportion value among what may be hundreds or thousands of patents, and how to estimate value if there are no comparable licenses covering only the patents in suit—a common problem, given that many SEPs are licensed as part of a broader, often global, portfolio. The question therefore arises whether there are any possible heuristics that courts could employ to resolve these issues well enough at acceptable cost, or at least to shift the burden to the party who is better able to produce the evidence needed for a more finely-tuned calculation.

One possibility—clearly the least costly to implement—would be to apply the principle sometimes referred to as "numeric proportionality," and assume that each of the SEPs relevant to a given standard is entitled to precisely the same royalty.

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[182] For a discussion of the case law to date, see Norman V. Siebrasse & Thomas F. Cotter, *Judicially Determined FRAND Royalties*, *in* 1 THE CAMBRIDGE HANDBOOK OF TECHNICAL STANDARDIZATION LAW (Jorge L. Contreras ed., forthcoming 2017).

[183] *See supra* text accompanying notes 174-75.

Some commentators have endorsed this approach[184]—and indeed there may be cases where attempting to estimate the value of individual patents simply would be too onerous[185]—but there also are some potential problems. The first is that, paradoxical though it may sound at first blush, some essential patents are more essential than others.[186] To say that a patent is "essential" means only that is essential to the practice of a standard adopted by an SSO; but not every essential patent is essential, in the everyday sense, to the users of those devices. In *Microsoft Corp. v. Motorola, Inc.*, for example, fourteen of Motorola's sixteen patents essential to the H.264 standard related to "interlaced video"—one of many features that H.264 requires as standard-essential but which, as a practical matter, is rarely used by consumers of devices such as Microsoft's Xbox.[187] (Put another way, firms would still find considerable value in marketing products compliant with an H.264 standard that omitted the interlaced video capability.) The district court appropriately took this relative lack of importance into account when comparing Motorola's H.264 patents with the patents included in the MPEG LA H.264 pool.[188] Thus, although one could accord all such patents an equal royalty—a practice that some, though not all, patent pools, have adopted as a matter of convenience—the principle of numeric proportionality conflicts with the intuition that, as a matter of innovation policy, the patents from which users derive more value should command a higher royalty. Second, although numeric proportionality conserves on adjudication costs somewhat, before awarding a royalty to a particular patent the trier of fact would still need to determine an appropriate royalty base, what portion of that base should be payable as aggregate patent royalties, and how many other valid SEPs read on that base. I return to these issues below.

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[184] *See* Philippe Chappatte, *FRAND Commitments: The Case for Antitrust Intervention*, 5 EURO. COMP. J. 319, 341 (2009) (stating that, while numeric proportionality "is a crude method, it is the only practical method for assessing relative contribution when a large number of patents need to be evaluated," though "[a]ppropriate adjustments should . . . be made to reflect, for example, that a number of the patents in the portfolio may be about to expire or be limited in certain territories.") ; Jorge L. Contreras, *Fixing FRAND: A Pseudo-Pool Approach to Standards-Based Patent Licensing*, 79 ANTITRUST L.J. 47, 82 (2013) (stating that "numeric proportionality, while perhaps less precise than might be achieved using a more finely-tuned valuation method, is intended to provide 'rough justice' in an efficient and administrable manner.").

[185] *See* Unwired Planet Int'l Ltd. v. Huawei Techs. Co., [2017] EWHC 711, ¶ 182 (Pat. Ct.) (Eng.) ("There was ample evidence before me that . . . parties negotiating SEP licences in fact use methods which are based on patent counting. That is evidence which supports a finding that a FRAND approach to assessing a royalty rate is to engage in some kind of patent counting. Indeed when one thinks about it some sort of patent counting is the only practical approach at least for a portfolio of any size. Trying to evaluate the importance of individual inventions becomes disproportionate very quickly.").

[186] *Cf.* GEORGE ORWELL, ANIMAL FARM 192 (2009) [1944] ("All animals are equal but some animals are more equal than others.").

[187] *See* Microsoft Corp. v. Motorola, Inc., Case No. C10-1823JLR, 2013 WL 2111217, at *39-49 (W.D. Wash. Apr. 25, 2013), *aff'd*, 795 F.3d 1024 (9th Cir. 2015).

[188] *See id.* at *85-86. In setting the rate of the 802.11 patents, the court similarly concluded that the Motorola SEPs that Microsoft used "provide[d] very minimal technical contribution to the identified portions of the 802.11 standard." *Id.* at *92.

A second possibility would be to borrow yet another page from Judge Robart's analysis in *Microsoft v. Motorola* and to use a pool rate—if there happens to be one for the standard on which the SEP in question reads—as the starting point for calculating a FRAND rate for the SEP in suit (which the owner chose not to include in the pool).[189] In *Microsoft* itself, Judge Robart inferred that Motorola's decision not to include its patents in the MPEG LA H.264 pool meant that it expected to derive more benefits from remaining outside, and he adjusted the royalty accordingly.[190] Nevertheless, given the difficulty of estimating the value to the owner of remaining outside the pool—a function of the benefits derived from having access to the pooled patents at a low rate in comparison with the cost of losing control over the licensing of one's own pooled patents—there is some risk that whatever adjustment is made will be, to some degree, arbitrary.[191] Aside from pool rates, there may be other sources from which courts can find reasonable comparables in other cases. In the recent decision of the English Patent Court in *Unwired Planet Int'l Ltd. v. Huawei Techs. Co.*, for example, the court was able to use as comparables licenses that Ericsson had previously granted to Huawei and others that included the very same patents that were in suit. (Huawei's license had expired, however, and Ericsson had assigned the relevant patents to Unwired Planet.)[192]

Yet another approach would be to apply some version of Judge Holderman's methodology in *In re Innovatio IP Ventures, LLC Patent Litigation*.[193] In *Innovatio* the court concluded that the patents in suit were (unlike the 802.11 patents at issue in *Microsoft*) "of moderate to moderate-high importance to the 802.11 standard," and thus that the Via 802.11 pool, which did not include any high-value patents, was not an appropriate comparator.[194] Finding none of the other licenses proffered by the parties to be comparable either, the court ultimately opted for the defendants' proposed "top-down" approach. As a first step, the court determined that the applicable royalty base would be a WiFi chip, which it determined was the SSPPU.[195] Second, the court calculated the average sales price of a chip ($14.85)

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189 *See id.* at *83-87.

190 *See id.* at *85 n.23.

191 For a (somewhat) critical discussion of Judge Robart's methodology, see Thomas F. Cotter, *The Comparative Law and Economics of Standard-Essential Patents and FRAND Royalties*, 22 TEX. INTELL. PROP. L.J. 311, 361-62 (2014); Siebrasse & Cotter, *Value*, *supra* note 60, at 1172-76.

192 *See Unwired Planet*, [2017] EWHC 711, ¶¶ 71, 180, 462; Siebrasse & Cotter, *supra* note 182, (manuscript at 22) ("The Ericsson licenses were particularly apt comparators because Unwired Planet had acquired all the patents in issue from Ericsson and the Ericsson licenses at one time included all the SEPs in issue: *Unwired Planet* ¶ 180. The agreement between Unwired Planet and Ericsson was a 'privateering' arrangement, in which Ericsson is entitled to a share of the revenue from UWP's licensing efforts (*Unwired Planet* ¶ 64-66), and so the approach adopted by Birss J is prima facie applicable to other privateering arrangements as well.").

193 *In re* Innovatio IP Ventures, LLC Patent Litigation, No. 11 C 9308, 2013 WL 5593609 (N.D. Ill. Oct. 3, 2013).

194 *Id.* at *36.

195 *See id.* at *12-18.

over what the court viewed as the relevant time period, 1997-2013.[196] Third, the court multiplied that price by the estimated average profit margin for WiFi chips over that period, 12.1%, which resulted in a reduction of the base to $1.80.[197] Fourth, the court multiplied the base by 84%, the value believed "attributable to the top 10% of 802.11 standard-essential patents, to obtain $1.51."[198] Finally, the court multiplied $1.51 by 19/300, based on its estimate that there are approximately 3,000 patents essential to the 802.11 standard, so that 300 fall within the "top 10%," and that Innovatio's 19 SEPs were among these patents.[199] My own view is that Judge Holderman's approach has merit, if viewed as a heuristic for according value to the patents in suit in accordance with some rough idea of their relative importance to the standard. Nevertheless, as Siebrasse and I argue elsewhere, the court's assumption that all of the royalties due for the 802.11 SEPs should be payable from the profits earned on sales of WiFi chips is problematic. Ideally, one would use the portion of the sales price that typically covers royalty payments, because the profit margin might stay the same depending on whether the implementer could charge a higher price to cover its costs.[200]

More generally, to apply either numeric proportionality or some version of the top-down approach would appear to require the court to employ some sort of starting assumption on some or all of the matters discussed below:

The portion of the base that typically is (or should be) payable as royalties. As noted above, Judge Holderman's assumption that the aggregate royalties due for the use of all of the SEPs reading on the 802.11 standard would be payable from the profits earned on the sales of WiFi chips is not very persuasive. Nevertheless, the intuition that a top-down approach requires some starting assumption of what the total royalty pool should be seems correct—and one benefit of such an approach (e.g., presuming that only x% of the revenue making up the base shall be payable as royalties) is that it would tend to reduce the risk of royalty stacking.[201] But the

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196 *See id.* at *41.

197 *See id.*

198 *See id.* at *43. The 84% figure comes from a 1998 article by Mark Schankerman, *How Valuable Is Patent Protection? Estimates by Technology Field*, 29 RAND J. ECON. 77, which concluded that "the top 10% of all electronics patents account for 84% of the value in all electronics patents." *Id.* I return to the use of the Schankerman study *infra* at notes 216-18 and accompanying text.

199 *See In re* Innovatio IP Ventures, LLC Patent Litig., No. 11 C 9308, 2013 WL 5593609, at *38, *43 (N.D. Ill. Oct. 3. 2013). The court noted, however, that "many of those 3000 patents are likely less valuable to the standard than Innovatio's patents because their essentiality has not been judicially confirmed." *Id.* at *37, *43.

200 *See* Siebrasse & Cotter, *Value*, *supra* note 60, at 1225-26, 1226 nn. 165-166 (arguing in addition that the court should have used the lower chip prices that have been experienced in recent years in calculating the base, because the use of such ex post information would better align the royalty with the technology's actual value). In *Unwired Planet*, Mr. Justice Birss used a top-down approach (as a "check" on the rate he derived from the use of comparables) with the estimated total royalty burden serving as the base. *See Unwired Planet*, [2017] EWHC 711, ¶¶ 178, 476-77, 806(9).

201 Siebrasse and I have described royalty stacking as occurring when "a seller incurs an excessive royalty burden as a result of marketing a product incorporating multiple, separately-owned

question remains where to find reliable evidence of what the appropriate "royalty cap" should be. According to one empirical study that was posted on SSRN in 2014, about 25% of the cost of producing an entire smartphone goes to patent royalties.[202] The study nevertheless has its critics[203] and (to my knowledge) has not been peer-reviewed. Alternatively, in the Japanese *Samsung v. Apple* case the court calculated a FRAND royalty on the assumption of a 5% royalty cap, based on the fact that other major SEP owners as well as a patent pool for the standard in question had agreed to such a cap.[204] As Siebrasse and I have noted elsewhere, however, the evidence presented to the court appears to have shown that the SEP owners agreed to a cap of *5% of the product price*, while the court applied this 5% to what it called the "contribution ratio," that is, the value it believed the patented technology added to the standard.[205] Because the published judgment redacted the amount of the contribution ratio, it is impossible to know what the actual effective cap was, but it would stand to reason that it surely was much less than 5% of the product price (and thus could have resulted in a seriously undercompensatory award). Third, the German Judges Thomas Kühnen and Christine Maimann are reported to have proposed at a January 2015 conference an "overall cap on cumulative royalties payable by an implementer" of "about 25–30 per cent of the

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patents," and have noted that stacking "can be viewed as a manifestation of the 'Cournot complements' problem, which arises 'when separate owners of complementary inputs each demand what is (for them) the individually profit-maximizing price, in exchange for permission to include those inputs in an end product,' with the result that 'the cost of producing the end product' will be 'higher than the social optimum.'" Siebrasse & Cotter, *Value*, *supra* note 60, at 1161 & n.5 (quoting Thomas F. Cotter, *Patent Holdup, Patent Remedies, and Antitrust Responses*, 34 J. CORP. L. 1151, 1169 (2009)). In yet another paper, we question whether the desire to avoid royalty stacking, however legitimate it may be, can be turned into an operable principle of law, and suggest that perhaps all an anti-royalty stacking principle "can amount to, as a practical matter, is something in the nature of a sanity check—as in *Microsoft*, where Judge Robart concluded that the rate Motorola was seeking for certain patents was excessive in part because (1) if every patent owner sought royalties similar to those Motorola was seeking, the price of the end product would be untenable, and (2) those particular patents constituted only minor contributions to the standard." Siebrasse & Cotter, *supra* note 182 (manuscript at 6) (citing Microsoft Corp. v. Motorola, Inc., No. C10-1823JLR, 2013 WL 2111217, at *73 (W.D. Wash. Apr. 25, 2013). Alternatively, Stern has argued there should be "at least . . . a rebuttable presumption that royalty stacking occurs at some SEP level, say 50 or 100 SEPS . . . . That would shift the burden to the patent holder to produce evidence of no stacking," Stern, *supra* note 180, at 552, but it's not clear to me exactly what the presumption's impact on damages would be.

202 *See* Ann Armstrong et al., *Surveying Royalty Demands for the Components within the Modern Smartphone* (May 29, 2014), at 14, *available at* http://ssrn.com/abstract=2443848.

203 *See* Jorge Contreras, *Patents, Technical Standards, and Standards-Setting Organizations: A Survey of the Empirical, Legal and Economics Literature*, *in* RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW, (forthcoming 2017) (manuscript at 18 & n.10) (*available at* https://papers.ssrn.com/abstract_id=2900540) (referencing the literature).

204 Intellectual Property High Court May 16, 2014, 2013 (Ne) 11043 (Japan), at 63-64 of English translation available at http://www.ip.courts.go.jp/eng/vcms_lf/25ne10043full.pdf. *See also Unwired Planet*, [2017] EWHC 711, ¶¶ 178, 476-79 (concluding, based on evidence presented, that the total royalty burden for 4G/LTE standard compliant multimode handsets was 8.8%).

205 *See id.* at 63.

net selling price of the highest-priced standard-compliant product,"[206] but the brief discussion of their proposal cited in the note below does not clarify how they derived this figure. Thus, while these three sources may be useful, more work needs to be done to establish a firm basis for a presumptive royalty cap.

The number of valid and essential SEPs reading on the base. To determine how much of the aggregate royalty should be attributable to the average patent requires some basis for inferring the number of such patents reading on the SEP. In some instances, there may be credible independent estimates of the number of SEPs reading on a particular standard. In the *Innovatio* case, for example, Judge Holderman relied on, among other things, a report prepared by the PA Consulting Group as evidence that there were approximately 3,000 patents *potentially* essential to the 802.11 standard.[207] More specifically, the PA report, which was developed independently of the litigation and "based on a search of all patents for keywords related to the 802.11 standard and a technical analysis of a portion of the search results" concluded that "there are 3106 patents potentially essential to the 802.11 standard."[208] Judge Holderman also noted that that the plaintiff's expert "testified that there are 'at least hundreds' of 802.11 standard-essential patents, and . . . did not disagree with an assertion that there are 'a couple of thousand patents' covering the 802.11 standard."[209] In addition, he cited Judge Robart's finding in *Microsoft v. Motorola* "that 92 entities have submitted letters of assurance to the IEEE indicating that they would license their over 350 patents at a RAND rate, and at least another 59 companies have filed blanket letters of assurance covering an undisclosed number of patents," and concluded that if the plaintiff had "an average size patent portfolio, and . . . each of the 59 companies submitting blanket letters of assurance has twenty-three patents like Innovatio, there would be approximately 1700 standard-essential patents," a number "consistent with Judge Robart's acceptance of Dr. Lynde's testimony in that case that there are possibly 'thousands' of patents essential to the 802.11 standard."[210] Finally, he noted that defense expert "Dr. Lynde relied on another report by Sunlight Research and concluded that there are

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[206] *See* Nadine Herrmann & Catherine Manley, *Germany: IP and Antitrust*, GCR EURO. ANTITRUST REV. 2016, *available at* http://globalcompetitionreview.com/reviews/72/sections/249/chapters/2922/germany-ip-antitrust/ (reporting on the judges' presentation); *see also* TORSTEN KÖRBER, STANDARDESSENTIELLE PATENTE, FRAND-VERPFLICHTUNGEN UND KARTELLRECHT/STANDARD ESSENTIAL PATENTS, FRAND COMMITMENTS AND COMPETITION LAW 228-51 (2013) (proposing that, for purposes of determining whether a party has made a FRAND offer, courts should consider, *inter alia*, aggregate royalty caps as proposed in "legal and economic scholarly writing," and perhaps should apply a rebuttable presumption of numeric proportionality under which all SEPs are entitled to an equal royalty).

[207] *See In re* Innovatio IP Ventures, LLC Patent Litig., No. 11 C 9308, 2013 WL 5593609, at *41 (N.D. Ill. Oct. 3, 2013).

[208] *Id.*

[209] *Id.*

[210] *Id.*

3,266 patents aside from Innovatio's patents that are potentially essential to the 802.11 standard."[211]

Judge Holderman also observed, however, that not all of the 3,000 or so patents estimated to read on the 802.11 standard were likely to be valid, essential in fact, and infringed.[212] Rather than trying to estimate how many patents fit into this category, however, he stated only that he would be "cognizant of the fact that many of those 3000 patents are likely less valuable to the standard than Innovatio's patents because their essentiality has not been judicially confirmed,"[213] which is the next point I address below. In addition, there is some independent evidence indicating that a large portion of declared SEPs are not, in fact, essential, though the most recent formal study of which I am aware is now a few years old.[214] As with the proposals on a royalty cap, more work needs to be done to firm up the number of valid, infringed, and essential SEPs that read on the standards that are showing up in litigation.[215]

The percentage of these SEPs that are of (roughly) equal importance to the patents in suit, and the percentage of standard value represented by this class of patents. As noted, Judge Holderman relied on a study published by Mark Schankerman finding that "the top 10% of all electronics patents account for 84% of the value in all electronics patents."[216] This particular finding from the Schankerman study, however, is based on the renewal rate for patents filed in 1970 in the U.S., France, Germany, Japan, and the U.K.,[217] which raises the question whether the "fit" between the finding and the facts specific to a contemporary patent

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211 *Id.*

212 *See id.* at 43 ("in the Microsoft case, Judge Robart explained that at least one of Motorola's alleged standard-essential patents was found not to be standard-essential by the Via Patent Licensing pool . . . . It is likely that many other allegedly standard-essential patents would be found not essential after undergoing a judicial analysis such as the one this court conducted during the July 2013 essentiality hearing to determine that all of the claims in Innovatio's twenty-three patents are standard-essential. Innovatio's confirmed standard-essential patents are by virtue of that confirmation more valuable to the 802.11 standard than many of the potentially essential patents, at least some of which will be found to be not essential.").

213 *See Innovatio*, 2013 WL 5593609, at *43.

214 *See* FAIRFIELD RESOURCES INTERNATIONAL, INC., REVIEW OF PATENTS DECLARED AS ESSENTIAL TO LTE AND SAE (4G WIRELESS STANDARDS) THROUGH JUNE 30, 2009 (Jan. 6, 2010), *available at* http://www.frlicense.com/LTE%20Final% 20Report.pdf; FAIRFIELD RESOURCES INTERNATIONAL, INC., REVIEW OF PATENTS DECLARED AS ESSENTIAL TO WCDMA THROUGH DECEMBER, 2008 (Jan. 6, 2009), *available at* http://www.frlicense.com/wcdma1.pdf (in studies conducted by Robert A. Myers and David J. Goodman and funded by Nokia, reporting that half or fewer of the patents declared essential to various standards were essential as judged by the authors' panel of experts).

215 *See also Unwired Planet*, [2017] EWHC 711, ¶¶ 200, 205, 377-79 (estimating that Unwired Planet owned 6 of 800 patent "families" reading on the 4G standard); Siebrasse & Cotter, *supra* note 182, (manuscript at 23).

216 *Innovatio*, 2013 WL 5593609, at *43 (stating that "Dr. Leonard adjusted the value attributable to Innovatio's patents in each of those cases by relying on a 1998 article finding that the top 10% of all electronics patents account for 84% of the value in all electronics patents. (See DTX–192, Mark Schankerman, How Valuable is Patent Protection? Estimates By Technology Field, 29 RAND J. Econ. 77, 94 tbl.5 & n.12 (1998).)").

217 *See* Schankerman, *supra* note 198, at 78.

case would satisfy the Federal Circuit's current understanding of the Federal Rules of Evidence.[218] Nevertheless, the core finding that patent value is highly skewed—with most of the high-value patents inhabiting the long tail of a log-normal distribution—is one that has been replicated in other studies involving other time periods, though the precise quantifications may vary.[219] Once again, further research might help to provide a firmer basis for a presumption.

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In summary, one might reasonably question whether the conclusions from the studies referenced above are extendable to cases arising at different time periods or involving different standards. And surely it would be a mistake simply to use *any* study that comes to hand as a starting point for calculating FRAND royalties. Indeed, to do so would be giving in too easily to the availability and representativeness heuristics (though as Landes and Posner have noted in a different context from within IP law, even the availability heuristic is not necessarily irrational).[220] As long as the basic finding at issue—that a large plurality of SEPs are not essential, that the aggregate royalty burden is unlikely to exceed a quarter or a third, that the number of SEPs reading on a given standard is in the thousands, or that only a small percentage of patents contribute most of the value—is in general defensible, perhaps the better practice even now would be to permit expert testimony premised on these assumptions holding true in the case at bar, while permitting the opposing side to rebut the premise with whatever counterevidence it can muster. As with Nash Bargaining, to forbid the testimony altogether means, again, that the court's only recourse may be to "comparable" licenses which themselves may be highly flawed indicators of the value of the specific patent in suit. Moreover, as I suggested above, in choosing among heuristics the goal should be to choose the one with the lower aggregate sum of administrative and error costs. Although these costs themselves are not quantifiable, if there is reason to believe that the assumptions underlying a top-down approach are at least in the ballpark, ruling out their use altogether on evidentiary grounds may be short-sighted.

V. Conclusion

The slogan "The perfect is the enemy of the good" may be a cliché, but it sums up the case for judicious (and judicial) use of heuristics pretty well. As this paper has shown, courts both employ heuristics, and respond to perceived heuristic biases on the part of factfinders, in a variety of situations relating to patent damages

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[218] I thank Rudi Bekkers for pointing this out to me in conversation.

[219] A recent study by Jonathan Putnam, for example, aggregates several other studies of patent value based on renewal rates and similarly reports a highly skewed value (though only 64%, not 84%, for the top 10% of patents), but the study is unpublished. *See* Jonathan D. Putnam, *Value Shares of Technologically Complex Products* (Apr. 16, 2014), *available at* www.competitiondynamics.com/wp-content/uploads/Value-Shares-20140416.pdf.

[220] *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 161 & n.31 (2005) (noting that "the availability heuristic is not necessarily irrational").

awards. Nevertheless, my perception is that courts often do not recognize their own vulnerability to heuristic biases—the fixation on supposedly comparable licenses could be seen as an example of representativeness bias, for example—or, more generally, that the choice facing them is often between or among competing heuristics. Ideally, that choice should involve a comparison of the aggregate sums of the administrative and accuracy costs of each alternative; and while a precise comparison of these sums surely lies beyond anyone's capability, I have argued that at least in some circumstances courts can reach a reasoned conclusion concerning which sum is likely to be smaller. Less rigorous proof may be warranted, for example, when the stakes of the dispute are low and the defendant is at fault; and courts arguably should be more open to experts' use of starting points such as the Nash Bargaining framework, aggregate royalty caps, and other related assumptions to avoid overreliance on suspect comparables. (In a sense, the approach I am advocating here is similar in spirit to that articulated by the German courts, and perhaps required of U.S. courts as well under § 284 of the Patent Act, of making a rough estimate of damages once the parties have met some minimal evidentiary threshold, even when that evidence falls short of the ideal.)[221] At the same time, courts should be vigilant in rejecting the allure of simple but illogical (or only weakly supported) rules like the U.K. rule relating to noninfringing alternatives or the late but (largely) unlamented U.S. version of the 25% Rule of Thumb.

Treading this line is, to be sure, a tall order, though as we have seen in the FRAND context in particular some courts appear to be moving in this direction. And there are analogies in other bodies of law as well. Perhaps the most obvious counterpart is antitrust law, where the initial questions presented often are whether the conduct at issue is so clearly anticompetitive that it may be conclusively presumed (per se) illegal, or whether its possible procompetitive benefits are such that a more nuanced rule of reason inquiry is appropriate; and if the latter, what evidence suffices to shift the burden of further evidentiary production from one party to the other and in what sequence. As the Supreme Court has intoned on more than one occasion, in such settings "the quality of the proof required should vary with the circumstances."[222] Courts would be well-advised to follow this maxim in the context of patent damages as well.

More controversial, perhaps, is the idea that courts should learn from experience by adopting presumptions or starting points based on the existing empirical evidence (assuming it meets some minimal standard of adequacy); encouraging the parties and others to develop better evidence over time; and when necessary adjusting these initial presumptions or starting points in the light of newly

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[221] *See supra* text accompanying notes 73-77.

[222] *See* FTC v. Actavis, Inc. 133 S. Ct. 2223, 2238 (2013) (quotations omitted). *See also* Tyson Foods, Inc. v. Bouaphakeo, 136 S. Ct. 1036, 1046 (2016) (affirming certification of a class of employees alleging lack of compensation for the time spent donning and doffing protective gear, based on representative evidence of the time a typical employee spends to perform these tasks; "[i]n many cases, a representative sample is 'the only practicable means to collect and present relevant data'") (quoting MANUAL OF COMPLEX LITIGATION § 11.493, at 102 (4th ed. 2004)).

developed evidence. To be sure, in some ways such a practice may seem a poor fit for an adjudicatory system that places a high value on stare decisis,[223] or to confuse the distinction between making law and finding facts.[224] Nevertheless, I am encouraged by the U.S. courts' efforts in the FRAND arena in particular to engage in efforts consistent with such an approach; and I hope that this paper's analysis of patent damages law as an exercise in heuristics will motivate others to improve upon my initial effort in this regard. For like other bodies of law, the law of patent damages is a work in progress. May it always be so.

[223] I thank Francis Shen—who also guided me to the literature on hyper- and metaheuristics—for raising this point.

[224] *Cf.* Rebecca Haw Allensworth, *Law and the Art of Modeling: Are Models Facts?*, 103 GEO. L.J. 825 (2015) (arguing that courts should review scientific and economic models as matters of law, not fact).