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Patent Uncertainty: Toward a Framework with Applications

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PATENT UNCERTAINTY: TOWARD A FRAMEWORK WITH APPLICATIONS

KEITH N. HYLTON*

INTRODUCTION	1117
I. STARTING POINTS.....	1120
II. STATIC UNCERTAINTY AND PATENTS	1124
A. <i>Statistical Artefact Uncertainty</i>	1125
B. <i>Inherent Uncertainty</i>	1130
C. <i>Strategic Uncertainty</i>	1133
III. DYNAMIC UNCERTAINTY AND PATENTS	1144
CONCLUSION.....	1148

There are three essential sources of uncertainty in the patent system: perceived uncertainty due to selective sampling (“statistical artefact uncertainty”), inherent uncertainty, and strategic uncertainty. It is only the strategic uncertainty source that should be of concern to reformers. With respect to this source, uncertainty in the patent system is largely a function of two variables: the degree of inherent abstraction associated with the patent, and the degree to which the patent provides notice of its scope. The maximal degree of uncertainty is observed in the category of abstract patents with poor notice, a category dominated today by software patents. I offer a few principles for validating patents in this category of maximal uncertainty.

INTRODUCTION

In August 2015 *The Economist* ran a leader arguing that the patent system is broken.¹ The core of the magazine’s argument is captured in these lines:

Patents are supposed to spread knowledge, by obliging holders to lay out their innovation for all to see; they often fail, because patent-lawyers are masters of obfuscation. Instead, the system has created a parasitic ecology

* William Fairfield Warren Distinguished Professor, Boston University; Professor of Law, Boston University School of Law, knhylton@bu.edu. This is a contribution to the Boston University Law Review’s “Notice & Notice Failure in Intellectual Property Law” Symposium, 96 B.U. L. REV. (forthcoming 2016). I thank Ben Roin for his helpful suggestions as symposium commentator for this contribution.

¹ *Time to Fix Patents*, THE ECONOMIST (Aug. 8, 2015), <http://www.economist.com/news/leaders/21660522-ideas-fuel-economy-todays-patent-systems-are-rotten-way-rewarding-them-time-fix> [<https://perma.cc/V4BB-7BEF>] (highlighting current problems with the patent system and emphasizing the need for a more clear and simplistic approach).

of trolls and defensive patent-holders, who aim to block innovation, or at least to stand in its way unless they can grab a share of the spoils.²

This statement accurately reflects a critique of the patent system that has gained standing in recent years.³ Masters of obfuscation create uncertainty that leads to unpredictable patent rights, which in turn generate litigation. Trolls and defensive patents have the perverse effect of reducing innovation incentives.

The problem of notice in patent law, a much discussed problem of late, is a version of the obfuscation problem.⁴ Patent lawyers, as masters of obfuscation, have given us a system that fails miserably in providing notice regarding the scope of patent rights. In other words, we have a property system in which boundaries are unclear, and the lawyers working within the system do their best to keep them as unclear as possible. If Bentham were raised from the dead, presumably he would point to the patent system today, rather than the system of property inheritance that he attacked in his time, as the source of sustenance for a thoroughly parasitic branch of the legal industry.⁵

² *Id.*

³ Economists Michele Boldrin and David Levine advocate the strongest anti-patent position. *See generally* MICHELE BOLDRIN & DAVID K. LEVINE, *AGAINST INTELLECTUAL MONOPOLY* (2008) (providing examples in copyright and patent law where property rights hinder innovation and harm public welfare). Other critiques have focused on particular inefficiencies in the patent system, such as the alleged tendency toward excessive property fragmentation. *See generally* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 *SCIENCE* 698 (1998) (arguing that too many owners of intellectual property in biomedical research leads to an underuse of resources). A third critique focuses on implementation problems in the patent system and potential solutions. *See generally* JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* (2008) (highlighting the challenges of abstract patents and the problem of notice for abstract patents).

⁴ *See* BESSEN & MEURER, *supra* note 3, at 10 (listing “[f]uzzy or unpredictable boundaries” and “access to boundary information” as “important deficiencies” in the implementation of patent notice); *see generally* DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* (2009) (addressing many problems with the current patent system including notice, capacity of the Patent and Trademark Office, and litigation abuse); ADAM B. JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT* (2006) (highlighting cases where general ambiguity led to increased patent litigation in recent years, and problems for overlapping and cumulative innovations); FED. TRADE COMM’N, *THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION* (2011), <https://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patentreport.pdf> [<https://perma.cc/HSX6-YFJF>] (recognizing patent notice as current challenge to the patent system during a series of hearings and workshops held by the Federal Trade Commission).

⁵ *See* GERALD J. POSTEMA, *BENTHAM AND THE COMMON LAW TRADITION* 267 (1986).

I want to step back from this critique and look generally at the question of uncertainty in the patent system. Like all property rights, patent rights cannot be perfectly certain or predictable. Any property right is uncertain because the state may choose to eradicate it at anytime.⁶ In addition, there is the issue of incremental or “static” uncertainty in determining the precise scope of a property right.⁷

What are the sources of uncertainty in the patent system? Is it possible to generate a framework for thinking about uncertainty in the patent system? I argue that there are three essential sources of uncertainty in the patent system: perceived uncertainty due to selective sampling (“statistical artefact uncertainty”), inherent uncertainty, and strategic uncertainty. It is only the strategic uncertainty source that should be of concern to reformers. With respect to this source, uncertainty in the patent system is largely a function of two variables: the degree of inherent abstraction associated with the patent, and the degree to which the patent provides notice of its scope. The two variables are not necessarily equivalent; it is possible for a patent to be abstract, and yet to provide nearly perfect notice of its scope. The maximal degree of uncertainty is observed in the category of abstract patents with poor notice, a category dominated today by software patents.

I offer a few principles for validating patents in this category of maximal uncertainty. I conclude that software patents that are based on business process algorithms, such as financial hedging, or that optimize the consumer-firm interface should be presumptively invalid. However, software patents with important spillover benefits beyond the specific application market, such as consumer safety enhancements, should not be presumptively invalid. Part I below sets out a theoretical framework for assessing the welfare effects of uncertainty in the patent system, distinguishing incremental or static uncertainty from the dynamic uncertainty associated with the wholesale abrogation of a right. Part II explores the concept of static uncertainty in patent law, which is the main focus of this paper. Part III extends the analysis to address dynamic uncertainty in patent law. A brief conclusion follows.

⁶ For a general discussion of uncertainty and legal rights, see BRUNO LEONI, FREEDOM AND THE LAW 77-94 (Liberty Fund 3d ed. 1991) (1961); Anthony D’Amato, *Legal Uncertainty*, 71 CALIF. L. REV. 1 (1983); Keith N. Hylton, *Fee Shifting and Predictability of Law*, 71 CHI.-KENT L. REV. 427, 429-34 (1995); William M. Landes & Richard A. Posner, *Legal Precedent: A Theoretical and Empirical Analysis*, 19 J.L. & ECON. 249 (1976).

⁷ See Hylton, *supra* note 6, at 429-30 (distinguishing types of uncertainty associated with law and defining static predictability as “refer[ring] to the ease with which the meaning of a legal rule can be comprehended”). The scope of a property right can be affected by many laws. For example, duty doctrines in trespass law help to determine the scope of property rights. See Keith N. Hylton, *Duty in Tort Law: An Economic Approach*, 75 FORDHAM L. REV. 1501, 1510-12 (2006) (“Some ‘no-duty’ rules in tort law are simply complements to property rules.”).

I. STARTING POINTS

Before looking closely at the uncertainty problem, I should start with a statement of my premise on the objective of the patent system. It is only within some definition of the system's objective that we can determine whether uncertainty is socially harmful, how harmful uncertainty is likely to be, and precisely what types of uncertainty should concern us. In our book on the economics of intellectual property, Ron Cass and I emphasize that the fundamental optimality condition for the scope of an intellectual property right requires a balance between the static monopolization cost of exclusion and the dynamic benefit from encouraging innovation. In short, the scope of an intellectual property right ends where static and dynamic costs are roughly equal at the margin.⁸ Static and dynamic costs are balanced when a slight increase in the scope of the property right, resulting in a welfare loss from monopolization of one dollar, also increases the social benefit from additional innovation by at least one dollar. We are by no means the first to make this point about the fundamental welfare tradeoff in determining the scope or duration of an intellectual property right.⁹ What differentiates our work is a sustained effort to apply this simple optimality condition explicitly as we surveyed the major doctrines of intellectual property law.¹⁰

One immediate implication of the optimal scope rule is that the bald claim that more patent protection leads to more innovation, and therefore enhances social welfare, is false. One can increase patent protection beyond the point at which static and dynamic costs are balanced, and once that happens additional protection reduces social welfare, and may reduce innovation as well.¹¹ Consider, for example, the nonobviousness requirement of patent law. One

⁸ RONALD A. CASS & KEITH N. HYLTON, *LAWS OF CREATION: PROPERTY RIGHTS IN THE WORLD OF IDEAS* 44-47 (2013) ("Intellectual property rights, like other property rights, are justified where—and only where—the costs of exclusion and related costs are outweighed by the benefits attending additional creation or discovery and the benefits of better management, promotion, and allocation of the property.").

⁹ This tradeoff has been clear to economists since the earliest studies of the economics of patenting. For an excellent survey of the economics and an application of the same theoretical argument to specific patent law doctrines, see Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990), though Merges and Nelson do not use the same terminology as Cass and Hylton and focus on industry-specific differences. The tradeoff has been emphasized for a long time in the antitrust literature. *E.g.*, David S. Evans & Keith N. Hylton, *The Lawful Acquisition and Exercise of Monopoly Power and Its Implications for the Objectives of Antitrust*, 4 COMPETITION POL'Y INT'L 203, 204, 233-34 (2008) (discussing "the tradeoff between static and dynamic efficiency"); J. Gregory Sidak & David J. Teece, *Dynamic Competition in Antitrust Law*, 5 J. COMPETITION L. & ECON. 581, 600-07 (2009) (discussing dynamic and static competition in the context of antitrust law and economics).

¹⁰ See generally CASS & HYLTON, *supra* note 8.

¹¹ See, *e.g.*, *id.* at 49-55 (describing the challenges of monopolization if patent protection were broadened to include mathematical formulae).

could arguably strengthen patent protection by abolishing this requirement. The result would be more patents. However, getting rid of the nonobviousness requirement would lead to many patents that involve “short-step” innovation; applications of ideas that only trivially extend some existing technology. As such patents multiply, so would the local monopolies associated with them, resulting in numerous atomistic patent monopolies. Where those small monopolies involve technologies that must be combined, the problem of “successive monopoly” would arise,¹² and the aggregate loss from monopolization would far exceed the loss that would result from a single monopoly that integrated all of the complementary technologies.¹³ Further, short-step innovation patents would impose significant dynamic costs as they choke off the rewards available to more substantial follow-on innovations.¹⁴ A version of Gresham’s Law might be observed, with low quality patents driving out high quality patents.¹⁵ The nonobviousness requirement in our patent system functions to prevent the natural tendency for prospective patentees to seek patents on short-step innovations. Such a strategy would not only be privately optimal for a prospective patentee, but it would be optimal for a government that adopts a mercantilist approach to global competition in technology. Such a government would direct its patent-awarding authority to give patents for short-step innovation. Unsurprisingly, commentators have suggested that the government of China has adopted precisely such a strategy.¹⁶ Short-step patents would be of little value within the U.S., where they would be rejected by the domestic patent office. But incumbent domestic

¹² See KEITH N. HYLTON, *ANTITRUST LAW: ECONOMIC THEORY AND COMMON LAW EVOLUTION* 334-35 (2003) (“The successive monopoly model views vertical mergers as a response to the large welfare losses that can result when two firms with monopoly power are in a vertical relationship.”); Joseph J. Spengler, *Vertical Integration and Antitrust Policy*, 58 J. POL. ECON. 347, 347-52 (1950) (outlining through mathematical principles the economic consequences of vertical and horizontal integration).

¹³ The successive monopoly problem is the fundamental economic phenomenon underlying the so-called tragedy of the anticommons. See Heller & Eisenberg, *supra* note 3, at 699.

¹⁴ CASS & HYLTON, *supra* note 8, at 68 (“For example, a patent awarded to a device that involves a mere reordering of elements of an existing device could effectively block a follow-on inventor from obtaining a patent for a significantly innovative variation.”).

¹⁵ *Id.* (describing how the inherent hierarchy in scientific development leads inventors to follow established paths rather than consider simpler but more fruitful solutions).

¹⁶ *Patent Fiction: Intellectual Property in China*, *ECONOMIST* (Dec. 13, 2014), <http://www.economist.com/news/finance-and-economics/21636100-are-ambitious-bureaucrats-fomenting-or-feigning-innovation-patent-fiction> [<https://perma.cc/S5G4-J3XR>] (suggesting that the 12th Five-Year Plan and Chinese National Development Strategy are drivers of the increase in patents in China, rather than a rise in innovative ideas). On the surge of Chinese patent filings, see Paul Kedrosky, *China Patent Surge*, *INFECTIOUS GREED* (Oct. 16, 2006), http://paul.kedrosky.com/archives/2006/10/china_patent_su.html [<https://perma.cc/L285-TGHR>] (comparing trends in patent filings in various countries).

firms based and operating in an emerging technological market would find such patents enormously useful—as a means of transferring wealth or technology—as foreign technology firms enter their home market and attempt to sell new technology or technological services there.

The optimal scope rule immediately suggests that empirical studies demonstrating that patent strengthening is not correlated with greater innovation are not generating findings that necessarily undermine the value of a properly functioning patent system.¹⁷ Making patents easier to get, broader in scope, or longer in duration, will not necessarily improve social welfare, and may reduce the overall rate of innovation. The interesting question is not whether increasing the degree of protection provided by patent law is always socially desirable, but whether the existing set of protections is greater than or less than the socially optimal level.

In spite of all that has been said about uncertainty, a patent is a property right. Every property right has a monopolizing effect, even if only to a trivial degree.¹⁸ If the government gives me a property right in an ideal location for a department store—say, in the busiest part of town—then it has given me a degree of monopoly power to the extent I can use the right to exclude competitors from that same ideal location. However, a government might think it optimal to protect my property right if it could be relatively sure that the static monopolization cost to society is offset by investments I would make in reliance on that right, which might enhance society's welfare. Thus, in return for having a property right in the location I have purchased, I may be willing to make investments in my store that are beneficial to consumers; these would be investments that I would not make if my property right were not secure. If any rival could co-locate at my store and sell his own goods there, I might stop making many investments necessary to supply the goods and services I offer from my store. Thus, the same general condition that applies to intellectual property rights appears to apply to all property rights.¹⁹ The key difference is that the static cost of monopolization due to property in land tends to be trivial for most tangible goods and products; a competing store down the street would force me to cut my prices to the competitive level, thus driving the static cost of geographically localized monopoly power to zero.²⁰ An intellectual property right such as a patent, by contrast, prevents a rival from offering an equivalent substitute to my patented technology, and the static cost is comparatively high

¹⁷ See Josh Lerner, *150 Years of Patent Office Practice*, 7 AM. L. & ECON. REV. 112, 141-42 (2005) (urging researchers to focus on “how the nature of patent office practice affects the innovation process”).

¹⁸ See Harold Demsetz, *Barriers to Entry*, 72 AM. ECON. REV. 47, 49 (1982) (“The essence of ownership is the general recognition that costs are to be borne if a person is to act in certain ways.”).

¹⁹ CASS & HYLTON, *supra* note 8, at 28-31 (exploring static and dynamic effects of real property rights to an apple orchard).

²⁰ *Id.* at 29.

since the marginal cost of supplying an idea is essentially zero and the spillover benefit from information is substantial.²¹

In thinking about property rights, there are fundamentally two sources of uncertainty. One is the *dynamic uncertainty* of a major alteration in the right, such as its elimination or expropriation by the government.²² The government might decide to take my property, or deny me an exclusive right in it, or a right may become obsolete through changes in tastes or technology.²³ This is not a major source of worry for most U.S. citizens because the U.S. Constitution protects property rights, though the protection is far from complete.²⁴ The other source of uncertainty is the *static uncertainty* of ascertaining the precise scope of the right.²⁵ Nuisance law, for example, works consistently with these static uncertainty questions, because it is not always clear whether some activity that a neighbor engages in can be enjoined, thus curtailing the neighbor's property rights, because the neighbor's activity reduces my enjoyment of my own property.²⁶

The dynamic uncertainty connected to intellectual property, especially patents and copyrights, is perhaps an order of magnitude greater than that associated with traditional property rights in real and in most types of personal property. Intellectual property rights have a shorter history than rights in real property; hence, a legislature or court might view it as less disruptive of the political order to terminate an intellectual property right in comparison to

²¹ *Id.* at 28-31 (explaining that monopolies are able to charge much more than the competitive price and therefore the static cost of exclusion, or the foregone utilitarian social benefit of providing a service at competitive prices, is likely to be high).

²² See Hylton, *supra* note 6, at 431 (defining dynamic uncertainty as “the degree to which parties who understand the meaning of a rule today can be sure that meaning will remain valid tomorrow”).

²³ See *id.* at 431-32 (“[I]f the law is likely to be changed in the near future, to a form that is unpredictable, then the current rule cannot be relied upon in the formation of long-term contracts and plans. Similarly, if conditions change in a way that gives the law, as it is framed today, a different meaning tomorrow, then it is unreliable as a basis for plans.”).

²⁴ Rent control, for example, seems to affect a taking, but the Supreme Court has not held that it generally violates the Constitution's Takings Clause. See *Pennell v. City of San Jose*, 485 U.S. 1, 15 (1988) (“[W]e hold that it is premature to consider appellants' claim [regarding the rent control Ordinance] under the Takings Clause and we reject their facial challenge to the Ordinance under the Due Process and Equal Protection Clauses of the Fourteenth Amendment.”).

²⁵ See Hylton, *supra* note 6, at 429 (defining static uncertainty as “the ease with which the meaning of a legal rule can be comprehended”).

²⁶ On uncertainty and cost-benefit balancing in nuisance law, see Keith N. Hylton, *The Economics of Nuisance Law*, in RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 326, 326-40 (Kenneth Ayotte & Henry E. Smith eds., 2011) (explaining that because “the core of nuisance doctrine involves balancing tests and limitations on scope that are not easily understood on the basis of transaction cost theory,” economics has been slow to provide a coherent account of nuisance doctrine).

terminating a right in real property. Patents and copyrights in the U.S. are recognized as property because of a clause in the U.S. Constitution that recognizes these entitlements.²⁷ An amendment to the Constitution, a difficult but not impossible change, could eliminate patents and copyrights. Indeed, if the case against patents stated by *The Economist* leader quoted at the start of this paper is correct,²⁸ then amending the Constitution to eliminate patents would appear to be not only wise, but consistent with the original intent of the constitutional framers. The intellectual property clause of the Constitution states its purpose, unlike most other clauses of the Constitution, which is “To promote the Progress of Science and useful Arts.”²⁹ If patents are no longer serving this purpose—or worse, obstructing this goal—then an amendment eliminating patent rights would further the clause’s stated purpose.

The static uncertainty associated with intellectual property rights is the familiar stuff we see in intellectual property litigation. The scope of a patent is uncertain. For any given patent there is a spectrum of potentially infringing innovations, ranging from exact and intentional copies that clearly infringe to technologies that share only the same general function at the most abstract level. Drawing the line at which the patent right ends is likely to be an imprecise endeavor in most cases. One can provide a general rule for drawing such a line—such as the optimality condition that the line should be drawn to balance static costs against dynamic costs—but even then the precise point at which the line should be drawn would remain unclear, and arbitrary to some degree in many cases.

II. STATIC UNCERTAINTY AND PATENTS

Static uncertainty is the focus of this essay, but it is difficult to understand precisely what it means. Uncertainty is inherent in the patent system, as in any system that requires fine distinctions to be drawn by the law. The negligence test, which often requires fine distinctions, generates a great deal of uncertainty.³⁰ Moreover, the uncertainty created by negligence doctrine has led to at least one famous call for its abolition by Guido Calabresi in 1970.³¹ But

²⁷ See U.S. CONST. art. I, § 8, cl. 8 (“The Congress shall have Power . . . [t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries . . .”).

²⁸ See *Time to Fix Patents*, *supra* note 1; *supra* text accompanying note 2 (criticizing the current state of patents as overrun by trolls and over-defensive patent holders, a situation which actually slows innovation).

²⁹ U.S. CONST. art. I, § 8, cl. 8.

³⁰ OLIVER WENDELL HOLMES, *THE COMMON LAW* 126-29 (1881) (describing the difficulty of determining bright-line negligence rules when “[l]egal, like natural divisions, however clear in their general outline, will be found on exact scrutiny to end in a penumbra or debatable land”).

³¹ See generally GUIDO CALABRESI, *THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS* (1970).

other than Calabresi, there have been few calls for abolishing the negligence test. The calls for reform of the patent system, by contrast, have been frequent and loud of late, leading to the question of why the patent system should be regarded as different from the tort system in a way that requires deep reform.³²

Static uncertainty in the patent system can be differentiated according to source. I think there are three sources supporting the complaints of uncertainty: statistical artefact, inherent uncertainty of the sort that I described previously, and strategic uncertainty created by actors in the system to gain an advantage.

A. *Statistical Artefact Uncertainty*

Some uncertainty in the patent system can be put down to statistical artefact. By the term “statistical artefact,” I mean the exaggerated appearance of systemic uncertainty resulting from patterns in the baseline sample from which observations are drawn. In the patent litigation context, the baseline sample from which observations are drawn consists of patent lawsuits. Observers who study such lawsuits may find evidence consistent with increasing uncertainty in the patent system, both in the amount of litigation and in the unpredictability of the results. But this evidence may mislead in some respects.

The problem I am referring to is a familiar one. When you drive to work in the morning, you are probably stunned by the number of poor drivers you encounter on a daily basis—both people who drive too slow, and people who drive too fast. But if you are a normal driver, one who drives within but relatively close to the speed limit, you are very likely to encounter a disproportionate percentage of drivers who are on the extremes. Everyone, it seems, is a fool behind the wheel.

Bessen and Meurer describe the huge run-up in patent litigation over the last two decades, attributing it the lack of “notice” in the patent system.³³ However, they also show that the problems of notice are not rampant throughout the patent system. Chemical and pharmaceutical patent litigation appear to have risen gradually in an almost lock-step relationship with the aggregate value of patents.³⁴ Patents in other fields, however, have generated litigation costs that have far outpaced the aggregate value of patents, suggesting that the problem

³² See, e.g., Brief of Amicus Curiae Group of Interested Patent Law Professors at 9-10, *Aventis Pharma S.A. v. Amphastar Pharm., Inc.*, 525 F.3d 1334 (Fed. Cir. 2008) (No. 2007-1280), 2008 WL 2967559, at *9-10 (“The loud call for reform from academics and practitioners shows that concern is shared both by those whose interests lie in the broader health of the patent system as well as by those immediately affected by this Court’s decisions.”).

³³ BESSEN & MEURER, *supra* note 3, at 11-28 (citing the rise in patent litigation as an effect of the decline in patent quality and “problematic boundaries associated with patents that are vaguely worded, overly abstract, of uncertain scope, or that contain strategically hidden claims”).

³⁴ *Id.* at 15 fig.1.1.

of uncertainty and notice have grown dramatically outside of the pharmaceutical patents area.³⁵

The drivers of this increase in litigation are surely worthy of careful study. However, the timing of the run-up in litigation involving non-pharmaceutical patents suggests that it is related to the introduction and rapid growth of software patents. Non-pharmaceutical patent litigation started to escalate in the mid-1990s, soon after the Federal Circuit began protecting software patents and around the same time that internet-based businesses built on software patents began to appear in great numbers. The rapid entry of new internet businesses, producing a phenomenon known as the “dot-com bubble” in the stock market, eventually faded, as many of the businesses failed.³⁶ These failures laid the seeds for the modern internet businesses that have become familiar in today’s economy. Over all of this time, however, software patents grew as a percentage of patents awarded. By 2011, more than half of new patents awarded were for software inventions.³⁷ Also by 2011, the number of lawsuits involving software-related patents exceeded the number of patent lawsuit filings not involving software-related patents.³⁸

The uncertainty and notice problems suggested by the escalation in patent litigation may be entirely due to the growth of software patents—that is, to a change in the composition of the baseline sample from which observations are drawn. The large increase in litigation over software patents likely had feedback effects in the litigation process. As the Federal Circuit granted more reliable protection to software patents, its change in viewpoint likely had an

³⁵ *Id.* However, this evidence is partially contradicted by data showing that patent litigation seems to track overall patents issued, and patents issued track GDP. See Brad Pederson, *Patent Litigation: Too Much as Compared to What?*, IPWATCHDOG (July 8, 2013), <http://www.ipwatchdog.com/2013/07/08/patent-litigation-too-much-as-compared-to-what/id=42868/> [<https://perma.cc/X5Y7-UPRU>] (finding that “the number of patent lawsuits filed in the US has stayed relatively constant as a percentage of patents issued” and that “there is a strong and persistent relationship between patent activity and economic activity”). Similar data are presented in a PricewaterhouseCoopers study. See PRICEWATERHOUSECOOPERS, 2014 PATENT LITIGATION STUDY 5 (2014), <http://www.pwc.com/us/en/forensic-services/publications/assets/2014-patent-litigation-study.pdf> [<https://perma.cc/GY4L-WMU9>] (“2013 continued the trend of high correlation (approximately 94% since 1991) between the numbers of patent cases filed and patents granted by the USPTO.”).

³⁶ See, e.g., *The Dot-Com Bubble Bursts*, N.Y. TIMES (Dec. 24, 2000), <http://www.nytimes.com/2000/12/24/opinion/the-dot-com-bubble-bursts.html> [<https://perma.cc/DB7M-S8S3>] (describing the rapid decline of the stock market as many young technology businesses failed or struggled to survive).

³⁷ See U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-13-465, INTELLECTUAL PROPERTY: ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY 13 (2013), http://www.uspto.gov/sites/default/files/aia_implementation/GAO-12-465_Final_Report_on_Patent_Litigation.pdf [<https://perma.cc/2M7E-KYRX>].

³⁸ *Id.* at 21 fig.5.

effect on general patent law. Bessen and Meurer suggest that the Federal Circuit's recognition of software patentability distorted well-established patent law on abstraction, but only with respect to software.³⁹ As a general matter, however, common law doctrines are inevitably shaped by the factual circumstances to which they are applied.⁴⁰ Distorting the doctrine in one factual context creates a precedent that can be used to justify a similar distortion in a different factual context. Many common law rules have been overturned through the progressive application of an exception that began as a specific and localized deviation from a general legal doctrine.⁴¹ Thus, it is unlikely that the Federal Circuit's expansion of software patentability had no impact at all on the general perception of fundamental constraints on patentability, such as abstraction and obviousness.⁴² The concept of abstraction, a factor that has long weighed against a finding of patentability,⁴³ was de-emphasized in the Federal Circuit's case law governing software;⁴⁴ otherwise, the explosion in software and business method patents would not have been able to occur. As litigants saw that the Federal Circuit was softening its stance on abstraction as a bar to patentability, they must have been encouraged to litigate more often on all types of patents, software-related or not.

The feedback effect I refer to need not have been a strong one to contribute to the litigation timeline presented by Bessen and Meurer. With so many software patents issued over the period of the litigation explosion, even a small feedback effect would be consistent with the pattern observed in the data.

This view receives some tentative support from the post-*Alice* evidence on litigation, though the evidence is preliminary. *Alice Corp. v. CLS Bank International*⁴⁵ ("*Alice*") invalidated a software patent on the ground that it

³⁹ BESSEN & MEURER, *supra* note 3, at 201-12 (arguing that the abstractness of software makes it difficult to place limits on abstract claims in software patents).

⁴⁰ See generally EDWARD H. LEVI, AN INTRODUCTION TO LEGAL REASONING 1-3 (1949).

⁴¹ Perhaps the most famous example is Judge Cardozo's opinion in *MacPherson v. Buick Motor Co.*, 111 N.E. 1050, 1053 (N.Y. 1916) (overturning common law precedent because "[p]recedents drawn from the days of travel by stage coach do not fit the conditions of travel to-day"). The path leading to *MacPherson* is discussed in LEVI, *supra* note 40, at 10-27.

⁴² On feedback effects of the sort described here, see Jonathan Masur, *Patent Inflation*, 121 YALE L.J. 470, 492 (2011) ("Every time the Federal Circuit moves the law, the PTO will respond accordingly, becoming slightly more permissive in granting patents.").

⁴³ *Bilski v. Kappos*, 561 U.S. 593, 602 (2010) ("[I]n order to receive the Patent Act's protection the claimed invention must . . . [be] fully and particularly described."); *Gottschalk v. Benson*, 409 U.S. 63, 68 (1972) (reversing the grant of a patent for an algorithm that was "abstract and sweeping"); CASS & HYLTON, *supra* note 8, at 59 ("The most important limiting doctrine governing process patents is the requirement that the process lead to particular, useful result.").

⁴⁴ BESSEN & MEURER, *supra* note 3, at 201-12 ("[T]he net effect of [the Federal Circuit's] changes is that there are few limits to abstract software patent claims.").

⁴⁵ 134 S. Ct. 2347 (2014).

embodied an abstract idea, and the opinion's language suggested that many software patents would be invalidated under the same reasoning.⁴⁶ The post-*Alice* data show a 13 percent decline in patent litigation in 2014.⁴⁷ The number of patent infringement lawsuits filed in 2013 was 6,497.⁴⁸ The number of patent lawsuits filed in 2014 was 5,686.⁴⁹ A probably more accurate source, Lex Machina, reports a patent litigation decline in 2014 of twenty-one percent,⁵⁰ and even this is an understatement because the reduction should be compared to the trend line established in previous years,⁵¹ and should hold fixed for the number of defendants involved in litigation.⁵² *Alice* led to the invalidation of more than 100 software patents and led many holders of software patents to drop their plans to sue for infringement.⁵³

Of course, this evidence is preliminary because more recent data for 2015 suggest an increase in patent litigation, though not enough to match the cases

⁴⁶ *Id.* at 2358 (“[W]holly generic computer implementation is not generally the sort of ‘additional featur[e]’ that provides any ‘practical assurance that the process is more than a drafting effort designed to monopolize the [abstract idea] itself.’” (quoting *Mayo Collaborative Servs. v. Prometheus Labs.*, 132 S. Ct. 1289, 1297 (2012))); *see also* Steven Seidenberg, *Business-Method and Software Patents May Go Through the Looking Glass After Alice Decision*, ABA J., Feb. 2015, at 1, http://www.abajournal.com/magazine/article/business_method_and_software_patents_may_go_through_the_looking_glass_after [<https://perma.cc/JLY7-2L98>] (reporting that after *Alice*, the U.S. Patent and Trademark Office was “striking down [software and business-method] patents in record numbers and denying applications that would previously have been granted”).

⁴⁷ Kevin A. Rieffel, *Patent Litigation Study Should Cause Patent Reform Pause*, IPWATCHDOG (May 20, 2015), <http://www.ipwatchdog.com/2015/05/20/study-should-pause-patent-reform/id=57946/> [<https://perma.cc/A7SD-H756>].

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ *2014 Patent Litigation Statistics*, MARATHON PAT. GROUP (May 29, 2015), <http://www.marathonpg.com/blog/detail/2248/2014-patent-litigation-statistics> [<https://perma.cc/XFP2-9NKB>].

⁵¹ *Id.* (observing that after factoring in the past trend of 12% litigation growth year over year, “the change was actually 33%—the 12% the number of lawsuits didn’t rise as expected based on past trends, plus the 21% the numbers dropped”).

⁵² Correcting for the number of defendants sued suggests that the decline in patent litigation actually started in 2012. Holding fixed for the number of defendants sued, patent litigation has been declining since the start of 2012. In fact, some suggest the rate of decrease is actually accelerating. *See* Michael Renaud et al., *No One Told John Oliver About the America Invents Act: Last Week Tonight Stuck in 2012*, MINTZ LEVIN (May 4, 2015), <http://www.mintz.com/newsletter/2015/Advisories/4920-0515-NAT-IP/> [<https://perma.cc/4FRN-KMTT>] (“By this measure, it is clear that, since a peak in 2012, the volume of patent litigation has decreased significantly. It also seems that the rate of decrease is accelerating.”).

⁵³ *See* Rieffel, *supra* note 47.

that would exist if litigation had continued according to the pre-*Alice* trend.⁵⁴ Much of this recent uptick might be due to *Alice* as well; and some patent lawsuits are generated by the new mechanism of *inter partes* review at the Patent Trial and Appeal Board, which is designed to facilitate patent challenges. The overall effect of *Alice* on litigation rates will depend on the behavior of patentees and potential infringers. The probability of a patentee lawsuit in response to an infringement depends on the percentage of patentees who perceive their patents as definitely dead under *Alice* versus the percentage who think their patents may survive. The rate of infringement depends on the percentage of potential licensees who no longer perceive a need to seek a license in light of *Alice*. The litigation rate pattern from 2014 to 2015 could be explained by a change in the percentage of patentees who believe they still have valid patents, or by a change in the percentage of potential licensees who perceive a need to seek a license, or by both factors. One simple explanation of the pattern may be as follows. Suppose the percentage of patentees who view their patents as valid dropped immediately after *Alice*, while the rate of infringement remained fixed in the short run. Then suppose the rate of infringement increased dramatically a few months after *Alice* as potential licensees responded behaviorally to the implications of the decision. This hypothesized set of reactions would generate a dip in patent litigation followed by a bounce-back surge, as observed in the data.

Another factor generating the appearance of uncertainty is the *lack* of systemic informational asymmetry in many areas of patent litigation, and especially in software patents. If one side of litigation (plaintiff or defendant) has a systemic informational advantage, plaintiff win rates will appear to be biased in favor of the informed side.⁵⁵ The reason is that a defendant who knows that he is likely to lose under the legal standard will prefer to settle, given an offer from the plaintiff that reflects the average probability of winning, while the defendant who is convinced that he will win will prefer to litigate rather than accept such a settlement.⁵⁶ For example, doctors have a systemic informational advantage over patients, and therefore innocent doctors will tend to prefer to litigate rather than accept a settlement reflecting the average likelihood of liability. Consequently medical malpractice litigation tends to generate low win rates for plaintiffs.⁵⁷ With a disproportionately large

⁵⁴ For recent data on patent lawsuit filings, see Lisa Shuchman, *New Data Shows Patent Litigation Filings Up in 2015*, CORP. COUNSEL (June 5, 2015), <http://www.corpcounsel.com/id=1202728387530/New-Data-Shows-Patent-Litigation-Filings-Up-in-2015A> [<https://perma.cc/3H9D-32H7>]; *2014 Patent Litigation Statistics*, *supra* note 50 (suggesting *Alice* is one of two major causes for the drop in patent litigation).

⁵⁵ Keith N. Hylton, *Asymmetric Information and the Selection of Disputes for Litigation*, 22 J. LEGAL STUD. 187, 188 (1993) (“[W]in rate patterns can be explained by the informational requirements of the relevant legal standard.”).

⁵⁶ *See id.* at 189.

⁵⁷ *See id.* at 206-10 tbls. A1, A2 & A3.

percentage of innocent doctors in the sample of disputes litigated to judgment, and forming the basis of appeals, the resulting appellate case law will appear to favor doctors,⁵⁸ and will also appear not to be plagued by uncertainty.⁵⁹ To an observer, it will all look rather simple: the doctor almost always wins. However, in software patenting, it is unlikely that the patentee has any information on the patentability of his invention that the alleged infringer does not have as well. In such an environment, litigation will be driven by idiosyncratic differences in information and errors in perception.⁶⁰ As a result, anyone who looks at a sample of litigated patent cases will probably find no apparent pattern. It will all look so uncertain that it would appear to be anybody's guess who would win in a patent lawsuit. The finding that the success rate for plaintiffs in patent litigation is roughly fifty percent is entirely consistent with this conjecture.⁶¹ In addition, the data suggesting that patent holder win rates have moved toward fifty percent over the 2000s is consistent with a sample of cases increasingly consisting of software patents, which generally confer no informational advantage on either side of the dispute.⁶²

B. *Inherent Uncertainty*

I have already referred to the inherent uncertainty associated with an optimal patent system. I began by noting that an optimal patent system would balance static and dynamic costs in determining the scope of a patent along any dimension.⁶³ For example, the optimal duration of a patent—whether ten,

⁵⁸ For an analysis of data on win rates at trial and on appeal in medical malpractice and other areas of litigation, see Michael Heise & Martin T. Wells, *Revisiting Eisenberg and Plaintiff Success: State Court Civil Trial and Appellate Outcomes* 13 (Cornell Legal Studies, Research Paper No. 15-24), <http://ssrn.com/abstract=2638846> (“[W]hile plaintiffs’ success rate at trial was only 24 percent, those plaintiffs’ success rate on warding off an appeal jumped to 67 percent.”).

⁵⁹ See Hylton, *supra* note 55, at 189 (“[G]uilty defendants will be more likely to settle than innocent defendants.”).

⁶⁰ See *id.* at 204 (“Press reports and the liability literature . . . generally have reflected frequently voiced concerns over doctrinal expansion and increased litigation in malpractice and product liability even though these win rates have remained well below 50 percent. This may be due to a general perception on the part of attorneys that the probability of success is relatively high in these areas in spite of low win rates . . .” (footnote omitted)).

⁶¹ See John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 *AIPLA Q.J.* 185, 205 (1998) (“Of the 300 final validity decisions in the data set, 162 (54%) found the patent valid, and 138 (46%) found the patent invalid.” (footnote omitted)).

⁶² For a chart on patent holder win rates over time, see PRICEWATERHOUSECOOPERS, *A CLOSER LOOK: 2008 PATENT LITIGATION STUDY: DAMAGES AWARDS, SUCCESS RATES AND TIME-TO-TRIAL* 8, at chart 5A (2008), http://www.patenthawk.com/blog_docs/2007_PWC_Patent_Trends.pdf [<https://perma.cc/K85Q-NENB>].

⁶³ CASS & HYLTON, *supra* note 8, at 52-62 (noting that “patent doctrine appears to be broadly consistent with the goal of minimizing static and dynamic costs”).

twenty, or thirty years—is a matter of trading off static and dynamic costs.⁶⁴ If a patent system were to attempt to rigorously apply such a balancing test, it would run into enormous difficulties in measuring static and dynamic costs. Needless to say, courts do not explicitly apply the optimal scope test. However, the legal tests that exist appear to have generated broad rules and categories of patentability (e.g., excluding mathematical formulae) that are consistent with the optimal scope rule.⁶⁵ Of course, legal tests are hardly ever as precise or as demanding of economic information as optimality rules in economics.⁶⁶ Sometimes the legal tests provide vague guidance to courts in determining the scope of patentability. The rules themselves create an unavoidable degree of uncertainty and unpredictability in the patent litigation system.

Alice is an illustration of this inherent, interstitial uncertainty in patent law. The rule from *Alice* asks courts to determine first if the software patent embodies an abstract idea, such as hedging risk in financial markets.⁶⁷ Second, the test asks whether the inventor has added an “inventive concept” to the idea, so that he is not merely using computer software to implement an abstract concept.⁶⁸ The combined test of abstraction-plus-inventive-concept offers distressingly little guidance to courts on what to do with software patents.⁶⁹ How is a judge to know what an inventive concept is, and how to identify one that is sufficiently important to enforce a patent? The best that courts can do, it seems, is use the facts of *In re Bilski*⁷⁰ and *Alice* as precedents against which to judge new patents. Still, *Alice* has had a large impact on perceptions of certainty, largely because it initially generated a widespread fear that software

⁶⁴ *Id.* at 75 (“Patent applicants naturally seek the broadest patent possible, which necessitates doctrines that can reduce the scope of patents . . . where the expected costs of protection exceed the expected social gains.”).

⁶⁵ *Id.* at 52-72 (explaining that “the balance of static and dynamic costs appears to tilt against granting patent protection for mathematical results.”).

⁶⁶ See *Barry Wright Corp. v. ITT Grinnell Corp.*, 724 F.2d 227, 234 (1st Cir. 1983) (“[W]hile technical economic discussion helps to inform the antitrust laws, those laws cannot precisely replicate the economists’ (sometimes conflicting) views. For, unlike economics, law is an administrative system the effects of which depend upon the content of rules and precedents only as they are applied by judges and juries in courts and by lawyers advising their clients. Rules that seek to embody every economic complexity and qualification may well, through the vagaries of administration, prove counter-productive, undercutting the very economic ends they seek to serve.”).

⁶⁷ *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 134 S. Ct. 2347, 2355 (2014) (“We must first determine whether the claims at issue are directed to a patent-ineligible [overly abstract] concept.”).

⁶⁸ *Id.* at 2357 (stating that the second prong of the inquiry is whether the inventor added an inventive concept that transforms the abstract idea into a patentable application).

⁶⁹ Seidenberg, *supra* note 46 (stating that district courts are largely left up to their own discretion in determining patent-eligibility).

⁷⁰ 545 F.3d 943 (Fed. Cir. 2008) (finding a patent for software that implemented industry-wide hedging calculations invalid).

patents are no longer enforceable.⁷¹ Guidelines issued by the PTO also suggest that most software processes should not be awarded patents.⁷² But the test of *Alice* is too vague to support this general belief, and this is probably the reason much litigation over software patents continues today.

The Federal Circuit appeared to have a much better grasp of the inherent uncertainty problem than the Supreme Court. The Federal Circuit in *Bilski* embraced a relatively clear, bright-line rule, the machine-or-transformation test, which would have effectively eliminated most software patents.⁷³ On appeal, the Supreme Court rejected *Bilski*'s machine-or-transformation test and instead relied on the abstraction test that was further developed in *Alice*.⁷⁴ As a general economic matter, the Supreme Court was correct to rely on the abstraction doctrine to invalidate the software patents in *Bilski* and *Alice*. As the degree of abstraction increases, the static monopolization costs associated with a patent increase too, and the dynamic gains from spurring invention can be overwhelmed by the discouragement of follow-on innovation.⁷⁵ However, the abstraction test of *Alice* has not been stated with sufficient clarity to serve as useful guidance in software patent litigation. Recall that by 2011, nearly half of new patents issued were for software-related innovation. The stock of commercially valuable patents may, at this moment, consist largely of software patents, many of questionable value after *Alice*. Moreover, many of these patents have value largely as preemptive forces in the marketplace, as a means of threatening competitors with lawsuits when they adopt software solutions to common, industry-specific business problems. The holders of these patents have enormous incentives to preserve their value, and therefore to litigate until the boundaries created by *Alice* have been clarified.

Indeed, as Robert Merges suggested in a blog post, Google's page-ranking process, a key part of its initial success, was awarded a software patent in 2001

⁷¹ See Seidenberg, *supra* note 46 ("In almost every case since *Alice* in which a party asserted that such patents consisted of ineligible subject matter, the courts have concurred and struck down the patent.").

⁷² Ryan Davis, *USPTO Patent Guidance Has Attys Fearing Wave of Rejections*, LAW360 (July 31, 2015, 9:13 PM), <http://www.law360.com/articles/685962/uspto-patent-guidance-has-attys-fearing-wave-of-rejections> [https://perma.cc/E96K-EM8G] ("The way the [guidance] categories are framed is so broad that it appears to be an invitation to examiners to reject many potential inventions as abstract ideas . . .").

⁷³ *Bilski*, 545 F.3d at 954 ("A claimed process involving a fundamental principle that uses a particular machine or apparatus would not pre-empt uses of the principle that do not also use the specified machine or apparatus in the manner claimed. And a claimed process that transforms a particular article to a specified different state or thing by applying a fundamental principle would not pre-empt the use of the principle to transform any other article, to transform the same article but in a manner not covered by the claim, or to do anything other than transform the specified article.").

⁷⁴ *Bilski v. Kappos*, 561 U.S. 593, 612 (2010).

⁷⁵ CASS & HYLTON, *supra* note 8, at 52-62.

(the “PageRank patent”),⁷⁶ which may be questionable today under *Alice*.⁷⁷ An algorithm for optimizing search by ranking web pages is just a mathematical algorithm performed on data. The notion of search optimization through a ranking system is certainly an abstract idea. These factors suggest that the PageRank patent is invalid under *Alice*. However, the case in favor of Google’s patent is that it is not a general algorithm such as hedging, and it produces a specific machine—the Google search process. But this justification is itself questionable because the “search machine” is just the software process that implements the algorithm.⁷⁸ In any event, other large businesses may also have such patents sitting at their foundations. This is quite a substantial force with incentives to push against an interpretation of *Alice* that would eradicate business-related software patents.

C. Strategic Uncertainty

Perhaps the most important source of static uncertainty in patent law is strategic, resulting from the strategic actions of participants in the patent system.⁷⁹ Within this category of uncertainty, the conduct of patentees appears to loom largest. Patent applicants, working with patent lawyers, frame their patent claims in a deliberately vague fashion in order to capture as much of the foreseeable and unforeseeable related innovation that might arise within the duration of the patent.⁸⁰ Vague and abstract wording of claims broadens the net of captured innovation, and also obstruct the efforts of others to find design-arounds of the patent.

This is a natural tendency within any patent system; the self-interest of patent applicants will always lead them to push for the broadest scope of claims that can be defended. Because of this incentive, the most important function of the courts is to provide doctrines limiting the scope of patents, which the courts have done, most prominently with the abstraction doctrine

⁷⁶ U.S. Patent No. 6,285,999 (issued Sept. 4, 2001).

⁷⁷ Robert Merges, *Symposium: Go ask Alice—What Can You Patent After Alice v. CLS Bank?*, SCOTUSBLOG, (June 20, 2014, 12:04 PM), <http://www.scotusblog.com/2014/06/symposium-go-ask-alice-what-can-you-patent-after-alice-v-cls-bank/> [https://perma.cc/NL2Q-RWEH] (“The Page patent claims what is known as the page rank algorithm: a way of weighting web pages by the density of links to them. . . . If a court were to become convinced that the Page patent claimed the abstract idea of ‘weighting,’ it might be invalid.”).

⁷⁸ But this may not matter because Google probably relies more on the secrecy of its search optimization methods than on the protection provided by the 2001 patent.

⁷⁹ Bessen and Meurer make much of this source of uncertainty in explaining the great increase in patent litigation over the last two decades. See BESSEN & MEURER, *supra* note 3, at 147-64.

⁸⁰ *Cf. id.* at 153 (“[T]he *clear boundaries* provided by patents on chemical structures and compositions explain the overall superior performance of the patent system in these industries.” (emphasis added)).

relied on in *Alice*.⁸¹ Moreover, the incentive to broaden the scope of patent claims has existed for a long time—long before the recent explosion of patent litigation.⁸² The patent administrative process could be reformed to limit the use of this strategy on the part of patent applicants.⁸³ However, the courts provide a useful check, indeed the most important check, independent of the administrative process. The Supreme Court recently limited the potential for drafters to assert the most expansive claims by demanding notice with reasonable certainty in *Nautilus, Inc. v. Biosig Instruments, Inc.*,⁸⁴ overturning an earlier rule that required only that claims not be “insolubly ambiguous.”⁸⁵ The Federal Circuit’s decision in *Williamson v. Citrix Online, LLC*⁸⁶ represents yet another recent step toward improving the incentives of claim drafters, though there is still much more that can be done.⁸⁷

The label “notice” offers a useful category for thinking about strategic uncertainty. Notice suggests an effort to signal, and in this context it is the signaling of patent boundaries that matters. Abstraction is another useful category concept. Abstraction is a more primitive feature that refers to the nature of the patent claim. A claim to patent a purely mathematical relationship is inherently abstract because it covers all uses of the relationship regardless of the precise form of its embodiment in some technology. Thus a patent can differ along the dimensions of notice and abstraction, generating the combinations of: (1) abstract with notice, (2) abstract without notice, (3) not abstract with notice, and (4) not abstract without notice.

Consider the first combination, abstract with notice. What is an example of such a patent? The patent in *Bilski* seems to be a perfect example: a patent for

⁸¹ *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 134 S. Ct. 2347, 2354 (2014) (stating one policy rationale of limiting the scope of patent law, through rules against abstraction, as a concern for preserving further discovery and invention).

⁸² ADRIAN JOHNS, *PIRACY: THE INTELLECTUAL PROPERTY WARS FROM GUTENBERG TO GATES* 258-59 (2009) (“Since the 1730s, applicants had to submit ‘specifications’ of their inventions. . . . But patent specifications often concealed as much as they conveyed. . . . [T]here was a distinct art to composing a patent specifications so as to reveal just enough to sustain the claim and identify the invention, but *not so much as to make the claim overly specific or to enable others to replicate it.*” (emphasis added)).

⁸³ Bessen and Meurer propose changes in the patent administrative system to limit the ability of patent applicants to expand the scope of their claims. See BESSEN & MEURER, *supra* note 3, at 244-47.

⁸⁴ 134 S. Ct. 2120, 2129 (2014) (“[A] patent must be precise enough to afford clear notice of what is claimed.”).

⁸⁵ *Id.* at 2124.

⁸⁶ 792 F.3d 1339, 1352 (Fed. Cir. 2015) (“[I]f a person of ordinary skill in the art would be unable to recognize the structure in the specification and associate it with the corresponding function in the claim, a means-plus-function clause is indefinite [and therefore the patent is invalid].”).

⁸⁷ See BESSEN & MEURER, *supra* note 3, at 24-27 (outlining reforms to improve notice).

hedging risk in energy markets.⁸⁸ The patent probably did not suffer from a lack of notice. Anyone in the relevant industry who used a computer program to hedge risk in energy markets would have been able to determine that he may have infringed the patent in *Bilski*. The reason for rejecting the patent in *Bilski* was the problem of abstraction, that it preempted a vast set of applications that had been carried on by businesses for a long time.⁸⁹ The static monopolization cost of enforcing the patent in *Bilski* was potentially enormous, and almost surely in excess of any gains in spurring the particular innovation, which would have occurred anyway from the desire and need to gain efficiency in a routine business endeavor. Market competition alone would push businesses to adopt hedging strategies and to use computer programs to help them implement those strategies.

Next, consider the second combination, abstract without notice. Bessen and Meurer offer fine illustrations of this problem in their discussions of the E-Data and Blackberry-RIM disputes.⁹⁰ The E-Data example involved vague, nearly unintelligible patent claims, later interpreted expansively to cover not only the electronic production of digital music recordings, its original intended scope, but also general online commercial transactions.⁹¹ One recent example in the courts involves a series of infringement lawsuits launched by EMG Technology, LLC, all filed in the U.S. District Court for the Eastern District of Texas, against several large firms for infringing its 2003 patents for navigating websites on a cellphone.⁹² Perhaps in 2003 the concept of navigating a website

⁸⁸ *Bilski v. Kappos*, 561 U.S. 593, 599 (2010) (deciding patentability of “a claimed invention that explains how buyers and sellers of commodities in the energy market can protect, or hedge, against the risk of price changes”).

⁸⁹ *Id.* at 612 (finding that “[t]he patent application here can be rejected under our precedents on the unpatentability of abstract ideas,” and that “[t]hese claims attempt to patent the use of the abstract idea of hedging risk in the energy market and then instruct the use of well-known random analysis techniques to help establish some of the inputs into the equation”).

⁹⁰ BESSEN & MEURER, *supra* note 3, at 8-9 (“The boundaries of the E-Data patent depend on the meaning of abstract phrases.”); *id.* at 48-50 (suggesting that for Blackberry-RIM, “[t]he costs of sorting through a large number of uncertain property rights is larger than the expected cost incurred when any one patent is asserted against the innovator”).

⁹¹ In 2001, the Court of Appeals for the Federal Circuit defined the patent at issue broadly by, for instance, defining point of sale location as any location with an Internet connection. BESSEN & MEURER, *supra* note 3, at 9.

⁹² Complaint, EMG Tech., LLC v. American Family Mut. Ins. Co., No. 6:15-cv-00498 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. Dillard’s, Inc., No. 6:15-cv-00499 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. Dollar Gen. Corp., No. 6:15-cv-00500 (E.D. Tex. filed May 27, 2015); Complaint, EMG Technology, LLC v. Dollar Thrifty Auto. Grp., Inc., No. 6:15-cv-00501 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. Family Dollar Stores, Inc., No. 6:15-cv-00502 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. GameStop Corp., No. 6:15-cv-00503 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. Hallmark.com, LLC, No.

on a cellphone may have seemed less than obvious or fully anticipated in practice. The defendants noted that the patent involved little more than a decision tree for guiding a computer program.⁹³

These cases are distinguishable from *Bilski* in the sense that the abstract concept in *Bilski* is well known and was in practice for centuries in financial markets before the patent at issue was sought. The only innovation involved implementing a financial hedging algorithm through a computer program. The cases in the “abstract without notice” category, by contrast, involve rather general conceptual functions. EMG Technology’s patent for navigating a website from a mobile device sought to capture a property right in a routine conceptual function—website navigation from a mobile device—that would soon dominate electronic commerce. The E-Data patent covered “reproducing information” at “point of sale location,” a conceptual function that would appear to encompass all of online commercial activity.⁹⁴

The third category, not abstract and with notice, consists of the sorts of inventions that have been associated with the patent system since its inception. Abraham Lincoln was granted a patent for a mechanism for lifting a boat over shoals.⁹⁵ This was at a time when patent applicants were required to present a model of the invention.⁹⁶ The prototype, still in existence, disproves any assertion that the invention was abstract in nature, and its utility was obvious. Still, the invention did not meet commercial success, failing to liberate Lincoln from his occupation as a lawyer with public service aspirations.

One could argue that the Lincoln patent was also a conceptual-functions patent, as I have used the term. The concept was to prevent a boat from being trapped by a sand bar, which was a serious danger in Lincoln’s day. The waters near Bermuda are littered with sunken ships caught by the numerous shoals and coral reefs surrounding the island. The difference between the traditional patent of Lincoln’s and the modern patents for functions such as web navigation is the implementation through software. Software patents, all essentially algorithms, inherently generate questions of scope that are not

6:15-cv-00504 (E.D. Tex. filed May 27, 2015); Complaint, EMG Tech., LLC v. Pier 1 Imps., Inc., No. 6:15-cv-00505 (E.D. Tex. filed May 27, 2015).

⁹³ Defendant’s Motion to Dismiss at 10-11, EMG Tech., LLC v. Dollar Gen. Corp., No. 6:15-cv-00500 (E.D. Tex. filed Aug. 11, 2015) (“The Asserted Patents thus amount to nothing more than claims covering a visual phone tree or a Choose-Your-Own-Adventure novel—that is, a simple decision tree. . . . Nothing contained in any claim elevates these patents beyond the abstract ideas that have been practiced by hand in various forms for decades.”).

⁹⁴ BESSEN & MEURER, *supra* note 3, at 8-9.

⁹⁵ U.S. Patent No. 6,469 (issued May 22, 1849).

⁹⁶ See, e.g., BESSEN & MEURER, *supra* note 3, at 66 (“In the past, inventors had to demonstrate a working prototype or scale model of the invention in order to demonstrate possession.”). Models were required of patent applicants until 1880. E.g., Kendall J. Dood, *Patent Models and the Patent Law: 1790-1880 (Part II—Conclusion)*, 65 J. PAT. OFF. SOC’Y 234, 271 (1983).

generated by physical machines or processes. Because of this, I will aim my remarks on the problems associated with conceptual-functions patents at software patents.

The fourth category, not abstract without notice, can exist only in special scenarios. The classic submarine patent might fall in this category.⁹⁷ The submarine patent begins as a vague application that morphs over time into specific claims issued, covering technologies actually on the market. Once the patent issues, the patentee seeks royalties from existing firms. Alternatively, in a patent system that simply fails to record patents awarded or currently in force, there could be non-abstract patents in existence whose records proving current validity cannot be found, and therefore fail to provide notice. The submarine patent problem has been reduced in importance by recent legislation, though it has been a prominent failure of the U.S. patent system for many years.

The most important source of strategic uncertainty in the patent system today comes from the conceptual-functions software patents that now dominate the “abstract without notice” category. While *Bilski*-like patents—algorithms implemented with software—are troubling, they do not pose the same threats to innovation as conceptual-functions patents. *Bilski*-like patents merely seek to appropriate the efficiency gains from computing software. These gains are significant, but their appropriation is unlikely to hinder innovation in the techniques reduced to computing. For example, the development of new hedging algorithms is unlikely to be discouraged by enforcing algorithmic patents of the sort in *Bilski*. Specialists in mathematical finance, doing basic research on optimization methods in financial markets, probably would have similar incentives to discover more efficient hedging algorithms irrespective of the ultimate patentability of computer programs implementing those algorithms. Conceptual-functions patents, by contrast, threaten to appropriate gains from innovation in business and operational methods. If EMG Technology can enforce its patents for website navigation, it will put itself in a position to tax firms that take advantage of a new forum for commerce—online search and purchase from mobile devices—which it did virtually nothing to help create. The gains from trade would be reduced by this tax, reducing the size of the market for online transactions. The gains that should go to consumers and businesses for exploiting new business and operational methods made available by information technology would be siphoned off to the holders of these patents.⁹⁸

⁹⁷ See generally Steve Blount, *The Use of Delaying Tactics to Obtain Submarine Patents and Amend Around a Patent that a Competitor Has Designed Around*, 81 J. PAT. & TRADEMARK OFF. SOC'Y 11, 13-17 (1999) (providing background on the submarine patent problem).

⁹⁸ EMG Technology is not the only firm attempting to enforce a conceptual-functions software patent that appropriates gains from innovation in operational and business methods. Here are four prominent and similar cases:

Alice is not, at present, an adequate legal framework for conceptual-functions software patents. The doctrinal test of *Alice* is too vague to provide much guidance in this area. The factual precedents provided by *Alice* and *Bilski* are narrow and do not involve conceptual-functions patents. *Alice* should be understood to set up a presumption of invalidity for business or financial

(1) *Data management and storage*: Evolutionary Intelligence, LLC had its patents on data management and storage held invalid under *Alice*, with defendants' lawyers noting that Evolutionary Intelligence's patents covered a process similar to that of looking for books on a topic at the library, or going through the books' checkout history to see whether they had been checked out frequently. See *Evolutionary Intelligence, LLC v. Sprint Nextel Corp.*, No. 13-04513, 2015 WL 5829783 (N.D. Cal. Oct. 6, 2015) (dismissing cases against Yelp, Inc., Facebook, Inc., Foursquare Labs, Inc., LivingSocial, Inc., Twitter, Inc., Groupon, Inc., Apple, Inc., Millennial Media, Inc., and Sprint Nextel Corp.); Daniel Langhorne, *Apple, Facebook Beat Data Processing, Storage Patent Suits*, LAW360 (Oct. 7, 2015, 10:42 PM), <http://www.law360.com/articles/712337/apple-facebook-beat-data-processing-storage-patent-suits> [<https://perma.cc/P5T7-BP6D>] ("A California federal judge on Tuesday dismissed [Evolutionary Intelligence, LLC's] patent infringement claims . . . holding the plaintiff's two disputed patents claimed abstract ideas regarding data management that are non-patentable.").

(2) *Video on demand*: A federal court in Hawaii invalidated Broadband iTV's patents covering video-on-demand technology. *Broadband iTV, Inc. v. Oceanic Time Warner Cable, LLC*, Civ. No. 15-00131, 2015 WL 5768943, at *17 (D. Haw. Sept. 29, 2015) ("[I]t nonetheless appears that the '336 Patent claims an abstract idea without sufficient inventive concept under *Alice*. It is therefore ineligible for patenting under Section 101, and invalid for enforcement against TWC."); Vin Gurrieri, *TWC, Hawaiian Telecom Get On-Demand Patent Nixed By Alice*, LAW360 (Oct. 1, 2015, 6:56 PM), <http://www.law360.com/articles/709803/twc-hawaiian-telecom-get-on-demand-patent-nixed-by-alice> [<https://perma.cc/EFS3-AMYQ>] ("The judge noted in both orders that Broadband iTV offered no suggestion of what the patent does claim if not an abstract idea and said that the patent was essentially aimed at automating a process that, in an earlier time, was done manually.").

(3) *Video and music streaming*: Affinity Labs of Texas, LLC had its patent for browsing and streaming digital media invalidated, because it involved an abstract idea. *Affinity Labs of Texas, LLC v. Amazon.com, Inc.*, No. W-15-CV-029, 2015 WL 3757497, at *8, *15 (W.D. Tex. June 12, 2015) (finding that the patent failed to do more than use a computer to implement an abstract idea); Gail Sullivan, *Amazon Shuts Down Patent Suit Over Music Store, App*, LAW360 (Sept. 24, 2015, 12:58 PM), <http://www.law360.com/articles/706619/amazon-shuts-down-patent-suit-over-music-store-app> [<https://perma.cc/FZ58-2P9L>].

(4) *Web shopping carts*: eDekka LLC had its web shopping cart patent invalidated, after suing numerous businesses, because it claimed only abstract ideas. *eDekka LLC v. 3Balls.com, Inc.*, No. 2:15-cv-541, 2015 WL 5579840, at *5 (E.D. Tex. Sept. 21, 2015) ("The Court finds that no inventive concept exists to transform the claimed abstract idea into a patent-eligible concept."); Matthew Bultman, *EDekka Shopping Cart Patent Knocked Out Under Alice*, LAW360 (Sept. 23, 2015, 7:37 PM), <http://www.law360.com/articles/706282/edekka-shopping-cart-patent-knocked-out-under-alice> [<https://perma.cc/55YY-BHBM>].

algorithms reduced to computer programs.⁹⁹ One recent proposed application of *Alice* to an algorithm for gambling on horse races should start with a presumption of invalidity under this view.¹⁰⁰ Again, algorithmic patents involve efforts to appropriate the gains from software or information technology generally. They are unlikely to be necessary to spur, or even important in encouraging, innovation on the level of optimizing algorithms; every gambling house has an incentive to find optimal methods of exploiting punters.¹⁰¹

⁹⁹ As another example of algorithmic patenting that should fall under the scope of *Alice*, consider auctions. Matthew Bultman, *Jewelry Channel Gets Rival's Auction Patent Axed Under Alice*, LAW360 (Oct. 20, 2015, 5:10 PM), <http://www.law360.com/articles/716392/jewelry-channel-gets-rival-s-auction-patent-axed-under-alice> [<https://perma.cc/4S6C-ZTEU>] (“The Patent Trial and Appeal Board has invalidated an auction patent that Jewelry Television had sued rival network, The Jewelry Channel Inc. USA, for infringing, finding the patent claimed only an abstract idea and thus making it invalid under the U.S. Supreme Court’s *Alice* decision. . . . It rejected Jewelry Television’s argument that it added the ‘inventive concept’ of using certain indicators to reduce the quantity of a product before a sale, making it patent eligible.”).

¹⁰⁰ See Complaint at 1-2, *RaceTech, LLC v. Kentucky Downs, LLC*, No. 1:15-cv-59 (W.D. Ky. Apr. 30, 2015); Jeff Zalesin, *RaceTech Says Horse Race Betting Patents Survive Alice*, LAW360 (July 31, 2015, 3:07 PM), <http://www.law360.com/articles/685843/racetech-says-horse-race-betting-patents-survive-alice> [<https://perma.cc/SE72-X37S>] (“Gambling machine maker RaceTech LLC told a Kentucky federal judge on Thursday that horse racing venue Kentucky Downs LLC and a rival gambling technology company can’t invalidate its historical racing patents, arguing that a patent examiner already approved the claims under the U.S. Supreme Court’s *Alice* decision.”).

¹⁰¹ A set of similar patent claims involves web-based promotional sweepstakes, often connected with online gaming:

(1) *Distributing promotional benefits to online gamers*: Inventor Holdings, LLC had its patent for distributing promotions invalidated as abstract. *Inventor Holdings, LLC v. Gameloft, Inc.*, C.A. No. 14-1067, 2015 WL 5769220, at *12 (D. Del. Sept. 20, 2015) (dismissing cases against Gameloft, Inc., GLU Mobile Inc., King.com Ltd., NGMOCO, LLC, Rovio Animation Company, and Supercell, Inc. because the ‘198 patent for distributing promotions is directed towards patent-ineligible subject matter); see Vin Gurrieri, *‘Candy Crush,’ ‘Angry Birds’ Makers Get Patent Nixed By Alice*, LAW360 (Sept. 30, 2015, 8:40 PM), <http://www.law360.com/articles/709397/candy-crush-angry-birds-makers-get-patent-nixed-by-alice> [<https://perma.cc/4H3W-E8EM>] (“Judge Stark agreed with the defendants that the ‘198 patent describes a way of using codes to unlock benefits in a mobile game, which the judge said is just an abstract idea that cannot be patented under *Alice*.”).

(2) *Sweepstakes prizes for online gamers*: Everglades Game Technologies, LLC’s patent covering a method “to give sponsors ‘total control over game piece distribution and price awards,’ primarily through the use of computer technology” in “collect-and-win” or “match-and-win” games was invalidated under *Alice*. *Everglades Game Technologies, LLC v. Supercell, Inc.*, No. 14-643-GMS, 2015 WL 4999654, at *1, *4 (D. Del. Aug. 21, 2015) (“The court agrees with Supercell that each of the claims of the ‘050 Patent lack meaningful limitations on the abstract idea.”).

Another recent proposed application of *Alice* to a conceptual-functions patent helps shed light on the problems in this area. The holder of a patent for a test of driver impairment sued Mercedes for infringement, and the district court held that the patent was invalid under *Alice*.¹⁰² The patentee, Kevin Roe, filed an appeal to the Federal Circuit, arguing that his innovation includes several inventive concepts and that his claims do not preempt the abstract idea of testing driver impairment.¹⁰³ The patentee also noted that his innovation was an important, potentially life-saving technology.¹⁰⁴

Stepping back, it does seem difficult on the most abstract level to distinguish Roe's patent from Lincoln's. Both involve conceptual functions, the former testing driver impairment and the latter preventing boats from being stranded on shoals. Both are potentially life-saving, and hence have value beyond their commercial measure. The difference is that one is software and the other is a physical device. Why should *Alice* apply to one and not the other?

The short reason *Alice* is applicable to Roe's patent and not to Lincoln's (if it were to be created fresh today) is that Roe's, as a software patent, is essentially an algorithm. As an algorithm, it creates the risk that it will preempt new algorithms directed toward the same conceptual function. That is a sufficient reason for finding *Alice* potentially applicable to Roe's patent.

The danger presented by *Alice* is that it threatens to invalidate innovations that could be enormously beneficial to society. A test for driver impairment could significantly reduce the number of alcohol or sleep-related fatal accidents on the roads. This is a significant problem, the solution to which would yield spillover benefits for everyone, whether automobile drivers or pedestrians.

Moreover, it is not clear that the market will always provide a sufficient incentive for life-saving innovations such as the Lincoln patent or the Roe patent (assuming the purported innovation is effective). A car maker might find that it generates no additional sales from installing an enhanced driver impairment testing mechanism, and that it gains little by advertising on this matter. A private individual, however, may be encouraged by the rewards of

¹⁰² *Vehicle Intelligence & Safety LLC v. Mercedes-Benz USA, LLC*, 78 F. Supp. 3d 884, 888-90 (N.D. Ill. 2015) ("The claims in this case broadly relate to the concept of testing operators of any kind of moving equipment for any kind of physical or mental impairment. This concept qualifies as an abstract idea and . . . is not an inventive concept.").

¹⁰³ *Vehicle Intelligence & Safety LLC v. Mercedes-Benz USA, LLC*, No. 2015-1411, 2015 WL 9461707, at *4 (Fed. Cir. Dec. 28, 2015) ("Vehicle Intelligence argues that its methods are embedded in 'specialized existing equipment modules,' as opposed to generic computers, which renders them patent-eligible." (citation omitted)).

¹⁰⁴ *Id.* at *5. In December 2015, the Federal Circuit affirmed the district court's decision. *Id.* The Federal Circuit, reviewing de novo, found that the claims are not limited to a specific type of impairment, and do not explain how the impairment tests are performed or how the "expert system" improves upon prior systems. *Id.* ("The claims merely state the abstract idea of testing an equipment operator for impairments using an unspecified 'expert system' running on equipment that already exists in various vehicles.").

the patent system to develop such a technology, and seek to make a profit by promoting the technology to car-makers or to regulatory authorities. In addition, a car manufacturer, if it had a sufficient incentive to develop such a technology, would use it to gain an advantage in the market over rivals. The individual inventor, in contrast, has no incentive to distort the market in favor of one particular firm; his incentive is to license the innovation to all. These arguments suggest that society should be reticent to adopt rules in the patent system that deny patent law's encouragement to certain safety-enhancing innovations.

Important distinctions between web navigation patents and impairment testing should be noted. Web navigation is one of many functions that every business has an incentive to optimize for its customers, whether patents are available or not. Competition will drive firms to adopt such functions. General technologies that improve safety across an entire industry are not necessarily functions that every business has an incentive to develop, a proposition established in the law since Learned Hand's opinion in *The T.J. Hooper*.¹⁰⁵ Some of the victims of unsafe conditions may not be customers of the industry—and the industry will have little incentive to devote resources to reduce such external losses.¹⁰⁶ The costs of developing a safety technology may be high, the benefits may not be appropriable, and competition may not reward such innovations.

This suggests at least one principle that should be adopted for conceptual-functions patents: *Conceptual-functions patents related to optimizing consumer-firm interactions should be presumptively ineligible for patents.* Every business has an incentive to optimize its interactions with consumers—to make its websites navigable by mobile devices, to order its messages to and from consumers efficiently,¹⁰⁷ to suggest alternative and higher priced goods or

¹⁰⁵ 60 F.2d 737, 740 (2d Cir. 1932) (recognizing that though many boats used radio technology, it had not yet become an industry standard and the court was in no position to demand that the rest of the industry conform).

¹⁰⁶ Richard A. Posner, *A Theory of Negligence*, 1 J. LEGAL STUD. 29, 39 (1972) (“Suppose the only benefit of a safety appliance is to a stranger to the industry in our earlier sense—someone with whom the enterprise has no contractual relationship and will not enter into one because of transaction costs. No firm in the industry will have an incentive to install the appliance.”).

¹⁰⁷ Two business-messaging patents asserted against Hewlett-Packard and Adobe were recently found invalid under *Alice*. *YYZ, LLC v. Hewlett-Packard Co.*, Civ. No. 13-136-SLR, 2015 WL 5886176, at *9 (D. Del. Oct. 8, 2015) (holding that the custom messaging component was neither specifically claimed nor sufficiently innovative and was therefore not patent-eligible). In a different and recent case, Home Depot was sued for infringing a patent that lets customers choose whether to have their receipts printed or emailed to them. *Complaint at 3-4, eCeipt LLC v. Home Depot, Inc.*, No. 2:15-cv-01672 (E.D. Tex. filed Oct. 21, 2015). Based on the argument of this paper, this claim should be rejected under *Alice*.

services,¹⁰⁸ and so on. The patent system should not grant exclusive rights in customer-oriented or supplier-oriented business functions.

If the presumption against patentability suggested by *Alice* is to be extended beyond algorithmic patenting into conceptual-functions patenting, which I have suggested may be desirable, the next set of concepts to bring under *Alice* are those involving the customer-firm or supplier-firm interface. The doctrinal test of *Alice* can remain without doing any harm; it is too vague to have much of an impact anyway on its own. If there is any practical rule that *Alice* should stand for, it is for a *presumption against patent eligibility for both algorithmic software applications and for business methods that enable firms to sell, advertise, or interact with consumers more efficiently*. This subset of conceptual functions should be left to the process of Schumpeterian competition.¹⁰⁹

For conceptual functions with potentially life-saving applications (such as the driver impairment testing claimed by the Roe patent), *Alice* must tread much more cautiously.¹¹⁰ The reason is that the additional incentive provided by the patent system for life-saving innovations should be considered worth preserving, and the market may be insufficient as a spur to such innovation. On the other hand, these patents have to be assigned boundaries. Although the principle disfavoring abstraction is well entrenched in patent law, it should be modified to constrain patentees more effectively in this area. A doctrine shifting the burden of proof to the patentee to show that his patent really does have boundaries and that there are realistic methods of innovation within the same conceptual function that are not preempted may be appropriate. *Alice* may have had this effect already.

¹⁰⁸ See *Tuxis Techs., LLC v. Amazon.com, Inc.*, No. 13-1771, 2014 WL 4382446 (D. Del. Sept. 3, 2014) (invalidating under *Alice* a patent for “upselling” (i.e., suggesting pricier options) to online consumers).

¹⁰⁹ CASS & HYLTON, *supra* note 8, at 71 (“Schumpeterian creative destruction[] involves the continual introduction of new methods that lead at times to temporary monopolies but are eventually copied by competitors. Patents might provide an additional incentive to develop new methods, but they will also obstruct the process of dissemination and emulation that is core to dynamic competition.”).

¹¹⁰ I should be clear that this suggestion is limited to *Alice* as a doctrine for invalidating patents. More traditional doctrines for invalidating patents, such as obviousness, do not have to tread cautiously as suggested here. Traditional grounds for invalidating patents have been in operation for many years and should not be affected by *Alice*. For example, the Patent Trial and Appeal Board granted TRW Automotive US LLC’s petition for *inter partes* review of a driver-assistance camera patent belonging to Magna Electronics Inc. after TRW demonstrated a reasonable likelihood it would be able to prove the patent was anticipated by previous technology. *TRW Auto. US LLC v. Magna Elec. Inc.*, No. IPR2015-00923, 2015 WL 5818392 (P.T.A.B. Oct. 1, 2015). Although this is an example of a “driver safety” innovation similar to the Roe patent discussed in the text, the difference is that the PTAB reexamined the patent on obviousness grounds, not on the basis of *Alice*.

My suggestion goes beyond life-saving innovations. Inventions occur along a spectrum from fundamental science, to production-oriented engineering, to methods that serve consumers or end-users efficiently. Fundamental science, such as math and physics, has in large parts been and should be considered ineligible for patents. Innovations that make the firm-consumer or firm-supplier interface more efficient should also be ineligible because the market is a sufficient spur. The production-oriented engineering level is where patents are most effective in enhancing social welfare, and much of this innovation is taking the form of software today. *Alice* is clearly applicable to this type of innovation. Where there is a danger of granting a property right in the abstract conceptual function, the burden should shift to the patentee to argue that his right will not preempt future innovation within the same conceptual function during the patent's term.

The precise boundary of *Alice* is unsurprisingly impossible to delineate with precision on the basis of general principles. Software that primarily optimizes the consumer-firm or supplier-firm interaction, or similarly facilitates business processes, should face a presumption of ineligibility under *Alice*. Potentially life-saving technology generally should not face such a presumption. Software in the online security area seems to fall somewhere in between these two poles.¹¹¹ Online security software may serve to protect a firm's data from expropriation from rivals, which is a purely business-centered function that is likely to be spurred sufficiently by market forces without the need for patent protection. Some online security, by contrast, may serve to protect consumers from identity theft, which provides benefits beyond the boundaries of the firm's own balance sheet. Indeed, given that the primary costs of identity theft fall on the consumer rather than the firm, a profit-oriented firm may have weak incentives to protect the consumer from such theft. The firm may trade off greater convenience in consumer transactions in exchange for less protection of the consumer. Just as in the case of the Lincoln patent, the market may provide inadequate incentives for firms to invest in innovations of this type. However, generally, the degree to which innovation provides important benefits to the public external to the firm's own income or expenses suggests a fundamental basis for identifying types of innovation that should be approached with great care under *Alice*.

¹¹¹ To a degree, the Federal Circuit seems to have edged toward the principles offered here in its *DDR* opinion, creating an exception to *Alice* for software "necessarily rooted in computer technology in order to overcome a problem specifically arising in the realm of computer networks." *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1257 (Fed. Cir. 2014). But this limitation is too general under the theory of this paper and might extend to online security systems that are functionally equivalent to general site security at a factory. In any event, the *DDR* decision has created an area in which *Alice* is applied cautiously. See, e.g., Vin Gurrieri, *PTAB Rejects Bids For Computer Security Patent Reviews*, LAW360 (Sept. 28, 2015, 4:17 PM), <http://www.law360.com/articles/707928/ptab-rejects-bids-for-computer-security-patent-reviews> [<https://perma.cc/Z9VL-TUWZ>].

These considerations suggest the following framework for *Alice* as a tool for controlling strategic uncertainty in the patent system: (1) business method software algorithms, such as the hedging program in *Bilski*, should be presumptively invalid; (2) software designed to optimize consumer-firm or supplier-firm interactions should be presumptively invalid; and (3) software innovation with substantial beneficial spillovers beyond the application market—for example, to enhance consumer safety or to preserve life—should not be presumptively invalid, though shifting the burden of proving specific boundaries to the patentee may be appropriate.

III. DYNAMIC UNCERTAINTY AND PATENTS

Dynamic uncertainty, recall, is the risk of a wholesale reversal or expiration of a property right.¹¹² This essay is on static uncertainty and patents, but there are connections between static uncertainty and dynamic uncertainty.

The great escalation in patent litigation over the last two decades appears to be largely attributable to the introduction of software patents.¹¹³ This escalation has in turn increased the degree of dynamic uncertainty in the patent system. Calls for deep patent reform, and even for the abolition of patents, have received a more respectful hearing lately. I doubt that Boldrin and Levine's aggressive attack on patents, *Against Intellectual Monopoly*,¹¹⁴ would have generated the interest that it has if the modern wave of patent litigation driven by software had not arisen. *The Economist* followed its lead article criticizing the patent system with a longer piece in the same issue that closes with suggestions for reforming the patent system, such as reducing patent terms, differentiating terms across types of innovation, and experimenting with prizes.¹¹⁵

Luckily for patent holders, wholesale abolition is unlikely given the need for a constitutional amendment. However, changing the patent term, or differentiating terms according to the type of innovation (software versus pharmaceutical) may be well within Congress's power, as suggested in *Eldred*

¹¹² See *supra* note 22 and accompanying text (defining and explaining dynamic uncertainty).

¹¹³ James Bessen offers useful data on software patents and litigation. His message is that software patents tend to get litigated, tend to have invalid claims, and are frequently picked up by trolls. James Bessen, *The Case Against Software Patents, in 9 Charts*, VOX (Sept. 15, 2014, 11:08 AM), <http://www.vox.com/2014/7/7/5862284/9-charts-that-show-patents-are-bad-for-the-software-industry> [<https://perma.cc/MD9R-SBHW>].

¹¹⁴ MICHELE BOLDRIN & DAVID K. LEVINE, *AGAINST INTELLECTUAL MONOPOLY* (2008).

¹¹⁵ *A Question of Utility*, ECONOMIST (Aug. 8, 2015), <http://www.economist.com/node/21660559> [<https://perma.cc/6CAA-NHX5>] (“A top-to-bottom re-examination of whether patents and other forms of intellectual-property protection actually do their job, and even whether they deserve to exist, is long overdue.”).

v. Ashcroft.¹¹⁶ Such changes can visit the same effect as wholesale abolition on a subset of patent holders, and redistribute the rewards of the patent system toward one set of entitlement holders and away from others.

The problem with patent reform is that any legislative effort of this sort will generate feverish interest group lobbying. Interest group lobbying is nothing new; the fact that it occurs was offered by the plaintiff in *Eldred* as a reason to deny Congress the power to increase copyright terms, an argument the Court promptly rejected.¹¹⁷ The core problem with legislative tampering is that the most effective interest groups are likely to be large corporations that spend heavily on lobbying. Thus, any substantial reform of the patent system will tend to reflect the interests of large businesses, not independent inventors. The switch from first-to-invent to first-to-file in the America Invents Act of 2011 (“AIA”) coincides with the interests of large businesses with the resources to manage patent prosecution efficiently.¹¹⁸

The rent-seeking, and hence dynamic uncertainty risks, associated with patent reform are perhaps most evident in the high-stakes patent infringement dispute between Apple and Samsung.¹¹⁹ After Apple prevailed in a patent infringement trial against Samsung, the Patent Trial and Appeal Board later ruled that one of the patents found to be infringed in the trial was invalid in an *inter partes* review process initiated by Samsung.¹²⁰ The interesting and novel feature of this event is that an administrative agency, the Patent Office, effectively reversed a decision by a federal district court finding a particular patent valid.¹²¹ To a student of public choice economics, or of the history of patent law, this is a troubling sequence of events, invoking issues that had been long buried in English patent reforms centuries ago. To offer a simplistic analogy, it is as if the king awarded a patent, an independent judge found the patent to have been infringed, and the infringer went directly to the king and asked him to revoke the patent. The obvious danger in this simple story is that the infringer might be a relative, friend, or patron of the king, and therefore in

¹¹⁶ 537 U.S. 186, 222 (2003) (“[T]he Copyright Clause empowers Congress to determine the intellectual property regimes that, overall, in that body’s judgment, will serve the ends of the Clause.”).

¹¹⁷ *See id.* at 203 (“The [Copyright Term Extension Act] reflects judgments of a kind Congress typically makes, judgments we cannot dismiss as outside the Legislature’s domain.”).

¹¹⁸ *See, e.g.,* Andrew L. Sharp, Note, *Misguided Patent Reform: The Questionable Constitutionality of First-to-File*, 84 U. COLO. L. REV. 1227, 1236-37 (2013) (explaining the benefits of first-to-invent patent systems for smaller entities over large corporations).

¹¹⁹ *See* *Apple, Inc. v. Samsung Elecs. Co.*, 735 F.3d 1352 (Fed. Cir. 2013).

¹²⁰ Derek F. Dahlgren, *The Saga Continues: Apple v. Samsung, Next Stop Supreme Court*, IPWATCHDOG (Sept. 29, 2015), <http://www.ipwatchdog.com/2015/09/29/apple-v-samsung-next-stop-supreme-court/id=62065/> [<https://perma.cc/2FAD-SPY9>] (“The Patent Office recently issued a non-final rejection in an ex parte reexamination finding that Apple’s U.S. Patent No. D618,677 is unpatentable on multiple grounds.”).

¹²¹ *See id.*

a position to persuade the king to take a far less objective view of the dispute than that taken by the judge. The English courts appeared to have solved this problem in 1603 in *Darcy v. Allen (The Case of Monopolies)*,¹²² divorcing the king's preferences from the standard by which judges would enforce patents against infringers.¹²³

The patent review processes of the AIA partially resuscitate the problem of executive intermeddling in the enforcement of patents. Obviously, the federal Patent Office is quite a bit removed from the simple-minded king in my example, but it is part of the executive branch, not part of the judicial branch which for many years has had the final word on the validity of patents. The great difference between the executive and the judicial branches is that the agents of the latter are relatively distant from the lobbying pressures imposed on and originating from the executive branch.¹²⁴ To permit an executive agency to reverse a decision by a federal judge is to take a step in the direction of a politicized patent system, which opens the door to all of the uncertainties associated with executive power intervention in the patent enforcement process.

¹²² (1603) 77 Eng. Rep. 1260 (K.B.).

¹²³ *Id.* at 1266 (“And our lord the King . . . expressly commands, that no suitor presume to move him to grant any [patents].”).

¹²⁴ To be sure, administrative patent judges are considered to be independent of the federal Patent Office Director, but some litigants have suggested that this purported independence is not nearly as complete as that of a federal judge. For example, hedge fund manager Kyle Bass claimed that federal Patent Office Director Michelle Lee had directed the administrative patent judges not to institute any *inter partes* reviews of petitions he had filed with the agency. See Susan Decker, *Bass Vows to Keep Fighting U.S. Drug Patents After Setbacks*, BLOOMBERGBUSINESS (Sept. 3, 2015, 6:09 PM), <http://www.bloomberg.com/news/articles/2015-09-03/bass-vows-to-keep-fighting-u-s-drug-patents-after-setbacks> [https://perma.cc/WD9Z-NGF8]. Moreover, administrative patent judges do not have Article III tenure as do federal judges, and the Patent Office Director may designate the panels that decide cases in the manner consistent with his or her preferences. See John F. Duffy, *Are Administrative Patent Judges Unconstitutional?*, 77 GEO. WASH. L. REV. 904, 908 (2009) (“It is true that the Director of the PTO retains a substantial supervisory role over the BPAI and can, for example, use his power to designate BPAI panels that he ‘hopes will render the decision he desires, even upon rehearing.’”); Masur, *supra* note 42, at 496 n.106. Administrative patent judges do not have the same protections as Article I administrative law judges because the legislature does not directly create their positions. See, e.g., Duffy, *supra*, at 904-05 (“Under 35 U.S.C. § 6, administrative patent judges of the Board of Patent Appeals and Interferences (‘BPAI’) are appointed by the Director of the Patent and Trademark Office (‘PTO’). That method of appointment is almost certainly unconstitutional, and the administrative patent judges serving under such appointments are likely to be viewed by the courts as having no constitutionally valid governmental authority.” (internal citations omitted)). In addition, administrative patent judges undergo a two-year probationary period. See *Job Announcement No. PTAB-2015-0023 (Administrative Patent Judge)*, USAJOBS, <https://www.usajobs.gov/GetJob/PrintPreview/393260300> [https://perma.cc/J8CD-6TTM].

Even proposals to pass legislation regulating patent trolls raise the risk of inter-group wealth transfers of a predictable nature. While there have been notable examples of abuse by patent trolls,¹²⁵ the troll also offers independent inventors and small businesses an affordable way of enforcing their patent rights, and by doing so helps to support innovation incentives. As I noted earlier, the troll, as a licensor of patents, ordinarily stands willing to license to all businesses rather than favor one business over another. Moreover, in the current patent litigation environment, trolls, as non-practicing entities, are relatively immune from threats of counterclaims typically used as a defensive mechanism by firms experienced in patent litigation. However, trolls are unnecessary to enforce patents from the perspective of large firms with in-house legal departments, and their presence only makes it more difficult to deter infringement claims brought by smaller firms. Hence, a statute that taxed or abolished trolls would benefit large firms at the expense of small ones.

The courts already have at their hands virtually all of the tools necessary to regulate patent trolls. The Supreme Court's decision in *Octane Fitness, LLC v. Icon Health & Fitness, Inc.*,¹²⁶ making it easier for victims of abusive patent infringement litigation claims to collect attorneys' fees, may be a sufficient regulatory mechanism for trolls.¹²⁷ A troll who recognizes that he may be forced to pay the attorneys' fees of a party he sues for infringement will tend to bring only the strongest infringement claims.¹²⁸

The optimal program for addressing uncertainty in the patent system is through the common law process of making marginal changes in the scope of patent rights through judicial decision-making. Many of these marginal changes can be applied with surgical accuracy to fix a particular problem without creating new ones. For example, the Court's decision in *Octane Fitness* removes much of the need for any special statute from Congress enacting a "loser pays" rule for allocating attorney expenses in patent infringement litigation initiated by patent trolls. If Congress does eventually pass a statute adopting a "loser pays" rule for patent trolls, it is likely to include other provisions that tilt the playing field in favor of businesses that

¹²⁵ See e.g., Susan Decker, *Notorious 'Patent Troll' MPHJ Will Ease Tactics: FTC*, BLOOMBERGBUSINESS (Nov. 6, 2014, 5:31 PM), <http://www.bloomberg.com/news/articles/2014-11-06/notorious-patent-troll-mphj-will-ease-tactics-ftc> [https://perma.cc/SU6E-B55T] ("MPHJ Technology Investments LLC will stop making deceptive claims. MPHJ, its sole owner Jay Mac Rust of Waco, Texas, and its law firm Farney Daniels had sent letters to thousands of small companies warning they face lawsuits unless they pay to license MPHJ patents, according to the FTC.").

¹²⁶ 134 S. Ct. 1749 (2014).

¹²⁷ *Id.* at 1756 (holding that the court may award attorneys' fees where the case "stands out from others with respect to the substantive strength of a party's litigating position" or where the case was litigated in an "unreasonable manner").

¹²⁸ On the filing incentives of fee shifting, see Hylton, *supra* note 6, at 444 (demonstrating that a plaintiff will only bring a case when his expected award exceeds the expected cost).

can afford to hire lobbyists. Indeed, as I have already suggested, *any* statute regulating patent trolls is likely to effect a wealth transfer from small business and independent inventors toward established technology businesses. Such wealth transfers work to reduce innovation among the numerous atomistic sources the patent system was designed to encourage and concentrate innovation incentives in corporations, with a likely reduction in the overall rate of innovation and a shift in the nature of innovation.

CONCLUSION

Courts should adopt doctrinal rules that reduce strategic uncertainty in patent law. This may seem to be an obvious statement, but it excludes some alternatives. First, inherent uncertainty, due to ambiguity in the statement of a rule, does not need to be a focus of reform, because the common law process is necessarily uncertain at an early stage of analysis of a particular class of legal claims. Second, the appearance of uncertainty that arises from changes in the composition of patent disputes should be understood for what it is. Third, uncertainty that results from strategic behavior of litigants—what I have called strategic uncertainty here—is the only source of uncertainty that should be addressed by reform-minded courts; and it should be addressed by the courts rather than the legislature, or hived off into the administrative process.