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The Infringement Continuum

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THE INFRINGEMENT CONTINUUM

Bernard Chao[†]

For many years, patent law has struggled with the issue of permissible claim scope. A patent's specification and its claims often suffer from a surprising disconnect. The specification generally describes an invention in terms of one or more specific implementations, suggesting a relatively narrow invention. But claims are drafted far more broadly. They frequently encompass unforeseen variations and even cover after-arising technology.

Although there are numerous existing doctrines that try to prevent claims from straying too far from their specification, these doctrines offer binary outcomes ill suited for patent law. Under these doctrines, as a claim encompasses subject matter further and further away from what the specification describes, there is a point where the inventor suddenly loses all rights. These outcomes make sense when all trespasses are considered equal wrongs. However, in reality, there is an infringement continuum. At one end of the continuum, infringement can look exactly like the invention described by a patent. That infringement should be treated far more seriously than infringement that resides at the other end of the continuum and looks very different from the invention.

Consequently, I propose a new theoretical framework that ties patent disclosure doctrine to the remedies the law provides. Although I would continue to use the claims to determine infringement, I suggest that the specification be used to assess the remedy. Specifically, I suggest replacing the current lost profits/reasonable royalty framework with one based on royalties that consider disclosure principles. The size of the royalty would be determined by comparing the infringement to the patent specification and adjusting the royalty based on the degree of similarity.

The proposal improves on existing doctrines in two fundamental ways. First, instead of offering binary outcomes, the proposed remedies are highly

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adjustable. Therefore, they are well suited for addressing the full infringement continuum. Second, this proposal does not just focus on the patentee's injury, as does the current law. Rather, it advances the public interest by optimizing incentives for both initial and follow-on innovators.

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INTRODUCTION

For many years, patent law has struggled with the issue of permissible claim scope. A patent's specification and its claims often suffer from a surprising disconnect.¹ The specification generally describes an invention in terms of one or more specific

¹ A specification is a written description of the invention, while a patent's claims delineate the boundaries of the property right. See *infra* notes 7–13 and accompanying text.

implementations, suggesting a relatively narrow invention. But claims are drafted far more broadly. They frequently encompass unforeseen variations and even cover after-arising technology.

This Article argues that patent law should manage overbroad claims by fundamentally changing the way patent law looks at its remedies. Patent law has always viewed patents like personal property and attempted to restore the patentees to the place they would have occupied had there been no infringement. But these “make whole” remedies are inconsistent with the professed goal of patent law—maximizing innovation in the name of the public welfare.² For patent law to be faithful to this view, it should not be single mindedly focused on redressing the inventor’s injury. Rather, the law needs to be concerned about providing incentives for *both* patentees and any infringers that build on a patentee’s work.

To allocate incentives properly, the law needs to be able to tune the remedy to match the full range of potential infringements. We can consider different types of infringement as falling along a continuum. At one end of the continuum, infringement can look exactly like the invention described by a patent. At the other end, infringement can be very different from the invention. Broad claims often reach deeply into this continuum. These broad claims cause significant problems. When claims reach technology that is too far afield from the invention, patentees are rewarded for something they did not invent and later innovators are unnecessarily burdened.

A number of existing patent doctrines attempt to address this problem. The enablement requirement, written description requirement, claim construction, subject matter patentability, and the reverse doctrine of equivalents all limit broad claims to one degree or another. Nonetheless, defining just how broadly inventors may claim their inventions has proven to be extremely challenging. The jurisprudence of these doctrines is confusing and often yields unpredictable results.

Numerous commentators have proposed various changes to these claim-limiting doctrines. For example, certain Federal Circuit judges advocate interpreting claims more narrowly based on the embodiments found in the specification.³ Other commentators suggest transforming the subject matter eligibility requirement so that its sole function would be to address overbroad claims.⁴ But no matter how the law might tinker with these standards and tests, these doctrines all suffer from one fundamental limitation. They yield only two outcomes. If the patentee is

² Ted Sichelman, *Purging Patent Law of “Private Law” Remedies*, 92 TEX. L. REV. 517, 529–36 (2014).

³ See *infra* notes 109–11 and accompanying text.

⁴ See *infra* notes 135–36 and accompanying text.

allowed to enforce a broad claim, all of patent law's remedies are available. On the other hand, if the claim is determined to be too broad, the patentee recovers nothing. Doctrines that only have binary outcomes will never be able to effectively handle the range of infringements that reside on the continuum.

Accordingly, I propose a more nuanced approach to the problem of overbroad claims. My proposal does not try to fix the different doctrines that limit claim scope and make them more predictable. To some extent, these problems are intractable. Instead, I suggest that patent law replace its current lost-profits/reasonable-royalty framework with a single royalty system that considers the proximity of the infringement to the invention. Under this theory, the patentee's remedy diminishes when the nature of the infringement looks less and less like what the specification describes. This theory is unconcerned with what the patentee lost and instead focuses on the relative contribution the patent made to the infringing device. By rethinking patent remedies in terms of disclosure principles, the proposal described in this Article tailors the remedy to better address the infringement continuum. Consequently, this proposal improves on existing doctrines that only offer binary outcomes.

Part I of this Article explains why claims can look so much broader than the invention the patentee describes and the difficulties this creates. Under the current system of peripheral claiming, patents consist of both a written specification and claims. The specification teaches the public how to practice the invention while the claims define the property right. In practice, specifications describe one or more specific embodiments of the invention. But patent attorneys intentionally draft the claims as broadly as possible. In many cases, these claims end up covering variations or improvements that have little resemblance to the original invention.⁵ Such overbroad claims reward inventors for technology that they did not invent and unnecessarily burden downstream innovation.

The problem of broad claims is exacerbated by the problem of unclear claims. Patent claims use words to try to describe the scope of technical concepts. To do so precisely is probably impossible.⁶ There are always disputes around what claims mean and even the proper methodology for interpreting those claims. The result is that patent

⁵ Timothy R. Holbrook, *Equivalency and Patent Law's Possession Paradox*, 23 HARV. J.L. & TECH. 1, 5 (2009) (noting that the doctrine of equivalents also "grants protection to patent holders for creations that by definition were not—and indeed could not have been—in their possession at the time of their patent applications"); Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1005 (1997) ("[P]atent claims may reach new and unanticipated inventions made after the patent issues, but which fall within the literal language of the claims.").

⁶ See David L. Schwartz, *Practice Makes Perfect? An Empirical Study of Claim Construction Reversal Rates in Patent Cases*, 107 MICH. L. REV. 223, 259 (2008).

scope is notoriously unpredictable. Because of this uncertainty, companies may avoid using technology not covered by a patent or simply pay undeserved licensing fees. Alternatively, companies may roll the dice and let the courts tell them if they are infringing a patent. Each of these choices burdens innovation in different ways.

Part II discusses the various patent doctrines that are used to restrain claims from straying too far from their specification. Several doctrines declare that overly broad claims are invalid. Chief among these is the enablement requirement; it requires that the written specification enable a person of ordinary skill in the art to practice the claimed invention. If the specification fails to teach the full scope of the claim, that claim is invalid. Applying different tests, the written description and subject matter patentability requirements also can be used to invalidate claims that cover subject matter that departs too far from the specification.

Other patent doctrines leave broad claims intact, but constrain their scope. Courts can use the patent's specification to interpret claims narrowly. Thus, even when claims are drafted broadly, they may not reach as far as the patentee intended. These cases typically result in a finding of non-infringement. The little-used reverse doctrine of equivalents applies to subject matter that falls within the literal scope of a claim. The doctrine says that there is no infringement because the subject matter departs too far from the spirit of the invention.

All these claim-limiting doctrines share two important characteristics. First, for the most part, these doctrines involve complicated concepts that make them difficult to apply. Consequently, outcomes are unpredictable. Second, all these doctrines have all-or-nothing outcomes. Under the enablement, written description, and subject matter patentability doctrines, a claim is either valid or invalid. When the courts interpret claims or look to the reverse doctrine of equivalents, the result leads to a finding of infringement or non-infringement.

These all-or-nothing outcomes are a poor match for the different kinds of infringement that exist. There are countless flavors of potential infringement. This "infringement continuum" reflects varying degrees of potential claim scope. Although reasonable minds may disagree on how far into the continuum a patent should reach, no one should dispute that some kinds of infringements should be treated more seriously than others. A company that does precisely what the patent describes owes a greater debt to the patentee than a company that modifies the invention in some unforeseen ways or adds its own contributions. Relying on this basic insight, this Article proposes a different-remedies framework that compares the infringement to what the patent discloses.

The concept of tying patent remedies to disclosure principles can trace its roots to two different sets of existing proposals—adjusting the law of permanent injunctions and central claiming. Part III describes these proposals and explains how the current reform builds upon them. Several commentators argue that courts should not grant permanent injunctions when an infringing product *significantly improves* on the patentee's invention. In effect, these proposals suggest that the patentee's remedy should be reduced when the infringement looks less like the patentee's original invention. But because these proposals only rely upon a single coarse lever (i.e., whether to grant a permanent injunction), they do not account for all the different kinds of infringement that exist. This Article takes the next step and suggests that money damages should be based on the proximity of the infringement to the patentee's original invention. Since there is a large range of potential money damages, this reform can better account for all the types of infringement that lie on the continuum.

Other commentators argue that U.S. patent law should return to a system of central claiming. This means that infringement determinations would be made by relying on the specification instead of the claims. The proposal would also place less weight on a patent's claims and more weight on the patent's specification. But instead of trying to fix claim scope, it assumes that the problem will always be with us. Consequently, the proposed reform attempts to adjust patent remedies to account for this uncertainty.

Part IV describes a proposal for basing money damages on the infringement continuum. It first critiques the existing reasonable-royalty/lost-profits framework. Both of these theories misguidedly focus on making patentees "whole" by returning them to the place they would have occupied had there been no infringement. But the goal of patent law is to promote the sciences. Any benefit that inventors receive is simply a necessary side effect of incentivizing innovation. The current system makes patentees whole at the cost of disincentivizing those who would build on existing technology. In contrast, using the infringement continuum to calculate damages would incentivize both the patentee and any innovating infringer by apportioning profits between them.

Part V goes on to identify several important characteristics of a remedies reform that would use the infringement continuum to determine money damages in patent cases. Specifically, this Article argues that the law should eliminate the current bifurcated lost-profits/reasonable-royalty regime and just use a royalty-based system. This "new" royalty calculation would not rely on the current *Georgia-Pacific* test. Instead, it would base damages on a comparison of the infringing product to the patent's specification.

There are two primary benefits of this reform. First, by calibrating damages to the contributions made by *both* the patentee and infringer, the proposal will allocate incentives in a manner that optimizes all kinds of innovation. Second, the proposed reform should reduce the cost of unclear claims. The problem of unclear claims looms largest at outer edges of a claim's scope. Because the current reform reduces damages at these edges, any errors associated with unclear claims are likewise reduced.

Finally, Part V also describes some exemplary methods for calculating damages using these principles. The primary example assesses similarity in two dimensions—how far the infringer has changed the basic invention and how much the infringer has added to the basic invention. Other variations are then added to this example to reflect the different values patent law may wish to highlight. The result is a flexible framework for balancing innovation incentives.

I. CLAIM SCOPE

Patents are made up of two primary components, the specification and the claims. The specification is a written description of the invention. It describes one or more embodiments (i.e., examples) of the invention and usually includes drawings to help explain the nature of the invention. The claims follow the specification; they are of paramount importance because the claims define the scope of the patented invention.⁷ Each claim contains several limitations that define the claim's attributes. Anyone who practices all the limitations found in any claim is said to infringe the patent.⁸

Infringement determinations are centered on the patent's claims and not its specification.⁹ Of course the specification still plays an important role. It is one of the primary sources of evidence used to interpret the meaning of the claims.¹⁰ But unlike the claims, the specification itself is never compared to the accused device.¹¹ This

⁷ *Astrazeneca AB v. Mut. Pharm. Co.*, 384 F.3d 1333, 1336 (Fed. Cir. 2004) (“It is axiomatic that the claims mark the outer boundaries of the patent right to exclude.”).

⁸ See *Freedman Seating Co. v. Am. Seating Co.*, 420 F.3d 1350, 1358 (Fed. Cir. 2005) (noting that the “all limitations” rule “holds that an accused product or process is not infringing unless it contains each limitation of the claim, either literally or by an equivalent”).

⁹ See Dan L. Burk & Mark A. Lemley, *Fence Posts or Sign Posts? Rethinking Patent Claim Construction*, 157 U. PA. L. REV. 1743, 1744 (2009) (“In modern American patent doctrine, we define what the patentee owns not by what she actually built or disclosed, but by what she claimed.”); see also Jeanne C. Fromer, *Claiming Intellectual Property*, 76 U. CHI. L. REV. 719, 731–43 (2009) (describing the evolution of patent law's claiming system).

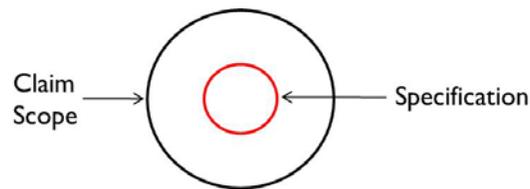
¹⁰ See *infra* note 102 and accompanying text.

¹¹ *SRI Int'l v. Matsushita Elec. Corp. of Am.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985) (“Infringement, literal or by equivalence, is determined by comparing an accused product not with a preferred embodiment described in the specification, or with a commercialized

arrangement is intended to give the public notice of the scope of the inventor's monopoly.¹² Presumably, it is easier to discern the scope of an invention by examining claims specially prepared to delineate boundaries as opposed to a description of the invention.¹³ However, relying on claims to define the invention has its problems. Because these two components are separate, there may be a surprising disconnect between the specification and the claims. The specification may appear to describe a narrow invention while the claims are extremely broad.¹⁴ Figure 1 below illustrates this point.

The specification typically describes embodiments that fall within the inner circle, but the claims inevitably read further, as depicted by the outer circle.

Figure 1



A. *Broad Claims*

Patent attorneys draft claims as broadly as they can. In fact, they often deliberately seek overly broad claims in the hope that the patent

embodiment of the patentee, but with the properly and previously construed claims in suit.” (citing *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1578 (Fed. Cir. 1984) and *Teledyne McCormick Selph v. United States*, 558 F.2d 1000, 1007 (Ct. Cl. 1977)).

¹² *Permutit Co. v. Graver Corp.*, 284 U.S. 52, 60 (1931) (“[A patent must contain claims that] inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.”).

¹³ Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 502 (2008) (explaining how the current system of using claims facilitates the public notice function of patents). *But see* Burk & Lemley, *supra* note 9, at 1783–99; Fromer, *supra* note 9, at 723 (arguing that the patent system should rely less on claims and more on a system of central claiming that would use the embodiments described in the specification to determine a patent’s boundaries).

¹⁴ Oskar Liivak, *Rescuing the Invention from the Cult of the Claim*, 42 SETON HALL L. REV. 1, 15 (2012) (“[T]he embodiments disclosed in the specification are *not the limit of the allowable subject matter*; rather, they form the starting point from which the claim scope negotiation begins.” (emphasis added)); Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 356 (2010) (“[C]ourts and the Patent Office typically allow patent claims that are of much broader scope than what is actually disclosed in a patent application.”).

office will accept them.¹⁵ The prior art serves as a check on claim breadth.¹⁶ Patents are only granted for new inventions. Consequently, claims that are drafted so expansively that they would cover the prior art are not patentable.¹⁷ Likewise, trivial claims that would be obvious in view of the prior art are also unpatentable.¹⁸

But the prior art is not the only restraint on broad claims. An inventor cannot claim all subject matter that is not found in or suggested by the prior art. There must be a sufficiently strong connection between what the inventor describes in the patent's specification and what she claims. In practical terms, the question is whether claims should be limited to the embodiment(s) disclosed in the specification or whether they can cover variations that were never described. If the latter choice is selected, the issue becomes how patent law can restrain the scope of the claims so that they are not unbounded.

The debate over claim breadth can be seen as far back as the nineteenth century. The famous inventor, Samuel Morse, obtained a patent containing several claims directed to what we now think of as the telegraph machine.¹⁹ However, the patent also contained an eighth claim that was not limited to any specific machinery. Rather it claimed the use of "electro-magnetism, however developed, for making or printing intelligible characters, letters, or signs, at any distances."²⁰ Morse sued O'Reilly for patent infringement and the case reached the Supreme Court.

In *O'Reilly v. Morse*, the majority was understandably concerned that the eighth claim would prevent future inventors from using an entirely different mode of writing or printing that was not described in Morse's patent.²¹ Essentially, the majority did not want the patent to

¹⁵ Robert P. Merges, *The Trouble with Trolls: Innovation, Rent-Seeking, and Patent Law Reform*, 24 BERKELEY TECH. L.J. 1583, 1603 (2009) ("In practice, clever lawyering can often produce a patent claim that covers more technological ground than is truly warranted by the underlying invention."); Chief Judge Paul Michel, *Lecture: Innovation, Incentives, Competition, and Patent Law Reform: Should Congress Fix the Patent Office and Leave Litigation Management to the Courts?*, 20 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1135, 1168 (2010) ("Let's be honest. Patent prosecutors are trying to get maximum scope, so they are always including some claims that are really well beyond what the inventor invented . . .").

¹⁶ Lemley, *supra* note 5, at 1001–02 (describing how the novelty and obviousness requirements limit the ability of inventors to draft broad claims).

¹⁷ 35 U.S.C. § 102(a) (2012).

¹⁸ *Id.* § 103. See *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415–22 (2007), for a discussion of the standard for determining obviousness.

¹⁹ See *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 81–88 (1853).

²⁰ *Id.* at 86.

²¹ See *id.* at 113 ("[S]ome future inventor, in the onward march of science, may discover a mode of writing or printing at a distance by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. His invention may be less complicated—less liable to get out of order—less expensive in construction, and in its operation. But yet if it is covered by this patent the inventor could not use it, nor the public have the benefit of it without the permission of this patentee.").

cover what Morse did not invent, and the eighth claim was declared invalid. But the dissent voiced legitimate concerns. It pointed out that patents should be able to cover simple improvements or changes to their inventions.²² The majority agreed saying that a patent can cover alterations to “unessential parts.”²³ Of course the difficulty is determining when any modifications are sufficiently substantial that they cannot be claimed. In Morse’s case, the prevailing view was that the eighth claim went too far.²⁴ Courts continue to struggle with similar problems to this day. How do you determine how far claims may reach beyond the embodiments found in the specification? In *O’Reilly*, the Supreme Court relied on the patent’s disclosure to limit claim breadth, but the decision did not provide a framework for using the specification to assess claim breadth.

As discussed in Part II, the idea of using a patent’s disclosure to assess the validity of a broad claim continues to be found in a number of current patent doctrines. To one extent or another, the enablement requirement, written description requirement, and subject matter patentability doctrine all rely on the patent’s specification to invalidate unduly broad claims.²⁵ Similarly, courts also can use the specification to constrain claim scope by interpreting claims narrowly or finding that there is no infringement under the reverse doctrine of equivalents.²⁶ Notably, these doctrines do not go so far as to limit claims to embodiments described in the specification.²⁷ Claims often cover variations of the invention that are not described in the specification.

In fact, broad claims can even encompass after-arising technology.²⁸ Consider one of the patents Apple is asserting against its

²² *Id.* at 134 (“The claim of the patentee is, that he may be protected in the exercise of his art as against persons who may improve or change some of the processes or machines necessary in its exercise.”).

²³ *Id.* at 123 (“It is a well-settled principle of law, that the mere change in the form of the machinery (unless a particular form is specified as the means by which the effect described is produced) or an alteration in some of its unessential parts; or in the use of known equivalent powers, not varying essentially the machine, or its mode of operation or organization, will not make the new machine a new invention. It may be an improvement upon the former; but that will not justify its use without the consent of the first patentee.”).

²⁴ *Id.* at 119–20.

²⁵ See *infra* Part II.A–B, E.

²⁶ See *infra* Part II.C–D.

²⁷ See *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) (en banc) (“[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments.”).

²⁸ Collins, *supra* note 13, at 497 (“A number of high-profile cases expressly sanction the reach of literal claim scope into [after-arising technology] The routine phenomenon of blocking patents—successively issued patents that encompass the same technological thing—implies that the scope of a patent claim grows over time to encompass technologies that by definition are not known . . . at the time of filing.”); Lemley, *supra* note 5, at 1005 (“[P]atent claims may reach new and unanticipated inventions made after the patent issues, but which fall within the literal language of the claims.”).

competitors in the ongoing smart phone patent wars. The invention of U.S. Patent No. 5,946,647 (the '647 patent) is related to automatically marking up types of data in an unstructured document in order to enable users to bring up other programs that process such data. The specification of the '647 patent disclosed several embodiments (i.e., examples) of the invention: recognizing a phone number and calling it or putting it in an electronic phone book; recognizing an address and writing a letter or putting the address in an address book; recognizing an e-mail address and sending an e-mail or putting the e-mail address in an e-mail address book; recognizing a date and putting it in an electronic calendar; and recognizing a name and writing a letter, calling the person, or putting it in a message folder.²⁹

The invention of the '647 patent clearly was intended to operate on personal computers.³⁰ The patent was filed almost twenty years ago—long before any phone had the ability to handle documents and e-mail.³¹ Not surprisingly, the specification never mentions smart phones. Nevertheless, Apple successfully argued that HTC's smart phones infringed this patent because they recognized phone numbers and turned them into hyperlinks. Users could then click on the hyperlinks to dial the phone numbers.³² Infringement was found even though the inventors probably did not foresee that their technology would be used in smart phones. Still, unlike Morse's eighth claim, the application of Apple's '647 patent to today's smart phones probably does not offend most people's sense of justice. After all, the accused smart phones were using technology that looked very similar to what Apple invented.

These examples illustrate how broadly claims can reach. Claims clearly cover technology that looks precisely like the embodiments described in the patent. Minor variations may also fall within the scope of a patent's claims even though they are not described in the specification. Finally, claims may also cover after-arising technology that could not be envisioned at the time the patent was filed. This happens in two ways. First, claims may cover unforeseen variations of the invention. For example, photographs are now routinely sent via e-mail. The '647 patent *might* cover a computer that automatically recognizes the faces in a photo and indexes the photos accordingly.³³

²⁹ U.S. Patent No. 5,946,647 fig.4 (filed Feb. 1, 1996) (depicting each of these actions in Figure 4).

³⁰ Figure 1 depicts the standard personal computer configuration of the time. See '647 Patent fig.1.

³¹ The patent was filed on February 1, 1996 and issued on August 31, 1999.

³² See *In Re Certain Pers. Data & Mobile Commc'ns Devices & Related Software*, Inv. No. 337-TA-710, USITC Pub. 4331, at 123-35 (Dec. 19, 2011) (Final), available at http://www.usitc.gov/publications/337/Pub4331_337-TA-710.pdf.

³³ Reasonable minds may differ about whether the '647 patent should reach this far. See *infra* note 160 and accompanying text.

Second, claims can cover competitors that add something unforeseen to the invention, like the many features of HTC's smart phone. These variations illustrate how the different kinds of infringement lie upon a continuum. But the point is that as a claim reaches further and further away from the specification, the law will eventually declare that the claim goes too far and cannot be enforced. That is what the Supreme Court concluded with respect to Morse's eighth claim.

Significant costs are associated with overly broad claims.³⁴ Broad claims can lead to underinvestment in technology that builds on existing patented technology.³⁵ Additionally, extremely broad claims offend our notions of fairness because they reward inventors for something that they did not invent.³⁶ Samuel Morse's eighth claim is a good example of this problem. Few would suggest that Morse deserves a patent on all electric machines that communicate.

This view stands in sharp contrast to Edmund Kitch's "prospect theory."³⁷ Prospect theory suggests that patents serve an important function beyond simply incentivizing innovation. Kitch argued that broad claims can be desirable because they allow a first mover to efficiently manage subsequent development and avoid wasteful duplicative investment.³⁸

However, I side with the critics of Kitch and reject the supposed benefits of prospect theory.³⁹ Prospect theory fails to adequately account for two real world features of patent law. First, patents do not give their inventors the exclusive right to practice the fruits of their invention. Rather, they just give the right to exclude others from practicing the claimed invention. Multiple patents are typically needed to make most products, and ownership of those patents is often divided. Thus, granting broad claims does not give any one company the ability to

³⁴ Of course there are often disputes about whether claims *are* overly broad.

³⁵ Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 875 (1990) ("Property rights that are too narrow will not provide enough incentive to develop the asset, while overly broad rights will preempt too many competitive development efforts."); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 32 (1991) ("[S]uch broad protection can lead to deficient incentives to develop second generation products.").

³⁶ See Liivak, *supra* note 14, at 26–30 (criticizing the current law for allowing patents to claim more than the actual invention).

³⁷ See Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 267 (1977).

³⁸ *Id.* at 276, 278–79.

³⁹ See, e.g., Donald G. McFetridge & Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197, 203 (1980) ("[P]rospect features [in a patents system] fail to assist market participants in their attempt to economize on the common property resource."); Merges & Nelson, *supra* note 35, at 872 (suggesting that Kitch's theory may make sense in principle, but not in practice).

coordinate further development.⁴⁰ Second, prospect theory overestimates what companies know about each other's patents. Most companies do not look for or know about the existence of patents that may affect them.⁴¹ Furthermore, many patent holders now deliberately lie-in-wait to assert their patents so that they can "holdup" the accused infringers.⁴² Because of the failure of patent law's notice function, patents do not avoid duplicative efforts. Of course these characteristics primarily describe the high-tech industry where thousands of patented inventions can be found in a single product.⁴³

Thus, this Article starts with the proposition that overly broad claims, particularly in the high-tech industry, are a problem that needs to be addressed. But the law also needs to be careful not to narrow claims too far. Issuing very narrow claims has its problems too. If claims were limited to the embodiment disclosed in the specification, others could make minor changes to the invention and avoid infringement.⁴⁴ That would devalue patents and under incentivize all inventors. For years the courts have struggled to balance these concerns and limit claim breadth appropriately. In effect, patent law needs to constrain claim scope so that it does not depart too far from the specification (as shown in the left of Figure 2) without limiting claims to the described embodiments and their most trivial variations (as shown in the right of Figure 2).

⁴⁰ John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 442 (2004) ("[T]he holder of a broad prospect patent covering an entire field of technology cannot stop another inventor from searching for, and patenting, improvements to the technology."). Duffy does suggest that early prospect patents may have different benefits than Kitch identified. They channel rivalry so that patents expire earlier and thereby diminish monopoly rents. *Id.* at 444.

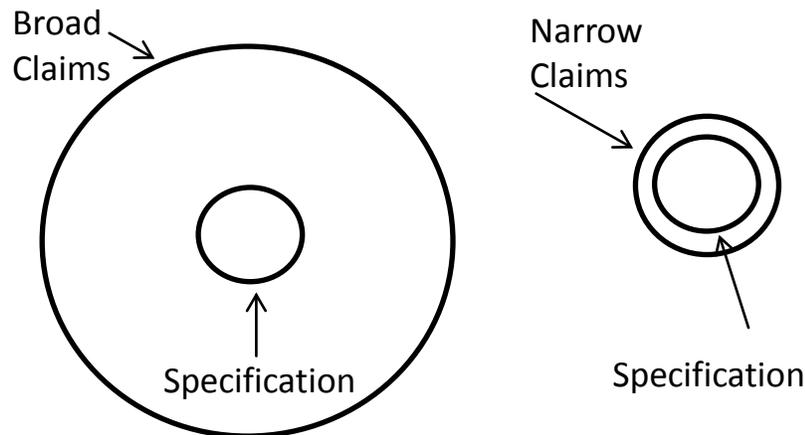
⁴¹ FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 80–81 (Mar. 2011) [hereinafter FTC, THE EVOLVING IP MARKETPLACE], available at <http://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307-patentreport.pdf> (explaining how the notice function of patents appears to work in the pharmaceutical industry but fails in the information technology industry); Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21 ("[B]oth researchers and companies in component industries simply ignore patents.").

⁴² FTC, THE EVOLVING IP MARKETPLACE, *supra* note 41, at 52–53 (explaining how ex post transactions overcompensate patent holders and thereby harm competition).

⁴³ But if we look at industries with products that are covered by a small number of patents (e.g., the pharmaceutical industry), it is unclear that there is much follow-on innovation to manage. To be fair, broad patent rights in the pharmaceutical industry would probably deter others from pursuing duplicative research.

⁴⁴ See Collins, *supra* note 13, at 496; see also *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 607 (1950) ("[C]ourts have . . . recognized that to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing."); *Invitrogen Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1071 (Fed. Cir. 2005) (suggesting that if patents were limited to the embodiments they disclosed, the patents "would rapidly become worthless as new modes of practicing the invention developed, and the inventor would lose the benefit of the patent bargain").

Figure 2



B. Unclear Claims

The problem of intentionally broad claims is compounded by the existence of unclear claims. Interpreting claims is not easy. Describing the boundaries of an invention is far more difficult than describing the boundaries of real property. After all, real property boundaries can use objective measurements while claims try to capture the essence of an invention with language.⁴⁵ This problem is made worse by attorneys. Now you might think that good attorneys would try to avoid drafting unclear claims.⁴⁶ Unfortunately, attorneys are incentivized to do just the opposite. I have heard more than once that patent attorneys should draft claims to give their client maximum flexibility. That means drafting claims that are intentionally vague.⁴⁷

Another feature of the law that makes patent claims even less certain is claim interpretation or claim construction. Claim interpretation is a process whereby courts provide definitions for key

⁴⁵ JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* 55 (2008) (“[I]t is much more complicated to map the boundaries of a technology from a verbal description than it is to map a plot of land using a standardized surveyor’s description.”).

⁴⁶ See, e.g., Harry Surden, *Efficient Uncertainty in Patent Interpretation*, 68 WASH. & LEE L. REV. 1737, 1810 (2011) (arguing that patentees should be required to include explicit definitions of claim terms).

⁴⁷ Burk & Lemley, *supra* note 9, at 1753 (“[M]any applicants don’t specify what they mean by ambiguous technical language, either because they don’t think about the issue or because they intend to exploit the ambiguity in obtaining or enforcing the patent.”).

phrases and words from the claims of the patent.⁴⁸ Ideally, the definitions or “claim constructions” clarify the meaning of the claims in a manner that helps resolve the dispute.⁴⁹ Almost every patent case involves a dispute over the meaning of the claims.⁵⁰ Indeed, local patent rules often recommend that courts conduct a hearing specifically to interpret claims.⁵¹

In 2005, an en banc panel of the Federal Circuit attempted to set forth a methodology that would make claim interpretation more predictable.⁵² The *Phillips v. AWH Corp.* decision valued intrinsic evidence (e.g., the claims, specification, and prosecution history) over extrinsic evidence (e.g., dictionaries and expert testimony).⁵³ Consequently, claims are now supposed to be interpreted primarily based on context (i.e., how the inventor used the terms); the plain meaning of a term is relevant, but given less weight.⁵⁴ Despite the *Phillips* decision, courts (including the Federal Circuit itself) either will not or cannot apply these principles consistently across different cases.⁵⁵

Given the difficulties with claim construction, it is not surprising that outcomes continue to be very unpredictable. There is a high claim construction reversal rate. In a study of Federal Circuit decisions, David Schwartz has found that “38.2% of cases had at least one term wrongly construed.”⁵⁶ “Moreover, 29.7% of the cases had to be reversed, vacated, and/or remanded because of an erroneous claim construction.”⁵⁷ Since Schwartz’s study, Jonas Anderson and Peter Menell have reported that reversal rates have decreased with around 29.5% of Federal Circuit decisions reversing at least one term.⁵⁸ This corresponded to a remand, reversal, or vacation in 23.1% of cases.⁵⁹ However, they do not attribute this improvement to increased clarity in the law. Rather, they suggest

⁴⁸ Since claim interpretation is a legal issue, the courts must perform this task. *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 384 (1996).

⁴⁹ See *Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1580 (Fed. Cir. 1991) (“[T]he construction of claims is simply a way of elaborating the normally terse claim language: in order to understand and explain, but not to change, the scope of the claims.”), *overruled on other grounds by Abbott Labs. v. Sandoz, Inc.*, 566 F.3d 1282, 1293 (Fed. Cir. 2009).

⁵⁰ See *Burk & Lemley*, *supra* note 9, at 1744.

⁵¹ See, e.g., N.D. Cal. Patent L.R. 4-1 to 4-7 (2009) (section titled “Claim Construction Proceedings”), available at <http://www.cand.uscourts.gov/localrules/patent>.

⁵² *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc).

⁵³ *Id.* at 1314–19.

⁵⁴ Christopher A. Cotropia, *What is the “Invention”?*, 53 WM. & MARY L. REV. 1855, 1868 (2012) (describing *Phillips* as a “specification-influenced claim interpretation methodology” as opposed to one relying on dictionaries).

⁵⁵ See *infra* notes 109–12 and accompanying text.

⁵⁶ Schwartz, *supra* note 6, at 248.

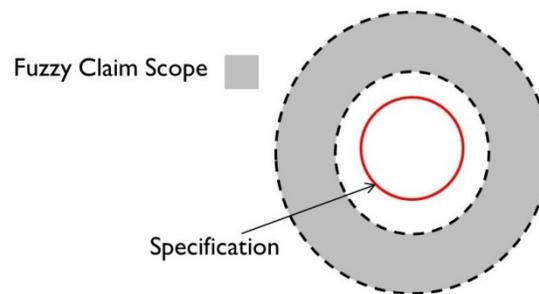
⁵⁷ *Id.* at 249.

⁵⁸ J. Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 NW. U. L. REV. 1, 39 (2014).

⁵⁹ *Id.*

that the Federal Circuit has been applying a level of unstated deference to district court claim construction rulings.⁶⁰ If Anderson and Menell are correct, parties are not much better off. They still will be unable to predict district court rulings with reasonable certainty. Figure 3 below depicts the uncertain scope of the patents. The area depicted in grey reflects the unknown. Until a patent is litigated, it is unclear whether this subject matter is covered by a patent's claims.

Figure 3



This uncertainty burdens innovation in several ways. When claim scope is uncertain, there is always the possibility that the claim will be interpreted too broadly. In other words, competitors do not just have to worry about stepping inside the boundaries protected by a patent's claims; they must worry about stepping near those boundaries too.⁶¹ As a result, companies may end up foregoing technology that is not actually covered by a patent. In these cases, no one wins. The company does not get to use its preferred technology. The patentee does not receive any royalties. More importantly, society loses too. A company's decision to forego technology will likely cause its product to become less desirable or more expensive.

Alternatively, uncertainty may cause companies to take licenses for patents that they do not need. This result is problematic too. These costs unnecessarily burden innovation. Mark Lemley and Carl Shapiro have argued that uncertainty even contributes to systematic over-compensation in the patent system.⁶² They created an economic model

⁶⁰ *Id.* at 52.

⁶¹ FTC, *THE EVOLVING IP MARKETPLACE*, *supra* note 41, at 78 ("When patents provide poor notice of their scope, the resulting uncertainty may force a firm to incur these costs unnecessarily for patents that would not be held to cover their product, burdening innovative activities and raising prices.").

⁶² Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 *TEX. L. REV.* 1991, 2017–25 (2007).

that calculates what royalty rates parties will negotiate. The model used the term “patent strength” to represent the likelihood that a patent was valid and infringed.⁶³ Lemley and Shapiro concluded that in some scenarios the negotiated royalty rate “does not involve any discounting based on patent strength.”⁶⁴ In other words, competitors often assume that patents will be interpreted broadly and do not discount for the possibility that the patent will be given a narrower construction or be found to be invalid. Especially for weak patents (i.e., narrow or invalid patents), this results in systematic overcompensation.⁶⁵

Uncertainty also increases transaction costs. Simply trying to assess the boundaries of a patent before litigation is expensive.⁶⁶ When companies roll the dice and let the courts tell them if the technology they are using is covered by another’s patent, the price is even higher.⁶⁷ Moreover, by the time a company even learns about a patent, there may already be significant sunk costs. Retooling a product to avoid future infringement often costs far more than designing a non-infringing product in the first instance.

This Article tries to address the problems caused by overbroad and unclear claims. But the proposal does not try to fix the doctrines that limit claims and make them more predictable. Instead it assumes that substantial uncertainty surrounding these doctrines is inevitable. Indeed, each of the different claim-limiting doctrines can be thought to produce a probability distribution. The closer the subject matter is to what the patent describes, the more likely the claim is either infringed or valid. In Part II, this Article describes each of these different doctrines and illustrates how unpredictable they are.

⁶³ *Id.* at 1996–97.

⁶⁴ *Id.* at 2004.

⁶⁵ *Id.* at 1993. Thus, Lemley and Shapiro suggest that patent holders actually benefit from uncertainty. But uncertainty can also cost patent holders. When patent rights are uncertain, some companies will undoubtedly escape liability even when they should be found liable for infringement.

⁶⁶ See BESSEN & MEURER, *supra* note 45, at 55 (“[A] legal ‘opinion letter’ on a technology typically costs about . . . \$20,000 to \$100,000[.]”); FTC, THE EVOLVING IP MARKETPLACE, *supra* note 41, at 77 (“[W]hen the notice function is poorly served, the costs of identifying and analyzing relevant patents can be onerous.”); U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-13-465, INTELLECTUAL PROPERTY: ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY 28 (2013), available at <http://www.gao.gov/assets/660/657103.pdf> (“[U]ncertainty of a patent’s scope . . . usually needs to be resolved in court . . .”).

⁶⁷ See BESSEN & MEURER, *supra* note 45, at 70 (“The cost of clearance ratchets up even more when patents have fuzzy boundaries . . .”).

II. TRADITIONAL SAFEGUARDS

Modern patent law has traditionally looked to the enablement requirement and claim interpretation to reign in claims that depart too far from the specification. More recently, the written description requirement has also been used to tap down on overly broad claims. Some commentators have suggested that subject matter patentability and the reverse doctrine of equivalents should also be used to curb broad claims. This section reviews each of these doctrines. To varying degrees of effectiveness, these doctrines all provide some limits on broad claiming. But these doctrines are relatively crude. The results are always binary; most of these doctrines result in a claim being found valid or invalid.⁶⁸ In the case of claim construction and the reverse doctrine of equivalents, the outcome is infringement or non-infringement. But the effect is the same; there is a winner or a loser with no middle ground. This problem is exacerbated by the complexity of these doctrines. Consequently, parties cannot predict whether they will win or lose.

A. *Enablement*

Under 35 U.S.C. § 112, the specification of a patent must describe “the manner and process of making and using [the invention], in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use . . . the invention.”⁶⁹ This requirement is satisfied when a person of ordinary skill in the art, after reading the specification, could practice the claimed invention without undue experimentation.⁷⁰ The enablement requirement serves two functions.⁷¹ First, it requires the inventor to inform the public how to practice the invention. Second, and more importantly for purposes of the current analysis, it serves to constrain the permissible scope of claims.⁷²

Historically, the enablement doctrine has primarily limited broad claims in the so-called unpredictable arts (e.g., chemicals and the life

⁶⁸ See Jeffrey A. Lefstin, *The Constitution of Patent Law: The Court of Customs and Patent Appeals and the Shape of the Federal Circuit's Jurisprudence*, 43 LOY. L.A. L. REV. 843, 883 (2010) (noting that the patent law's binary inquiries are not “optimal instrument[s]” for making policy).

⁶⁹ 35 U.S.C. § 112(a) (2012).

⁷⁰ See *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986) (“Enablement . . . is not precluded even if some experimentation is necessary, although the amount of experimentation needed must not be unduly extensive . . .”).

⁷¹ CRAIG ALLEN NARD, *THE LAW OF PATENTS* 87 (2d ed. 2011).

⁷² *Id.*

sciences).⁷³ For example, claims directed at “all possible genetic sequences that have EPO-like activity” were found not to be enabled when the specification only disclosed how to make one gene and a handful of analogs.⁷⁴ Similarly, a claim directed toward a vaccine on all pathogenic RNA viruses was invalidated when the specification only disclosed a vaccine that conferred immunity in chickens against one type of RNA tumor virus.⁷⁵

But enablement law is both confusing and badly fractured. To determine whether a broad claim in the unpredictable arts is properly enabled, the eight *Wands* factors must be considered.⁷⁶ Of course, an eight-factor test is not conducive to yielding consistent results. To make matters worse, the Federal Circuit cannot agree on how to handle patents in the predictable arts (e.g., mechanical and electrical technology). Earlier decisions applied a simple rule. They suggest that a claim in the predictable arts is enabled when the specification describes a single embodiment that falls within the scope of that claim.⁷⁷ While the “single embodiment rule” is easy to apply, it does little to curb broad claims because the boundaries of the claim can be quite distant from the single embodiment described by the specification.⁷⁸

Several recent decisions in the predictable arts have ignored the single embodiment rule and applied the new “full scope rule.”⁷⁹ Under the full scope rule, every embodiment that falls within the scope of the

⁷³ See Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 137 (2008) (“[T]he judiciary has required more detailed disclosure in chemistry and the experimental sciences.”); see, e.g., *In re Fisher*, 427 F.2d 833, 839 (C.C.P.A. 1970) (“In cases involving unpredictable factors, such as most chemical reactions and physiological activity, the scope of enablement obviously varies inversely with the degree of unpredictability of the factors involved.”).

⁷⁴ *Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1214 (Fed. Cir. 1991).

⁷⁵ *In re Wright*, 999 F.2d 1557, 1560–62 (Fed. Cir. 1993).

⁷⁶ See *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). The factors are:

- (1) [T]he quantity of experimentation necessary,
- (2) the amount of direction or guidance presented,
- (3) the presence or absence of working examples,
- (4) the nature of the invention,
- (5) the state of the prior art,
- (6) the relative skill of those in the art,
- (7) the predictability or unpredictability of the art, and
- (8) the breadth of the claims.

Id.

⁷⁷ See *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1533 (Fed. Cir. 1987) (“If an invention pertains to an art where the results are predictable, e.g., mechanical as opposed to chemical arts, a broad claim can be enabled by disclosure of a single embodiment . . .”); see also *In vitro Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1070–71 (Fed. Cir. 2005) (even applying the single embodiment rule in the unpredictable arts); *Engel Indus. v. Lockformer Co.*, 946 F.2d 1528, 1533 (Fed. Cir. 1991); *In re Vickers*, 141 F.2d 522, 527 (C.C.P.A. 1944).

⁷⁸ This Article adopts the nomenclature from my previous article on enablement. See Bernard Chao, *Rethinking Enablement in the Predictable Arts: Fully Scoping the New Rule*, 2009 STAN. TECH. L. REV. 3, 56, available at <http://stlr.stanford.edu/pdf/chao-rethinking-enablement.pdf> (discussing the different enablement standards applied by the Federal Circuit).

⁷⁹ See *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008); *Auto. Techs. Int’l, Inc. v. BMW of N. Am., Inc.*, 501 F.3d 1274, 1282 (Fed. Cir. 2007); *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1378 (Fed. Cir. 2007).

claim must be enabled. For example, in *Automotive Technologies International, Inc. v. BMW of North America, Inc.*, the Federal Circuit found that claims that generally encompassed both electronic and mechanical side impact sensors were not enabled when the specification described the mechanical sensors in detail but only provided a conceptual diagram of an electronic sensor.⁸⁰ Although the “full scope” rule is clearly designed to address overly broad claims, it is unworkable. There is always an unforeseen embodiment that falls within a claim.⁸¹ In many cases, that embodiment will not be enabled. But a claim should not be invalidated simply because the inventor did not foresee every embodiment that may eventually fall within its scope.

Currently, there are four different conflicting enablement standards that have support in Federal Circuit case law: the *Wands* factors, the single embodiment rule, the full scope rule, and a blended rule that depends on whether the patent is in the predictable or unpredictable arts.⁸² This state of affairs has been described as “doctrinal chaos.”⁸³ Parties have little sense of what the enablement doctrine would permit a claim to reach.⁸⁴ Enablement’s unpredictability is aggravated by the fact that there can be only two outcomes. A claim is either valid or invalid.⁸⁵ The result is a system of winners and losers.

B. *Written Description*

The written description requirement has recently emerged as another potential tool to reign in overly broad claims.⁸⁶ Like the enablement requirement, the written description requirement is rooted in 35 U.S.C § 112. The relevant passage says that “[t]he specification

⁸⁰ *Auto. Techs.*, 501 F.3d at 1285.

⁸¹ Chao, *supra* note 78, at 89 (“[T]he full scope rule allows defendants to identify *any* embodiment and try to prove that the patent does not enable it.”); Jeffrey A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1175 (2008) (“Due to the infinite scope of patent claims, a patentee certainly need not, and in most instances cannot, enable every embodiment falling within the ‘full scope’ of the claims.”).

⁸² See Chao, *supra* note 78, at 50–55 (describing the different standards).

⁸³ Kevin Emerson Collins, *Enabling After-Arising Technology*, 34 J. CORP. L. 1083, 1085–89 (2009).

⁸⁴ Tun-Jen Chiang, *Fixing Patent Boundaries*, 108 MICH. L. REV. 523, 537–38 (2010) (noting that this problem also exists with respect to the written description doctrine discussed in the following section).

⁸⁵ *But see* Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 157–60 (2006) (arguing that enablement principles should be used to interpret claims and thereby curb unduly broad claims). Although Holbrook would use enablement principles to narrow the scope of the claim, this proposal also still only has two results—a finding of infringement or non-infringement.

⁸⁶ Stephen McJohn, *Top Tens in 2011: Patent and Trademark Cases*, 10 NW. J. TECH. & INTELL. PROP. 313, 320 (2012) (“The written description requirement acts as a safeguard against overbroad claims.”).

shall contain a *written description* of the invention.”⁸⁷ Until recently, it was unclear whether this doctrine required the specification to provide any disclosure beyond what was already required to enable the claimed invention.⁸⁸ In *Ariad Pharmaceuticals, Inc. v. Eli Lilly & Co.*, an en banc panel of the Federal Circuit answered that question by stating that the written description and enablement requirements were separate and distinct.⁸⁹ To satisfy the written description requirement, the specification “must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed.”⁹⁰ *Ariad* went on to explain that this requirement “ensures that when a patent claims a genus by its function or result, the specification recites sufficient materials to accomplish that function.”⁹¹ In other words, the written description requirement guards against claims that depart too far from the invention actually found in the specification.

There are two notable differences between the written description and enablement requirements. First, the enablement requirement assesses whether the specification adequately teaches *others* while the written description requirement assesses whether the specification demonstrates that *the patentee* was in possession of his invention at the time the application was filed.⁹² Thus, the two requirements are evaluated from slightly different perspectives. Second, enablement is a question of law with underlying factual issues⁹³ and the written description is a question of fact.⁹⁴ Courts will decide whether a claim is valid under the enablement requirement while juries will decide if the claim satisfies the written description requirement.

Despite these differences, there are serious doubts whether the written description requirement will provide any significant new limitations on broad claims.⁹⁵ Even if the requirements are distinct, the

⁸⁷ 35 U.S.C § 112(a) (2012) (emphasis added).

⁸⁸ See *Univ. of Rochester v. G.D. Searle & Co.*, 375 F.3d 1303, 1305 (Fed. Cir. 2004) (Newman, J., dissenting from the denial of rehearing en banc) (“The issue of whether patent law contains a separate written description requirement has percolated through various panels of this court, on a variety of facts.”).

⁸⁹ *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1349 (Fed. Cir. 2010) (en banc). The written description requirement has traditionally been used to prevent the late claiming of new matter (i.e., to prevent patent applicants from adding new inventions to an older disclosure). The question in *Ariad* was whether the requirement also applied to originally filed claims.

⁹⁰ *Id.* at 1351 (alteration in original) (quoting *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991)) (internal quotation marks omitted).

⁹¹ *Id.* at 1352.

⁹² See *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1158 (Fed. Cir. 1998) (asking whether the application “reasonably convey[s] to one of skill in the art that the inventor possessed the []claimed subject matter at the time the [patent] application was filed”).

⁹³ *AK Steel Corp. v. Sollac*, 344 F.3d 1234, 1238 (Fed. Cir. 2003).

⁹⁴ *Ariad*, 598 F.3d at 1351.

⁹⁵ Numerous judges argued that a separate written description requirement was not justified on policy grounds. See *id.* at 1360 (Gajarsa, J., concurring); *id.* at 1372 (Rader & Linn, JJ., dissenting in part and concurring in part).

enablement defense already guards against overly broad claims in much the same way that the written description requirement does. They both measure the breadth of the claims against the specification, albeit with slightly different perspectives in mind. Studies also suggest that a separate written description requirement will not have much effect. Dennis Crouch reviewed Board of Patent Appeals and Interference patent opinions and “found that none of the outcomes of those decisions would have been impacted by a legal change that entirely eliminated the written description requirement of § 112.”⁹⁶ Earlier, Chris Holman came to the same conclusion in a study of both federal courts and PTO decisions.⁹⁷ Holman only identified nine original claims that were rejected for lacking written description and concluded that each of those rejected claims was, or “could have easily been,” held invalid for lacking enablement.⁹⁸ The *Ariad* court was aware of these studies and admitted that the enablement and written description requirements “often rise and fall together.”⁹⁹

Thus, it seems unlikely that the written description requirement will reign in broad claims beyond what the enablement requirement already has. What is more, there is no reason to believe that the written description will be any easier to apply than the enablement requirement.¹⁰⁰ Thus, like enablement, the binary outcomes will result in big winners and losers.

C. Claim Interpretation

Claim interpretation can also safeguard against overly broad claims.¹⁰¹ Defendants typically ask courts to adopt a narrow claim interpretation that closely tracks the embodiments disclosed in the specification. By interpreting claims in light of the specification, defendants are able to find support for these narrow interpretations.¹⁰² In response, patentees point out that claims are not limited to the

⁹⁶ Dennis Crouch, *An Empirical Study of the Role of the Written Description Requirement in Patent Examination*, 104 NW. U. L. REV. 1665, 1667 (2010). This conclusion assumed that the Patent Office would still “reject claims based on the addition of ‘new matter.’” *Id.*

⁹⁷ Christopher M. Holman, *Is Lilly Written Description a Paper Tiger?: A Comprehensive Assessment of the Impact of Eli Lilly and Its Progeny in the Courts and PTO*, 17 ALB. L.J. SCI. & TECH. 1, 78 (2007).

⁹⁸ *Id.* at 71.

⁹⁹ *Ariad*, 598 F.3d at 1352.

¹⁰⁰ See Chiang, *supra* note 84.

¹⁰¹ See Stephen McJohn, *Scary Patents*, 7 NW. J. TECH. & INTELL. PROP. 343, 367 (2009).

¹⁰² See *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed Cir. 2005) (en banc); see also *United States v. Adams*, 383 U.S. 39, 49 (1966) (“[I]t is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention.” (citations omitted)).

preferred embodiments and a broader interpretation is warranted.¹⁰³ Since both principles are well supported in the law, judges can justify a broader or narrower interpretation by simply relying on the appropriate principle. Indeed, this “classic” claim construction dispute occurs all the time. Decisions repeatedly discuss the fine line between impermissibly importing limitations from the specification and appropriately interpreting a claim in light of the specification.¹⁰⁴

This problem was recently highlighted in *Retractable Technologies, Inc. v. Becton, Dickinson & Co.*¹⁰⁵ The patent at issue related to medical syringes that contained a needle that retracted into the syringe body after use and thereby lowered the risk of later accidental needle sticks. The disputed claim term was “body.” The defendant argued that “body” was limited to a one-piece structure, but the district court rejected that view.¹⁰⁶ The defendant appealed this ruling to the Federal Circuit. Writing for the majority, Judge Lourie focused on the fact that the specification only disclosed one-piece structure syringe bodies and distinguished prior syringes that were made of multiple pieces. By interpreting the claims in light of the specification, the majority was able to conclude that the term “body” was limited to a single-piece structure.¹⁰⁷

Chief Judge Rader dissented. He argued that the plain meaning of body is not limited to a single-piece structure.¹⁰⁸ Chief Judge Rader also pointed out that some of the patent’s other claims specifically limited the body to a one-piece barrel. These claims suggested that, by itself, body was not limited to a single-piece structure.¹⁰⁹ Finally, unlike the

¹⁰³ *Phillips*, 415 F.3d at 1323 (“[C]laims may embrace ‘different subject matter than is illustrated in the specific embodiments in the specification.’” (quoting *Nazomi Commc’ns, Inc. v. ARM Holdings, PLC*, 403 F.3d 1364, 1369 (Fed. Cir. 2005))); *see, e.g.*, *Comaper Corp. v. Antec, Inc.*, 596 F.3d 1343, 1348 (Fed. Cir. 2010) (refusing to limit the term “case” to the sole embodiment of an “enclosed” case in the specification).

¹⁰⁴ *Phillips*, 415 F.3d at 1323 (“[W]e recognize that the distinction between using the specification to interpret the meaning of a claim and importing limitations from the specification into the claim can be a difficult one to apply in practice.”); *Comark Commc’ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1186–87 (Fed. Cir. 1998) (“[T]here is sometimes a fine line between reading a claim in light of the specification, and reading a limitation into the claim from the specification.”).

¹⁰⁵ *Retractable Techs., Inc. v. Becton, Dickinson & Co. (Retractable I)*, 653 F.3d 1296 (Fed. Cir. 2011).

¹⁰⁶ *See id.* at 1304.

¹⁰⁷ *Id.* at 1304–05.

¹⁰⁸ *Id.* at 1312 (Rader, C.J., dissenting in part).

¹⁰⁹ *Id.* at 1311–13. Under the doctrine of claim differentiation, “the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.” *Phillips*, 415 F.3d at 1315. *But see* *Digital-Vending Servs. Int’l, LLC v. Univ. of Phx., Inc.*, 672 F.3d 1270, 1282 (Fed. Cir. 2012) (Moore, J., dissenting) (“[T]he doctrine of claim differentiation does not serve to broaden claims beyond their meaning . . . in light of the specification.” (first alteration in original) (quoting *Toro Co. v. White Consol. Indus., Inc.*, 199 F.3d 1295, 1302 (Fed. Cir. 1999))).

majority, Chief Judge Rader found nothing in the specification that contradicted the broad, plain meaning of body. Consequently, he concluded that the majority was improperly importing limitations from the specification.¹¹⁰ The patentee filed a petition to have the entire Federal Circuit rehear the issue. Although the petition was rejected, Judge Moore joined Chief Judge Rader in dissent arguing that the majority's opinion impermissibly changed the plain meaning of "body" to tailor the scope of the patent to what the panel believes was the "actual invention."¹¹¹ In the end, two Federal Circuit judges concluded that "body" was limited to a single-piece structure and two others concluded that it could encompass multiple pieces. *Retractable Technologies* illustrates how judges that regularly construe claims can select different rules to justify different claim scope. Unfortunately, this kind of dispute happens regularly in patent law.¹¹²

Judges do not just struggle with claim breadth. There are many other doctrines that make claims construction unpredictable. Determining the meaning of patent claims requires a judge to break the text of a claim into discrete "elements." But it is unclear how to determine what part of a claim is an element.¹¹³ Moreover, the scope of a claim can change over time.¹¹⁴ Finally, there is the problem of "metaconstruction."¹¹⁵ Even after courts interpret a claim, parties often fight over the meaning of the courts' new definitions.¹¹⁶ Consequently, parties do not know how far a given patent's claims extend. Moreover, like every doctrine discussed here, there are binary outcomes. While other doctrines lead to findings of validity or invalidity, a claim construction decision generally results in findings of infringement or non-infringement.

¹¹⁰ *Retractable I*, 653 F.3d at 1311–13 (Rader, C.J., dissenting in part).

¹¹¹ *Retractable Techs., Inc. v. Becton, Dickinson & Co. (Retractable II)*, 659 F.3d 1369, 1372 (Fed. Cir. 2011).

¹¹² See Tun-Jen Chiang, *The Levels of Abstraction Problem in Patent Law*, 105 NW. U. L. REV. 1097, 1109 (2011) ("Contradictory doctrine makes claim construction outcomes difficult to predict without litigation, and judicial disagreement frequently arises when such issues are litigated."); Cotropia, *supra* note 54, at 1870 ("Opinions after *Phillips* switch between methodologies; some rely mainly on the claim language's plain meaning whereas others depend heavily on the specification's text and drawings.").

¹¹³ Dan L. Burk & Mark A. Lemley, *Quantum Patent Mechanics*, 9 LEWIS & CLARK L. REV. 29, 31 (2005) ("[T]here are no hard and fast standards in the law by which to make the 'right' decision as to either the size of the textual element or the level of abstraction at which the element will be evaluated.").

¹¹⁴ See Collins, *supra* note 13, at 510 (explaining how claims regularly expand to cover after arising technology).

¹¹⁵ Burk & Lemley, *supra* note 9, at 1760.

¹¹⁶ *Id.*

D. Reverse Doctrine of Equivalents

Theoretically, the reverse doctrine of equivalents could operate as some form of check on overly broad claims. The reverse doctrine of equivalents is an equitable doctrine designed “to prevent unwarranted extension of the claims beyond a fair scope of the patentee’s invention.”¹¹⁷ The Supreme Court has said that it applies “where a device is so far changed in principle from a patented article that it performs the same or a similar function in a substantially different way, but nevertheless falls within the literal words of the claim.”¹¹⁸

Yet, the reverse doctrine of equivalents is disfavored by the courts. In fact, in *Tate Access Floors, Inc. v. Interface Architectural Resources, Inc.*, the Federal Circuit declared that the doctrine did not survive the Patent Act of 1952.¹¹⁹ *Tate Access* overstates the demise of the reverse doctrine of equivalents. The doctrine is rarely seen in practice.¹²⁰ But there are Federal Circuit decisions that have considered the reverse doctrine of equivalents since 1952¹²¹ and commentators have labeled *Tate Access*’s pronouncement regarding the doctrine as dicta.¹²² The reverse doctrine of equivalents has far greater respect in the academic community. Numerous commentators have mentioned its importance

¹¹⁷ *Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1581 (Fed. Cir. 1991), *overruled on other grounds by* *Abbott Labs. v. Sandoz, Inc.*, 566 F.3d 1282, 1293 (Fed. Cir. 2009) (en banc).

¹¹⁸ *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608–09 (1950).

¹¹⁹ *Tate Access Floors, Inc. v. Interface Architectural Res., Inc.*, 279 F.3d 1357, 1368 (Fed. Cir. 2002) (“Not once has this court affirmed a decision finding noninfringement based on the reverse doctrine of equivalents. And with good reason: when Congress enacted 35 U.S.C. § 112, after the decision in *Graver Tank*, it imposed requirements for the written description, enablement, definiteness, and means-plus-function claims that are co-extensive with the broadest possible reach of the reverse doctrine of equivalents.”). *But see Scripps*, 927 F.2d at 1581 (finding a factual issue with respect to the reverse doctrine of equivalents and reversing summary judgment of infringement).

¹²⁰ *Roche Palo Alto LLC v. Apotex, Inc.*, 531 F.3d 1372, 1378 (Fed. Cir. 2008) (“The reverse doctrine of equivalents is rarely applied, and this court has never affirmed a finding of non-infringement under the reverse doctrine of equivalents.” (citing *Tate Access*, 279 F.3d at 1368)).

¹²¹ *See, e.g., DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1339 (Fed. Cir. 2009) (finding that defendant should not be sanctioned for raising a reverse doctrine of equivalents defense); *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1351 (Fed. Cir. 2003) (considering but rejecting the defendant’s reverse doctrine of equivalents defense on the merits); *Scripps*, 927 F.2d at 1581.

¹²² *See* Burk & Lemley, *supra* note 9, at 1174 n.122.

and called for its use.¹²³ To date, the courts have not responded to those calls.¹²⁴

But even if the reverse doctrine of equivalents were to be revived, it also yields only two outcomes. Either the patentee wins and there is infringement, or the accused infringer wins and there is none. The current law does not reduce the remedy simply because there was a good, albeit losing, reverse doctrine of equivalents defense.

E. *Subject Matter Patentability*

Section 101 of the Patent Act broadly defines patentable subject matter as “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof.”¹²⁵ Although the legislative history of the Patent Act suggested that “anything under the sun that is made by man” is patent eligible,¹²⁶ the courts have created exceptions.¹²⁷ “[L]aws of nature, physical phenomena, and abstract ideas” are not eligible to be patented.¹²⁸ Surprisingly, the issue of claim scope has emerged as an important factor in determining when claims cover one of these unpatentable concepts.

An invention is not unpatentable simply because it *includes* an unpatentable concept.¹²⁹ “[A]n application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.”¹³⁰ Just in 2012, in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, the Supreme Court suggested that when a claim adds “enough” to an unpatentable concept to change it into an application, the claim is patent eligible.¹³¹ Unfortunately, the

¹²³ See, e.g., DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 128 (2009); Michael A. Carrier, *Cabining Intellectual Property Through a Property Paradigm*, 54 DUKE L.J. 1, 118–19 (2004); Holbrook, *supra* note 5, at 12–15; Lemley, *supra* note 5, at 1010–13; Merges & Nelson, *supra* note 35, at 856–66.

¹²⁴ Brian J. Love, *Interring the Pioneer Invention Doctrine*, 90 N.C. L. REV. 379, 399 n.82 (2012) (“Parties in fourteen appeals raised the reverse doctrine of equivalents between 2001 and 2010.”).

¹²⁵ 35 U.S.C. § 101 (2012).

¹²⁶ S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952).

¹²⁷ See *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

¹²⁸ *Id.*; see also *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (saying that a mathematical expression is simply a “scientific truth” and unpatentable).

¹²⁹ See *Diamond v. Diehr*, 450 U.S. 175, 187 (1981).

¹³⁰ *Id.* (emphasis omitted).

¹³¹ *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1297 (2012) (framing the issue in *Mayo* as whether “the patent claims add *enough* to their statements of the [natural law] to allow the processes they describe to qualify as patent-eligible processes that *apply* natural laws”).

Mayo decision did not provide a framework that explains how to determine what enough is.¹³²

Instead, the Supreme Court simply gave a few examples of what was *not enough* to render a claim patentable. For example, *Mayo* said that overly broad claims that do no more than “apply the algorithm” are unpatentable.¹³³ Previous decisions had already warned that a claim cannot preempt all the applications of a law of nature, physical phenomenon, or abstract idea.¹³⁴ If assessing subject matter patentability were as simple as just examining claim breadth, the doctrine would probably become more certain. Mark Lemley, Michael Risch, Ted Sichelman, and R. Polk Wagner proposed precisely this kind of framework in 2011.¹³⁵ But in *Mayo*, the Supreme Court already appears to have rejected their proposal.¹³⁶

Instead the Court looked at many different factors without explaining how they fit together. First, the Supreme Court found that adding three types of limitations do not make an unpatentable concept patentable: “(1) limiting an unpatentable concept to a particular audience, (2) telling someone about the concept, or (3) adding a conventional or obvious [pre-solution] activity.”¹³⁷ The decision also compared the invention in *Mayo* to the inventions in *Parker v. Flook*¹³⁸ and *Diamond v. Diehr*,¹³⁹ earlier Supreme Court cases on patentable subject matter. Without any real explanation, *Mayo* concluded that the invention at issue was closer to *Flook* and therefore unpatentable.¹⁴⁰ But the patents in these two cases appear to cover very similar inventions making it even more difficult to understand how to apply the law of subject matter patentability.¹⁴¹

¹³² See Bernard Chao, *Moderating Mayo*, 107 NW. U. L. REV. 423 (2012) (critiquing *Mayo* and proposing a framework for determining when additional limitations render an unpatentable concept patent eligible); Michael Risch, *Patentable Subject Matter, the Supreme Court, and Me*, MADISONIAN.NET (Mar. 20, 2012), <http://madisonian.net/2012/03/20/patentable-subject-matter-the-supreme-court-and-me> (complaining about how difficult it will be to determine what detail needs to be added).

¹³³ *Mayo*, 132 S. Ct. at 1301–02 (characterizing both the claims in *Mayo* and *Benson*, 409 U.S. at 71, as overly broad).

¹³⁴ *Benson*, 409 U.S. at 71–72; *O’Reilly v. Morse*, 56 U.S. (15 How.) 62, 112–20 (1853).

¹³⁵ See Mark A. Lemley, Michael Risch, Ted Sichelman & R. Polk Wagner, *Life After Bilski*, 63 STAN. L. REV. 1315, 1317, 1339–41 (2011) (proposing that subject matter patentability should be recast as a five-factor test for overclaiming).

¹³⁶ See *Mayo*, 132 S. Ct. at 1303 (citing Lemley, Risch, Sichelman & Wagner, *supra* note 135, and responding that “our cases have not distinguished among different laws of nature according to whether or not the principles they embody are sufficiently narrow”).

¹³⁷ Chao, *supra*, note 132, at 429.

¹³⁸ 437 U.S. 584 (1978).

¹³⁹ 450 U.S. 175 (1981).

¹⁴⁰ *Mayo*, 132 S. Ct. at 1299–300.

¹⁴¹ See Kevin Emerson Collins, *Propertizing Thought*, 60 SMU L. REV. 317, 349 (2007) (“*Flook* and *Diehr* are difficult to reconcile.”); Horacio E. Gutiérrez, *Peering Through the Cloud: The Future of Intellectual Property and Computing*, 20 FED. CIR. B.J. 589, 590 (2011) (noting

Compounding the confusion, before *Mayo*, the belief was that the machine-or-transformation test was the primary mechanism for determining subject matter patentability.¹⁴² Under this test, a process was only patentable if it was tied to a particular machine or transformed an article to another state. Of course there were problems with this test. For example, it was unclear whether the test applied exclusively to process patents.¹⁴³ Moreover, no one knows what types of computers, if any, can qualify as a “specific machine.”¹⁴⁴ The Supreme Court muddied the waters even further when the *Mayo* decision appeared to diminish the test’s importance.¹⁴⁵

Simply put, subject matter patentability has never been more uncertain than after *Mayo*. Many patents in the biotechnology, medical diagnostics, and software industries have an unpatentable concept at their core. But after *Mayo*, it is unclear whether these patents have added “enough” to the claims to render them patent eligible.¹⁴⁶ The Supreme Court recently attempted to provide some clarity for the biotechnology industry in *Association for Molecular Pathology v. Myriad Genetics, Inc.*¹⁴⁷ Relying on the rule against patenting “naturally occurring things,” the Court held that claims drawn to isolated genomic DNA did not cover patent eligible subject matter.¹⁴⁸ However, the Court distinguished claims drawn to complementary DNA (cDNA) because cDNA is not naturally occurring.¹⁴⁹ Thus, after *Myriad*, isolated DNA claims are not patent-eligible but cDNA claims are. But the analysis underlying these two results is still unclear. After all, isolated genomic DNA does not actually occur in nature. Chemical bonds must first be severed. Thus, *Myriad* suggests that some structural differences are

that *Diehr* and *Flook* had “very similar facts” with opposite results); Mark A. Lemley, *Point of Novelty*, 105 NW. U. L. REV. 1253, 1278 (2011) (characterizing the claims in *Diehr* and *Flook* as “almost exactly parallel”).

¹⁴² See *Bilski v. Kappos*, 130 S. Ct. 3218, 3227 (2010) (stating that “the machine-or-transformation test is a useful and important clue [or] investigative tool,” but it “is not the sole test for deciding whether an invention is a patent-eligible ‘process’” under § 101); Chao, *supra* note 132, at 427 (“Unfortunately, the Court did not identify other tests that should be used, and the lower courts continue to rely on the machine-or-transformation test while rotely noting that it is not the only test.”).

¹⁴³ See Lemley, Risch, Sichelman & Wagner, *supra* note 135, at 1322–23 (discussing the ambiguities in the machine-or-transformation test).

¹⁴⁴ See *id.*

¹⁴⁵ See *Mayo*, 132 S. Ct. at 1303 (“[I]n stating that the ‘machine-or-transformation’ test is an ‘important and useful clue’ to patentability, we have neither said nor implied that the test trumps the ‘law of nature’ exclusion.” (emphasis omitted) (quoting *Bilski*, 130 S. Ct. at 3225–27)).

¹⁴⁶ See Chao, *supra* note 132, at 432; Risch, *supra* note 132.

¹⁴⁷ *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107 (2013).

¹⁴⁸ *Id.* at 2116–20.

¹⁴⁹ *Id.* at 2119. cDNA is a synthetically created exons-only molecule.

sufficient to establish patent eligibility while others are not.¹⁵⁰ How much is unclear. Christopher Holman identifies a number of technologies that fall within this netherworld.¹⁵¹

The question of whether and what software is patent eligible is even more confusing. In 2013, the Federal Circuit attempted to address whether adding computer limitations to an otherwise unpatentable concept could render software patents eligible.¹⁵² Unfortunately, the judges could not find common ground and the decision contained seven separate opinions reflecting at least three distinct approaches.¹⁵³ Just recently, the Supreme Court has agreed to take up *CLS Bank International v. Alice Corp.*¹⁵⁴ Hopefully, the Court will provide clearer guidance. Thus, some of the most fundamental questions of patent eligibility are now in a state of flux. Although the courts are trying to provide greater clarity to the doctrine, so far they have failed. For now, subject matter patentability remains part of the large list of patent law doctrines that are difficult to apply and have only two outcomes, valid or invalid.

F. *Flaws with the Current Approaches*

The problem with the current approaches to overly broad claims is that they do not account for the different types of infringement that exist. These doctrines only allow for two outcomes. The claim either can or cannot reach particular subject matter that departs from the patent's specification. In the former case, the claim is infringed and valid. In the latter case, the claim is either not infringed and/or invalid. These results would make sense if infringement also came in only two flavors. But in reality, there are many different types of potential infringement. These different types can be thought to fall along an infringement continuum.

The infringement continuum is simply a reflection of claim breadth.¹⁵⁵ Returning to Apple's '647 patent, the different examples of

¹⁵⁰ Christopher M. Holman, *In Myriad the Supreme Court Has, Once Again, Increased the Uncertainty of U.S. Patent Law*, 32 BIOTECHNOLOGY L. REP. 289, 291–92 (2013) (discussing the implicit requirement of significant structural change). *But see* Arti K. Rai, *Biomedical Patents at the Supreme Court: A Path Forward*, 66 STAN. L. REV. ONLINE 111, 112–15 (2013) (discussing how both *Mayo* and *Myriad* could be interpreted as focusing more explicitly on innovation).

¹⁵¹ Holman, *supra* note 150, at 292–93 (Holman questions whether “a DNA-based gene therapy vector based on a naturally occurring DNA sequence” or “monoclonal antibody-based drugs” are now patent eligible).

¹⁵² See *CLS Bank Int'l v. Alice Corp.*, 717 F.3d 1269 (Fed. Cir. 2013) (en banc), *cert. granted* 134 S. Ct. 734, 735 (2013).

¹⁵³ See Bernard Chao, *Finding the Point of Novelty in Software Patents*, 28 BERKELEY TECH. L.J. 1217 (2013) (discussing *CLS Bank* and critically reviewing the different tests for determining whether software patents are eligible under § 101).

¹⁵⁴ *CLS Bank Int'l*, 717 F.3d 1269.

¹⁵⁵ See *supra* notes 32–34 and accompanying text.

claim breadth can be recast as different points along an infringement continuum. An infringing product can look precisely like the embodiments described in the patent. In the case of the '647 patent, a personal computer that recognizes a phone number and allows the user to automatically dial the number plainly infringes the patent.¹⁵⁶ An infringing product may also be a minor variation of the disclosed embodiment. For example, a personal computer that appends the number one before dialing an out of area number would almost certainly infringe the patent. This is true even though the specification never mentioned prepending the number one. However, some infringements may also look like something totally different and unexpected. Smart phones may add unforeseen technology yet infringe the patent. Kevin Collins classifies this kind of after-arising technology as a "complement" because consumers desire both the original property (i.e., recognizing a phone number, calling it, and putting it in an electronic phone book) and the new property (i.e., the new smart phone features).¹⁵⁷ Alternatively, the '647 patent may cover unforeseen variations like computers that recognize faces in photographs and index the photographs accordingly. Collins characterizes technology with this property as a "substitute" because it replaces the original property disclosed in the patent.¹⁵⁸

Thus, the infringement continuum can be thought of as extending in two different dimensions. Along one dimension, new technology may change the fundamental nature of the invention. Nonetheless, this new technology may still fall within the scope of the patent's claims. Along the second dimension, new technology may arise in ways that are not central to the heart of the invention.¹⁵⁹ Likewise, this technology may also fall within the scope of the patent's claims. This Article uses Collin's "substitutionary" and "complementary" terminology to describe these two dimensions of the infringement continuum.

¹⁵⁶ Claim 15 of the '647 patent is probably the simplest and broadest claim. It recites:

In a computer having a memory storing actions, a method for causing the computer to perform an action on a structure identified in computer data, comprising the steps of: receiving computer data; detecting a structure in the data; linking at least one action to the detected structure; enabling selection of the structure and a linked action; and executing the selected action linked to the selected structure.

U.S. Patent No. 5,946,647 col. 8 l. 22-33 (filed Feb. 1, 1996).

¹⁵⁷ Kevin Emerson Collins, *Getting into the "Spirit" of Innovative Things: Looking to Complementary and Substitute Properties to Shape Patent Protection for Improvements*, 26 BERKELEY TECH. L.J. 1217, 1296-97 (2011).

¹⁵⁸ *Id.*

¹⁵⁹ This analysis assumes that claims have a "point of novelty," a proposition that is not uncontroversial. For a discussion explaining why not all claim limitations should be treated equally, see generally Bernard Chao, *Breaking Aro's Commandment: Recognizing That Inventions Have Heart*, 20 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1183 (2010) and Lemley, *supra* note 141.

Now many of us may disagree on the proper scope of the '647 patent. Some may suggest that the claims cannot be interpreted to cover smart phones or facial recognition technology.¹⁶⁰ Others would suggest claims that reach that far afield from the specification must fail the enablement and written description requirements. One might even argue that interpreting the '647 patent renders the claim unpatentable because it covers an abstract idea—the concept of recognizing unformatted data. On the other hand, there are reasonable arguments that the '647 patent covers each of the examples described above.

But even if reasonable minds cannot agree on proper claim scope, they should be able to agree that some of these infringements should be treated differently than others. A company that does precisely what is described in the specification owes a greater debt to the patentee than a company that modifies the invention in some unforeseen ways or adds its own contributions. Relying on this insight, this Article offers a different framework that ties disclosure principles to the remedies patent law provides. The details of earlier proposals and my proposal follow.

III. EXISTING PROPOSALS

My proposal builds on two existing concepts found in the academic literature. First, several commentators have argued that the standard for determining whether to grant permanent injunctions should consider significant differences between the infringement and the patented invention. The effect would be to base part of a patentee's remedy on the proximity of the infringement to the patented invention. However, these proposals do not allow for much fine tuning because decisions regarding permanent injunctions typically result in one of two outcomes, a simple denial or grant.¹⁶¹ Second, a different set of commentators have suggested that patent law return to a system of "central claiming" whereby infringement determinations are made by relying on the patent's specification, and not its claims. In the following two sections, I describe these proposals and their potential benefits. I then explain why my own proposal improves on the suggestions to

¹⁶⁰ Collins argues that courts should be more permissive in allowing patents to encompass complementary after-arising technology (e.g., the smart phone) but less permissive for after-arising substitutes (e.g., the facial recognition technology). Collins, *supra* note 157, at 1300–02.

¹⁶¹ *But see* Bernard H. Chao, *After eBay, Inc. v. MercExchange: The Changing Landscape for Patent Remedies*, 9 MINN. J. L. SCI. & TECH. 543, 563–64 (2008) (discussing how injunctions can be tailored to avoid the patentee overcompensation); John M. Golden, *Injunctions as More (or Less) than "Off Switches": Patent-Infringement Injunctions' Scope*, 90 TEX. L. REV. 1399, 1455 (2012) (discussing how courts have occasionally issued "moderated injunctions" that permit some types of limited infringing activity).

modify the permanent injunction standard and provides different advantages than a central claiming system would.

A. *Adjusting Injunctions*

For many years, courts had automatically awarded prevailing patentees a permanent injunction against further infringement. However, in *eBay Inc. v. MercExchange, L.L.C.*, the Supreme Court held that courts should apply the traditional four-factor test they use in other areas of the law.¹⁶² Although the first three *eBay* factors focus on the patentee and the infringer, the fourth *eBay* factor discusses the public interest. Moreover, Justice Kennedy's concurrence implicitly recognized that there are circumstances when it is against the public interest to allow a patent owner to control her invention.¹⁶³ This discussion suggested a shift in focus from one based purely on the property rights of patentees to a more public-minded analysis. Several scholars have seized upon this opening to offer proposals that would improve the public welfare. In one form or another, each of these proposals argues that permanent injunctions should not be granted when the infringing product looks significantly different from what the inventor described. In other words, they all suggest that at least part of the patentee's remedy should depend on where the infringement lies upon the infringement continuum.

Timothy Holbrook has argued that when there is infringement under the doctrine of equivalents, the patentee should not be entitled to a permanent injunction.¹⁶⁴ Holbrook views infringement under this doctrine as fundamentally different from literal infringement. Under the doctrine of equivalents, an accused infringer that does not literally fall within the boundaries of the claim "may nonetheless be found to infringe if there is 'equivalence' between . . . the accused product or process" and elements of the claim.¹⁶⁵

The most common justification underlying the existence of the doctrine of equivalents is that it would be unfair to allow someone to

¹⁶² *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 390–91 (2006). Those factors are: (1) whether the plaintiff will suffer irreparable harm without the injunction; (2) whether there is an adequate remedy at law; (3) the balance of hardships on the respective parties; and (4) whether granting an injunction would disservice the public interest. *Id.* at 391; *see also* Chao, *supra* note 161, at 549–64 (discussing the emerging trends in applying *eBay*'s four-factor test).

¹⁶³ *See eBay*, 547 U.S. at 396–97 ("When the patented invention is but a small component of the product the companies seek to produce and the threat of an injunction is employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest.").

¹⁶⁴ Holbrook, *supra* note 5, at 46–48.

¹⁶⁵ *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 21 (1997).

escape infringement when she practiced the essence of the invention, but for some reason the words of the claim did not happen to cover her.¹⁶⁶ Of course, there are problems with the doctrine of equivalents too. The doctrine makes it more difficult to ascertain a patent's boundaries.¹⁶⁷ Parties cannot just analyze the literal language of a patent's claims. They must also determine whether an accused component that does not fall within the literal scope of the claim matches the function, way, and result of the claimed element or whether the component is known to be interchangeable with a claimed element.¹⁶⁸

Oddly, the doctrine of equivalents has evolved so that it grants greater protection to patent holders for creations that were not foreseeable at the time of their patent applications.¹⁶⁹ Consequently, there can be infringement when the accused device is not found within precise boundaries of the claim nor closely connected to the embodiments described in the specification.¹⁷⁰ That means that an inventor "can exclude others from practicing a technology that she did not create," including advancements over the patented invention.¹⁷¹ Holbrook calls this the "possession paradox."¹⁷²

Under current law, the fact that infringement was under the doctrine of equivalents does not affect the remedy. All of patent law's traditional remedies are available to the patent holder, including damages and the possibility of a permanent injunction. Holbrook would reduce the impact of the "possession paradox" by prohibiting the patentee from receiving a permanent injunction when infringement is

¹⁶⁶ *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 607 (1950) (explaining that without the doctrine of equivalents an inventor would be left "at the mercy of verbalism" and the law "would be subordinating substance to form"); see also Holbrook, *supra* note 5, at 31–35 (discussing how some justify the doctrine of equivalents on the basis of "[c]laim [c]orrection," "[e]fficiency [g]rounds and [r]efinement [t]heory," and "[f]airness to the [i]nventor").

¹⁶⁷ See *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 732 (2002). As discussed earlier, unclear claims cause the same problems that overbroad claims do because companies have to worry that the claims will be interpreted broadly. See *supra* note 61 and accompanying text.

¹⁶⁸ See *Warner-Jenkinson*, 520 U.S. at 35–36.

¹⁶⁹ Holbrook, *supra* note 5, at 6; see also *Festo*, 535 U.S. at 740 (holding that prosecution history does not bar the application of the doctrine of equivalents when the patentee demonstrates that the equivalent in question was unforeseeable at the time of the narrowing amendment); Mark A. Lemley, *The Changing Meaning of Patent Claim Terms*, 104 MICH. L. REV. 101, 120 (2005) ("Indeed, covering equivalent technology not contemplated when the patent claims were written is one of the major benefits of the doctrine of equivalents.").

¹⁷⁰ See *Johnson & Johnston Assocs. Inc. v. R.E. Serv. Co.*, 285 F.3d 1046, 1054 (Fed. Cir. 2002) (en banc) (holding that the doctrine of equivalents does not apply to embodiments disclosed in the specification but not claimed).

¹⁷¹ Holbrook, *supra* note 5, at 6.

¹⁷² *Id.* at 2, 7.

found under the doctrine of equivalents.¹⁷³ This proposal would still leave the patent holder with the ability to recover past damages and an ongoing royalty.

Holbrook's proposal would modify patent law so that courts could respond to broad claims with more than only two results: (1) a patentee win, entitling the patentee to the typical array of remedies, or (2) a patentee loss. Under Holbrook's proposal, a patentee could win but be denied the ability to obtain a permanent injunction because infringement was only found under the doctrine of equivalents.

Peter Lee is also concerned about broad claims.¹⁷⁴ But he does not limit his recommendations to the doctrine of equivalents. Lee suggests that when significant improvements are found to infringe a patent (either literally or under the doctrine of equivalents), the patentee should not be entitled to a permanent injunction.¹⁷⁵ These are improvements that fall within the scope of a patent's claims but improve on the technology in a manner that is not described by the specification.¹⁷⁶

Lee explains that holders of broad "blocking" patents may end up preventing the commercialization of later improvements. Ideally, when patents on an underlying technology and on its improvement are held by different parties, the parties will be able to negotiate a cross license. However, Lee points out that the parties often fail to arrive at an agreement because of high transaction costs or because the holder of the blocking patent may seek an undue portion of the rents arising from the improvement.¹⁷⁷

To counteract such market failures, Lee looks to property law's accession doctrine for a solution. "According to this doctrine, when an innocent party improves someone else's personal property in a way that significantly enhances its value or changes its nature, the improver may take title to the improved item, contingent upon compensating the original owner for the raw materials."¹⁷⁸ Lee applies the same principles to patent law and recommends that courts integrate the accession

¹⁷³ *Id.* at 46.

¹⁷⁴ See Peter Lee, *The Accession Insight and Patent Infringement Remedies*, 110 MICH. L. REV. 175 (2011).

¹⁷⁵ *Id.* at 202–03.

¹⁷⁶ Lee defines both the terms "significant" and "improvement." First, an improvement occurs when a party "creat[es] a technology that serves a similar technical objective as the existing invention, but does so with greater efficiency or enhanced functionality." *Id.* at 184. Second, Lee borrows a definition of "significant" from Mark Lemley. See *id.* at 185. Lemley classifies significant improvements as those that are independently patentable over the original patented invention. Lemley, *supra* note 5, at 1008–10.

¹⁷⁷ Lee, *supra* note 174, at 180; see also, Lemley & Shapiro, *supra* note 62, at 1994–2010 (discussing how the threat of an injunction can enable a patent holder to negotiate royalties far in excess of patent holder's economic contribution).

¹⁷⁸ Lee, *supra* note 174, at 196.

insight into the *eBay* framework for determining whether to issue a permanent injunction.¹⁷⁹ The result would be to “deny injunctive relief when an infringer substantially improves on an underlying patented invention.”¹⁸⁰ Substantial improvers will still have to pay damages. However, the improver will be able to continue to use the patented technology by paying the patent holder an ongoing royalty.¹⁸¹

Finally, Katherine Strandburg also focuses on broad claims that block improvements.¹⁸² She proposes a multi-faceted patent fair use defense.¹⁸³ One aspect of her proposal places limits on broad claims. Specifically, certain classes of infringers would be exempt from liability entirely or at least not be subject to permanent injunction.¹⁸⁴ Among those classes would be those that substantially improve on the patented invention.¹⁸⁵ Substantiality would be judged by assessing the relative sizes of the initial invention and the improvement. Presumably, that requires a comparison of the improvement with the patent’s specification, not just its claims. Strandburg has two justifications for this exemption. First, she compares substantial improvements in patent law to transformative uses in copyright law and argues “that the public should not be deprived of a major advance because the initial author refuses to ‘play along.’”¹⁸⁶ Second, like Peter Lee, she points to various market failures that prevent the improver from ever receiving a license to the dominant patent.¹⁸⁷

I agree with all these proposals as far as they go.¹⁸⁸ But the law needs to go even further. These proposals only offer one way to adjust the remedy. Under the current law, an overly broad claim results in a loss for the patentee. If the claim is not too broad, the patentee wins and is entitled to all the typical remedies.¹⁸⁹ These include money damages and the possibility of an injunction. Holbrook’s, Lee’s, and Strandburg’s proposals would make the possibility of an injunction dependent on the

¹⁷⁹ *Id.* at 212–15.

¹⁸⁰ *Id.* at 240.

¹⁸¹ *Id.* at 215 (“[C]ourts applying this proposal would generally compel a defendant to pay royalties to a pioneer patentee as a condition of ongoing infringement.”).

¹⁸² See Katherine J. Strandburg, *Patent Fair Use 2.0*, 1 U.C. IRVINE L. REV. 265 (2011).

¹⁸³ *Id.* at 293–304.

¹⁸⁴ *Id.* at 293, 300–01.

¹⁸⁵ *Id.* at 297–99.

¹⁸⁶ *Id.*

¹⁸⁷ *Id.* at 298–99.

¹⁸⁸ I am only discussing Strandburg’s weaker proposal—exempting certain types of infringers from the possibility of a permanent injunction. Her stronger proposal—a complete fair use defense—would not change the number of outcomes. It would narrow the scope of broad claims so that they do not cover substantial improvements.

¹⁸⁹ A win would be a claim construction that encompasses the accused infringer, but does not invalidate the relevant claims of the patent.

nature of the infringement. Of course these proposals only operate on a single policy lever, the permanent injunction.¹⁹⁰

There is no reason why patent law cannot use money damages as an additional lever to tune the remedies even more finely. In other words, money damages should also depend on how close the infringing product is to the invention found in the patent's specification (i.e., where the infringement lies upon the infringement continuum). As described in further detail in Part V, that means that a jury would be instructed to base the amount of damages on how closely the infringement looks like the embodiments described in the specification.

B. *Central Claiming*

The proposal described in this Article relies on the patent's specification to tune the remedy that a patentee would receive.¹⁹¹ This would radically expand the role the specification plays in patent law. Under current law, the primary purpose of the specification is to teach the public how to use the invention.¹⁹² Of course the specification is also used to interpret the claims, but the claims delineate the patentee's property rights. However, the general idea of placing more weight on the specification is not new.

In two separate articles, Jeanne Fromer and Dan Burk and Mark Lemley have suggested that patent law should focus less on what inventors claim and more on what they describe.¹⁹³ These commentators identify a number of problems with our current system of "peripheral claiming."¹⁹⁴ They argue that too many resources are spent drafting claims and interpreting them.¹⁹⁵ What is worse, these efforts are often wasted because the claims are unclear and thus fail to

¹⁹⁰ To be fair, injunctions can be tailored providing a limited amount of flexibility. See Golden, *supra* note 161.

¹⁹¹ Presumably, the three proposals regarding permanent injunction would also rely on the specification and expand its role. For example, even though infringement under the doctrine of equivalents is based on examining each claim limitation, the specification helps us determine whether some other feature that does not fall within the literal scope of that limitation: serves the same purpose, has the same function, or achieves the same result. Moreover, assessing whether an infringement substantially improves on the patented invention would undoubtedly involve looking at the patent's specification, not just its claims.

¹⁹² See *supra* notes 70, 87 and accompanying text (describing the enablement and written description requirements).

¹⁹³ See Burk & Lemley, *supra* note 9; Fromer, *supra* note 9.

¹⁹⁴ In the current system, the claims define the outer limit of the patentees' property right. This approach is referred to as "peripheral claiming." Burk & Lemley, *supra* note 9, at 1744.

¹⁹⁵ See Burk & Lemley, *supra* note 9, at 1761-65 (discussing the costs of claim construction); Fromer, *supra* note 9, at 774 ("Drafting patent claims is costly, in large part due to the abundance of drafted claims and the expensive abstract wording the patentee employs to garner broad coverage.").

give the public adequate notice of the claimed property right.¹⁹⁶ Often the interpretation of those claims does not even accurately reflect the fundamental nature of the invention.¹⁹⁷

Consequently, Fromer, Burk, and Lemley recommend that the United States move toward a system of central claiming.¹⁹⁸ Under a central claiming approach, claims would not define the scope of the patentee's rights. Much as it does now, the specification would describe the central or prototypical embodiments. But instead of just being used to help interpret the claim, these exemplars would actually define the scope of the patent. The patent would cover a broader set of similar embodiments.¹⁹⁹

While the remedies reform recommended here and central claiming share some basic traits, their solutions are quite different. First, central claiming addresses two problems that I do not. Central claiming would eliminate the costs associated with drafting and interpreting claims.²⁰⁰ It also attempts to better align the scope of the patent with the patentee's actual invention.²⁰¹

Now both the proposal described in this Article and central claiming attempt to address claim breadth, but they do so using fundamentally different mechanisms. By placing a greater focus on the invention, central claiming eliminates the practice of drafting claims far afield from the invention.²⁰² In contrast, my proposal accepts that there will be some very broad claims, but reduces the cost of any infringement that lies near the edge of those claims.

But central claiming does very little, if anything, about unclear claims.²⁰³ Indeed, Burk and Lemley admit that central claiming is

¹⁹⁶ See Burk & Lemley, *supra* note 9, at 1751–52; Fromer, *supra* note 9, at 758.

¹⁹⁷ Burk & Lemley, *supra* note 9, at 1765 (“The focus on the meaning of individual words in patent claims drafted by patent lawyers has displaced a focus on what the patentee actually invented and how significant that invention is.”).

¹⁹⁸ *Id.* at 1747; Fromer, *supra* note 9, at 719.

¹⁹⁹ Fromer, *supra* note 9, at 727 (“[In central claiming,] the rightsholder describes the central, or prototypical, set members, but the right tends to cover a broader, similar set of items.”).

²⁰⁰ See Burk & Lemley, *supra* note 9, at 1787 (suggesting that central claiming would lead to “lower-cost applications and more efficient . . . examinations”); Fromer, *supra* note 9, at 759.

²⁰¹ See Burk & Lemley, *supra* note 9, at 1787 (“The primary advantage of central claiming is that it puts the focus on what the patentee actually invented rather than on what patent lawyers later (often much later) drafted as claims to cover the ground in that invention.”).

²⁰² *Id.* at 1762 (“If the patent lawsuit were focused on the central features of what the patentee invented, overclaiming wouldn’t work.”); Fromer, *supra* note 9, at 775 (noting that patent examiners often have a difficult time imagining all the embodiments that may fall within a given claim).

²⁰³ See Tun-Jen Chiang, *Defining Patent Scope by the Novelty of the Idea*, 89 WASH. U. L. REV. 1211, 1239 (2012) (arguing that central claiming has the same problems of the current system of peripheral claiming).

unlikely to clarify patent rights²⁰⁴ while Fromer is equivocal. She says that central claims “might be” more effective at providing adequate notice to the public because people should understand central claiming better.²⁰⁵ In contrast, my proposal accepts that vague claims will always be with us and attempts to adjust remedies law accordingly.

In sum, advocates of central claiming recommend a fundamental change in patent law. They would place less weight on a patent’s claims and more weight on the patent’s specification in infringement determinations. This Article takes the same tact, but applies it to patent remedies. This approach leads to a very different result. The primary benefits of central claiming are eliminating the costs of peripheral claiming and realigning property rights more closely with the actual invention. In contrast, my proposal tailors remedies to the different types of infringement that fall upon the infringement continuum. This results in a system that is fairer and more predictable. Notably, both peripheral and central claiming result in binary outcomes with all-or-nothing results. Consequently, the reform proposed here could improve either the current peripheral claiming system or any of the central claiming proposals.

IV. THE CURRENT SYSTEM

The available remedies for patent infringement are money damages and a permanent injunction. As discussed earlier, others have already argued that a permanent injunction should not be granted for infringement that departs too far from what the patent described. These proposals exemplify the concept of adjusting the patentee’s remedy based on the proximity of the infringement to the patentee’s invention. However, they only suggest one coarse adjustment, granting or denying a permanent injunction. This Article takes the concept further by proposing to calibrate the patentee’s remedy more precisely with money damages. To accomplish this goal, there needs to be fundamental reforms to the way patent law awards damages. This Article proposes to eliminate the current bifurcated lost-profits/reasonable-royalty regime and replace it with a royalty framework that calculates damages based chiefly on the proximity of the infringement to the invention described in the patent’s specification.

²⁰⁴ See Burk & Lemley, *supra* note 9, at 1794 (“Central claiming avoids the problem [of unclear claims], not by offering greater determinacy, but by avoiding the pretense that such determinacy is possible.”).

²⁰⁵ Fromer, *supra* note 9, at 776 (“Central claims will not excise the problem of language ambiguities; but because people appear to build central models of categories in their mind, central claims might be just as, if not more, effective to provide content notice to the public.”).

Currently, there are two primary forms of money damages: lost profits and a reasonable royalty. Under the statute governing patent damages, a prevailing patentee can receive lost profits.²⁰⁶ But if the patentee does not have any lost profits or is unable to prove them, a reasonable royalty is always available.²⁰⁷ Both types of damages are intended to return the patentee to the place she would have occupied had there been no infringement.²⁰⁸ However, both precedent²⁰⁹ and commentators²¹⁰ agree that the fundamental purpose underlying patent law is to promote innovation. To the extent that inventors receive financial rewards, it is simply a byproduct of encouraging innovation.²¹¹ This concept is found at the constitutional root of our country's patent laws.²¹² Yet, as Ted Sichelman has complained, patent remedies jurisprudence overlooks this basic premise.²¹³ By focusing on restoring patentees to the position they had prior to any infringement, patent remedies often ignore the public's interest in encouraging innovation that builds on existing patented technology.²¹⁴ The result is that both the current lost profits and reasonable royalty frameworks overcompensate the patentee.²¹⁵

²⁰⁶ See 35 U.S.C. § 284 (2012) (“Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.”).

²⁰⁷ See *id.*

²⁰⁸ *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 507 (1964) (“[The] question (is) primarily: had the Infringer not infringed, what would Patent Holder-Licensee have made?” (quoting *Livesay Window Co. v. Livesay Indus.*, 251 F.2d 469, 471 (5th Cir. 1958))); *Yale Lock Mfg. Co. v. Sargent*, 117 U.S. 536, 552 (1886) (stating that a patentee's damages are “the difference between his pecuniary condition after the infringement, and what his condition would have been if the infringement had not occurred”).

²⁰⁹ See, e.g., *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 9 (1966) (“The patent monopoly was not designed to secure to the inventor his natural right in his discoveries. Rather, it was a reward, an inducement, to bring forth new knowledge.”).

²¹⁰ See, e.g., WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW* 294 (2003) (“The standard rationale of patent law is that it is an efficient method of enabling the benefits of research and development to be internalized, thus promoting innovation and technological progress.”); Sichelman, *supra* note 2, at 530–31 (“[A]ny form of private law right afforded to the patentee is purely incidental to the aim of patent law in promoting innovation.”).

²¹¹ See *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 511 (1917) (“[T]his court has consistently held that the primary purpose of our patent laws is not the creation of private fortunes for the owners of patents, but is ‘to promote the progress of science and the useful arts’” (quoting U.S. CONST. art. I, § 8)).

²¹² The Constitution authorizes Congress to make laws “[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.” U.S. CONST. art. I, § 8, cl. 8.

²¹³ See Sichelman, *supra* note 2, at 536 (“[The] problem . . . is that the private law remedies usually associated with tort law—injunctions and compensatory damages—are not always sensible for optimally encouraging innovation.”).

²¹⁴ See *id.*

²¹⁵ There are also other sources of overcompensation in the current remedies regime that are not caused by the way patent law calculates damages. See Bernard Chao, *The Case for*

This Article takes the public interest more seriously and argues that patent law should replace the current bifurcated lost-profits/reasonable-royalty framework with a single scheme that is primarily based on the proximity the infringement has to the actual invention. Under this proposal, the award a patentee would receive would more closely measure what it actually contributed to the infringing product. In the next two sections, this Article reviews the lost-profits/reasonable-royalty framework and explains how each theory focuses on making patent holders whole instead of optimizing innovation. This Article then proposes a single royalty remedies framework that balances incentives for both early innovators and improvers.

A. *Lost Profits*

Generally, a lost profits theory of damages concerns itself with the money the patentee would have made, *but for* the infringement. This measure of damages applies when the infringer competes with the patentee. The basic framework for lost profits consists of a four-part test. To obtain lost profits, the patentee must show: “(1) demand for the patented product, (2) [the] absence of acceptable noninfringing substitutes, (3) [her] manufacturing and marketing capability to exploit the demand, and (4) the amount of profit [s]he would have made.”²¹⁶ If a patentee satisfies these four requirements, she has shown what profits she would have realized had there been no infringement. Thus, lost profits simply attempts to restore the patentee to the position she would have enjoyed had the infringement never occurred.

Unfortunately, the theory of lost profits makes no attempt to properly allocate incentives between the patentee and the infringer.²¹⁷ The theory is only concerned about the profits the patentee lost. It is not concerned about leaving the infringer with any return on its efforts. Consider the following hypothetical. Assume that the patentee, SmartCo, sells smart phones in a two-supplier market and has a patent on some aspect of touchscreen technology that is often used in these phones. The infringer, and SmartCo’s only competitor, CellCo, uses the same touchscreen technology in its competing smart phones and sells a million phones. If SmartCo is seeking lost profits, it will try to prove that

Contribution in Patent Law, 80 U. CIN. L. REV. 97, 116–18 (2011) (explaining how juries may overestimate the value a component patent contributes to a complex product); Lemley & Shapiro, *supra* note 62, at 2008–09 (explaining how the threat of an injunction leads to systematic overcompensation). This Article does not address these problems.

²¹⁶ *Panduit Corp. v. Stahl Bros. Fibre Works*, 575 F.2d 1152, 1156 (6th Cir. 1978).

²¹⁷ See Scotchmer, *supra* note 35, at 30 (“The challenge is to reward early innovators fully for the technological foundation they provide to later innovators, but to reward later innovators adequately for their improvements and new products as well.”).

it would have sold an additional million smart phones, but for CellCo's infringement.²¹⁸ If CellCo made \$10 profits per smart phone, SmartCo's profits were likely to be in that same neighborhood. Thus, SmartCo will probably recover \$10,000,000—more or less, the profits that CellCo made.

This award makes sense when the patent provides all the value for the competing products (i.e., the patentee and the infringer added nothing of value to the patented technology to make their smart phones).²¹⁹ However, modern electronic devices often involve hundreds if not thousands of patented technologies.²²⁰ Moreover, infringers rarely just copy patented technology.²²¹ They almost always contribute something.²²² Some infringers develop unforeseen variations and/or improvements of the patented technology. Others may combine the patented technology with existing technologies that have no connection to the patent.²²³ Both of these types of infringing activity regularly occur in the context of complex electronic devices.²²⁴ Still others add more vanilla value like “know-how, materials, and marketing efforts.”²²⁵

In the hypothetical discussed above, both the patentee and the infringer's smart phones undoubtedly would have used other patented (and unpatented) technology. Smart phones contain fourth-generation (4G) communications technology, global position systems (GPS), mobile browsers, and software applications like Facebook and iTunes. Yet, the patentee would recover all the smart phone profits because it patented touch screen technology. Thus, the current lost profits framework overcompensates the patentee in all but the simplest cases.²²⁶ This, in turn, under incentivizes infringers that hope to improve on the patented technology.²²⁷

The reason why lost profits systematically overcompensates patentees is because the remedy is not designed to promote innovation.

²¹⁸ For the purposes of this hypothetical, I assume a simplified two-supplier world.

²¹⁹ See Brian J. Love, Note, *Patentee Overcompensation and the Entire Market Value Rule*, 60 STAN. L. REV. 263, 272 & n.39 (2007) (suggesting that an award of lost profit overcompensates the patentee because the patentee receives “profits earned from value it did not create”).

²²⁰ See Chao, *supra* note 215, at 105–06 (discussing various studies that suggest that there are hundreds if not thousands of patents involved in today's everyday electronic devices).

²²¹ Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1424 (2009) (finding that copying is quite rare in patent litigation).

²²² Mark A. Lemley, *Distinguishing Lost Profits from Reasonable Royalties*, 51 WM. & MARY L. REV. 655, 663–64 (2009) (“[I]t is effectively never the case that the patent is responsible for all of the value of a product.”).

²²³ See Collins, *supra* note 157, at 1247–51.

²²⁴ See Love, *supra* note 219, at 289.

²²⁵ Lemley, *supra* note 222, at 663 (pointing out that infringers often add more mundane value like “know-how, materials, and marketing efforts”).

²²⁶ In contrast, a patent on a drug's active ingredient may really be the basis for the consumer demand. Thus, the rule may make sense for pharmaceutical industry patents.

²²⁷ See Merges & Nelson, *supra* note 35, at 843–44.

Rather, its goal is to make the patentee whole by returning the patentee to the place she would have occupied had there been no infringement. However, this type of “make-whole” remedy is fundamentally inconsistent with patent law’s goal of encouraging innovation rooted in the Constitution.²²⁸ If patent remedies were really structured to encourage *all* innovation—infringers that add value to the patent would be allowed to retain some of their profits.

Breaking down the problem further, the current lost-profits framework improperly places the focus on the patentee’s entire product even when its patent only covers one aspect of the product. It looks at the products the patentee would have sold but for the infringer’s sales. In contrast, a remedies framework that is concerned about innovation would compare the patent to the infringing product to determine what contribution the patent made to the product. It would then apportion the profits between the patentee and the infringer to provide incentives for both the patentee and any contributions the infringer added.

B. *Reasonable Royalties*

When lost profits are unavailable, the patentee may seek a reasonable royalty. Like lost profits, a reasonable royalty award concerns itself with the money the patentee would have made, *but for* the infringement. This typically occurs when the patentee does not compete with the infringer. For example, many patents are asserted by entities whose sole business is to assert patents.²²⁹ These entities do not sell products and have no profits to lose. Even when there is competition, patentees may seek a royalty when they cannot prove lost profits or when those profits are just too small.

Patent law uses the *Georgia-Pacific* test to calculate reasonable royalty awards.²³⁰ Jurors are instructed to ascertain the royalty that the

²²⁸ Sichelman, *supra* note 2, at 518–19 (characterizing patent remedies as tort like, not innovation based).

²²⁹ See Colleen V. Chien, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, 62 HASTINGS L.J. 297, 328–31 (2010) (describing how “patent assertion entities” behave).

²³⁰ See *Ga.-Pac. Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), *modified by* 446 F.2d 295 (2d Cir. 1971). Reasonable royalty awards can also be calculated using “the so-called ‘analytical approach.’” See *TWM Mfg. Co. v. Dura Corp.*, 789 F.2d 895, 899 (Fed. Cir. 1986); accord JOHN SKENYON ET AL., PATENT DAMAGES LAW & PRACTICE § 3:8 (2013). But this test is almost never used. Therefore, I will not address it. See Christopher B. Seaman, *Reconsidering the Georgia-Pacific Standard for Reasonable Royalty Patent Damages*, 2010 BYU L. REV. 1661, 1673 (“Today, nearly all reasonable royalty awards are based on the fifteen-factor [*Georgia-Pacific*] test . . .”). The Model Patent Jury Instructions from the Federal Circuit Bar Association does not even mention the “analytical method.” See FED. CIRCUIT BAR ASS’N, MODEL PATENT JURY INSTRUCTIONS (Feb. 2012), available at <http://memberconnections.com/olc/filelib/LVFC/cpages/9004/Library/2012%20Updated%20FCBA%20Model%20Patent%20>

parties would have agreed upon had they successfully negotiated a license just before infringement began. The hypothetical negotiation assumes that the patent at issue is valid and infringed. Of course this is different from what would happen during any actual negotiations where some discount would be applied for the possibility that the patent is not infringed or invalid.²³¹ There are a mind-boggling fifteen factors that are used to calculate the royalty under this analysis.²³²

Jury%20Instructions.pdf. Rather, it defines a reasonable royalty in terms of the hypothetical negotiation. *See id.* § 6.6.

²³¹ See ROGER D. BLAIR & THOMAS F. COTTER, *INTELLECTUAL PROPERTY: ECONOMIC AND LEGAL DIMENSIONS OF RIGHTS AND REMEDIES* 229–30 (2005) (explaining why the hypothetical negotiation needs to make these counterfactual assumptions to avoid under-compensation).

²³² See *Ga.-Pac.*, 318 F. Supp. at 1120. The factors are:

1. The royalties received by the patentee for the licensing of the patent in suit, proving or tending to prove an established royalty.
2. The rates paid by the licensee for the use of other patents comparable to the patent in suit.
3. The nature and scope of the license, as exclusive or non-exclusive; or as restricted or non-restricted in terms of territory or with respect to whom the manufactured product may be sold.
4. The licensor's established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly.
5. The commercial relationship between the licensor and licensee, such as, whether they are competitors in the same territory in the same line of business; or whether they are inventor and promoter.
6. The effect of selling the patented specialty in promoting sales of other products of the licensee; that existing value of the invention to the licensor as a generator of sales of his non-patented items; and the extent of such derivative or convoyed sales.
7. The duration of the patent and the term of the license.
8. The established profitability of the product made under the patent; its commercial success; and its current popularity.
9. The utility and advantages of the patent property over the old modes or devices, if any, that had been used for working out similar results.
10. The nature of the patented invention; the character of the commercial embodiment of it as owned and produced by the licensor; and the benefits to those who have used the invention.
11. The extent to which the infringer has made use of the invention; and any evidence probative of the value of that use.
12. The portion of the profit or of the selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions.
13. The portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements, the manufacturing process, business risks, or significant features or improvements added by the infringer.
14. The opinion testimony of qualified experts.
15. The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had

Although this framework differs from how lost profits are calculated, the reasonable royalty is still a kind of make-whole remedy. Instead of trying to restore the patentee to the position she would have occupied had there been no infringing conduct, a reasonable royalty award attempts to place the patentee in the position she would have been had the infringer taken a license and continued its conduct. Assuming that the goal is to maximize innovation, even this approach overcompensates patentees. It does so by intentionally awarding damages that are not properly attributable to the patented invention. In addition, there are unintended ways that the reasonable royalty framework operates in practice that allow patentees to receive even larger recoveries.

First, the entire market value rule explicitly allows patentees to recover damages based on the value of the entire product, not just the value of the patented component. Ostensibly, the rule only applies “where the patented feature creates the ‘basis for [the] customer demand’” of the entire product.²³³ However, as discussed earlier, that is almost never true.²³⁴ Particularly for the high-tech industry, many different technologies and contributions are necessary for any given product. Nonetheless, the entire market value rule is routinely applied to cases where value can be attributed to things beyond the patent at issue.²³⁵ In practice, that means patentees are overcompensated.²³⁶

Additionally, the infringer may have even made substantial contributions when the patented feature is the basis for the consumer demand. Recall the ‘647 patent. It described a computer that recognized e-mail addresses, dates, and names in documents and automatically allowed the user to perform an action.²³⁷ The claims appeared to reach substantially further than these embodiments. So software that

been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee—who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.

Id.

²³³ *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1318 (Fed. Cir. 2011) (quoting *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1336 (Fed. Cir. 2009)).

²³⁴ See *supra* notes 220–25 and accompanying text.

²³⁵ See *Love, supra* note 219, at 277 (describing cases where the entire market value rule is applied even though “unpatented components of the accused device have independent economic value”).

²³⁶ *Lemley, supra* note 222, at 664 (“But since there is always at least some value to the defendant’s product not attributable to the patent, any application of the entire market value rule in a reasonable royalty setting necessarily overcompensates the patent owner by giving it value not in fact attributable to the patent.”); see *Love, supra* note 219, at 289 (concluding that the entire market value rule makes little sense “in the arena of complex electronic devices”).

²³⁷ See *supra* text accompanying notes 29–32.

recognizes facial images and automatically indexes them may be covered by a broad claim. Assume this feature is the basis for the consumer demand for a digital photo frame, a device that allows a user to display a variety of digital images. The entire market rule would apply and the patentee would be able to capture royalties based upon the infringing digital frames that contain the facial recognition software. Nonetheless, it is clear that substantial contributions beyond the '647 patent went into the digital photo frames. It may be the infringer's own contributions. But more likely, facial recognition technology was the result of cumulative incremental efforts from numerous different entities.²³⁸ Unfortunately, the entire market value rule ends up attributing all of these contributions to the patentee because they fall within the scope of the broad claim.

Mark Lemley and Brian Love have pointed out how this problem is exacerbated by the manner in which “convoyed sales” affect reasonable royalty calculations.²³⁹ The sixth *Georgia-Pacific* factor instructs the jury to consider “[t]he effect of selling the patented specialty in promoting sales of other products of the licensee; that existing value of the invention to the licensor as a generator of sales of his non-patented items; and the extent of such derivative or convoyed sales.”²⁴⁰ Consequently, reasonable royalties can be increased because of sales of related items that are not covered by the patent at issue. Again this analysis fails to consider what else others contributed. For example, these products may have been covered by the defendant's own patents. This is especially likely to occur when these other products are not the infringing product themselves. Once again, this shows how the current framework does not concern itself with leaving any incentives to develop technology that works with existing patented technology.

Although *Georgia-Pacific* does provide some basis for the jury to consider the relative value of the patent, practical problems render these factors ineffectual. Factor nine discusses advantages of the patent over

²³⁸ See FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 25–26 (Oct. 2003), available at <http://www.ftc.gov/sites/default/files/documents/reports/promote-innovation-proper-balance-competition-and-patent-law-and-policy/innovationrpt.pdf> (“[T]echnology developed in industries such as semiconductors, computer hardware, and software can contain a large number of incremental innovations.”).

²³⁹ Lemley, *supra* note 222, at 665 (“[Allowing royalty rates to consider convoyed sales] suffers from the same flaw as the application of the entire market value rule: it attributes the value of unpatented technologies to the patent owner in circumstances in which the patent owner would not have made sales of those technologies, and, therefore, in which the infringer would have had to pay to develop or acquire the technology from somewhere else.”); Brian J. Love, *The Misuse of Reasonable Royalty Damages as a Patent Infringement Deterrent*, 74 MO. L. REV. 909, 931 (2009) (“[T]he ‘convoyed sales’ doctrine . . . overcompensate[s] patent owners by allowing them to earn a royalty on value they did not create.”).

²⁴⁰ *Ga.-Pac. Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), modified by 446 F.2d 295 (2d Cir. 1971).

old modes and devices and factor thirteen discusses the portion of the profit attributable to the invention as opposed to non-patented elements.²⁴¹ Both of these factors suggest that juries should consider the relative worth of the patent, but that does not happen in practice. As Chris Seaman suggested “at trial, juries hear extensive evidence from the patent holder regarding the critical importance of the patented invention but often receive little or no information regarding ‘all the other things that contribute to the success’ of the accused product.”²⁴² This may be caused in part by the scarcity of trial days. Patent litigants probably do not have the time to offer all the evidence they want. In addition, there are tactical reasons why defendants want to concentrate the time they do have challenging liability instead of rebutting damages.²⁴³ Plainly, juries really do not consider the other contributions that helped form the infringing product. The result is that patent remedies do not account for the public’s interest in encouraging innovation that builds on existing patented technology.

V. REFORMING REMEDIES

For patent law to properly incentivize technology that builds upon (or works with) existing patented technology, the law needs to employ a more balanced perspective. Specifically, when awarding damages the fact finder should consider both: what damages the patentee should be awarded and what money the infringer should retain. The infringement continuum provides a useful device for considering these issues. Some infringement looks just like what the patentee invented. Other infringement lies on the outer boundaries of the property right. Of course still other forms lie somewhere between these two poles. Patentees clearly deserve more compensation when infringement looks just like what the patentee invented. Correspondingly, infringers deserve to retain more of their own proceeds when they provide larger contributions. This occurs when the infringing products depart significantly from what the patentee invented.

A. *The Framework*

I suggest that patent law consider a framework that adjusts the amount of damages by the proximity the infringer’s use has to the use

²⁴¹ *Id.*

²⁴² Seaman, *supra* note 230, at 1697–98.

²⁴³ See Chao, *supra* note 215, at 117–18 (discussing how defendants fear that presenting an alternative damages case may be interpreted by the jury as a concession on liability).

envisioned by the inventor. This Article sets forth the basic framework; additional details and nuances could be added as parties and courts apply the notion of an infringement continuum in awarding damages. But I can identify several important characteristics of how patent law should use the infringement continuum to calculate monetary damages. First, patent law should do away with the bifurcated lost-profits/reasonable-royalty regime and instead award all successful patent plaintiffs a form of royalty. Second, I would discard much of current reasonable royalty framework and replace it with a “new” royalty that would be based primarily on where the infringement lies upon the infringement continuum. Third, this “position” can be calculated by comparing the infringing product to the patent specification. The law should use this result to determine the royalty the patentee is awarded.

The first characteristic of my proposal is to do away with lost profits entirely. By its very nature, awarding lost profits fixes a problem that patent law was not intended to address. The theory of lost profits is very much a tort theory intended to make an injured party whole.²⁴⁴ But if patent law really does not care about enriching inventors,²⁴⁵ then awarding lost profits to aggrieved patentees makes no sense. The question should not be: how does the law make the patentee whole? But rather, what compensation is needed to properly incentivize innovation? That means considering incentives for both the patentee and any of the infringer’s contributions. A properly framed royalty-based calculation is better suited to accomplish this goal because it can look beyond what the infringer “lost.” But the existing reasonable royalty framework does not do this.

Consequently, the second characteristic of my proposal is to jettison much of current reasonable royalty law and replace it with a calculation based on the infringement continuum. That means eliminating the entire market value rule. Since a patented feature almost never serves as the entire basis for the consumer demand, the rule does not apply to the vast majority of cases.²⁴⁶ Moreover, when a patented feature forms the basis for the consumer demand, the rule effectively gives all the credit to the patentee. That does not make sense when the infringer developed a new and improved variation of the patented invention.

²⁴⁴ See *supra* Part IV.A.

²⁴⁵ See *supra* notes 210–11 and accompanying text.

²⁴⁶ The exception is where the patentee contributed the entire value of the infringing product. But that is an easy case that the current proposal handles well. When the infringer adds nothing of value, the patentee should be allowed to recover most of the infringer’s proceeds. To the extent that the infringer is allowed to retain some of its proceeds, that should be based on non-technical contributions like marketing and manufacturing operations.

The new royalty calculation also needs to discard the *Georgia-Pacific* test. There are a number of reasons why this test is not well designed to optimize innovation. First, like lost profits, framing a reasonable royalty based on a hypothetical negotiation is a kind of make-whole remedy. It tries to restore the patentee to the position she would have occupied had the infringer taken a license. But as others have noted “a patentee need not reap the entire social value of its invention in order to be sufficiently incentivized.”²⁴⁷ On a more practical level, juries cannot be expected to make sense of a fifteen-factor test.²⁴⁸ In addition, many of those factors are not concerned with the public good. For example, factors four (the licensor’s licensing practices), five (the commercial relationship between the patentee and the infringer), and fifteen (the amount the parties would have agreed to) all consider the relationship of the patentee and the infringer.²⁴⁹ A patentee may wish to keep its competitor from using a patented technology and only license it for a higher fee. But it may be in the public interest to have the competitor include the technology in its product for a smaller fee.²⁵⁰ In sum, royalties that are calculated using the infringement continuum will look quite different than royalties under the *Georgia-Pacific* test.

The “new” reasonable royalty would calculate damages based on where the infringement lies on the infringement continuum. That means the patentee will receive a higher royalty when the infringement looks very much like what the patentee invented. The corollary is that the infringer will retain more of its own proceeds when the infringement looks very different. This should occur when the infringer’s contribution is greater.²⁵¹

Of course this determination cannot be made by comparing the claims to the infringing devices. Claims merely list properties; they do not look like anything tangible. To determine where an infringing product lies on the infringement continuum, the infringing product

²⁴⁷ Sichelman, *supra* note 2, at 552; see also Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1046 (2005) (“The assumption that intellectual property owners should be entitled to capture the full social surplus of their invention runs counter to our economic intuitions in every other segment of the economy.”).

²⁴⁸ Daralyn J. Durie & Mark A. Lemley, *A Structured Approach to Calculating Reasonable Royalties*, 14 LEWIS & CLARK L. REV. 627, 628 (2010) (“[The *Georgia-Pacific* test] overloads the jury with factors to consider that may be irrelevant, overlapping, or even contradictory.”); Seaman, *supra* note 230, at 1688 (“*Georgia-Pacific* gives juries little guidance on how to weigh the numerous factors and reach a decision on an appropriate royalty.”).

²⁴⁹ See *Ga.-Pac. Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970), modified by 446 F.2d 295 (2d Cir. 1971).

²⁵⁰ See Eric E. Bensen & Danielle M. White, *Using Apportionment to Rein in the Georgia-Pacific Factors*, 9 COLUM. SCI. & TECH. L. REV. 1, 36 (2008) (arguing that value of the patent should be judged from a market perspective, not the perspective of the patentee and infringer).

²⁵¹ Alternatively, the infringer could be relying on contributions from third parties.

must be compared to the patent's specification. The degree of similarity can then be used to calculate the royalty.

B. *Benefits*

Incentive royalties addresses the problem of unclear and unduly broad claims. Although the reform will not clarify claim scope or narrow unduly broad claims, it will ameliorate the problems caused by these types of claims. As discussed earlier, the goal of the patent system is to maximize innovation. Unduly broad claims thwart this goal. When claims reach too deeply into the infringement continuum and cover products that look very little like what the patent describes, innovation can suffer. Innovators are less willing to build on patented technology. This problem is exacerbated when damage awards are high and do not reflect contributions that the infringer added to the patented invention.

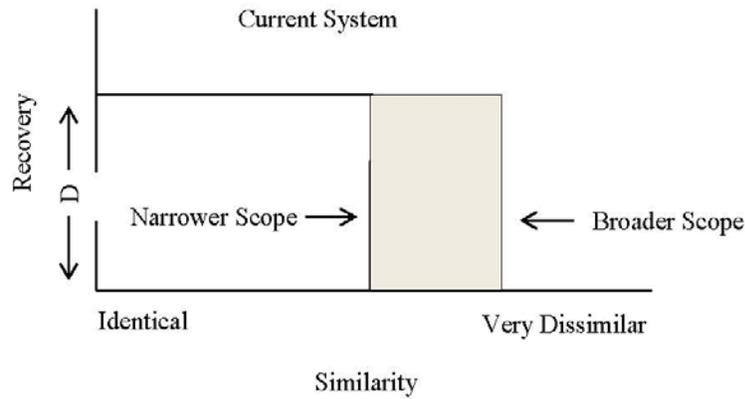
My proposal directly addresses this problem. While the current lost-profits/reasonable-royalty framework is just concerned with providing incentives for the patentee, the proposed reform also allows for incentives for those that build on existing patented technology. When infringers are making their own contributions that build on patented technology, their products will look less like what the patentee invented (i.e., the specification). In those situations, the patentee will recover less so that the infringer can receive some benefit for its innovation.

Since this solution does not curb claim scope, it does not solve the problem of unduly broad claims. Some patentees will still be able to successfully assert their patents against products that are fundamentally different from the patented inventions. However, their recoveries should be much smaller because those kinds of infringements will lie deep along the continuum. This in turn should make follow-on innovation more likely.

The proposal should also reduce the problem of unclear claims. Figure 4 below illustrates the problem under the current system. The different types of infringement that lie upon the infringement continuum are found on the horizontal x-axis. The magnitude of the patentee's recovery, D , is shown on the vertical y-axis. D represents the damages a patentee receives under the current bifurcated lost-profits/reasonable-royalty system. The shaded area represents uncertainty. Since uncertainty generally lies at the outer boundaries of a claim, the shaded area is shown to the right. Initially, no one knows whether the patent will be interpreted to have a narrower or broader scope.

Figure 4

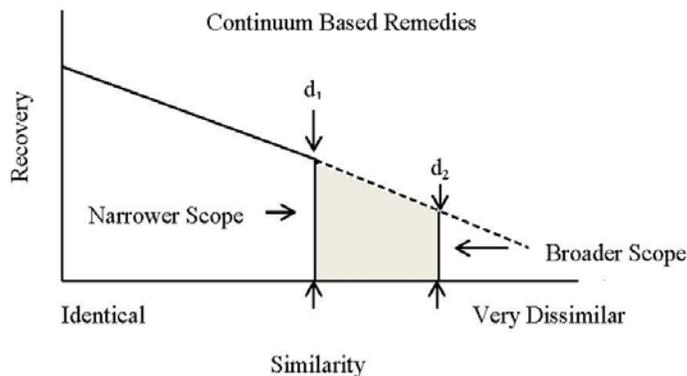
So long as the infringer falls within the scope of the claim, the



patentee's recovery is D . But as soon as the infringer falls outside the scope of the claim, the patentee recovers nothing. This suggests that damages are not based on where the infringement lies on the infringement continuum. Thus, when either party incorrectly anticipates whether there is infringement of a valid claim, the size of its error is D .

Now consider the effects of uncertainty when royalties are calculated relying on the infringement continuum. Figure 5 shows that the patentee's recovery decreases as the infringement looks less like what is described by the patent's specification. At the outer edge of its claim, the patentee's potential recovery ranges from d_1 to d_2 . In either case, both d_1 and d_2 are substantially less than D , which represents the make-whole damages awarded under the current system of lost profits/reasonable royalties. Likewise, the cost of incorrectly anticipating whether there is infringement of a valid claim is also between d_1 to d_2 .

Figure 5



Reducing the costs of legal uncertainty provides several benefits.²⁵² First, when the cost of making a mistake is smaller, companies will be less likely to forego technology that they were entitled to use.²⁵³ That benefits both the companies themselves and the consuming public. Products are more likely to contain the best technology. At the same time, companies are less likely to pay for patent licenses they do not need.²⁵⁴ This also reduces the costs to the end consumers.

C. Exemplary Implementations

So far, this Article has only discussed the theory of basing remedies on the infringement continuum. This section sets forth a few possible examples. In its simplest form, a single score could be used to assess the overall similarity between the infringing product and the patent's specification. But by describing a slightly more complex example, this Article illustrates how nuanced the proposed framework can be. As discussed earlier, similarity can be considered in (at least) two dimensions—how far the infringer has changed the basic invention and how much the infringer added to that invention.²⁵⁵ Kevin Collins characterized the former type of developments as substitutes and the

²⁵² For a general discussion of the costs of legal uncertainty, see John E. Calfee & Richard Craswell, *Some Effects of Uncertainty on Compliance with Legal Standards*, 70 VA. L. REV. 965 (1984).

²⁵³ See *supra* note 61 and accompanying text.

²⁵⁴ See *supra* notes 62–64 and accompanying text.

²⁵⁵ See *supra* text accompanying notes 157–58.

latter as complements.²⁵⁶ We could ask the fact finder to measure differences in these dimensions by considering percentages.²⁵⁷ One hundred percent describes infringement that is identical to what is disclosed in the specification. One percent describes an infringing product that bears almost no resemblance to anything described in the specification.²⁵⁸ The substitute similarity score and complement similarity score can be combined to determine what percentage of the proceeds the patentee should receive. For the current analysis, “proceeds” should be thought of as the infringer’s profits.²⁵⁹ The result can be characterized by the following formula:

$$\text{Royalty} = S \times C \times \text{Proceeds}^{260}$$

Looking at the ‘647 patent example again, we can illustrate how this proposal operates through two examples. First, consider a smart phone that recognizes e-mail addresses in a document and allows the user to automatically put them in his address book. The ‘647 patent disclosed the e-mail recognition technology in the context of a personal computer, but not a smart phone.²⁶¹ Thus, the e-mail features are very similar to what the patent describes. In other words, the infringer adds very little to the way the patent already handles e-mail addresses and the substitution similarity score should be high. Let us assume that the substitute similarity score, S, is 90%.²⁶² In contrast, smart phones were unknown at the time the ‘647 patent was filed. Moreover, they clearly contain many contributions unrelated to the gist of the ‘647 patent. Let us assume that the complement similarity score, C, is 5%. The result would be that the patentee would be entitled to 4.5% (i.e., 90% x 5%) of the infringer’s proceeds.

Next let us consider a digital picture frame with facial recognition technology that allows a user to automatically display selected pictures of family members. The ‘647 patent does not describe either digital picture frames or facial recognition technology. Thus, the substitution

²⁵⁶ See *supra* notes 157–58 and accompanying text (discussing substitutes and complements).

²⁵⁷ This approach is not without problems. Collins himself acknowledges that “[i]dentifying the ‘spirit’ of an invention is an information-intensive and error-prone exercise.” Collins, *supra* note 157, at 1237.

²⁵⁸ Zero percent describes a situation where there is no infringement and it is not available for a determination of damages. If the fact finder is already determining the monetary damages, there is already a finding of infringement.

²⁵⁹ Others may suggest that proceeds should refer to revenue so that infringers that suffer losses still pay some compensation. As long as the damages formulation makes some allowance for the infringer’s costs, that does not change the basic point of assessing damages based on the infringement continuum.

²⁶⁰ S represents the substitution similarity score and C represents the complement similarity score.

²⁶¹ See *supra* note 29 and accompanying text.

²⁶² Ideally, 100% will be reserved for direct copying.

similarity score, S, and the complement similarity score, C, should be very low. Assume that the fact finder gives the inventors of the '647 patent a little more credit for the digital picture frame than for the facial recognition technology so that $S = 2\%$ and $C = 5\%$. The patentee royalty would be 0.1% (i.e., $2\% \times 5\%$) of the infringer's proceeds. This example illustrates how the patentee's recovery diminishes when the infringing product looks less like what the patentee invented.

The example outlined above is fairly simple. There are many variations that could be used. For example, Collins also suggested that it is more appropriate to allow claims to encompass after-arising technology with properties that are complements rather than substitutes.²⁶³ Under that view, a broad claim from the '647 patent should be allowed to encompass smart phones with the ability to recognize e-mail addresses and automatically allow a user to send an e-mail to that address. However, the claim should not be allowed to cover devices that use facial recognition technology to allow a user to sort photos. Although Collins's insight relates to liability (i.e., whether there is infringement), it can also be used to tune the remedy. In other words, the preceding formula could be modified to include a coefficient, s , which adjusts the relative importance of substitutes and complements.

$$\text{Royalty} = (s \times S) \times C \times \text{Proceeds}$$

If s were .5, that would suggest that the law gives an infringer more credit for contributions that change the heart of the invention (i.e., substitute for the primary concept) and less credit for contributions that are complements (i.e., change features that are peripheral to the heart of the invention).

Moreover, there may well be other proposals that should be folded into a new royalty calculation. For example, Amy Landers suggests that damages be apportioned based on the incremental value the patented invention adds to the prior art.²⁶⁴ This prevents a patentee from receiving compensation for earlier third-party inventions. Hopefully, this will avoid royalty stacking problems, where companies are forced to pay multiple patent holders for the same technology.²⁶⁵ Lander's proposal can be combined with the previous example by simply introducing a term I , which represents the incremental value of the

²⁶³ See Collins, *supra* note 157, at 1302.

²⁶⁴ Amy L. Landers, *Patent Claim Apportionment, Patentee Injury, and Sequential Invention*, 19 GEO. MASON L. REV. 471, 473–74 (2012). As Landers recognizes, the basis for her proposal is already rooted in the law, but has been lost in the complex *Georgia-Pacific* test. See *id.* at 489–91; see also Lefstin, *supra* note 68, at 886 n.194 (suggesting the patentee's remedy be limited “[i]f the claimed invention is only a trivial advance over the prior art”).

²⁶⁵ Landers, *supra* note 264, at 473–74.

patented invention over the prior art.²⁶⁶ A value of one would suggest that there is no useful prior art. As the value of the patented invention's contribution decreases so does I .²⁶⁷ The resulting formula would be:

$$\text{Royalty} = I x (S x C) x \text{Proceeds}^{268}$$

For the most part, adding the coefficient I should reduce royalty awards. This reflects value that is attributed to the prior art. Of course if the prior art is covered by any unexpired patents, those patentees may be entitled to some of the infringers proceeds too.

The point of this discussion is not to endorse any particular variation, but merely to show that the proposed reform is neither complete nor exclusive. Rather, this Article describes a general framework for reforming patent remedies based on the infringement continuum. This proposal manages incentives for innovation far better than the current system. But there may well be other refinements that should be added.

CONCLUSION

The problem of overbroad claims is one of the most important and intractable problems in patent law. Prior proposals have attempted to address this problem by changing the various doctrines that limit claim scope. This Article outlines a different tact. It assumes that these troublesome claims will remain with us. With this perspective in mind, this Article proposes a fundamental reform to patent remedies to ameliorate the effects of overbroad claims.

This proposed reform is novel in two respects. First, it rejects current patent remedies as wrongly attempting to restore patentees to the place they would have occupied had there been no infringement (i.e., a tort law view). Instead, this Article points out that the purpose of patent law is to maximize innovation (i.e., a regulatory view). Consequently, the proposal takes into account incentives for *both* patentees and any infringers that build on a patentee's work. Second, the proposal ties patent disclosure principles to the remedies patent law provides. Thus, it elevates the importance of a patent's specification by making it part of the damages calculation.

²⁶⁶ This calculation could be far more nuanced by thinking of "improvement" as a continuum much like the infringement continuum described in this Article. For the current purposes, it is sufficient to consider a simpler view of incremental improvement.

²⁶⁷ " I " should always be greater than zero. A value of zero would suggest that the invention yields no benefit over the prior art.

²⁶⁸ A formula reflecting Collins's, Landers's, and my proposal would be $\text{Royalty} = I x (s x S) x C x \text{Proceeds}$.

The proposed reform should have two primary benefits. First, by calibrating damages to the contributions made by *both* the patentee and infringer, this proposal will optimize incentives for both early innovators and those that would build on basic technology. Second, the proposal should reduce the cost of unclear claims. Since the problem of unclear claims looms largest at the outer edges of a claim's scope and because the proposal reduces damages at these edges, any errors associated with unclear claims are likewise reduced.