Using Signal Theory to Determine Nonobviousness of Inventions

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ARTICLE

USING SIGNAL THEORY TO DETERMINE NON-OBVIOUSNESS OF INVENTIONS

Michael O'Brien* & Idonah Molina**

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The patent system exists as a quid pro quo between an inventor and the government. The inventor provides a disclosure of how to make and use an invention; in exchange, the government provides a limited period during which the inventor can prevent others from making, using, or selling that invention within that government’s jurisdiction. This exclusive right is valuable, enabling an inventor to sell a patented product at a monopoly price that is much higher than the competitive market’s equilibrium price, which would exist in the absence of a patent.

The Federal Trade Commission (FTC) writes reports advocating that economics should guide patent policy. In one such report, the FTC argues that society only benefits from the patent system when inventions that offer a substantial advance to the state of the art are awarded patents. Furthermore, when inventions that provide a lesser benefit to society receive patents, innovation is actually harmed. The FTC recommends that inventions be rigorously screened for patentability.

This Article examines the issue of questionable patents cited by the FTC and looks at the problem of patents that are obvious in view of preexisting material. This Article then analyzes how unexpected results can be effective for proving patentability and concludes with a proposal for a rigid application of unexpected results to better discern which advances are beneficial to society and which are not. In particular, Part II of this paper explains the economic underpinnings of the Patent System. Part III discusses the legal underpinnings of the Patent System. Part IV describes the patent requirement of non-obviousness. Part V further elaborates on how declarations on an invention’s unexpected experimental results can be used to overcome rejections for non-obviousness. Part VI proposes using signal theory to determine non-obviousness of intentions when a declaration is submitted and provides a framework for doing so. Part VII concludes the Article with a way forward in this regard.


3 FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra note 1.

4 Id. at ch. 4, at 3.

5 Id.

6 Id. at ch. 6, at 18–20.
II. ECONOMIC UNDERPINNINGS OF THE PATENT SYSTEM

The literature in economics of patent systems has been robustly debated since the Patent Act of 1952 was first proposed. On one hand, patents provide an incentive to inventors to disclose their inventions to society by offering the sovereign’s enforcement of exclusive rights to make, use, and sell the product within the sovereign’s borders. On the other hand, patents can create market exclusivity, causing fewer products to sell at higher prices than would otherwise sell under perfect competition. The debate over the past few generations has resulted in few concrete conclusions.

From a microeconomic perspective, most patents have no microeconomic value. This is especially true when the underlying technology is never produced, sold, or licensed. Ninety-five percent of patents fall into this category, representing ventures that simply never materialized for inventors.

Among the group of patents that do get produced, many claim only one of several approaches to a particular end goal. Of these patents, enforcement does not result in monopolies because these patents cannot lead to exclusivity in a defined marketplace. In re Lowry is an exemplary case regarding such patents. In this successful appeal, Lowry patented the primary key as a way of indexing data by using a rather small amount of memory connected to a

8 Fed. Trade Comm’n, To Promote Innovation, supra note 1, at ch. 6, at 1–2 (citing U.S. Dept. of Justice & Fed. Trade Comm’n, Antitrust Guidelines for the Licensing of Intellectual Property § 1.0 (Apr. 6, 1995)).
9 Fed. Trade Comm’n, To Promote Innovation, supra note 1, at ch. 1, at 3 (quoting 1 Herbert Hovenkamp et al., IP and Antitrust: An Analysis of Antitrust Principles Applied to Intellectual Property Law § 1.2 at 1-5 through 1-6 (2002)).
14 Fed. Trade Comm’n, To Promote Innovation, supra note 1, at 9.
15 Id.
16 In re Lowry, 32 F.3d 1579 (Fed. Cir. 1994).
microprocessor. Since the data could be indexed in any way, there was no marketplace exclusivity for data indexing, and thus no monopoly. Contrast *Lowry* with *Ritz Camera & Image, LLC v. Sandisk Corporation*, where Sandisk controlled roughly 75% of the market for flash memory, thereby giving it the ability to exercise monopoly power.

Economists have spent little time analyzing situations discussed in Erich Kaufer’s “The Economics of the Patent System” or *In re Lowry*, where the patent simply failed to result in market exclusivity. Rather, the economic research that has received substantial attention over the past twenty years has been patent stacking. Patent stacking occurs where a single person, or cartel, obtains a large number of *Lowry*-style patents and effectively takes over all varieties of indexing data.

The problem of patent stacking can initially be analyzed by having a first mover in a market for the sale of goods. In this market, the seller determines quantity based on where the seller’s marginal revenue is equal to their marginal cost. The seller will then raise their price to the demand curve, resulting in a consumer surplus.

Being the initial entrant within the relevant market, a first mover acquires a monopoly status; with that, an entrant naturally has market dominance and can charge a monopolistic price. Economists have noted that this situation is not necessarily a negative, and that a consumer surplus that exists as a result of a monopoly is better than no consumer surplus at all.

The problem with this model is that modern innovation rarely involves a single good in a single market. More frequently, there is a consumer that desires many separately patented technologies to make a single device. This problem is not new; in fact, Antoine Augustin Cournot, a notable French

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17 Id. at 1580–82.
18 Id. at 1583–84.
23 Id. at 63.
24 Id. at 62.
27 Hall, *supra* note 2, at 573.
28 Id.
economist and mathematician, analyzed this precise situation in 1838. Cournot suggested a hypothetical involving a brass manufacturer who required copper and zinc, each of these materials being controlled by different monopolists. The French economist explained that the resulting price of brass was higher when a division of monopolies controlled the necessary articles, than if a single monopolist controlled the copper and zinc. These independent monopolies resulted in higher prices for consumers, less revenue for each of the material producers, and the end producer subsequently obtaining most of the available surplus.

Beginning with this framework, Economist Carl Shapiro expanded on Cournot, and stated that the industrial organization of patent rights holders would be to form cartels, eliminating the inefficiency of multiple blocking patents, and thus demand single monopolist prices from the end producer. Shapiro argued that “patent pools” would form among holders of complementary patents, with those holders using their rights either to extract greater royalties from end producers, or simply to make the goods themselves. Patent pools are a collection of distinct patents held by separate entities that are pooled for purposes of joint licensing. This model argues that social welfare will increase when goods are perfect complements, and that social welfare will decrease when goods are perfect substitutes.

Shapiro’s expanded economic theory explains firm behavior for creating patent pools, but it fails to consider the aggregate effect of the patent system on the macroeconomy. The patent system’s effect on the macroeconomy is usually measured in terms of capital accumulation and correlating that to stock of patents.

Economic growth can be measured as a time derivative of real gross domestic product (GDP) per worker. Real GDP is a measure of the value of
economic output adjusted for inflation. When divided by population, this measure per worker gives an assessment of average human capital. Human capital is an amalgamation of a worker's knowledge, skills, and abilities, which enable that worker to perform labor that creates economic value. Human capital's existence is proven; whether it is properly utilized is up for debate. Human capital is a function of the economy's use of labor divided by the economy's use of capital. As a result, more investment in human capital leads to more growth and a more efficient use of labor in the economy as a whole.

Economists refer to this conclusion as the "endogenous growth model." Tatsuro Iwaisako & Koichi Futagami, studied the effects of strengthening patent protection, in one instance, by increasing the patent term length. They proffered that lengthening the patent term would increase innovation, but would decrease capital accumulation. If the effect of the former were to outweigh that of the latter, then the policy was deemed sound. If a decrease in capital accumulation outweighed a resulting increase in innovation, the policy should be altered. They concluded "strengthening patent protection reduces the growth rate of output, if the productivity of R&D relative to the production of physical capital is sufficiently low." Returning to the microeconomic framework, a firm has a decision as to whether it should buy existing equipment or innovate new equipment. The firm should do whatever is most profitable and the sovereign should create policies that encourage likewise behavior.

An extension of Iwaisako and Futagami would be that if patent protection were weakened the results would include a lower cost of patenting, greater access to novel ideas for the benefit of progress, and a more level-playing field between large and small companies in the same fields. Michele Boldrin & David K. Levine note that there is no evidence for increased innovation and

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40 Id.
41 Id.
43 Id.
44 Id.
46 Iwaisako & Futagami, supra note 38, at 631.
47 Id. at 649.
48 Id. at 650.
49 Id.
50 FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra note 1, Exec. Summary, at 6.
51 Id. Exec. Summary, at 3.
52 Iwaisako & Futagami, supra note 38, at 634.
productivity as a result of patents.\textsuperscript{53} While Tun-Jen Chiang may agree with Levine and Boldrin’s observation, he does note that there is still an overall social benefit due to producer surplus dissipation.\textsuperscript{54} Additionally, Hubbard mentioned that with a more efficient patenting process, this can allow for competitive economic rivalry, which then leads to economic growth.\textsuperscript{55}

José M. Ortiz-Villajos studied the results of the relationship between technology and economic development at the level of sovereigns in twenty countries between 1800 and 2000.\textsuperscript{56} Historically, he found a strong relationship between the total number of patents issued and per capita income, along with a strong relationship between the number of patents issued and capital accumulation.\textsuperscript{57} He observed that at the same time, society moved resources from consumer spending to capital investment.\textsuperscript{58} This conclusion would seem to contrast the endogenous growth model as though society is investing in R&D spending over individual to obtain exclusive protection from patents.

That is not to say, however, that individuals did not benefit.\textsuperscript{59} One study of business method patents in Australia found that the number of patents issued per capita was generally correlated with economic well-being; and that business method patents in particular had little effect on this result.\textsuperscript{60} Additional research studied the impact of patents on macroeconomic growth and concluded that both patents and technical standards contributed to economic growth.\textsuperscript{61} In 2013, Hubbard proposed restructuring the patent process so that patents could allow for economic competitive advantage, which could lead to economic growth.\textsuperscript{62} Moreover, Shapiro and Hassett noted that patents could increase global investments and overall global economic growth.\textsuperscript{63} They found that for every 1% increase in the degree of patent protection in a developing

\begin{itemize}
  \item[54] Chiang, supra note 22, at 60–61.
  \item[57] Id. at 333–34.
  \item[58] Id. at 335.
  \item[60] Id. at 9, 74.
  \item[61] Id. at 11.
  \item[62] Hubbard, supra note 55, at 1913.
\end{itemize}
country, the United States invests 0.45% into that country, which promotes international economic relations and an overall social benefit.\textsuperscript{64}

III. LEGAL UNDERPINNINGS OF THE PATENT SYSTEM

The preceding historical studies considered whether a series of events had a positive or negative impact on society. However, they offer little insight into contemporary policy changes. Mark Lemley and others explain that, at the time of filing a patent application, it is unclear which patents will provide positive benefits to society and which patents will be a drain on social resources.\textsuperscript{65} To clarify, the positive benefits to society occur if the advance in technology disclosed in the patent were to spur further innovation in the United States.\textsuperscript{66} Alternatively, the patent would be considered an economic drain if it merely caused an increase in prices or prevented others from working in the field of innovation.\textsuperscript{67}

The FTC has defined questionable patents as those that are "likely invalid or contain claims that are likely overly broad," causing the economic drain cited by Lemley.\textsuperscript{68} A patent is likely invalid if it exclusively contains features that existed prior to the date on which the application is filed.\textsuperscript{69} A patent's claims are likely overly broad if they claim a combination of new and existing technology such that the development lacks significant technological advancement.\textsuperscript{70} One purpose of patent prosecution is to have the U.S. Patent and Trademark Office (USPTO) filter patent applications for inventions that are likely invalid, or overly broad.\textsuperscript{71} Patent claims to inventions that are likely invalid or overly broad can be characterized as "obvious" in view of either a single prior art reference or a combination of prior art references.\textsuperscript{72}

Rejecting patent application claims in view of a combination of prior art references was traditionally challenging for the USPTO.\textsuperscript{73} In a 2003 report, the

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{64} Id. at 9.
\item \textsuperscript{65} Mark Lemley et al., \textit{What to Do About Bad Patents?}, 28 REG. 10, 12 (Winter 2005).
\item \textsuperscript{66} Hubbard, supra note 55, at 1928–29.
\item \textsuperscript{67} Id. at 1929–30; \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, Exec. Summary, at 5.
\item \textsuperscript{68} \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, ch. 1, at 5; Lemley et al., supra note 65, at 12.
\item \textsuperscript{69} 35 U.S.C.S. § 102 (2012); \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, ch. 1, at 10 n.65.
\item \textsuperscript{70} 35 U.S.C.S. § 103 (2012); \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, Exec. Summary, at 10.
\item \textsuperscript{71} 35 U.S.C.S. § 2 (2012); \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, Exec. Summary, at 14.
\item \textsuperscript{72} 35 U.S.C.S. § 103.
\item \textsuperscript{73} \textit{FED. TRADE COMM'N, To PROMOTE INNOVATION}, supra note 1, ch. 6, at 10–12.
\end{itemize}
\end{footnotesize}
FTC expressed concern that the USPTO required proof of a "suggestion" to combine prior art references in order to demonstrate obviousness of an invention. Before Congress could respond, the United States Supreme Court, in *KSR Int'l Co. v. Teleflex, Inc.*, held that if a combination was obvious to try, then the combination was not patentable, largely resolving the FTC's concern.

While the *KSR* decision did some work to alleviate the problem of questionable patents, granting obvious patents remains a problem.

**IV. AN EXPLANATION OF OBVIOUSNESS**

To put *KSR* and the problem of obviousness into context, a brief overview of the patent prosecution system is useful. At a high level, a patent is a contract between the public and an inventor, where the public receives knowledge of how to make and use an invention and, in exchange, the inventor is granted the exclusive right to make, use, sell, or offer to sell the invention within the United States. To obtain a patent, an inventor submits an application, along with a fee, to the USPTO to have the application reviewed by a patent examiner. If the patent examiner finds that the application meets certain requirements, then the examiner will officially grant the patent. Alternatively, if the examiner does not believe that the invention is patentable, then the examiner issues an office action rejecting the claims and giving the applicant time to respond. A study of issue-specific patent appeal statistics revealed that the most common basis for a rejection is finding the claims obvious in view of some prior art reference or combination.

If the patent examiner rejects the application twice, the applicant can appeal to the Patent Trial and Appeal Board (PTAB), then the U.S. Court of Appeals for the Federal Circuit, and finally to the U.S. Supreme Court. In practice, few patent applications make it this far on appeal. Typically, most cases are resolved by an agreement as to patentability between the examiner and the

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74 Id.
76 Hall, *supra* note 2, at 568; *Davis Airfoils, Inc. v. United States*, 129 Ct. Cl. 514, 124 F. Supp. 350 (1954). ("A patent is a contract between the inventor and the public, the terms of which are formulated by the United States Patent Office.").
79 Id. § 706.
applicant. This agreement involves the patent examiner ultimately awarding a patent for any new, useful, and non-obvious advance in technology. When an agreement cannot be reached between the examiner and the applicant, the most common issue on appeal to the PTAB is obviousness.

The Patent Act explains that no patent shall be awarded "if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious . . . to a person having ordinary skill in the art" at the time the application was filed. Obviousness is a legal conclusion based on underlying facts. The underlying factual inquiries in evaluating the obviousness of claims include: (i) the scope and content of the prior art; (ii) the differences between the prior art and the claims at issue; (iii) the level of ordinary skill in the field of the invention; and (iv) relevant secondary considerations including commercial success, long felt but unsolved needs, failure of others, and unexpected results.

When issuing a rejection based on section 103, the patent examiner must demonstrate a prima facie case of obviousness by showing that the skill level of one of ordinary skill in the art could bridge the differences between the prior art and the claimed invention. The burden then shifts to the applicant to rebut this conclusion or argue that the secondary considerations outweigh the examiner's finding of obviousness. At a high level, the legal conclusion of obviousness represents society's effort to balance the concerns expressed by the FTC, where only inventions that offer a substantial improvement to the state of the art should be granted a monopoly. At a low level, the requirements establish objective criteria for evaluation by courts and the PTAB. From either perspective, the function of unexpected results to support the finding of an invention as non-obvious is to filter out non-meritorious patents.

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84 Gaudry & Mallon, supra note 80.
86 In re Kotzb, 217 F.3d 1365, 1369 (Fed. Cir. 2000).
89 MPEP § 2142.
90 Id.
91 FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra note 1, ch. 4, at 2–3.
92 Graham, 383 U.S. at 17–18.
93 FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra note 1, ch. 4, at 15.
An inventor can overcome a prima facie finding of obviousness by establishing unexpected results in an experiment and detailing these results in their submission of a declaration under 37 C.F.R. § 1.132, commonly referred to as a “Rule 132 declaration.” Unexpected results require (i) a hypothesis of how the claimed invention would perform; (ii) an experiment under controlled scientific conditions that tests the hypothesis; (iii) a prior art device, similarly tested in the experiment; (iv) results showing that the claimed invention exceeds both the hypothesis and the prior art; and (v) results that are “different in kind and not merely in degree of the prior art.”

Arguing “unexpected results” in the face of an obviousness rejection has both a subjective and an objective component. The subjective component requires that the unexpected results exceed expectations; therefore, a predicted or expected outcome needs to be established as a baseline. Once this expected result is established, one can subjectively discern if the actual result is unexpected. The objective component involves comparing the claimed invention to the closest prior art. Results are unexpected if the experiment shows that the applicant surpassed both the hypothesis and the closest prior art in the same test.

Turning first to the subjective component, expected beneficial results are inherent in the inventive process and do not confer patentable subject matter onto a claim. Accordingly, the person completing the testing is required to include a statement that “the results were unexpected” within the declaration,

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94 37 C.F.R. § 1.132 (2015); MPEP § 716.
95 In re Klosak, 455 F.2d 1077, 1080 (C.C.P.A. 1972).
96 In re Baxter Travenol Labs, 952 F.2d 388, 392 (Fed. Cir. 1991).
97 MPEP § 716.02(b)(III).
98 In re Harris, 409 F.3d 1339, 1344 (Fed. Cir. 2005); In re Soni, 54 F.3d 746, 748–49 (Fed. Cir. 1995).
101 In re Burckel, 592 F.2d 1175, 1179 (C.C.P.A. 1979).
102 See MPEP § 716.02(a)(I) (instructing, “a greater than additive effect is not necessarily sufficient to overcome a prima facie case of obviousness because such an effect can either be expected or unexpected. Applicants must further show that the results were greater than those which would have been expected from the prior art to an unobvious extent, and that the results are of a significant, practical advantage.”).
103 In re Harris, 409 F.3d at 1344.
104 MPEP § 716.02(a)(11).
expressing subjective approval of the claimed invention. For example, In re Skoner involved an application that claimed a method for putting zinc coatings on iron substrates in a vacuum. The method claimed use of wire brushing to make abrasions on the iron substrate to better allow the zinc to adhere to the iron. The Court of Custom and Patent Appeals found that wire brushing to cause adhesion was known, and that its application here had an entirely predictable result. Failing to state a hypothesis leaves the applicant vulnerable to the USPTO’s claim that the results of the experiment were merely expected beneficial results.

When attempting to illustrate unexpected results, the experiment itself needs to be controlled for all variables except one. The single uncontrolled variable is the difference between the claimed invention and the prior art. The application at issue in In re Dunn, for example, dealt with using inert N-alkyl pyrrolidone as the solvent medium in an acrylic acid ester synthesis. Although Dunn’s experimentation resulted in better synthesis when compared with other solvent mediums, it was unclear whether the results were attributable to the inert N-alkyl pyrrolidone or something else. That lack of clarity resulted in the Court of Customs and Patent Appeals denying Dunn’s patent entirely.

An experiment used to successfully show unexpected results also needs to be commensurate in scope with the protection sought by the claims. The PTAB has defined “commensurate in scope” to mean that the evidence in the Rule 132 declaration “provides a reasonable basis for concluding that the untested embodiments encompassed by the claims would behave in the same manner as the tested embodiments.” Simply, the tests for the claimed

107 In re Skoner, 517 F.2d 947 (C.C.P.A. 1975).
108 Id.
109 Id. at 950.
110 Id. at 950-51.
111 See In re Dunn, 349 F.2d 433, 439 (C.C.P.A. 1965) (holding that appellants’ experimentation failed to support a sufficient rebuttal for non-obviousness by unexpected results since “comparative examples” must be “truly comparative,” and “[t]he cause and effect sought to be proven is lost . . . in the welter of unfixed variables”).
112 Id.
113 Id. at 435.
114 Id. at 439.
115 Id.
116 In re Burckel, 592 F.2d 1175, 1177 (C.C.P.A. 1979).
invention can only include the features claimed. If a range such as "elevated
temperatures" is claimed, the tests need to cover all elevated temperatures. Where a patent's claims call for combinations or ranges, a representative sample must be tested, not just one combination or value. However, applicants are not required to test every embodiment within the scope of their claims. Rather, where a series of tests indicate other embodiments falling within the claim will behave in the same manner as those tested, those tests performed are sufficient.

While an experiment needs to compare the claimed invention to the closest prior art, there is no one way to determine what the closest prior art is. If the examiner cites a primary reference in a rejection, then that reference is deemed the closest prior art. However, if the applicant asserts that a single reference is the closest prior art then the examiner has the burden to prove otherwise. Regardless, the closest prior art is generally either a single reference, or two references applied independently, but not some combination of references which forces the applicant to test the claimed invention against itself.

Once the experiment is complete, the results must be compared to both the hypothesis and the closest prior art. There are many published cases that fail to state a hypothesis, causing a flawed declaration that fails to demonstrate non-obviousness. Unsurprisingly, of those cases with a declaration stating a hypothesis, none predicted that the claimed invention would perform worse than the closest prior art. However, merely exceeding the hypothesis and the prior art is insufficient. Rather, the declaration must state that the results

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118 Id. at *8.
120 In re Lindner, 457 F.2d 506, 508 (C.C.P.A. 1972).
121 In re Huai-Hung Kao, 639 F.3d 1057, 1068 (Fed. Cir. 2011).
122 See MPEP § 706.02(l) (instructing examiners on choosing prior art).
123 In re Cescon, 474 F.2d 1331, 1334 (C.C.P.A. 1973).
124 See id at *15.
127 See id. at 175 (discussing In re Geisler, 116 F.3d 1465 (Fed. Cir. 1997), where the Board held "that Geisler failed to rebut the prima facie case of obviousness" based in large part on his failure to describe the test results contained in his specification as unexpected).
128 See id. at 171–72 (discussing the decision in In re Soni, 54 F.3d 746, 748–49 (Fed. Cir. 1995), where the Federal Circuit overturned the Board and examiners rejection of the patent based significantly in part on the language in the specification, stating "that the claimed compositions have significantly improved physical and electrical properties..." as well as the inclusion of comparative experimentation).
129 See supra notes 128–29 and accompanying text.
were unexpectedly better than the declarant projected in the hypothesis.\textsuperscript{131} Anything short of that incantation, even an attorney’s assertion that the declarant meant “unexpected,” is insufficient.\textsuperscript{132}

Even if the results of an applicant’s test are different and better than anticipated, this only informs patentability as the results are “different in kind and not merely in degree from the results of the prior art.”\textsuperscript{133} This inquiry looks to whether a skilled artisan would be able to make the modification that brings the prior art to the level of the claimed invention.\textsuperscript{134} The analysis, proceeds in one of two ways.

First, tinkering with a variable known to affect the outcome of some experiment is not usually considered inventive.\textsuperscript{135} This includes changing relative percentages of a composition of matter or changing the heat or pressure in making that composition of matter.\textsuperscript{136} Such minor changes are regarded to be within the skill of one in the art.\textsuperscript{137} The exception to this is changing a variable that a skilled artisan would not expect to have an impact on the outcome.\textsuperscript{138} That optimization would be patentable if the outcome of the claimed invention was significantly different than tinkering with the “result-effective variables” that one would expect to change the outcome of experiments.\textsuperscript{139}

Second, applying obvious principles of science creates results of type, not kind.\textsuperscript{140} Here, courts have dealt with issues like harder materials being more resistant to wear and the color black providing more heat transfer.\textsuperscript{141} If prevailing scientific knowledge would indicate an invention would not work as well as the prior art, then that invention exceeding the prior art would be an unexpected result.\textsuperscript{142}

As a practical matter, the patent examiner here usually issues a notice of allowance. However, out of fifty-nine cases that have approached the issue in the past five years, the PTAB has had only one case that was resolved in favor.
of the applicant when the applicant demonstrated that the prevailing science was contradicted.\footnote{Ex parte Epstein, No. 2011-6369, 2013 Pat. App. LEXIS 891, at *14 (B.P.A.I. Mar. 1, 2013).}

That case, \textit{Ex parte Epstein}, dealt with a method for treating cancer that involved administering a cancer-targeting molecule linked to a liver-expressed chemokine (LEC) to a patient.\footnote{Id. at *1.} The molecule attacked the tumor and the LEC inhibited the tumor’s ability to grow.\footnote{Id.} The method also involved reducing the activity of T-cells in the body to prevent those cells from interfering with the molecule.\footnote{Id. at *2.} The PTAB noted that the last step was peculiar in that the patent examiner was unable to find any reference to show that preventing T-cell activity would reduce tumor size.\footnote{Id. at *11.} Typically, T-cells naturally fight cancer, so disabling them would seem counterintuitive. The PTAB found Epstein’s claims patentable.\footnote{Id. at *14.} This demonstrates that unexpected results contrary to prevailing scientific thought demonstrate non-obviousness.

\section*{VI. USING SIGNAL THEORY TO DEMONSTRATE NON-OBSVIOUSNESS}

When Shapiro is considered in view of the post-\textit{KSR} legal landscape the manifesting problem is the issuance of patents on obvious inventions that are substitutes for one another.\footnote{Shapiro, \textit{supra} note 30, at 120.} The industrial organization of those patent holders is to form patent pools that are able to charge monopolistic prices.\footnote{\textit{FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra} note 1, Exec. Summary, at 6.} At the same time, it is important that those who are producing complementary inventions be able to receive patents to have a better effect at maximizing consumer and social welfare.\footnote{Shapiro, \textit{supra} note 30, at 123.} This can be accomplished with signal theory.

Signal theory has its origins in the work of Michael Spence.\footnote{See Michael Spence, \textit{Job Market Signaling}, 87 Q.J. \textit{ECON.} 355 (1973).} Signal theory explores the situation where there is a principal determining whether to grant a benefit to the agent.\footnote{Id. at 356.} The principal will only grant the benefit if the principal will get more from the agent than the agent receives.\footnote{Id. at 356–57.} The principal selects an agent for the benefit on the basis of a signal.\footnote{Id. at 357.} A valid signal will distinguish a
productive agent from an unproductive agent. Spence argued that credentialed education was a valid signal because unproductive agents would not undergo the effort to obtain the signal. Agents with more education were valued more as productive or were seen as potentially more productive when compared to others with less education. Therefore, signal theory works best with asymmetric information such as asymmetric level of education. Similarly, the act of patenting can create a valid signal if costs of demonstrating unexpected results are unreasonably high for substitute inventions and reasonably low for complementary inventions.

A. SIGNAL COST AND BENEFIT

With regard to patents, the only signal that can distinguish one substitute from another is how well the substitute works. The only way to gauge that is by requiring test results to prove that the substitute is a substantially better solution than what existed in the field at the time the patent application was filed. However, before applying unexpected results to the tests, the testing system requires some modification.

Some modification is needed because the American patent framework for discerning unexpected results is ineffective. First, the entirety of the subjective element is useless. The likelihood of an informed applicant producing a declaration which did not state “the results were unexpected” or would perform worse than the prior art is minimal. Second, the “control variable” requirement is misleading. The control variable could affect some other part of the claimed invention, which is responsible for the enhanced performance. Finally, there would be inherent testing bias as testers would be compensated by the applicant to agree with the applicant. This creates a problem that previously existed in having expert testimony in federal court prior to 2000.

There are two kinds of witness testimony in federal court: lay witness testimony under Federal Rule of Evidence (FRE) 701, and expert testimony under FRE 702. Lay witness testimony can be provided by anyone who perceived an event relevant to the matter at trial. Expert testimony is much more restrictive and requires “a witness qualified as an expert by knowledge,
skill, experience, training, or education” and whose testimony is generally limited to a relevant opinion that will assist the trier of fact in a case.\textsuperscript{162} However, not just any opinion can be proffered. Expert opinion testimony requires “sufficient facts or data” obtained by “reliable principles and methods” where the witness has reliably applied the principals and methods to the data to reach the opinion.\textsuperscript{163}

The current witness requirements at the USPTO confuse the requirements of ordinary observers (lay witnesses) and skilled observers (expert witnesses). Lay witness testimony can be provided by anyone about anything and, by its nature, has a strong subjective component.\textsuperscript{164} A lay witness can say something is big, small, strong, or weak and needs no justification.\textsuperscript{165} An expert must use reliable methods.\textsuperscript{166} The expert, the methods, and the data must be presented to the judge and approved before they can be submitted to the trier of fact.\textsuperscript{167} The confusion between lay and expert “opinion” in Rule 132 practice undermines the value of the data obtained. Europe has developed a framework that resolves most of these issues, and could be applied to the United States.\textsuperscript{168}

In Europe, the inventive step test, as assessed by the “problem-and-solution approach,” governs a non-obviousness inquiry.\textsuperscript{169} The test requires a “technically skilled assessment” of the claimed invention with the closest prior art and information that is within the common general knowledge of one skilled in the art.\textsuperscript{170} In Europe, the test must be more rigorous than in the United States. Europe requires that the measurably better result be “convincingly shown to have its origin in the distinguishing feature of the invention.”\textsuperscript{171} This resolves all of the issues present in the American patent system except the inherent bias in the declarant.

To remove bias and reform the American framework for determining unexpected results, this Article proposes a form of arbitration to resolve issues of patentability. Arbitration would be optional and the applicant would incur the additional cost. The arbitration panel would complete a test to determine if unexpected results are present and then make an opinion as to patentability.

\textsuperscript{162} FED. R. EVID. 702(a).
\textsuperscript{163} FED. R. EVID. 702(b)-(c).
\textsuperscript{164} FED. R. EVID. 701.
\textsuperscript{165} Id.
\textsuperscript{166} FED. R. EVID. 702(c).
\textsuperscript{167} FED. R. CIV. P. 26(a)(2).
\textsuperscript{169} Id.
A patent application would be eligible for patent arbitration if the only issue remaining for patentability was obviousness. Therefore, the claimed invention is patent eligible under 35 U.S.C. § 101, is not anticipated by a single prior art reference under 35 U.S.C. § 102, and the underlying application clearly explained how to make and use the claimed invention under 35 U.S.C. § 112. If any of these elements were disputed, then the recourse would be an appeal to the Patent Trial and Appeal Board.

At this point, a classic adverse selection problem exists. Adverse selection exists when undesirable results occur as a result of asymmetric information.\(^{172}\) This causes a sequential turn game where the applicant and the arbitration panel take turns either providing or interpreting test results. Each side makes a decision based both on its own imperfect data supplemented with opinion about the other side. The applicant has to choose from the possible combinations of testing types and number of trials (or subgames) based on its opinion of how the arbitration panel would respond. Where a subgame is selected based on such circumstance, the players seek a Perfect Bayesian Equilibrium.\(^{173}\) This assumes that sellers (in this case, inventors) knew their products better than buyers (here, the arbitration panel).\(^{174}\) The panel would either need a process or signal for screening out the valid patents from invalid ones.

This Article proposes that a two-turn game could be played as follows. There are two players: the applicant and the arbitration panel. Those players operate in a state of nature where the arbitration panel proposes at least two tests to be used to compare the invention with at least one of the closest prior art references. The tests and prior art references can be joined to form a series of tests and references having different costs associated with increasingly elaborate experiments. The applicant can choose one combination. While any combination could indicate patentability, more tests on more inventions increase the chance that the arbitration panel could be convinced. The arbitration panel would not know whether it is dealing with a substitute or a complement, but it would know the amount of testing data it has before it. More data indicates a greater likelihood of certainty that the performance of the product is non-obvious. The cost in building discrete systems is high and the cost of building complementary components is comparatively low. Thus, the Perfect Bayesian Equilibrium will be to patent complements instead of substitutes.


\(^{174}\) Akerlof, supra note 172, at 489.
The arbitration panel would not need to be comprised of Administrative Patent Judges. Rather, it could be made up of technically qualified experts, say from the National Institute of Standards and Technology (NIST).

Technically qualified experts from NIST combined with other experts to create a problem of competing experts at the ex parte stage was addressed in *Newman v. Quigg.*\(^{175}\) Newman claimed to have invented a machine that produced more energy than it received.\(^{176}\) The Second Law of Thermodynamics says that this is impossible.\(^{177}\) As a result, the USPTO, via its commissioner Quigg, rejected the application as claiming to do something that was impossible.\(^{178}\) At trial, the judge ordered a special master to review Newman’s invention.\(^{179}\) The master concluded that the invention, in fact, produced more energy than it used.\(^{180}\) Quigg hired his own expert from NIST, who determined that the invention did not produce more energy than it used.\(^{181}\) Newman blamed this result on the invention not being properly configured; nonetheless, the trial judge found in favor of Quigg, and Newman appealed to the Court of Appeals for the Federal Circuit.\(^{182}\)

The Federal Circuit affirmed, stating that Newman was present at the NIST experiment and could have reconfigured his machine if desired.\(^{183}\) Perhaps, rather than disparaging the NIST experiment, Newman would have done better to explain it. In Halpern’s words, “physicists sometimes don’t know the proper arena within which certain laws apply.”\(^{184}\) However, this would have required another layer of expert testimony to interpret the results of the two experiments. At that stage, the expense for Newman, having already paid for lengthy federal court litigation, was simply too much. Instead of using expensive expert opinion, he relied on his own inexpensive lay assessment of the circumstances. This shows the strength of the signal involved.

Seemingly, the signal—that the Second Law of Thermodynamics did not apply here in the way that Quigg believed—was possible, though extremely expensive to obtain. Newman chose not to obtain the signal, and the U.S. District Court chose not to order Quigg to issue a patent. Both of these decisions were perfectly rational cost-benefit analyses.

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\(^{175}\) *877 F.2d* 1575 (Fed. Cir. 1989).

\(^{176}\) *Id.* at 1577.


\(^{178}\) *Newman,* 877 F.2d at 1577.

\(^{179}\) *Id.*

\(^{180}\) *Id.*

\(^{181}\) *Id.* at 1578.

\(^{182}\) *Id.* at 1579–80.

\(^{183}\) *Id.* at 1581.

\(^{184}\) HALPERN, *supra* note 177, at 81.
The rules for a patent arbitration panel would not make it impossible for a substitute invention to be patented. Rather these rules simply need to make it so expensive that the effort is not worth its cost. The patent arbitration panel would make a threshold determination as to whether there was a gap between the closest prior art and the claimed invention. The panel would then determine what test would be best for discerning whether that gap was sufficient to demonstrate non-obviousness. The examiner and applicant could proffer tests as well. The test chosen would need to be relevant for the particular field involved. For instance, ASTM International has created thousands of tests to evaluate a variety of products which could be used in particular subsets of cases to ensure that substitutes could not be easily patented.\footnote{See generally Detailed Overview, ASTM INTERNATIONAL, http://www.astm.org/ABOUT/full_overview.html (last visited Mar. 29, 2006) (describing the formation and use of ASTM standards).}

The test results should be validated using signal theory. A claimed invention that improves upon prior art should be easily patentable because the cost of testing an existing system should be minimal, and the benefit is readily quantifiable. This complement, if patented, would likely cause an increase in consumer surplus and benefit to society. The test result must be substantially better than the hypothesis for any invention to be patented. This is because patenting substitutes tend to lead to dangerous patent pools that cause prices to go up, quantities to go down, and consumer surplus to decrease.\footnote{See Patent Pools and Antitrust—A Comparative Analysis, WORLD INTELLIGENCEAL PROP. ORG. (Mar. 2014), http://www.wipo.int/export/sites/www/ip-competition/en/studies/patent_pools_report.pdf.}

Once the panel decides on a test, the panel would create a hypothesis, and then it would perform the test or hire someone else to do so at the expense of the applicant. Once the test has been completed, the panel would determine whether the test results exceeded the hypothesis. If so, the invention would be patentable. At this point, the invention could only be found not patentable in litigation if this result was one of clear error. This is a higher standard of review than “clear and convincing evidence,” which is currently required to invalidate a patent.\footnote{FED. TRADE COMM’N, TO PROMOTE INNOVATION, supra note 1, ch. 5, at 26.}
VII. CONCLUSION

Patents that are granted and obvious in light of prior art are questionable patents that create a drag on the economy. One way to increase economic competitive advantage within and between nations is to decrease the number of invalid patents. Demonstrating non-obviousness by unexpected results is presently problematic in the United States because test results from the inventor may be unreliable. The inventor also has a motivation to bias the results. However, for those applications that claim an invention that is demonstrably better than the prior art by independent testing, a higher standard of review should apply in litigation. The solution is to create an arbitration panel to test the invention and determine whether those test results merit a patent issuing.

188 Lemley et al., supra note 65, at 12 (“Some bad patents, however, are more pernicious. They award legal rights that are for broader that what their relevant inventions actually invented and they do so with respect to technologies that turn out to be economically significant.”).

189 Hubbard, supra note 55, at 1948.