Flashes of Genius, Toiled Experimentation, and Now Artificial Creation: A Case for Inventive Process Disclosures

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F. Scott Kieff
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Dedication

To my wife Sarah,

Thank you for believing in me
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Abstract

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Recent advancements in computing technology have yielded groundbreaking methods of automating invention. Use of this technology, whose implements are known as “artificial creation systems,” may pose significant problems for United States patent law as it forms a gap in the inventive process between human ingenuity and the final product of invention that current law may be unable to accommodate. It is predicted that in the near future these systems will enable people to invent without expending time or effort. The current patent laws were not drafted with this possibility in mind. This article demonstrates the potential problems on theoretical and practical levels in applying current patent law to inventions of artificial creation systems. This article further demonstrates that granting patents for these inventions will be contrary to the drafters’ intent. However, this article does not suggest immediate action because the actual uses and abilities of this technology are still unknown. This article proposes a program of “encouraged disclosure” to enable fact gathering of inventive processes over the next several years to facilitate future decision makers in working out how to deal with these and other inventive techniques that may be violative of the intent of the Patent Act. This article submits that, while the current ban on considering inventive techniques was necessary when implemented, there are mechanisms in place today, namely the Federal Circuit, that are capable of handling considerations of inventive processes without departing from the intent of the patent laws. Even if true artificial creation never comes to fruition, the public will still benefit by being provided a glimpse into the inventive process behind inventions that are about to receive monopoly protection.
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I. Introduction

The United States patent system is built on a bargain between the public and inventors wherein the public is willing to grant limited monopoly rights for inventions in exchange for their disclosure.¹ This is known as the “quid pro quo” of the patent system.² The public is willing to grant such significant rights to an inventor because of the value of new public knowledge and enlightenment that would not be gained but for the patent system.³ In addition to serving as a teaching tool for this new knowledge, the disclosure is also “essential to warn the industry concerned of the precise scope of the monopoly asserted”⁴ and to ensure that the invention is a product of “substantial creative effort,” justifying the grant of monopoly rights.⁵

There is a new technology that significantly replaces humans in the creative process of inventing. Its implementations are products of recent advancements in computing technology and will be referred to as “artificial creation systems.” Their use may pose material problems for the application of current patent law, the requirement that a patentable invention be a product of substantial creative effort, and the question of whether the patent system functions to promote the development and disclosure of inventions created using them. Normally, the courts, the Patent Office, and even the public could make determinations on these types of issues by looking through the disclosures in patent applications. However, the use of artificial creation systems is not being disclosed because current law does not seem to require it.⁶ Their use will likely not

² See id.
be disclosed without changes to the law or Patent Office procedures. Without such changes, any attempt to address the potential problems of their use will likely rely on inadequate information.

For the purposes of this article, something is an artificial creation system if it exhibits problem solving capabilities that yield specific inventive solutions without direct guidance from a human controller. Artificial creation systems seem to make their own choices and act autonomously. They operate without the constraints of human knowledge, time, or bias.\(^7\) More detail on this will be presented in the next section, but to get a quick idea of what all this means, think of the popular term “artificial intelligence” and IBM’s *Jeopardy!*-playing supercomputer, “Watson.”

It is believed that in the near future, the use of artificial creation systems will enable a person to simply ask a machine to solve a problem and, without being given any additional instructions, the machine will not only understand the problem, but also develop a novel solution that may be beyond human creative capacity.\(^8\) For example, imagine a situation where a person describes to a machine, in plain English, some symptoms of an unknown illness that she has and the machine not only understands her natural language and is able to diagnose her illness, but is also able to design a new drug to treat this illness—all of this from only the input of her symptoms. In this hypothetical situation, the patient could take this new drug design and seek patent protection for it, and there would likely be no impediment to her gaining monopoly rights over the drug in the current patent system.

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\(^7\) *See id.* at 1-4.

\(^8\) *See id.* at 3.
This brings up the first of three themes that run throughout this article: that patents granted for inventions created using artificial creation systems may be unjust on a philosophical level. In other words, some may take issue with the idea that the patentee received monopoly rights for something that she put forth no real effort in discovering. While this article will take no stance on this issue, leaving the question to the policy makers, it should be kept in mind to see the importance of the issues that are addressed. The second theme is that current law, as a practical matter, may be incapable of handling the inventions of artificial creation systems. The third, and perhaps most fundamental, theme for this article is that without the disclosure of the use of artificial creation systems, not only is the law hampered in dealing with these inventions, but it is frankly too difficult to tell whether there realistically is a problem that even implicates the first theme.

This article is comprised of three basic parts. The first part (section II) will concisely illustrate the perceived philosophical problems of the use of artificial creation systems by providing some background on the purpose of the patent system and some additional technical details on how artificial creation systems work. This background is necessary to see the disjunction in the creative process between problem identification and solution acquisition and to demonstrate how this technology is different from anything that previously existed. The second part (sections III and IV) will analyze the practical problems in applying current patent law to inventions created using artificial creation systems, with careful attention paid to the historical development and fundamental intent behind those laws. This part will show how there could be different outcomes in applying the law if disclosure of creative processes were to be considered.
The third part (sections V and VI) will present a range of possible solutions to the problems identified in the other sections and analysis thereof.

This article will conclude that even though the use of artificial creation systems may bring about significant problems to the current patent system, this perception may be largely based on futuristic speculation. There simply is not enough data to make any real determinations on the matter. Thus, instead of trying to solve a problem without knowing whether there even is a problem, it would be wiser to implement a program of “encouraged disclosure” that would not require any material changes to the current patent laws and would enable lawmakers in the future to have a much better grasp on the issue. This would further enable the public to determine whether it really has a problem with patents being granted for inventions created with this technology. Should the public decide to update the law, this program will provide it with realistic data that will facilitate the drafting of better legislation.

II. Background

Even though the purpose of this article is not to determine whether it should be the public policy of the United States to extend patent protection to inventions created using artificial creation systems, this question is nevertheless important to contemplate to better understand the impetus behind what follows. This section will begin with a brief description of a few popular theoretical justifications for having a patent system and end with a discussion of potential conflicts with these justifications that the use of artificial creation systems may cause. Parts of this section may come across as hand-wavy, and this is because this section is only meant to provide pertinent general background
information to make the deeper analysis in the next section possible. When more detail is required, it will be provided in the relevant section of the analysis.

A. Theoretical Backbone of the Patent System

1. Justifications

Many possible theoretical bases for the patent system have been proposed and debated for hundreds of years, and any attempt at a thorough discussion of them would easily exceed the practical limitations of this article. Admittedly giving extremely short shrift to this topic, this article will only discuss two of the most common, just for the purposes of illustration.

The first common justification is known as the “incentive to invent.” The idea here is that without the prospect of patent protection, people would be unwilling to undertake costly research and development to create patentable inventions. The Supreme Court has treated this theory as United States patent policy.

The second major justification is known as the “incentive to commercialize.” Many inventions require large capital investment to manufacture and distribute. For this reason, it is proposed that without the protection of a patent, many inventions would simply never make it to the marketplace because of the fear that competitors would quickly copy any successful product and wipe out most of the profits. Under this

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9 See generally DONALD S. CHISUM ET AL., PRINCIPLES OF PATENT LAW 66-71 (3d ed. 2004) (providing a concise explanation of several theories and many valuable citations for more detailed study).
10 Note that every use of the word “cost” in this article refers to total economic cost, unless otherwise stated.
11 CHISUM ET AL., supra note 9, at 66-67.
12 E.g., Kewanee Oil, Inc. v. Bicron Corp., 416 U.S. 470, 484 (1974) (Comparing incentives for trade secret and patent protection, the Court said: “Certainly the patent policy of encouraging invention is not disturbed by the existence of another form of incentive to invention.”)
13 CHISUM ET AL., supra note 9, at 68-71.
theory, without the patent system there may be an invention, but the public never gets the benefit of it. This theory has gained traction over the last several decades and was the theory that Judge Giles Rich, widely considered the “founding father of modern patent law,” most advocated.\(^\text{14}\)

2. Elements of Patentability

No matter what theory one agrees with for the justification of having a patent system, it is generally accepted that it works on a *quid pro quo* exchange of value.\(^\text{15}\) In this exchange, the patentee receives a limited monopoly in return for disclosing a valuable invention that is not already possessed by the public and that belongs to a class of innovations that has been deemed patentable. This exchange is embodied in the five essential statutory elements of patentability: utility, novelty, nonobviousness, subject matter restrictions, and enablement.\(^\text{16}\) This section will provide a very brief and general explanation of these requirements.

The utility requirement simply means that there has to be some value to the invention—it has to work. This requirement just sets up the basis for exchange in the *quid pro quo* as the public is unwilling to grant monopoly rights for something that is useless.\(^\text{17}\)

The novelty and nonobviousness requirements serve the same function of preventing patents for things that are already in the public domain. For something to be

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\(^\text{14}\) *Id.* at 24, 68-69.


\(^\text{16}\) *See* 35 U.S.C. §§ 101-103, 112-114.

\(^\text{17}\) CHISUM ET AL., *supra* note 9, at 735.
novel, it must be different from anything else already available to the public.\textsuperscript{18} Difference alone though is not enough for a patent; recall that a patentable invention must be a product of “substantial creative effort.”\textsuperscript{19} This is expressed in the additional requirement that the invention be “nonobvious.” Basically, this means that if an ordinary member of the practicing public, termed “one of ordinary skill in the art,” would be able to come up with the same invention with normal effort,\textsuperscript{20} that the invention was in fact already possessed by the public.\textsuperscript{21}

On top of these requirements, the public has added subject matter restrictions that limit the types of inventions that can be patented, regardless of whether they are useful, novel, and nonobvious.\textsuperscript{22} To be patentable, an invention must be a process, machine, manufacture, or composition of matter.\textsuperscript{23} This means that something that is a product of nature, natural law, or mathematical formula cannot be patented.\textsuperscript{24} As an example, a doorknob is patentable but the Pythagorean Theorem is not.

The final element for patentability is enablement. This is the core public benefit of the \textit{quid pro quo} exchange.\textsuperscript{25} This requirement is comprised of several technical parts, but its essence is disclosure of the invention to the public. For an invention to be “enabled,” it must be described with sufficient detail that an ordinary member of the practicing public would be able to make and use the invention from the description in the patent application.\textsuperscript{26} This disclosure also serves to clearly identify what the invention is,

\begin{thebibliography}{99}
\bibitem{nonobvious} I.e., it would be \textit{obvious} to the member of the practicing public.
\bibitem{schwartz} See Schwartz & Goldman, supra note 18, at 84.
\bibitem{enablement} See id. at 68-69.
\bibitem{universal oil} See 35 U.S.C. § 112.
\end{thebibliography}
so that the public knows the extent of the monopoly protection and to warn what would constitute infringement of the patent.  

B. Perceived Problems With Use of Artificial Creation Systems

Artificial creation systems are computer systems that are capable of solving problems without explicit instructions from a human controller and come in many forms. They operate using brute force trial-and-error and are capable of testing millions of prototypes in a matter of days and are not limited by human biases or time constraints. Some examples are IBM’s “Watson” computer, evolutionary computing systems, and neural networks. This technology is in its infancy, but there have already been some products created using it. The Oral-B “Cross Action” toothbrush is an example. As of May 25, 2010, there is one known patent to have been granted for an invention created with an artificial creation system. With advances in parallel processing architecture, it is expected that these systems will become much more commonplace, resulting in an exponential increase of products created using them. However, it is unclear exactly how little human interaction will be required to utilize these systems. There may come a time when a system is able to function autonomously and become a full-fledged “Genie in the Machine,” but right now the technology is simply too new and predictions seem

27 Universal Oil, 322 U.S. at 484.
28 See PLOTKIN, supra note 6, at 67. Also, refer to the attached Appendix.
29 Id. at 51-55.
31 Id. at 276-77.
32 Term coined by Robert Plotkin describing autonomous artificial creation systems. See PLOTKIN, supra note 6.
speculative. It appears that artificial creation systems are still one key step removed from becoming autonomous black-box invention machines. A human must still program the “fitness function,” which is the machine algorithm that defines the criteria for selecting one prototype over another. This function does not need to be specific to the problem being solved or even provide much instruction on what a solution should look like but it still requires some level of human ingenuity in the process of selecting solutions. Advancements in developmental genetic programming and knowledge-based expert systems indicate that the needed level of human guidance on selection is diminishing and may ultimately disappear—it is just not there yet. For more detail, refer to the attached Appendix for a walkthrough on modern artificial creation technology.

One thing is certain though: the use of this technology is on the rise and significant problems for the patent system may lie ahead. Even current incarnations may lead some to question whether the patenting of artificial creation products undermines the purposes of the patent system. There are several objections that can be made to the patenting of artificial creation products.

For those that subscribe to the “incentive to invent” theory, the first problem is that because of the ease of using artificial creation systems, there is no longer an incentive created by the patent system. If this technology becomes as widely available and simple to use as predicted, anyone could use one of these systems to create solutions to a large range of problems without needing substantial time, effort, or expertise.

35 See Plotkin, supra note 6, at 57-58.
Without these significant research and development costs, there is little reason not to invent, and thus the public is gaining little in the *quid pro quo* exchange. With prevalent artificial creation systems, there should be less of a concern that someone would copy the invention, because little cost and effort went into creating it and another invention could possibly be created just as easily.

The “incentive to commercialize” supporters should also be concerned. It may seem like the patent system actually still serves its purpose by providing an incentive to bring the products of artificial creation systems to the market, but the continuing rise of non-practicing entity (“patent trolls”) litigation activity indicates that it will likely have the opposite effect. Patent trolls have no intention of actually making whatever is described in their patents.\(^\text{36}\) They make their money by purchasing others’ patents, building up their own patent portfolios, finding practitioners that may be infringing on the patents, and threatening to sue them for infringement.\(^\text{37}\) With the threat of huge damages awards and injunctions, the practitioners often agree to pay for a license to avoid litigation.\(^\text{38}\) This is a lucrative business right now. The problem that artificial creation systems bring to the table in this climate is that now the patent trolls may not even need to purchase patents from others. If a patent troll has an artificial creation system at his disposal, he could just have this system crank out invention after invention, get patents on these inventions, and get to work threatening practitioners. Thus, it is not difficult to see that, very quickly, the majority of patents for inventions created using artificial means may not be granted to individuals with any intention of bringing them to market.

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\(^{37}\) *Id.*

Related to the problem of patent trolls is the prospect of a patent flood with the rise of artificial creation systems. It may become so easy to create patentable inventions that a very large number of patents are sought for them.\textsuperscript{39} Besides the obvious burden on the Patent Office that would now be inundated with applications, this flood could bring about the problems of the anticommons and patent thickets. The problem of the anticommons means that if too many patents for too many things in a field are granted then it will become nearly impossible to actually practice anything in that field without infringing.\textsuperscript{40} To be patentable, an invention does not need to be a fully marketable product. For example, there may be a patent for a transistor design that, by itself, has limited use, but could be a critical component for a microprocessor. If there are too many patents in the microprocessor field held by individuals with a real desire to exclude, there could be no microprocessors manufactured without infringing. Or, put another way, “consider how problematic walking through your neighborhood would be if every piece of sidewalk were privately owned by a different person and you were required to obtain permission to take each step.”\textsuperscript{41}

A “patent thicket” is very similar to the anticommons problem, but this term refers to potential overlapping rights where more than one patent may actually cover the same subject matter.\textsuperscript{42} The issue with a patent thicket is that there may be more than one entity that owns the rights to an invention.\textsuperscript{43} Because a patent only grants a right to exclude, and not a right to practice, patent thickets can cause patent holders to be

\textsuperscript{39} See Plotkin, supra note 6, at 10, 107, 136.
\textsuperscript{40} Dan L. Burk & Mark A. Lemley, The Patent Crisis and How the Courts Can Solve It 75-77 (2009).
\textsuperscript{41} Id. at 76.
\textsuperscript{42} Id. at 77-78.
\textsuperscript{43} Id.
prevented from practicing their own inventions. With many people having access to artificial creation systems, and seeking patent protection for their products, the possibility of the anticommons or patent thickets being brought on by a patent flood is a real concern.

In some industries, the flood of new entrants may disrupt the patent culture. Not every field treats patents the same way. In some industries, patents are largely ignored and not enforced to enable innovation and basic business functions. The microprocessor example illustrates this. In the semiconductor industry, a new microprocessor would likely infringe thousands of patents, but there is an industry-wide agreement to not sue for infringement through cross-licensing so that the industry can continue to progress and build on each others’ innovations. A new entrant with no sunk costs or investment in research and development of semiconductors, because it used an artificial creation system for its inventions, may not want to play by the same rules. It could be a patent troll or it could just be somebody that actually intends to make the invention but is unwilling to engage in expensive cross-licensing. It is hard to know exactly what new entrants without any background in the industry will do, but it is not difficult to see that they will disturb the status quo.

It is also possible that some may just have a problem with patents being granted for products of artificial creation systems because it “feels” unfair in the abstract. The patent system requires “substantial creative effort,” and this concept is difficult to quantify. The current laws attempt to do so with the obviousness requirement, but this is certainly not perfect. The use of artificial creation systems may trigger a need to rethink what “substantial creative effort” means. As some commentators have suggested, we

44 Id. at 90-92.
may need to shift our focus from patents on the end product to somehow protecting the identification of the problem, as that will become the truly valuable part of future inventive processes.\textsuperscript{45}

There is a major issue with all of these problems: they are all predicated on the assumption that nearly autonomous artificial creation systems will become widely used. As mentioned earlier, this is speculative. So, before attempting to fix the patent system, it would be prudent to gather better information on how artificial creation systems are actually being used. The problem is that, right now, their use is not required to be disclosed, greatly limiting the availability of this information.

III. The Patentability of Artificially Created Inventions

Under the current system, patents are being granted for inventions created through artificial processes.\textsuperscript{46} However, for the one patent granted for an invention that is known to have been created using an artificial creation system, the Patent Office did not consider the effect of the use of this system in the creative process, and no court has been asked to rule on the patentability of such inventions.\textsuperscript{47} The reason for this is simple: there is a belief that there is no mandatory disclosure requirement of inventive processes to the Patent Office.\textsuperscript{48} Thus, patent applicants are not disclosing their inventive processes at the time of application.\textsuperscript{49} There is no technical requirement to include a disclosure of inventive processes for a complete patent application (the application only needs to

\textsuperscript{45} PLOTKIN, supra note 6, at 119-23.
\textsuperscript{46} See PLOTKIN, supra note 6, at 1, 136.
\textsuperscript{47} See id. at 105-106. There is no mention anywhere in the patent file wrapper of the use of an evolutionary system for the creation of the invention described by U.S. Patent no. 6,847,851 (issued January 25, 2005) even though it was created using such a system.
\textsuperscript{48} See id.
\textsuperscript{49} See id.
describe the invention itself) and because there is no clear duty to disclose it outside of the technical patent application requirements, the use of artificial creation systems in the inventive process is largely being kept secret.\textsuperscript{50} Without this information in the application, the Patent Office has no way of beginning an inquiry and, unless the applicant discloses this information in some other way, it may never even be brought up in future litigation for the courts to decide. For this reason, the question of whether these inventions are patentable under current law is not settled. This section will highlight many of the problems with the current patent system that the Patent Office and the courts would have to deal with if disclosure was required and show how they should rule on these issues.

A. Patentable Subject Matter

To start with, an invention must be of a class of inventions that is deemed patentable under § 101 of the Patent Act. At first glance it may seem that the provisions of § 101 on patentable subject matter will not pose any problems for inventions created using artificial creation systems because this section is only concerned with the end product that is being patented. This section of the Patent Act enumerates several specific types of patentable inventions.\textsuperscript{51} Generally speaking, courts are inclined to be very lenient when it comes to determining whether an invention qualifies as one of these invention types under § 101 of the Patent Act, going so far as to say that “anything under

\textsuperscript{50} Cf. id.
the sun that is made by man” is patentable subject matter.\footnote{\citeseq{Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980). \textit{See also} ROGER E. SCHECHTER & JOHN R. THOMAS, INTELLECTUAL PROPERTY: THE LAW OF COPYRIGHTS, PATENTS AND TRADEMARKS 291-92 (2003) (“It is hardly an exaggeration to say that under current law, if you can name it, you can claim it.”).} Inquiries as to whether a patent applicant has met its burden under § 101 seem to almost always center around whether the invention properly fits into one of the categories listed in the section and whether the applicant is attempting to claim a “law of nature.” Given the extremely broad construction that the Supreme Court has given to § 101, subject matter challenges are relatively rare and many commentators believe the recent \textit{Bilski} decision will effectively end future inquiries on the topic.\footnote{\citeseq{E.g., Dennis Crouch, \textit{Bilski v. Kappos}, PATENTLY-O, Jun. 28, 2010, http://www.patentlyo.com/patent/2010/06/bilski-v-kappos-business-methods-out-software-still-patentable.html.}} Thus, most tangible inventions created with artificial creation systems will probably be safe from patentable subject matter challenges under current applications of the law.

However, there may be an underlying problem with this limited application of § 101, specific to the use of artificial creation systems. Early in the life of the Patent Act of 1952, this question was directly addressed in the seminal article “Some Absurd Presumptions in Patent Cases,” by Cyril Soans.\footnote{\citeseq{Cyril A. Soans, \textit{Some Absurd Presumptions in Patent Cases}, 10 IDEA 433, 438 (1966). Cyril Soans was a partner at the Chicago law firm now known as Fitch, Even, Tabin & Flannery and served as Chairman of the American Bar Association Section of Patent, Trademark and Copyright Law. \textit{A Brief History of Fitch, Even, Tabin & Flannery}, http://64.118.79.176/2E8FB4/pdf/news/Brief_History_of_FETF.pdf; Sections and Committees, 42 A.B.A. J. 993, 1073 (1956).}} This article is noteworthy because it was in this article that the term “PHOSITA”\footnote{\citeseq{This is a very common term used among patent practitioners that is short for “Person Having Ordinary Skill In The Art.”}} was coined for the first time.\footnote{\citeseq{Dan L. Burk & Mark A. Lemley, \textit{Is Patent Law Technology-Specific?}, 17 BERKELEY TECH. L.J. 1155, 1185 n.126 (2002).}} The immediate preceding paragraph to the section where PHOSITA was born explicitly states that an invention must be the product of human mental processes:

...
Computer machines have been used for years, but I have never heard of a patent claim which was invented by a computer. A new patentable concept is universally regarded as a mental creation by a human being, or by a group of human beings if a joint invention. It would seem that a computer can be used by Mr. Phosita (see below) to expedite the *ex post facto* reconstruction of the applicant's claimed subject matter by a hindsight approach *after the invention has been made*. But first the invention must be created and programmed by human beings.\(^{57}\)

The fact that this author went so far as to say that it is “universally regarded” that to be patentable it must be created by a human and not a computer is a very clear statement on the beliefs of the time. To be sure, this belief may have changed since then, but an argument can be made that this understanding of patentability is inherent in the Patent Act of 1952. The problem is, the courts have never been able to answer this question because, without disclosures or evidence of inventive processes to look at, there is no way for them to reach this issue.

**B. Inventorship**

The use of artificial creation systems may cause problems in even figuring out whose name to put on the patent application. Unique to United States patent law is a requirement that the patent applicant actually be the inventor.\(^{58}\) Under the law, an inventor is not only someone who “invents” in the creative sense, but also someone who discovers.\(^{59}\) In order to be an inventor, a person must “contribute to the conception” of

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\(^{57}\) Soans, *supra* note 54, at 438. It may be of interest that an earlier draft of this article, titled “Alice in Presumption Land,” was found in Judge Giles Rich’s archive at the Library of Congress. It appears that Soans had given Rich this early draft for comment and editing. There are no material changes made between the earlier draft and this published version and there were no markings on this section by Judge Rich. Thus, it could be inferred that Judge Rich, a primary drafter of the Patent Act, agreed with what was written in this paragraph. Container 647, Giles S. Rich Papers, Manuscript Division, Library of Congress, Washington, D.C.

\(^{58}\) MPEP 2137.01

the invention. The court in *Mahurkar v. C.R. Bard* explained what it means to “conceive” of an invention:

To have conceived of an invention, an inventor must have formed in his or her mind “a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.” The idea must be “so clearly defined in the inventor’s mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation.”

A person “contributes” to conception when that person adds something more than what was already known to the art and the marketplace. Finally, “one who suggests an idea of a result to be accomplished, rather than the means of accomplishing it, is not a coinventor” Businesses, machines, computers, and other non-human entities are not entitled to be listed as “inventors” under the current law—inventors must be human.

Applying these rules to any invention is a heavily fact-specific endeavor. Nevertheless, the current law provides guidance as to how the use of artificial creation systems can affect inventorship. To start with, there must be a human that can be named as the inventor on the patent application or there can be no patent. There are several options for potential human inventors. The first is the person who initiated the artificial creation system by providing the computer with the problem to be solved (the “Inputter”). The second could be a person that receives the output from the artificial creation system.

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60 Fiers v. Revel, 984 F.2d 1164, 1168 (Fed. Cir. 1993).
(the “Recipient”). A third option could be the programmer of the artificial creation system itself (the “Programmer”). These can be three different people.

Assume for the time being that they are three different people, that the artificial creation system is one of the more autonomous systems that is capable of drawing on knowledge databases independently, and the Programmer only knows how it was initially coded. Also assume that this is a system that does not require high levels of technical skill to operate. In this circumstance, the only one of the three that has “a definite and permanent idea of the complete and operative invention” is the Recipient, who gained this instantly upon receiving the output. The Inputter only identified the problem and the Programmer has only designed a machine to solve problems. It does not matter how much effort or creativity either of them put into the process because neither one of them ever had the fully-developed final product in their mind, nor could either suggest a means of accomplishing the desired result. To do that requires knowledge of the solution, which only the Recipient has. Therefore, the only name that can be placed on the patent application in the “inventor” box is that of the Recipient.

While this result may not seem to fit with the common understanding of what it means to be an “inventor,” there is other support in the statute that this applicant is technically an inventor, and thus entitled to apply for a patent, by virtue of having merely stumbled upon something. Thus, it is the policy of the United States to encourage people to come forward with any new and useful discoveries that they might make.

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65 Id. at 586.
66 See 35 U.S.C. § 101 (“Whoever invents or discovers . . . .”) (emphasis added). See also A.O. Smith Corp. v. Petroleum Iron Works Co. of Ohio, 73 F.2d 531, 538 (6th Cir. 1934) (Quite clearly discovery is something less than invention. Invention requires genius, imagination, inspiration, or whatever is the faculty that gives birth to the inventive concept. Discovery may be the result of industry, application, or be perhaps merely fortuitous. The discoverer, however, is entitled to the same protection as the inventor.)
Whether or not they are ultimately patentable is another question. The problem here is that the person coming forward may be unfairly rewarded because this ignores the contributions of the Inputter, who labored in identifying the problem, and the Programmer, who designed the system to solve it.\textsuperscript{67} In most current cases, all three people described above are actually the same person, making this a non-issue.\textsuperscript{68} But, in a future circumstance where they may be different, this problem will arise.

Stemming from this, there are three other issues that will need to be considered. The first is the issue of derivation.\textsuperscript{69} A person is not entitled to a patent if “he did not himself invent the subject matter sought to be patented.”\textsuperscript{70} Courts have construed this to mean that there must be “both prior conception of the invention by another and communication of that conception to the patentee.”\textsuperscript{71} In a situation where the Recipient actually relays the output from the artificial creation system to someone else, who in turn files for a patent, there may be an issue here. As an illustration, imagine a scenario where the Inputter hires the Recipient as a technician whose only job is to watch for the output from the artificial creation system and immediately report that output back to the Inputter, who then files for a patent. Now there may be an impermissible derivation situation and the Inputter is still not an inventor. In this situation, the technician both conceived (by viewing the output) and communicated his “conception” to the Inputter. Thus, the elements for § 102(f) derivation are there, and the Recipient is the only inventor that may be listed on the patent application.

\textsuperscript{67} See Vertinsky & Rice, supra note 64, at 585.
\textsuperscript{68} In the case of the one known patent for an invention from an artificial creation system, the inventor was also one of the programmers. See PLOTKIN, supra note 6, at 55-56.
\textsuperscript{69} See Vertinsky & Rice, supra note 64, at 586.
\textsuperscript{70} 35 U.S.C. § 102(f).
\textsuperscript{71} Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573 (Fed. Cir. 1997).
The second issue is the issue of determining joint-inventors for a patent application. Suppose there are two Recipients who, together, receive the output at the exact same time and want to be listed as joint-inventors on the application. Someone is a joint-inventor and must be listed if he made a contribution to the subject matter of at least one claim in the patent.\textsuperscript{72} Now there is a conundrum. What did either one of them contribute? All either one of them did was read the output from the artificial creation system. Thus, each one of them conceived of 100\% of the invention. Without the efforts of either one of them, the entire invention was still conceived by the other. So, simultaneously, each one of them could be considered as contributing 0 and 100\%. There is no clear answer to how this situation could be handled under the current law. Just trying to figure out whose name to put on the patent application becomes an incredibly difficult task when dealing with inventions created by artificial creation systems.

A final issue on inventorship arises if there is a fight over inventorship between the Inputter and the Recipient in the Patent Office. The United States, being a first-to-invent country, has a procedure for resolving these issues in the Patent Office known as “interference” proceedings. The basic method to defeat an adverse claim of invention in an interference is to prove first conception and “diligent” work reducing the invention to practice since that point.\textsuperscript{73} It is clear that this avenue will not be of any use to the Inputter since he could not have conceived of the invention until he saw the output.

Disclosure of the inventive process will not change who the inventor is and the problems with inventorship predominantly seem to fall in the abstract unjust “feel” category. What disclosure will do is allow the public to see the contributions of the

\textsuperscript{72} See 35 U.S.C. § 116; MPEP 605.07.
\textsuperscript{73} See generally SCHECHTER, supra note 62, at 352-54.
Inputter and the Programmer. So, even though these participants cannot be listed as technical inventors, they can still receive some credit in the patent file. This will allow the public to get a better picture of the process that created the invention. Furthermore, after seeing how these inventive processes actually work, the public may decide that it is time to redefine “inventor.” So, disclosure of inventive processes will likely not have any material legal effect for inventorship, but it will aid in public understanding of the invention and could improve abstract fairness.

C. Enablement

There is nothing too problematic about enablement of inventions created through artificial processes under current law. Part of the *quid pro quo* of receiving a limited monopoly is that the inventor must disclose to the world how to *make* and *use* his invention.74 This requirement is only on the invention itself, not the method of inventing it. Thus, as long as a person of ordinary skill could look at the disclosure in the patent and be able to recreate the invention without undue experimentation, the enablement requirement is met.75 There will likely be nothing unique about this issue for inventions from artificial creation systems.

However, it has been argued that as artificial invention processes become more advanced, it may be the case that it will become too difficult to succinctly describe how to make and use currently unforeseeable, but likely very complicated future inventions.76 If this occurs, the invention may need to be defined by the process to invent it. It is surmised that artificial creation systems will not only be used to invent, but also to

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75 In re Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993).
76 PLOTKIN, supra note 6, at 159-62.
describe inventions and aid in their understanding.\textsuperscript{77} For such complicated or advanced inventions, it may not be clear \textit{why} the invention works only from a description of the end product, only \textit{that} it works.\textsuperscript{78} In this circumstance, it may be necessary to use artificial creation systems to recreate and see the inventive process for a full understanding of the invention or possibly even use one to reverse engineer the invention. If this ever happens, it may further be necessary to reconsider how the enablement requirement will still be met under the current law. After all, it is from the enabling disclosure that the public derives its benefit in the \textit{quid pro quo}, that benefit being an understanding of the invention.

D. Obviousness

The area of current patent law where the problems caused by the use of artificial creation systems are most apparent is in the requirement that an invention be nonobvious. This is a statutory requirement in the United States that imposes a burden on a patent applicant beyond merely showing that the invention is \textit{new} (the novelty requirement). To be patentable, an invention must be the product of substantial creative effort. The Patent Act attempts to quantify this concept by stating that no patent shall be granted “if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. . . .”\textsuperscript{79} The practical issues of applying this standard have been discussed by other commentators. This section will give a brief description of these and other issues to illustrate the perceived problems and set up the

\textsuperscript{77} Id.
\textsuperscript{78} Id. at 160-61
\textsuperscript{79} 35 U.S.C. § 103(a).
discussions in the next sections that will look at the intent behind the specific wording of the patent laws and a solution that will enable interested parties to start to get a handle on the real effect of this emerging technology.

Obviousness inquiries under this standard are heavily fact-specific endeavors. The basic inquiry begins with the three-pronged Graham analysis: 1) determine the scope and content of the prior art, 2) determine the differences between the prior art and the claims at issue, and 3) determine the level of ordinary skill in the art.\textsuperscript{80} Once these determinations have been completed, the question of whether the invention is obvious is addressed.\textsuperscript{81} Secondary considerations are also reviewed and may have an impact on the ultimate determination of obviousness.\textsuperscript{82} The first two prongs of the Graham test and the secondary considerations are so fact specific that they will not be examined in this article.\textsuperscript{83} The third prong instantly presents problems.

There is no single formula to determine the level of ordinary skill. Some factors that courts will look to for guidance are: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.”\textsuperscript{84} This is not an exhaustive list, but it boils down to what resources a normal practitioner has at its disposal and the state of the industry. In the context of artificial creation systems, the pertinent questions are whether

\begin{itemize}
  \item \textsuperscript{80} Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17 (1966).
  \item \textsuperscript{81} Id.
  \item \textsuperscript{82} Examples are commercial success, long felt but unsolved needs, and the failure of others. Id. at 17-18.
  \item \textsuperscript{83} It may be helpful to assume that the prior art was all created without the use of artificial invention processes to get a better feel for the real effect of the introduction of artificial inventions into the current patent system.
  \item \textsuperscript{84} Envtl. Designs, Ltd. v. Union Oil Co. of Cal., 713 F.2d 693, 696-97 (Fed. Cir. 1983).
\end{itemize}
this hypothetical normal person\textsuperscript{85} would have access to an artificial creation system and whether they are normally used in the industry.

The level of ordinary skill will likely be determined without consideration of the availability of these invention processes, resulting in a likelihood that the court will make incorrect determinations on the level of ordinary skill.\textsuperscript{86} Even though someone might have used an artificial invention process, the level of skill that her invention will be judged against will likely be of someone who had to do things the old fashioned way, unless there have been outside disclosures indicating a prevalence of artificial creation systems in the field.\textsuperscript{87} On the other hand, the Patent Office or a court could make a determination that the use of artificial creation systems is part of the level of ordinary skill, even without disclosures of the process during the prosecution of other patents.\textsuperscript{88} If the court makes this determination based on the kinds of other limited disclosures that are seen today, such as occasional scientific journal articles, then there will be many patents for inventions created the old fashioned way that will be incorrectly judged against a level of skill that regularly utilizes artificial creation systems.\textsuperscript{89} Without disclosures or other documentation of inventive processes available as evidence, overcoming such a finding will be difficult.

Once a determination of the Graham factors is made, the next question is whether the invention would be obvious to a person of ordinary skill in light of those factors.

There is no single test to determine whether something is obvious. The Supreme Court

\textsuperscript{85} The person having ordinary skill is a hypothetical person that is presumed to have access to all prior art references in its field. In re Rouffet, 149 F.3d 1350, 1357 (Fed. Cir. 1998).
\textsuperscript{86} PLOTKIN, supra note 6, at 106-107.
\textsuperscript{87} Id.
\textsuperscript{88} PLOTKIN, supra note 6, at 104-105.
\textsuperscript{89} Id.
recently expanded what things may be considered in determining whether an invention is obvious and outlined many different approaches that can be used including looking at market forces, whether the solution was obvious to try, and the old teaching/suggestion/motivation test.\textsuperscript{90} The Court stated that in making these determinations, “a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”\textsuperscript{91} Thus, it appears that if it only requires ordinary skill to create the invention, then the invention will be found obvious and unpatentable.\textsuperscript{92} Applying these standards to the use of artificial creation systems, because their use will require less skill to produce a large range of solutions than is required today, many more solutions should be found obvious.

However, because of the incredible power of being able to test and improve upon thousands of generations of prototypes in a short amount of time, these inventions are actually unlikely to be found obvious because they may be well beyond the creative capabilities of the human practitioners that they will be judged against.\textsuperscript{93} A determination on obviousness is a largely factual question and since there are no disclosures being made of inventive processes, the ultimate findings on this question are destined to be flawed.\textsuperscript{94}

To illustrate this difficult concept, assume for a moment that an obviousness inquiry is undertaken and that the inventive process can be taken into account. Consider these two questions: 1) what is the level of ordinary skill in microprocessor design without artificial creation systems? 2) what is the skill level if artificial creation systems

\textsuperscript{91} Id. at 418.
\textsuperscript{92} See PLOTKIN, supra note 6, at 104.
\textsuperscript{93} Id. at 106-107.
\textsuperscript{94} Id.
are available to every microprocessor designer? In the first instance, the level of ordinary skill is probably a person with an electrical engineering degree and several years work experience. The second question becomes much trickier. With artificial creation systems in use, almost anyone can be a microprocessor designer as long as they are capable of using the system to design microprocessors. In this way, perhaps the ordinary level of human skill is lowered, dramatically. It may not matter though, because the key is what is “obvious,” and the limit of what is obvious will likely be pushed to the limits of computational power. If this is the end result, it would be the end of microprocessor patents because every microprocessor design would be obvious.

Inventors have little reason to disclose because, by doing so, it would cause courts to begin to take artificial creation processes into account in determining the level of ordinary skill in the art, resulting in fewer patents for the industry. This actual risk of crippling the patentability of inventions within an industry by disclosing may result in the likelihood that the types of evidence necessary to establish the use of artificial creation systems as ordinary skill in the art to not come to light until long after it has actually reached that point. The incentive to keep the use of artificial creation systems secret may just be too high. Determining this level of ordinary skill will likely have to be based on guesswork.

This may result in either inventions receiving patents that are not deserved or inventions being wrongfully denied patents. This illustrates all three themes mentioned in the introduction. First, patents granted or denied wrongfully is unfair. Second, this unfairness comes from the current law’s inability to handle inventions from artificial creation systems. And, thirdly, if there were disclosures, the courts and the Patent Office
would have a much better understanding of how artificial creation systems work and how widespread their use really is, enabling them to make better findings. So the question is: why are the Patent Office and the courts unable to gather and consider disclosures?

The bare language of the second sentence of § 103 is what has led to this practice of nondisclosure. This sentence clearly states: “Patentability shall not be negatived by the manner in which the invention was made.” Because, by statute, an inventor’s own inventive processes cannot be used against him, there is no disclosure of it. This leads to yet another problem with artificial creation systems. Because these systems can be highly adaptable to different fields, use of them allows new entrants to immediately begin creating inventions using much less than ordinary skill in the art. In other words, if a single person has access to an artificial creation system in a field of thousands that do not, this person can get patents on inventions without much effort. Without a disclosure of inventive processes and the ability to use that against this new entrant, there is nothing stopping this new entrant from flooding the field with patents. Once the field has stabilized a bit and the use of artificial creation systems becomes “ordinary” in the eyes of the courts, the damage will already be done.

Because the problems with artificial creation systems and the nonobvious requirement are so fundamental, section IV of this article will demonstrate that it was not the intention of the drafters for the prohibition on considering inventive processes to extend as far as they do. The entire concept of nonobviousness is very complicated and

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95 See PLOTKIN, supra note 6, at 105-106.
97 See Koza, supra note 30, at 270.
98 See PLOTKIN, supra note 6, at 10 (“Dr. Thaler told me that although he could flood the Patent Office with such patent applications [from his Creativity Machine], so far he has chosen not to do so.”) (emphasis added). This exemplifies one of the main concerns with artificial creation systems. Their unchecked use under current law can leave the states of entire industries to the whims of a single person.
will likely need to be reevaluated as artificial creation systems become commonplace. The “ordinary skill” metric seems inadequate for this new invention process. This article does not contain the answers to fix these problems, but it will propose a tool that can be used by others to fix them in the future: disclosure.

IV. Intent of the Patent Act of 1952

The nonobviousness requirement is at the core of the patent system. It is in this requirement that Congress has set forth what many might consider to be the true definition of “invention.” While the words of the statute themselves may cause problems for the patenting of inventions from artificial creation systems, it should become clearer by looking at the intent behind those words that patents granted for these inventions may be in direct conflict with the purpose of the laws. This section will try to uncover this intent in context as well as show that the prohibition on considering inventive processes will need to be reconsidered, as the intent behind this prohibition was much more specific to the time it was written than its broad language indicates.

A. The Historical Origins of § 103

The nonobviousness requirement, now embodied in § 103 of the Patent Act, is generally believed to have originated from the Supreme Court’s 1850 decision in Hotchkiss v. Greenwood. The Hotchkiss case dealt with whether ceramic doorknobs were patentable in a world where wooden and metal doorknobs were commonplace. At the time, the only two requirements for a patent were novelty and utility. The issue

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100 Hotchkiss v. Greenwood, 52 U.S. 248, 265 (1850).
before the Court was whether a jury instruction was appropriate that required the patent
to be held invalid if no more ingenuity or skill than possessed by an ordinary mechanic
was required to create the ceramic doorknob. The Court held that the jury instruction
was appropriate, creating a rule that “unless more ingenuity and skill . . . were required . . .
than were possessed by an ordinary mechanic acquainted with the business, there was an
absence of that degree of skill and ingenuity which constitute essential elements of every
invention.” This specific language was interpreted by later courts as creating a new
third requirement for patentability: “invention.”

Before the Hotchkiss rule evolved into today’s § 103, it underwent several
mutations. For most of this time, the requirement for “invention” was so vague that
Judge Giles Rich, in describing the history of the invention requirement, referred to it as
“the plaything of the judiciary,” whose meaning could be twisted to whatever someone
wanted it to mean. Probably the most notable time period where the judiciary
struggled with this confusing term was the Depression Era, where the courts became
notably hostile towards patents. It was during this time that the Supreme Court decided
one of the most famous cases defining the term “invention.” In Cuno, the Court said that
to qualify as an invention, the new device “must reveal a flash of creative genius, not
merely the skill of the calling.” Unsurprisingly, subsequent courts invalidated many

101 Id. at 264-65.
102 Id. at 267. (The Court rephrased its holding in the next sentence, noting that “the improvement is the
work of the skillful mechanic, not that of the inventor.”)
103 Giles. S. Rich, Why and How Section 103 Came to Be, FED. CIR. B. J. 181, 185-186 [hereinafter Rich,
104 Id. at 185.
105 Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941).
patents after latching onto this language and vainly searching for such “flashes.”

Indeed, it got to the point where, as Justice Robert H. Jackson put it, “the only patent that is valid is one which this court has not been able to get its hands on.”

In the midst of this late-Depression Era hostility towards patents, President Roosevelt established the National Patent Planning Commission to review the American patent system and “consider whether the system now provides the maximum service in stimulating the inventive genius of our people in evolving inventions . . . .” The Commission, recognizing “some mysterious ingredient connoted in the term ‘invented,’” proposed in its report “that Congress shall declare a national standard whereby patentability of an invention shall be determined by the objective test as to its advancement of the arts and sciences.” Unfortunately, the Commission did not define this new standard very well, and so no direct congressional action was taken based on the report. Nevertheless, the report did plant the seed in the minds of many members of the Patent Bar that, in order to resolve this problem, it was necessary to stop thinking about what is invention altogether, and instead focus on what should be patentable.

This seed sprouted and took root in the minds of members of the New York Patent Law Association (NYPLA), who had sent then-attorney Giles Rich to testify

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106 See, e.g., Great Atlantic & Pac. Tea Co. v. Supermarket Equip. Corp., 340 U.S. 147, 152 (1950) (Often referred to as the “A&P case,” which interpreted the “flash of creative genius” test as requiring “unusual or surprising consequences from the unification of elements” to establish invention).
108 Exec. Order No. 8,977, 6 Fed. Reg. 6,441 (Dec. 12, 1941). It is interesting to note that President Roosevelt took the time to issue this order a mere 5 days after the attack on Pearl Harbor, demonstrating his belief that stability in the patent system is essential to facilitate innovation, especially in wartime.
112 See id.
before Congress in hearings concerning two bills that attempted to solve the standard of invention problem. The NYPLA looked favorably upon one of the bills, which tracked closely the earlier recommendations from the National Patent Planning Commission, and prepared a counterproposal based on this bill that contained no reference whatsoever to an “invention” requirement. Even though this counterproposal did not make it into law immediately, the House subcommittee decided that a rewriting of the patent statutes was in order and tasked P.J. Federico, an Examiner-in-Chief at the Patent Office, with their drafting. The National Council of Patent Law Associations involved itself in this effort and created a two-man Drafting Committee, consisting of Giles Rich and Paul Rose, to represent the Patent Bar and assist Federico in drafting the new laws. These three men, along with Henry Ashton, formed the “working nucleus of the revision effort.” After a few short years of work together, this group completed a draft that was intended to replace the common law requirement for “invention” with a new condition, which was passed into law in the Patent Act of 1952 and still exists as current § 103(a) Conditions for Patentability; Non-Obvious Subject Matter:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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113 See id. at 188.
114 Id. at 189.
115 Id.
B. The Purpose of the Nonobviousness Requirement

Even though the preceding basic history of the origin of the nonobviousness requirement is helpful, it still does not give the full story as to what this section was intended to accomplish. To figure that out, a deeper look into the mindset of the lawmakers is necessary. Trying to find out exactly what members of Congress were thinking when they passed a particular piece of legislation is a difficult task. Aside from the fact that it is nearly impossible to know what anyone is actually thinking at any point in time, often the only resource available that gives any clues is the legislative history.\textsuperscript{120}

It may be surprising to learn that, despite its importance to modern industry, the Patent Act of 1952 has an incredibly limited legislative history. The House bill that introduced the Act passed by way of the Consent Calendar,\textsuperscript{121} which meant that it was passed without debate, questions, or even explanation.\textsuperscript{122} Its time in the Senate yielded an even more limited record.\textsuperscript{123} Even though the full chamber may not have spent much time on the legislation, the Patent Act was, however, the subject of lengthy committee

\begin{footnotes}
\item[120] “Legislative history” is any account (usually written) relating to the process of enacting the legislation. Typical examples are: committee reports, floor debates, and other Congressional records. \textit{See generally} JACK DAVIES, LEGISLATIVE LAW AND PROCESS, 295-329 (3d ed. 2007) (providing a comprehensive explanation of the general process of statutory interpretation).
\item[121] The Consent Calendar was a procedure in the House used to pass noncontroversial measures without spending too much time on them. It fell out of use and was abolished in the 1990s. It was replaced in part by the current Corrections Calendar. Walter J. Oleszek, The House’s Corrections Calendar, CRS Report for Congress 1 (Dec. 4, 2003), http://www.rules.house.gov/archives/97-301.pdf.
\item[122] Congressman Crumpacker, member of the House Subcommittee on Patents at the time this bill was being considered, had this to say about the legislative process of enacting the Patent Act of 1952: A good 95% of the members of both bodies never knew that the legislation was under consideration, or that it had passed, let alone what it contained. In the House the bill went through on the Consent Calendar - along with, on the same day, dozens of other pieces of legislation. When it was reached on the calendar no questions were asked and no explanations were offered. There was not even an insertion in the record to explain the bill. The entire time consumed by the passage of the bill probably did not total 30 seconds. Only a handful of members - the members of the ‘Objectors’ Committee’ on the two sides of the aisle-were paying any attention to what was going on. How can the House, as a legislative body, be said to have had any ‘intent’ with respect to the bill? Rich, \textit{Congressional Intent}, supra note 117, at 75.
\item[123] \textit{See id.} at 75. \textit{See also} 98 CONG. REC. 9,323 (1952).
\end{footnotes}
hearings in the House.\textsuperscript{124} It is clear that the committees intended for § 103 to bring “uniformity and definiteness” to the national patent laws with respect to the common law invention requirement, similarly to the way that the National Patent Planning Commission had recommended several years earlier.\textsuperscript{125} A review of the testimony before committee reveals that there was some debate as to whether to positively state objective indicia of nonobviousness, and that it was ultimately decided to frame the requirement in the negative, by stating a condition which would defeat patentability.\textsuperscript{126} In general, the committee members seemed to defer to the practitioners and experts, as they did not actually write much of the Act itself.\textsuperscript{127} Thus, it has been said that the intent of the House was simply to create a noncontroversial set of laws that, for the most part, simply codified what had already been established by the courts and that would be passed without debate.\textsuperscript{128}

Unfortunately, this does not give any useful insight into what the specific words of § 103 were meant to convey. Representative Crumpacker, who was heavily involved in the House committee hearings, recognized this deficiency and offered some advice to those trying to discern the legislative intent of the Patent Act:

When the courts, in seeking to interpret the language of the Act, go through the ritual of seeking to ascertain the ‘intent of Congress’ in adopting same, they would do well to look to the writings of these men - Federico, Rich, Harris, and the others - as they, far more than any member of the House or Senate, knew and understood what was intended by the language used.\textsuperscript{129}

\textsuperscript{124} 98 CONG. REC. 9,323 (1952) (statement of Sen. McCarran).
\textsuperscript{125} See H.R. REP. NO. 82-1923, at 7 (1952).
\textsuperscript{127} Rich, Congressional Intent, supra note 117, at 73.
\textsuperscript{128} Id. at 77.
\textsuperscript{129} Id. at 78.
Following his advice, the next two subsections will show what the two sentences of § 103(a) were designed to address.

1. “Obvious” and “Ordinary Skill”

Dating back to at least the *Hotchkiss* decision, there has been a general sentiment that to be patentable, something more than a trivial change on what already exists is necessary.\(^{130}\) As mentioned above, this “something more” had come to be known as the vague requirement of *invention*, which is essentially undefinable.\(^{131}\) Also mentioned above, Giles Rich decided in his mind that, in order to standardize the application of this “something more,” the use of the term *invention* needed to stop altogether.\(^{132}\) His intent in helping draft the section was to get people thinking not in terms of *invention*, but in terms of *patentability*, as he believed that one of the fundamental problems with the former term was that there are many *inventions* that are nevertheless *unpatentable* because they are not novel.\(^{133}\) He displayed this intention early on, as one of his first suggested changes was to rename the title of the section from “Conditions for patentability, lack of invention” to “Conditions for patentability, non-obvious subject matter.”\(^{134}\)

According to Rich, they chose the word “nonobvious” because they felt it was the closest word to the meaning of the main gist of the invention requirement that “better

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\(^{130}\) See Rich, *Kettering Address*, supra note 110, at 139.
\(^{131}\) See McClain v. Ortmayer, 141 U.S. 419, 426-27 (1891).
\(^{133}\) Rich, *Kettering Address*, supra note 110, at 141 (“[T]he same things are invented over and over-by the use of the inventive faculties or by inventive acts. . . .”).
opinions” had applied. The rest of the words, he says, “followed naturally” as they thought through the process of applying the standard. Federico, who was the lone author of the original draft, similarly said that the “person having ordinary skill in the art” language was simply a synthesis of language that had been used by courts for several decades. Their efforts to avoid controversy by using already-existing terminology paid off in that it got the bill passed easily, but had the side effect of propagating the notion that the section was a mere codification of pre-existing law. Rich, Federico, and Harris all stated that §103 was not a mere codification of old law, but rather a fundamental change in the way the third requirement for invention was to be analyzed.

This explains the reason they chose the specific words that they did, but it still does not explain why they decided to include this section in the first place. After all, they essentially had a clean slate and a mandate to only say “something” on the question of invention. If they wanted, they conceivably could have recommended an abolishment of the third requirement altogether and returned to the pre-Hotchkiss two-pronged novelty and use analysis. The fact that they chose not to indicates that they all felt that some greater requirement was necessary to justify a patent.

136 Rich, Tyranny of Words, supra note 135, at 206.
137 Recall the “ordinary mechanic” language from Hotchkiss. Federico actually used the nominally different phrase “ordinary person skilled in the art” in earlier drafts. Federico, supra note 118, at 92.
138 See Rich, Tyranny of Words, supra note 135, at 206.
139 Id. See Patent Law Codification and Revision: Hearing on H.R.3760 Before the H. Comm. On the Judiciary, 82nd Cong. 38 (statement of P. J. Federico, Examiner in Chief, United States Patent Office); L. James Harris, Some Aspects of the Underlying Legislative Intent of the Patent Act of 1952, 23 GEO. WASH. L. REV. 658, 661 (1955). Somewhat paradoxically, Federico also stated in his testimony that the new § 103 was an attempt “to write down a condition which exists in the law and has existed for well over 100 years.” However, there is no contradiction with these words because they were not codifying the existing standard of invention laws, but rather the condition of nonobviousness. See Rich, Kettering Address, supra note 110, at 143.
140 See Rich, Why and How, supra note 103, at 189.
Federico was the lone author of the first draft to include the section, so it would seem that his thought process for the inclusion would be the most important to understand. Disappointingly, he never explained why he chose to put it in.\textsuperscript{141} Rich, on the other hand, did provide his rationale for the inclusion of the entirety of § 103. He described the previous requirement for \textit{invention} as filling a “void” in the patent law.\textsuperscript{142} Explaining this void, he is famously quoted for saying:

As we refrain from granting patents on inventions that are not new, we must also refrain from granting patents on those inventions which would arise \textit{spontaneously}, given the need or desire for them, as the yelp of the dog surely follows from stepping on his tail, or with only a \textit{nominal expenditure of time, effort, money or wit} - especially if the invention is one of real utility likely to meet with popular demand.\textsuperscript{143}

Thus, according to Rich, the intent of the first sentence of § 103 is to prevent patents from being granted that would arise \textit{spontaneously} or with little \textit{time, effort, money or wit}. The drafters chose the “ordinary person” and “obvious” language to provide a standard metric from which to make these determinations.

2. “The Manner in Which the Invention was Made”

The second sentence of § 103, standing alone, appears to be very straightforward in displaying the intent of the drafters that they felt that how someone came to create an invention was completely irrelevant in determining its patentability. If it is interpreted in this way, this whole inquiry as to whether patents granted for inventions created through artificial means are contradictory to the purpose of the nonobviousness requirement may

\textsuperscript{141} R. Carl Moy, Moy’s Walker on Patents § 9:8 n.1 (4th ed. 2010). In fact, he seemed to want to humbly deflect into his own subjective intent, as he ended his discussion on the origins of § 103 with a citation to a case where the Patent Office Board of Appeals declared the views of the “individuals who may have been responsible for drafting the language” of another part of the Act are considered incompetent to speak to the intent of Congress. Federico, \textit{supra} note 118, at 98.
\textsuperscript{142} Rich, \textit{Tyranny of Words}, \textit{supra} note 135, at 207.
\textsuperscript{143} Rich, \textit{Kettering Address}, \textit{supra} note 110, at 139.
seem like a waste of time. It is not a waste of time for two reasons. First, there is still the metric of “ordinary skill” in the first sentence which, despite prohibition on the inquiry as to the inventive process, may still take it into account if it becomes standard practice in the industry. Second, and more importantly, a review of the history of the process that the drafters went through in creating this sentence shows that their purpose was much narrower than what the codified language seems to indicate.

The record on why this sentence was included is very clear. Its primary purpose was to kill off the “flash of creative genius” test. The House Report went so far as to include this exact language when describing why the second sentence was there. The fact that this sentence was created entirely for this purpose is undisputed by the drafters. This answers the question of what it was intended to do, but to really understand the language that they chose to do it in context, it is critical to understand why they wanted to get rid of the “flash of creative genius” test in the first place.

Recalling the discussion of the historical origins of § 103 in part 1, the “flash of creative genius” test originated in the precedential Cuno decision, and quickly brought about a new era of heightened hostility towards patents among the courts. The Patent Bar and related industries responded immediately, and this was one of the main impetuses behind the move to codify the laws in the Patent Act. Most innovations do not occur

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144 This was explained section III.
145 H.R. REP. No. 82-1923, at 18 (1952) (Revision note) (“The second sentence states that patentability as to this requirement is not to be negatived by the manner in which the invention was made, that is, it is immaterial whether it resulted from long toil and experimentation or from a flash of genius.”).
146 Rich, Why and How, supra note 103, at 191 (“Its real purpose being to knock out ‘flash of creative genius’ holdings. . . .”); Henry R. Ashton, Opening Remarks at the American Bar Association Section of Patent, Trademark, and Copyright Law Symposium on Patents, San Francisco: The Patent Act of 1952 - Ten Years of Interpretation (1962) (“The intent of the Committee in adopting the second sentence of Section 103 was clear and simple. We intended thereby to bury - we hoped permanently - the “flash of genious”[sic] doctrine which had grown up in the courts.”).
from such “flashes,” but instead occur through time-consuming trial and error, incremental improvements, and combinations of things that existed before.148 The “flash of creative genius” test required some sort of an epiphany149 that simply does not happen for the vast majority of innovations. For this reason, Congress intended to make the courts friendlier toward patents and promote real-world innovative processes by eliminating this new strict “departure.”150

The drafters set out with this mindset to eliminate the “flash of creative genius” test. Federico, in his original draft, devoted an entire paragraph to this challenge which read: “Patentability as to this condition shall be determined by the nature of the contribution to the advancement of the art, and not by the nature of the mental processes by which such contribution may have been accomplished.”151 The term “mental processes” clearly would limit the prohibition on inquiry to only what was going on in the inventor’s mind, leaving open both non-mental human processes152 and all non-human processes for investigation.153 As mentioned before, the intention of this section was to eliminate recent “departures” from the historical laws on patentability, departures by regional circuit courts that usually looked into mental processes. A prohibition on looking at mental processes had been in existence in patent law for several decades preceding the Patent Act of 1952, long before the “departures” that Congress was trying

149 See Great Atlantic & Pac. Tea Co. v. Supermarket Equip. Corp., 340 U.S. 147, 155 n.1 (1950) for some examples of what the courts have interpreted “inventive genius” to mean over the years.
150 See Harris, supra note 139, at 679.
152 Manual labor might be an example of a non-mental human process.
153 If no human is involved it cannot be “mental.” See WEBSTER’S NEW TWENTIETH CENTURY DICTIONARY UNABRIDGED 1125 (2d ed. 1977) (definition of “mental”).
to eliminate.\textsuperscript{154} This historical prohibition contained an exception when the character of the invention was such that it “excluded the possibility of thought, design, ingenuity or labor having been exercised in its production, or exercised to any considerable extent.”\textsuperscript{155}

Thus, it is arguable that even though Federico had included a prohibition on examination of mental processes, this prohibition would have kept the historical exception because it predated the departures that the paragraph was designed to abolish.

The term “mental” was removed from later drafts and does not exist in the current second sentence of § 103.\textsuperscript{156} The reason it was taken out is unclear as no record has been found explaining this change.\textsuperscript{157} An argument can be made that because this was an intentional removal of a limitation that the broadest possible meaning must be given to the word “process”\textsuperscript{158} and its correct interpretation must be of the plain meaning of the word. The problem with this approach is that there are pieces of the history that may indicate that this is beyond the drafters’ intent.

The point of walking through all this detailed history is to show that § 103 was not developed in a vacuum. There were real-world pressures on the drafters and they were describing things in familiar ways to accomplish their urgent task. Their goal was to kill the “flash of creative genius” test. They had seen it arise from, more or less, casual

\textsuperscript{155} Id.
\textsuperscript{156} Rich, Why and How, supra note 103, at 189.
\textsuperscript{157} Federico had put the term in his first draft but it was already gone by the time H.R. 9133 was introduced 6 months later. Compare Staff of H. Comm. on the Judiciary, 81st Cong., Proposed Revision and Amendment of the Patent Laws 13 (Comm. Print 1950), with H.R. 9133, 81st Cong. (1950). It is known that this term was removed by the Coordinating Committee of the National Council of Patent Law Associations. Federico, supra note 118, at 94. If the explicit reason for this change is deemed important to find, a record of the Coordinating Committee is likely the only source that would contain it. This author has found no records from the drafters on the change at the Library of Congress or the Patent Office, nor any records of the Coordinating Committee.
\textsuperscript{158} Similarly, this broadening would arguably apply to the current term: “manner.”
phraseology and loose interpretations of those words.\textsuperscript{159} Recall that the drafters’ goal was to reestablish patentability for inventions that were the result of “long toil and experimentation.”\textsuperscript{160} The simplest way to do that was to remove conditional language and limitations that might give a hostile court enough leeway that they could still “depart” from the intended norm.

In the 1950s there were only two known methods to create substantial steps forward in innovation: toiled experimentation and true “flashes of creative genius.”\textsuperscript{161} The words of the second sentence were chosen only to bring back the innovations by toiled experimentation, as the drafters could not reasonably be expected to have even had a concept of another type. Judge Rich, over and over, discussed this second sentence only in terms of re-allowing patents for inventions created from long toil—he consistently described patentable inventions as arising from only flashes or toil.\textsuperscript{162} Thus, an inference can be made from the combination of this desire to reincentivize toiled experimentation with the pre-“flash” era exception which allowed a look into mental

\textsuperscript{159} See Sirilla & Rich, supra note 116, at 477-85.
\textsuperscript{160} H.R. REP. No. 82-1923, at 18 (1952) (Revision note).
\textsuperscript{161} Artificial invention technology did not exist yet. Also, remember that the “flash of creative genius” test did not kill off all patents, just the vast majority. It was still a possible, albeit uncommon, method of innovation.
\textsuperscript{162} Giles S. Rich, Interpretation of Section 103, 35 J. PAT. & TRADEMARK OFF. SOC’Y 307 (1953) (The second sentence states that patentability as to this requirement is not to be negatived by the manner in which the invention was made, that is, it is immaterial whether it resulted from long toil and experimentation or from a flash of genius.” This seems to be a rather clear indication of the intent of the second sentence. . . . The amazing interpretations which people are capable of putting on the language of the new act are a constant source of wonder to the people who wrote it.) (emphasis added); Giles S. Rich, Address on The Patent Act of 1952 at The New York Patent Law Association (Nov. 6, 1952) (“Finally, the last clause of Section 103 is intended to lay the ghost of the ‘flash of genius’ furore. [sic] It says, ‘Patentability shall not be negatived by the manner in which the invention was made.’ That is, long toil stands on an equal footing with flashes.”) (emphasis added); Giles S. Rich, Speech to Philadelphia Patent Law Association: Taking a New Look at Patents (Jan. 26, 1953) (Furthermore, the Courts need no longer be concerned with whether the invention was made by flash or by sweat (by research or by feminine(?) intuition), in view of the new provision, also in Sec. 103, that “Patentability shall not be negatived by the manner in which the invention was made.”) (emphasis added).
processes if the character of the invention excluded the possibility of such toil having been exercised, that even though the words of the statute may seem to clearly forbid any inquiry as to the inventive process, there still exists a prohibition on patents for things that required no toil or “flashes” to create. This inference matches perfectly with Giles Rich’s statement on the policy underlying the nonobviousness requirement, quoted above, that “we must also refrain from granting patents on those inventions which would arise . . . with only a nominal expenditure of time, effort, money or wit.” He would surely agree that as the world and technology changes, it will be necessary to revisit and update the patent laws from times-gone-by so that they will maintain usefulness in evolving times.  

C. Obvious Policy Failures

From the discussion above, two important things are now clear. The first is that it was the intention of the drafters of § 103 to reward inventors with a patent only where there was more than “a nominal expenditure of time, effort, money or wit.” The second is that under the laws drafted with that purpose, it is now possible to receive patent protection for inventions that were created with extremely little time, effort, money, or wit by using artificial invention processes. Thus, the current codification of § 103 is no longer able to serve its intended purpose if it continues to be interpreted as it is today.

The nonobviousness requirement itself is grounded in good policy: the promotion of innovation and the desire to reward inventors for hard work that they may not undertake but for the prospect of a patent.\textsuperscript{164} However, the complete purposeful ignorance of the method of invention by the Patent Office and the courts makes little sense in this day and age. Looking back to the history of where this requirement came from, it is clear that it was a reactionary measure that was done in a way that avoided debate which may have yielded a more complete economic analysis. Other commentators have recognized this deficiency in other high-technology contexts and have proposed a revisiting of the justification for the requirement by way of a complete economic analysis.\textsuperscript{165}

As then-attorney Giles Rich said to Congress in a hearing leading to the creation of the Patent Act of 1952, “[y]ou don’t want to grant patents to every trifling advance in an art that any skilled mechanic could produce the minute the problem was presented to him.”\textsuperscript{166} If artificial creation systems advance as predicted, that is exactly what could happen under the current law. The fact of the matter is nonobvious inventions (under the current interpretation) can now be created without toiled experimentation or flashes of creative genius. This is simply something that the drafters did not anticipate.

\textsuperscript{164} See Sirilla & Rich, supra note 116, at 557.
\textsuperscript{165} Rebecca S. Eisenberg, Analyze This: A Law and Economics Agenda for the Patent System, 53 Vand. L. Rev. 2081, 2092-93 (2000) (noting how the routine task of high-throughput DNA sequencing consistently yields patentable results).
V. Potential Solutions

The problem of patent laws not being able to keep up with current technology is not new. Seemingly with each new breakthrough, fundamental concepts have to be bent or stretched to work in the new era. Unlike previous technological revolutions, though, we are now at a point where creation itself may no longer require human effort, rendering many of the current laws unworkable or illogical. This section proposes a few solutions to attempt to harmonize the American patent system with this new era of innovation. This section will present and analyze 3 types of potential solutions, always with a desire to promote innovation and the use of artificial inventive processes: A) special rules for inventions created with artificial invention processes, B) patent law reformation ideas, and C) a fundamental rethinking of the patent system.

A. Special Rules

1. Inventorship

Given the extensive overview of the problems inherent with even trying to determine who the “inventor” is for purposes of applying for a patent, it is clear that new rules are needed to bring this basic concept up-to-date. The United States is unique in having a first-to-invent system and this first solution will attempt to preserve that philosophy.

“Invention” under the United States patent system requires conception and reduction to practice.\textsuperscript{167} Because reduction to practice is not really a creative process, and because the act of filing a patent application qualifies as constructive reduction to

practice,\textsuperscript{168} this does not seem to be a problem with artificial creation systems. Conception, on the other hand, is a major issue. A third issue is that an inventor must be a human because patents cannot be granted to any other entity.\textsuperscript{169} The result is that a person may be a legal inventor simply because he was in the room at the right time when the machine concluded its calculations.

To address these problems, a simple solution can be employed. As the law currently stands, an inventor is one who conceives or contributes to conception.\textsuperscript{170} Because conception does not occur when an artificial creation system is used until the invention is revealed at the end, a person may be entitled to “inventor” status without having done any work towards the invention whatsoever. Thus, a solution would be to relax the requirements for conception.

The proposal is to, first, maintain the current definition of conception but change it from a hard-line rule to a rebuttable presumption in one circumstance. That is, if a person is first to conceive of the full embodiment of the invention, she is still the inventor as would be found under the current law unless a specific event occurs. The one circumstance that would enable the rebutting of the presumption is if a potential inventor notifies the Patent Office that he intends to use a creativity-augmenting method to solve a problem before actually beginning computations with such a system. This notification need be nothing more than a simple alert that such a system is going to be used and what problem it is going to be used to solve. The Patent Office would then just keep this notification on file under this “preliminary applicant’s” name (and other identifying information) to be used at a later time if need be.

\textsuperscript{168} Id.
\textsuperscript{169} Vertinsky & Rice, \textit{supra} note 64, at 585.
\textsuperscript{170} \textit{See} Fiers v. Revel, 984 F.2d 1164, 1168 (Fed. Cir. 1993).
The importance of the notification comes into play if an inventorship challenge arises later on by the preliminary applicant. In such a circumstance, the applicant under the classic definition of “conception” is still presumed to be the inventor, but the preliminary applicant may now present evidence to show that he was the one who identified the problem, chose the creativity-augmentation method, set up the machine, calculated parameters, actually proceeded the way he described in the original notification, and other facts that demonstrate that he was the one actively trying to innovate. On a case-by-case basis, the Patent Office can make a determination as to whether the preliminary applicant met whatever threshold it deems necessary to take over as the true inventor.

This solution has several benefits. First, it preserves most of the current precedent and laws that the Patent Office and courts are used to applying. By only adding one specific incidence when traditional notions of conception may be challenged, there should not be too much upheaval within these tribunals. Second, it gives the applicant an incentive to disclose the use of artificial creation mechanisms, putting the Patent Office on notice that such a system has been used, and allowing them to be able to examine the resulting application in light of this. Third, it provides would-be inventors reassurance that they will still be entitled to the invention in spite of the technicalities of the patent law. Of course there are other ways that the preliminary applicant could preserve his rights, such as through a contract, but this provides a safety net.
2. Obviousness

A well-known proposal to fix the nonobviousness requirement in the face of artificial creation technologies is to update the standard from a person having ordinary skill to a person having ordinary skill “and a computer on her desktop equipped with the kind of artificial invention software commonly used by inventors in the same field”\textsuperscript{171}. This solution would clearly allow examiners and courts to consider what a person \textit{could} produce using artificial invention technologies and compare whatever the subject matter in question was against that. This solution still does not, however, permit the Patent Office or the courts to inquire as to the actual inventive processes that the applicant used. Instead, it assumes that every applicant that comes to the Patent Office could have used an artificial inventive system if that is what would have been common in their field.

This solution has a large potential negative side effect. It will likely continue to cause the use of artificial creation systems to be purposefully kept secret. It could also open the door to the slight possibility that, in certain industries where patent protection is seen as highly valuable (such as pharmaceuticals),\textsuperscript{172} tacit agreements to \textit{not} use artificial invention techniques may be made, at least until current research and development projects are complete. So, when they go to the Patent Office they will have the benefit of not being judged against what someone could have made with an artificial creation process. The negative side effect is that it could discourage the use of artificial creation techniques and hamper innovation. Given the examples of the huge improvements that artificial evolutionary techniques have been able to create over the last few years, inhibiting this, especially in the pharmaceuticals, would unnecessarily delay the benefit to

\textsuperscript{171} \textsc{Plotkin}, \textit{supra} note 6, at 110.
\textsuperscript{172} \textsc{Burk} & \textsc{Lemley}, \textit{supra} note 40, at 49.
the public from these innovations. The biggest problem is this solution still does not require disclosure of the use of artificial creation techniques, leaving the factual basis for any decisions left largely to guesswork.

B. Patent Law Reformation

1. A Better Solution: Encouraged Disclosure

The problem with artificial creation systems is not the technology itself. The patent system has been able to adapt to new technologies and developments in inventive processes for much of its history. However, because of the second sentence of § 103, the Patent Office and the courts are going to be unable to address the issues brought on by artificial creation systems effectively and thus their ability to adapt will be hampered. As discussed above, there is good policy behind this sentence. But, the world is different now and it may be time to lift the outright ban on considering inventive processes. Before going down that road, which carries the risk of unintended and unforeseen consequences, it would be wise to get a better handle on whether there really is an issue that undermines the patent system.

As of right now, there has been one known patent granted for an artificial creation product.173 This is publicly known because one of the inventors, an electrical engineering professor at Stanford University who specializes in evolutionary computing research, has been open about the process he used by publishing papers on it as well as even filing for a patent on the artificial creation method itself.174 A reading of this documentation reveals that the process was certainly not the easy task of just asking a computer a question and

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174 See id.; PLOTKIN, supra note 6, at 1. The patent on the artificial creation method he used is U.S. Patent no. 7,117,186 (issued October 3, 2006).
having the computer figure everything out from there.\textsuperscript{175} It was an involved process that required significant programming expertise and a good handle on the subject matter being developed. It does not appear that anything about this patent rises to a level where it would implicate any of the problems with patenting artificial creation products that were outlined before.

That being said, one of the only reasons that the public knows how this invention was created is that the inventor volunteered the information in the interest of furthering knowledge in the study of evolutionary computing. Without this kind of openness from inventors, there is no way to know how these systems are being used. It is possible that there have been other inventions patented that used artificial creation processes that the public does not know about. However, it is currently impossible to know the number or how those processes worked. Thus, any present attempt to change the law to account for artificial creation systems will necessarily be based on extrapolation and speculation and could just be a solution looking for a problem.

The prudent thing to do now is to develop a mechanism to collect data on how artificial creation systems are being used to create inventions where patent protection is sought. Then, after sufficient data has been collected, policy makers will be able to base their decisions on the realities of the technology. This article proposes that a new program of “encouraged disclosure” can help achieve this goal.

The proposed Encouraged Disclosure Program (Program) is designed to create incentives for inventors to disclose their inventive processes to the Patent Office, at the time of filing an application, without risking the validity of their patents. The Program will have a built-in time limit, at the end of which the collected data will be summarized.

\textsuperscript{175} See Plotkin, supra note 6, at 55-59.
and presented to the public so that policy makers, members of industry, and any other entity that has an interest will be able to see the trends in the use of artificial creation systems. The collected data will be evaluated to determine if sufficient information was gathered to draw conclusions from. If it becomes clear at this point that artificial creation systems are indeed on their way to becoming autonomous solution machines, then lawmakers should be able to better see the problems that they pose for the patent system, and begin the process of reforming the laws accordingly. If, on the other hand, it becomes clear that artificial creation systems will not pose a problem or, based on the data, the public decides that it is not bothered by their use in patentable inventions, lawmakers can decide to take no action on the matter. Either way, the decisions will be more likely to be based on facts rather than conjecture. If the results are inconclusive, the Program can be modified and extended for another set period of time. The data collected by the Program will not be intended as a replacement for conventional methods of studying industry trends, but rather a supplement.

The time limit should be long enough to allow for developments in the technology to progress enough that trends can be seen. The time limit will also serve to allow for a period for comment and debate on the issue in the public, well in advance of a lawmaking procedure. This will put everyone on notice that this is an issue that is of concern and that there may be significant changes to the law ahead. This will hopefully result in more proactive solutions to the potential legal problems. It should also be long enough to discourage potential patentees from trying to “wait it out” in the hope of the process reverting to what it is today. Based on these criteria, a time period of around 15 years
would probably be sufficient.\textsuperscript{176} In the event that this technology progresses more rapidly than predicted and more immediate problems become apparent, there should be some provision that makes it clear that Congress may act before the time limit expires if it is deemed necessary. The purpose of the time limit and the whole Program is not to inhibit lawmaking, but to enhance it.

a. The Program

There are two components of the Program: disclosure and incentive. This section will discuss possible levels of disclosure and present four incentives in order of increasing consequence. Each incentive description will also contain a discussion of major legal hurdles and possible methods of overcoming them in order to implement the Program.

The purpose of the Program is to collect useful data on the status of the use of artificial creation systems by prospective patentees. The level of disclosure could range anywhere from a simple checkbox on a patent application all the way to a full disclosure of everything they used, how the systems work, the data they gathered, etc. The greater the level of disclosure, the more likely the data gathered will be useful. The disclosures will be a part of the original filing of an application. They will be reviewed early on in the Patent Office to determine whether they adequately disclose the inventive method used. Obviously, if the level of required disclosure is just a checkbox indicating that an

\textsuperscript{176} This number is just provided as a starting place. It was calculated based on Moore’s Law which states that processing power doubles every two years. Based on this law alone, it is expected that in 15 years, computer processing will be about 4,096 times as powerful as the system used for the lone patented artificial invention. This may seem too long to wait, but, again, this technology is still in its infancy and is still greatly dependent on human coding. 15 years should allow for the software programming side to advance to a degree where it should become more apparent whether artificial creation systems have the capability of becoming autonomous invention machines. For charts and further explanation of increasing processing power vs. real-world artificial creation products, refer to: Koza, supra note 30, at 274-75.
artificial creation system was used, the process of determining adequacy will not be too intensive. For more detailed disclosure levels, what constitutes an “adequate” disclosure should be left up to the Patent Office because it likely has the resources and expertise to make determinations on what is and is not a useful disclosure.

In order to encourage applicants to disclose their inventive processes, there should be an incentive. Because this disclosure cannot be used to determine patentability, other types of incentives need to be considered.

The first level is to just have an optional survey for applicants. This level does not provide much incentive, besides an appeal to applicants to voluntarily help out the Patent Office. The data collected from this level will likely be minimal.

The second level of incentive is “priority examination.” The Patent Office generally examines applications in the order they are received. Under the priority examination incentive, applications that include disclosures of inventive processes will be moved up in line, similar to current Petitions to Make Special. The prospect of an expedited application should provide a decent incentive to disclose. Many applicants will not want to be at the back of the line and so, if enough applicants take advantage of this procedure, this could become an incentive to be a part of the “normal” patent queue. Under this incentive, applications would be examined in the following order: 1) those granted special status with inventive disclosures, 2) those granted special status without disclosure, 3) regular applications with disclosures, and 4) regular applications without disclosures. Thus, the changes to current Patent Office procedures would be minimal and this should be something that it already knows how to do.

177 MPEP § 708.02
To implement this incentive, it may not be necessary to initiate a rulemaking procedure. Currently, under the patent rules, there are a few enumerated categories of applications that qualify for advanced examination. The Patent Office has the authority to "establish regulations, not inconsistent with law, which . . . shall govern the conduct of proceedings in the Office." Patent Office rule changes must comply with Administrative Procedure Act (APA) informal rulemaking procedures unless the proposed rule falls into an exception. Rules of agency procedure or practice are excepted. Adding applications that include inventive process disclosures to the list of categories that qualify for advanced examination would likely be considered a rule concerning agency procedure and is not inconsistent with any provision of the Patent Act. Thus it should fall into the exception allowing this rule to be made without informal rulemaking. However, a rule may not even be necessary as the current patent rules also provide the Director of the Patent and Trademark Office (Director) discretion to allow other, non-enumerated application types to be eligible for special status if the Director believes it is justified. The Director has exercised this authority to allow special status to extend to applications for AIDS treatments, biotechnology inventions by small entities, cases where actual infringement is currently happening, among other things. So, the Director could recognize the potential looming problems with artificial creation systems, and allow applications with disclosures to qualify for advanced examination. The

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180 Id. at 2124.
182 37 C.F.R. § 1.102(a) (2011).
183 See MPEP § 708.02.
Director may also exercise this authority to expedite the business of the Patent Office.\textsuperscript{184} An argument could be made that since the primary business of the Patent Office is to execute the patent policy of the United States, and because the Program will enable a faster resolution of an issue that implicates the basis of that policy, that allowing applications with inventive disclosures to be moved up in line to incentivize disclosure will, in fact, expedite the business of the Patent Office in the long term. This argument is likely unnecessary though, since the Director can allow special status under the other provision. This procedure should be easy to implement and there are several options to do it.

Once these applications are deemed acceptable for advanced examination, a few other changes need to be made to Patent Office procedures. Right now, special status applications are all treated the same under MPEP § 708.02(a). This incentive is not meant to cause all applications with disclosures to be entitled to current special status procedures. Thus, the procedures need to be modified to incorporate the order of examination outlined above. This way, applications that qualify for special status under the current rules will still be near the front of the line. If these applications contain disclosures, an effort should be made to examine them first. Applications that are not entitled to special status under the current rules should also not be entitled to the full expedited application process outlined in the MPEP, but rather simply moved ahead of applications without disclosures. Attempting to provide the full expedited examination procedure to these applications will likely be infeasible because it will overburden the Patent Office.

\textsuperscript{184} 37 C.F.R. § 1.102(a) (2011).
In the event that this does not work, it will be necessary to undertake an informal rulemaking procedure under the APA to create a new rule for advanced examination of applications with inventive process disclosures. This very common procedure is outlined in § 553 of the APA and will not be discussed except to point out that this route would probably take more time than the method above.\textsuperscript{185}

The third level of incentive is more substantial. This will be termed the “Extra Patent Term” incentive. Under this incentive, the term for patents that are filed without disclosure will be shorter than they are now. Patents filed with disclosures will have extra years tacked on. The applicant still has the option to receive patent protection without disclosing inventive processes. However, in order to get the full available patent term, the applicant must disclose the inventive process. The reduction from the current term should not be so severe that it effectively eliminates the value of having a patent. It should also not be so short that there is no real incentive to disclose. A term of somewhere between 14 and 17 years for patents without disclosures and 20 years for patents with disclosures may make for a good balance of these considerations. Some study and discussion would be required to determine the actual terms under this plan, but these numbers give a starting point. At 17 years, there is only a 15% decrease in the non-disclosure patent term. In many industries, particularly the ones with the resources to have early access to artificial creation systems, those three years may be quite valuable. But, in other industries, three years may not make any difference because the market has moved on from their product. A larger difference would create a larger incentive. Even though the new patent period may seem to reduce the force of some patents, this should not run afoul of the second sentence of § 103 of the Patent Act because it does not affect

\textsuperscript{185} See 5 U.S.C. § 553.
patentability and the “manner in which the invention is made” is not being considered. The new term becomes the base term and patents that contain disclosures receive extra term.

Implementing this incentive will require significantly more work than priority examination. The Patent Act explicitly states that a utility patent has a term of 20 years from the date of filing. Thus, reducing the term would require an Act of Congress. Language would need to be added to the Patent Act that identifies what an inventive disclosure is, set the term for patents lacking this disclosure to the reduced term, and state that patents containing a disclosure are entitled to the full term of 20 years. After Congress has passed this law, the Patent Office will likely need to develop its own rules to execute it. This process would likely require the APA informal rulemaking procedure. At the conclusion of this process, this strong incentive would be in place.

The fourth level is the most significant incentive. At this level, the disclosure becomes a requirement for a complete application. While this is not really an “encouraged” disclosure anymore, it is included here as the top-end of the incentive spectrum while still not requiring a re-writing of § 103 of the Patent Act. The incentive provided by having a required disclosure is that if the applicant wants patent protection, he must disclose. The disclosure will still not be used to determine patentability, but just to meet a requirement to begin patent prosecution. To prevent a potential loss of right by inadequate disclosure at the time of application, failure to disclose will be treated like

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187 Otherwise, the rule would be inconsistent with the law, thus exceeding the scope of the Patent Office’s statutory authority.
188 Rules would be required to “implement” the new statute, necessitating APA procedures. See Mack, supra note 179, at 2124-25.
failures to pay application fees or file oaths and result in a Notice of Missing Parts\textsuperscript{189} being sent to the applicant that must be responded to in order to begin prosecution. An application without an adequate disclosure at the time of filing will still be given a filing date.

This strongest incentive will also require Congressional action. The Patent Act specifies what is required in a patent application in § 111.\textsuperscript{190} Because these inventive disclosures are to be kept separate from the application content used to determine patentability and because it is not intended for a failure to disclose to affect the filing date, it seems most appropriate to describe the requirement for disclosure with other application requirements that are treated similarly. These are the fee and oath requirements. Thus, the “Fee and oath” and “Failure to submit” subsections of § 111(a) should be amended to include the inventive disclosure requirement. This way it will be clear how these disclosures are meant to be treated. Following this Congressional action, the Patent Office will need to amend its rules on completed applications to incorporate the new statutory provisions.\textsuperscript{191} Again, this process would likely require an APA rulemaking procedure.

In summation, the more incentive provided to disclose, the more difficult it will be to implement. On top of the legal hurdles, the greater disclosure incentives will likely receive greater resistance from industry because they require more work from applicants to receive the same patent rights that they enjoy today.

\textsuperscript{189} See e.g., MPEP § 601.01(a); MPEP § 602.05(a); MPEP § 607.
\textsuperscript{190} 35 U.S.C. § 111.
\textsuperscript{191} The procedural rules are contained in 37 C.F.R. § 1.53(f) (2011) and the rules regarding fees associated with late filing of missing parts are contained in 37 C.F.R. § 1.16(f) (2011).
No matter which incentive is chosen, there will also need to be a “grandfathering” provision that protects patentees that disclosed their inventive processes from having their patents invalidated due to the process they used if the second sentence of § 103 is ultimately changed. This will be needed to make it clear that these disclosures will not have any effect on patentability and that if the law is changed, it will not be applied retroactively. This should alleviate fears of applicants and further encourage them to disclose.

A penalty for inadequate disclosures should also be considered. Under the required disclosure incentive, a hefty penalty is built in: no patent. However, under the other incentives, there is the potential that valuable Patent Office resources could be wasted on reviewing inadequate disclosures and the applicant still walks away with a patent, albeit without the benefit of the incentive. The penalty should be a fee that is assessed if an applicant attempts to take advantage of the incentive and either fails to correct the disclosure or decides to change to the non-disclosure route. This way, the Patent Office may be able to recoup some of its wasted resources. This is not a necessary addition to the Program, but it should be considered.

b. Advantages and Disadvantages

There are several advantages and disadvantages to the Program. On the positive side, the Program allows time for comment and research before substantive changes to the law are to be made. The Program provides a mechanism that does not currently exist to try to gather data on what inventive processes are being used for inventions where patent protection is sought. Because, under the Program, the research is tied to patent
applications, this will have the unique ability to give real insight into the inventive processes behind patents. The data from these disclosures will give the public a greater understanding of the inventions that it has granted monopoly rights for, thus adding more value to the *quid pro quo* bargain of the patent system. Another benefit this will have to the public is that these disclosures will be useful in determining the level of ordinary skill for obviousness analysis of other patent applications. Meaning that while the inventive process cannot be used to negate the patent it is disclosed in, these disclosures will help in building a better understanding of what the level of ordinary skill is in various fields.

The Program is not without its disadvantages. To start with, the implementation of this program will signal to innovators that changes in the law may be ahead. This could create uncertainty in the market as innovators may be unwilling to undertake costly research and development until they see what the ultimate outcome of the Program is going to be.

The major drawback to the Program will be increased costs. Greater disclosure requirements will result in higher costs for both the applicant and the Patent Office. Processing disclosures will require time and manpower. This processing cost should be low because the Patent Office only needs to determine whether the disclosures are adequate. Disclosures through the Program will explicitly not have any effect on patentability, so there is no need to do extensive analysis on them. That being said, this will increase the workload in an already overburdened Patent Office and, depending on the level of disclosure required, additional fees may be necessary to offset the cost of reviewing them for adequacy.
This disclosure will also increase the costs to the patent applicant. These costs will include potential increased fees to the Patent Office and also the increased cost of having to write the disclosure. Again, these costs will depend on the level of disclosure required. For small entities, this increased cost in patent prosecution may be relatively significant. An increase in cost runs a slight risk of discouraging innovation as some inventors may not be willing to undertake research and development for fear that they will not be able to afford to pay for more expensive patent prosecution.

The largest cost will be the increased risk of inequitable conduct activity. As will be explained in Section VI, inequitable conduct can seemingly be found in any communication with the Patent Office, regardless of its relevance to patentability. Adding another piece of communication will raise this risk. The prospect of added inequitable conduct risk will likely lead many applicants to refrain from disclosing. On the other hand, if the incentive is attractive, they may over-disclose to avoid inequitable conduct, and place a larger burden on the Patent Office. To top it off, more money will have to go to patent attorneys to write and review disclosures to ensure compliance with inequitable conduct doctrine. The risk of inequitable conduct and cost to avoid it may be high enough to prevent the Program from gaining industry support. Therefore, inequitable conduct reform is also recommended and will be addressed in Section VI.

After weighing the pros and cons of the four incentive options, it appears that the priority examination incentive with moderately-detailed disclosures would be the best to pursue in the short term. There are several reasons for this. First, it should not require significant lawmaking action, making it easy to implement. Second, the Program should be considered a first step towards a new understanding of “invention,” and priority
examination for inventive disclosures is a small step that should not put undue pressures on patent applicants. The current state of artificial creation technology does not appear to be at a point where immediate action is needed. The incentive level can always be escalated if the Program is renewed. In 10 to 15 years, this technology may begin to approach autonomy. At that point, the public would have over a decade’s worth of inventive process data from which to decide to either escalate the Program or review the laws. The data would certainly be incomplete, but this option would prevent significant upheaval in the patent system in the short term, allowing industry and the public to begin thinking about the implications of this technology without any immediate ramifications. The more severe options, while likely to produce better data, require Congressional action, making them significantly more difficult to implement. Thus, at this early stage, it seems best to take a small step building data that can be used in a later Congressional proceeding on the larger issues, reducing the need to go to Congress for action more than once.

At this point, it is important to remember the purpose of the Program: to facilitate fact gathering for more sound future legislative action. Because the use of artificial creation systems may undermine the patent system, and because “bad facts make bad law,” it should be a high priority to get solid facts. There is a risk of future legislation being based on speculation or, maybe worse, a reaction to a flood of artificial creation patents. The potential for the Program to mitigate that risk should be valuable enough to offset the disadvantages.
2. Inventorship

The problems determining which person is the “inventor” that were outlined earlier could be partially eliminated by changing to a “first-to-file” system. A first-to-file system is a system where whichever inventor gets to the Patent Office first to file for a patent on an invention will be the only person entitled to the patent. Most other developed countries use this system. The push to move to a first-to-file system in the United States has been growing steadily for many years.\(^\text{192}\) A move to a first-to-file system would bring the United States in line with foreign systems and may be a step towards a global patent system.\(^\text{193}\)

Currently, Congress is attempting to change from the current first-to-invent system to a “first-inventor-to-file”\(^\text{194}\) system. Changing to this system eliminates interferences because now all that matters is the filing date, not the invention date. First-inventor-to-file provisions are contained in S. 23\(^\text{195}\) and H.R. 1249,\(^\text{196}\) which have both been passed by their respective chambers. These bills, entitled the “America Invents Act,” are currently going to conference committee. All current predictions point to the first-inventor-to-file provisions being left intact and the President has stated that he will sign the bill when it emerges from conference.\(^\text{197}\) Thus, the concerns over interferences should be eliminated with the passage of this law.

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\(^{193}\) See id. at 26.


\(^{195}\) S. 23, 112th Cong. § 2 (2011).

\(^{196}\) H.R. 1249, 112th Cong. § 3 (2011).

However, the other concerns remain, and given the argument that there is no real “inventor” anyway when using an artificial inventive process, this may not be enough. A move to change the nomenclature in the patent application from “inventor” to “applicant” may alleviate confusion and perceived unfairness and should be considered as an easy change. Furthermore, Congress should consider providing better guidance on who the applicant should be. While S. 23 does provide a definition for “inventor” as the “individual . . . who invented . . .”, this is clearly not helpful. In the short term, it may be that this concept is still too abstract to try to legislate. If that is the case, the Program should help by illuminating the inventive process.

A suggestion that would eliminate the entire problem would be to no longer even require an “inventor” to be the applicant. An applicant could be anyone who had not stolen the idea from another and just leave it at that. This would enable the Inputter and Programmer to be named on the application if the Recipient tells them the invention and gives them permission to file for the patent, if for some reason they are unable to view the output directly from the machine themselves. Since, if these are three different people, it is this scenario that is most likely to occur anyway, this would make the law fit more with how artificial creation systems are used.

3. Rethink the Patent Laws

Once the public is armed with real data on the status of artificial creation systems, it will be time to rethink the patent laws as they are currently written. Recalling that the second sentence of § 103 was written specifically to kill the “flash of creative genius” test, it is time to revisit this sentence in modern times. First off, there is now the Federal 198 S. 23, 112th Cong. § 2 (2011).
Circuit which handles almost\textsuperscript{199} all appellate patent cases. This court only came into existence in 1982, 30 years after the Patent Act was drafted. The purpose of this new court was to provide uniformity in how the patent laws are interpreted.\textsuperscript{200} Since the creation of the Federal Circuit, there has been much evidence that uniformity in the patent laws is being achieved.\textsuperscript{201} Uniformity in the patent laws was also the purpose of the second sentence of § 103. The “flash of creative genius” test arose from departures that regional circuit courts had taken. Now that regional circuit courts do not have jurisdiction in most patent cases, the risk of any further “departures” is minimal.\textsuperscript{202} The Federal Circuit is made up of judges and law clerks that are well acquainted with current technology and the purpose of the patent laws: to promote innovation.\textsuperscript{203} This court can adapt to new technologies\textsuperscript{204} and, because of its experience in patent matters, is unlikely to resurrect the “flash of creative genius” test, or create some other anti-innovation test, if allowed to consider inventive processes. The second sentence of § 103 was written for a different era when “rogue” courts were a real concern in patent cases. That is not the case today.

Secondly, the sentence was written during a time when only two inventive processes were known: toiled experimentation and flashes of creative genius. After data has been gathered from the Program, it will be time to consider whether the invention method of using artificial creation systems, which theoretically requires neither toiled experimentation nor flashes, should be patentable. After this debate, Congress should

\textsuperscript{201} See id. at 711, 719-20, 728-35 (providing opinions and empirical data on uniformity due to the creation of the Federal Circuit).
\textsuperscript{202} See id. at 676-83.
\textsuperscript{203} See id.
\textsuperscript{204} Id. at 735.
make a decision on the language of the second sentence. If there is no apparent problem with artificial creation systems, it may decide to keep the broad language. It may also decide to modify the language, by defining what types of inventive methods lead to patentable inventions and what methods do not. Or, Congress could simply do away with the second sentence altogether and let the courts work through the problem. If Congress does decide that there is a new third inventive process that is unpatentable, it will need to lift the second sentence so that the courts can see whether there was toil or a flash.

While Congress is considering this and if “inventor” has not been adequately defined by previous Acts, it should also reconsider the idea of “conception.” The data gathered from the Program should be illustrative of the effort levels required to create patentable inventions in the modern world. These disclosures may demonstrate that much of the creative work is done on the front end—the identification of the problem. At this juncture, Congress could choose to define the conception requirement to better reflect where the true creative effort is. If not, the courts would still have some better data from which to hone the common law idea of conception.

By the same token, Congress should also reconsider what the invention actually is. Artificial creation systems may blur the line between inventive processes and the inventions themselves. With the data from the Program, Congress will be able to consider this. This may result in a new definition of enablement as well.

The bottom line is that after gathering data from the Program, Congress, the Patent Office, and the public will now have a tool to approach patent law reform that they did not have before. This will enable decisions based on fact, not fear.

205 Such as the America Invents Act.
C. Fundamental Rethinking of the Patent System Itself

The patent system has been in existence for hundreds of years.\textsuperscript{206} For much of that time, there has been very little questioning of the merits of the system as it has simply been assumed that it was necessary to protect innovation. Recently, however, there has been a growing body of research and scholarly work that indicates that the patent system itself is actually stifling innovation in many industries and that doing away with it altogether might better achieve the constitutional mandate “to promote the progress of science and useful arts.”\textsuperscript{207} Beyond historical and economic studies, empirical evidence gathered through computer simulations of competitive economic environments with human participants indicates that innovation rates are significantly higher in an environment without a patent system.\textsuperscript{208}

While the merits of the patent system as a whole are well beyond the scope of this article, as the debates to the fundamental necessity of the patent system as a whole heat up, it will be important to take into account the effect that artificial invention technologies will have on any future system. If most future innovation is really going in the direction of artificial creation processes, it may be that an elimination of patent restrictions might be the best way to promote innovation. One way or another, this issue is an issue that will continue to need consideration.

\textsuperscript{206} See Rich, Kettering Address, supra note 110, at 138.
\textsuperscript{207} See generally JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE (2008) (showing how patent rights do not provide expected economic return); MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY (2008) (arguing that competition has historically driven innovation better than intellectual property protection); DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2009) (demonstrating how usefulness of patent protection depends on industry); ERIC VON HIPPEL, DEMOCRATIZING INNOVATION (2005) (analyzing individuals’ personal justification for innovating themselves versus paying someone else to do it for them).
\textsuperscript{208} Andrew W. Torrance & Bill Tomlinson, Patents and the Regress of Useful Arts, 10 COLUM. SCI. & TECH. L. REV. 130, 167 (2009).
VI. The Elephant in the Room: Inequitable Conduct

The recurring theme in this article has been that with disclosure, many of the potential problems of artificial creation systems would come to light and either Congress or the courts would be able to handle them. The main solution presented in this article is one of “encouraged disclosure.” Any time a disclosure to the Patent Office is at issue, inequitable conduct is on the top of every practitioner’s mind and this solution certainly raises that issue.

A. The Plague of Inequitable Conduct

Given the problems of determining inventorship and obviousness, there may be a question of inequitable conduct for not disclosing the use of artificial creation systems to the Patent Office. As explained above, the prevailing thinking right now is that there is “no legal requirement to identify machine participants, regardless of the materiality of the role played by these machines.” Inequitable conduct claims do not arise though, unless the patent is the subject of litigation. These claims are raised commonly enough that they have been termed a “plague” on patent cases. Because the use of artificial invention processes is growing, it can be assumed that these inventions will be the subject of future litigation and that there will be inequitable conduct claims against the patent holders. Whether any of these claims will be with respect to the nondisclosure of the inventive process is impossible to know right now, but given the widespread use of the defense, it seems likely at some point. Because the widespread use of inequitable conduct as a

209 See generally 37 C.F.R. § 1.56 (the basic rule governing disclosures to the Patent Office).
210 Vertinsky & Rice, supra note 64, at 586.
211 Kingsdown Medical Consultants, Ltd. v. Hollister, Inc., 863 F.2d 867 (Fed. Cir. 1988) (“[T]he habit of charging inequitable conduct in almost every major patent case has become an absolute plague.”)
defense is a more recent development that applies to seemingly every area of patent law, this section will give an explanation of the more recent decisions that are still molding the law and show that, while the underlying problem of inequitable conduct claims will not be unique to artificial invention processes, the use of artificial creation systems will likely exacerbate the problems. This section will be a little different from the rest of the article because it is addressing a real, current problem with patent law and is not necessarily dependent on speculative facts. And, because inequitable conduct claims are directly tied to disclosures and statements made to the Patent Office, this is an issue that must be resolved for the primary solution of “encouraged disclosure” to be effective.

Monopolies are against public policy and because patents are meant to promote innovation, if a patent applicant commits fraud against the Patent Office in obtaining that patent, he will simultaneously lose the enforceability of the patent for inequitable conduct and be exposed to Sherman antitrust liability for having obtained an unlawful monopoly. The Federal Circuit has provided instructions for inequitable conduct analysis:

[An] inequitable conduct analysis is performed in two steps comprising “first, a determination of whether the withheld reference meets a threshold level of materiality and intent to mislead, and second, a weighing of the materiality and intent in light of all the circumstances to determine whether the applicant’s conduct is so culpable that the patent should be held unenforceable.”

From this rule, there are two elements that need to be established in order to find inequitable conduct: materiality and intent. The meaning of these terms is very difficult

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to discern and courts will often infer intent from materiality, eliminating the distinction between the two elements.

The confusion begins for an applicant at the Patent Office. The standard by which the PTO determines whether a prior art reference is material is governed by C.F.R. § 1.56(b). In 1992 this provision was amended to its current *objective* standard from its former *subjective* standard of what a “reasonable examiner” would deem material. While this might seem to have helped reduce confusion because an applicant now has an objective basis from which to look at whether a reference is material or not, it has actually increased confusion because the Federal Circuit has not adopted the same standard. Thus, in the current state of affairs, the standard for whether a specific reference is material or not is quite different at the time of application than it is during litigation. Indeed, the question of whether something is material or not and the problem of this dual standard has been examined at length by many commentators.

The question of intent is also quite nebulous as a recent line of cases exemplifies. In *Ferring*, the Federal Circuit explained that, on the issue of intent, a finding of inequitable conduct is appropriate where “(1) the applicant knew of the information; (2) the applicant knew or should have known of the materiality of the information; and (3) the applicant has not provided a credible explanation for the withholding.” In this case, the court found that the patentee had engaged in inequitable conduct when it submitted expert declarations as to the definition of “peroral” from declarants that were

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214 37 C.F.R. § 1.56(b)
216 Id. at 272.
218 Ferring, 437 F.3d 1181, 1191.
former employees and persons who had received research funding from the patentee and not disclosing this potential bias to the Patent Office.\textsuperscript{219} As the dissent pointed out, the court came to this conclusion despite the fact that the expert declaration, which simply aided in providing the meaning of an ordinary term, was not even considered by the Patent Office when it came to actually issuing the patent.\textsuperscript{220} Thus, the fact that the patentee did not mention that the declarant, who provided an effectively meaningless declaration when it came to the validity of the patent, happened to be someone that used to receive funds from the patentee was enough to rise to the level of “intent to deceive” for the court to hold the entire patent unenforceable for inequitable conduct.

The strongly worded dissent in \textit{Ferring} chastised the majority for ignoring the objective rules set forth in the earlier \textit{Kingsdown} case and deciding that deceptive intent must be inferred without any evidence to that effect.\textsuperscript{221} Notwithstanding the requirement that this element be proved by clear and convincing evidence, the majority relied on adverse inferences and presumptions that the patentee intended to deceive because it did not disclose that it had provided funding for its expert in the past.\textsuperscript{222} From an objective standpoint, the dissent seems more reasonable, as it is difficult to see how the court could have rationally found that this extremely minor omission amounted to material fraud on the Patent Office.

The Federal Circuit seemed to move back the other way toward a more restrictive interpretation in \textit{Star Scientific} where it laid out the rule that even though district courts may infer facts supporting an intent to deceive from indirect evidence, that inference

\begin{footnotesize}
\textsuperscript{219} \textit{Id.}
\textsuperscript{220} \textit{Id.} at 1197 (Newman, J., dissenting).
\textsuperscript{221} \textit{Id.} at 1198.
\textsuperscript{222} \textit{Id.}
\end{footnotesize}
must nevertheless be the single most reasonable inference to be drawn.\textsuperscript{223} Thus, in this case, the court is trying to tighten the reins on inequitable conduct because in earlier cases it seemed that as long as an inference of intent to deceive could be drawn, it was enough.

Yet, the court again seemed to revert back to the broader inequitable conduct doctrine when it decided Larson. In this case, the court applied essentially the same standard for finding intent to deceive from the Ferring case. The concurrence in this case stated that the majority had already diverged from the principles set down in Star Scientific by inferring that the patentee had intent to deceive based on the fact that it should have known that the information was material.\textsuperscript{224} Judge Linn explained that there were many other inferences that could also have been drawn and that the fact that the patentee should have known that something was material was not enough for the single most reasonable inference to be drawn that the patentee omitted it with intent to deceive.\textsuperscript{225} The fact that this case came just one year after Star Scientific exemplifies the problem of inconsistency with current inequitable conduct law.

Another case which exemplifies the unpredictability of the current inequitable conduct doctrine is Aventis.\textsuperscript{226} In this case, the court held a patent unenforceable because the patentee had failed to disclose the fact that it used different dosage levels for an experiment that the Patent Office had asked it to run than the levels in the prior art.\textsuperscript{227} In a dissent, Judge Rader indicated that the recent trend in inequitable conduct cases had placed too much of an emphasis on the materiality prong of the analysis and have often

\begin{footnotes}
\textsuperscript{223} Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 537 F.3d 1357, 1368 (Fed. Cir. 2008).
\textsuperscript{224} Larson Manufacturing Co. v. Aluminart Products Ltd., 559 F.3d 1317, 1344 (Fed. Cir. 2009) (Linn, J., concurring).
\textsuperscript{225} Id.
\textsuperscript{226} Aventis Pharma S.A. v. Amphastar Pharms., Inc., 525 F.3d 1334 (Fed. Cir. 2008).
\textsuperscript{227} Id. at 1341.
\end{footnotes}
ignored the requirement to find intent. He opined that the patentee’s actions in this case looked more like a good faith mistake than a purposeful act with the intent to deceive the Patent Office. The fact that such a seemingly insignificant, and correctable, error was enough for a finding of inequitable conduct is troublesome. Other, earlier cases have indicated that if a patentee acted with minimal culpability or in good faith that it would be inequitable to strike the patent down, thus requiring a finding of intent to deceive. That being the case, it would seem that the dissent in Aventis was more correct in applying the law.

In Nilssen, the Federal Circuit struck down a perfectly valid patent because the patentee incorrectly claimed small entity status and priority benefits. First off, the patentee never relied on the priority benefit claims to try to swear behind other prior art in this case, so this has no bearing on the validity of the patent. Second, the fact that the patentee incorrectly claimed to be a small entity also has no bearing whatsoever on patentability. The law on inequitable conduct encompasses any misrepresentation to the Patent Office. Nevertheless, in the case of small entity status, it is difficult to understand how this could serve the purpose of promoting better, more fully examined patents. The discrepancy with small entity status could easily have been remedied by charging the patentee the correct fee rate.

McKesson was yet another case where deceptive intent was found for seemingly innocuous conduct. In this case, the patentee was held to have engaged in inequitable conduct for having failed to “inform the examiner of the examiner's grant of a related

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228 Id. at 1350.
229 Id. at 1351.
230 Star Scientific, 537 F.3d 1357, 1366.
231 Nilssen v. Osram Sylvania, Inc., 504 F.3d 1223, 1235 (Fed. Cir. 2007).
case of common parentage a few months earlier, a case that was examined by the same
examiner and whose existence has previously been explicitly pointed out by the same
applicant.\textsuperscript{232} The dissent in this case again tried to point to the \textit{Kingsdown} decision and
require clear and convincing evidence of intent to deceive, not evidence of mistake.\textsuperscript{233}
Notwithstanding, once again we see a case where the inequitable conduct doctrine strikes
down another patent because of purely Draconian rules.

There are a few cases that may mitigate the widespread abuse of the inequitable
conduct doctrine. In \textit{Rohm}, the Federal Circuit laid out steps that a patentee who had
been charged with inequitable conduct could take to “cure” it and thus keep his patent
intact.\textsuperscript{234} Of course, this is a much older case and does not seem to have had any
appreciable impact on the state of things. A very recent case, the recent Supreme Court
decision of \textit{Ashcroft v. Iqbal}, requires that pleadings relating to inequitable conduct, such
as fraud or mistake to be pled with particularity.\textsuperscript{235} This may have some impact on
inequitable conduct problems because now the defendants in patent suits will have to tie
their claims of inequitable conduct to specific evidence at the outset.

The duty to report material information to the Patent Office that the applicant
should know about appears to be expanding also. In the recently vacated decision,
awaiting rehearing, of \textit{Taffas v. Doll}, the Federal Circuit explained current rules requiring
a preexamination prior art search to be done by the applicant when there are many claims
in an application.\textsuperscript{236} Such a preexamination search requires the applicant to examine not

\textsuperscript{232} McKesson Info. Solutions, Inc. v. Bridge Med., Inc., 487 F.3d 897 (Fed. Cir. 2007) (Newman, J.,
dissenting).
\textsuperscript{233} \textit{Id}.
\textsuperscript{234} Rohm and Haas Co. v. Crystal Chemical Co., 722 F.2d 1556, 1572 (Fed. Cir. 1983).
\textsuperscript{236} Tafas v. Doll, 559 F.3d 1345, 1357 (Fed. Cir. 2009) (vacated).
only patents but non-patent literature as well. The court described such a search as not necessarily needing to be a world-wide library tour, but a thorough search nonetheless under the current patent laws. Considering the extremely liberal standards that are applied to determinations as to what could constitute prior art under the current patent laws, it would seem that the duty imposed on applicants to perform preexamination searches requires them to find and disclose pretty much anything that a court would consider to be prior art in an invalidity action. Thus, because of this rule, the door is open for inequitable conduct charges against patent applicants who fail to disclose some relevant prior art because they had not performed an exhaustive search before examination.

As can be seen from this small sampling of cases, the state of inequitable conduct in patent litigation is quite volatile. And so, even though it is widely believed that how an invention was made does not need to be disclosed to the Patent Office, there is a risk that a court may nevertheless deem that information material and at least entertain an inequitable conduct claim based on its withholding. After all, there are many decisions above that show courts finding inequitable conduct for withholding information that had nothing to do with patentability. At the same time, if inventive processes are disclosed, that also opens the door for inequitable conduct findings. Thus, this problem affects artificial invention patents whether there is a required disclosure or not. The problems of

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237 Id.
238 Id.
239 See, e.g., In re Hall, 782 F.2d 897 (Fed Cir. 1986) (finding a single doctoral thesis, written in German, on file in one library in Germany was sufficiently accessible to a person exercising reasonable diligence). Given the ease with which many of these searches can be done on the Internet now, if such a document were placed in an online catalog, the courts would certainly find something like this to be well within the scope of a reasonable search.
inequitable conduct determinations are a major problem in patent law today and need to be solved.

B. Curing the Plague

1. Therasense

On May 25, 2011, the Federal Circuit decided *Therasense v. Becton*, an *en banc* decision in an inequitable conduct case that should solve most of these problems. The court made four significant changes to the way that inequitable conduct cases will be evaluated. First, and most importantly, the court has established a but-for test for the materiality of references for a finding of inequitable conduct. Now a reference is only material if the Patent Office would not have allowed a claim had it known of the withheld reference. By doing so, it rejected adopting the Patent Office’s objective criteria in 37 C.F.R. § 1.56. Second, the court included an “egregious misconduct” exception to this general rule that allows materiality to be found for affirmative actions, such as filing an “unmistakably false affidavit,” among other things. Third, the court reasserted the requirement of specific intent to deceive the Patent Office, where even gross negligence is not enough for egregiousness. Fourth, the court untied materiality from intent and firmly established them as separate requirements. In response to this case, the Patent

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243 Id.
244 Id. at *14.
245 Id. at *12-13.
246 Id. at *9. This is a reassertion of the earlier *Kingsdown*(supra note 211) case. Johnston, supra note 241, at 15.
247 Id. at *10.
Office issued a Notice of Proposed Rulemaking on July 21, 2011 to revise its rules and bring them in line with the *Therasense* decision.\footnote{248}{Johnston, *supra* note 241, at 16.}

These four changes do a great deal to solve the problems identified in the last section. There are several concerns though. First, this was a split decision with only six out of eleven judges joining the majority. Seeing as how the court has seemed to flip-flop on inequitable conduct issues for the last few decades, there may be a legitimate concern that this ruling will not endure. On that note, there is a belief that the Supreme Court may grant *certiorari* in the next month on this case and overturn a significant part of it.\footnote{249}{Id. at 17.} Another concern pointed out by commentators is that the new rules will not actually solve the problems of inequitable conduct because the “egregious conduct” exception is “so great it will swallow the whole.”\footnote{250}{Id. at 16.} Given all of this, it is still too early to know how these holdings will play out in the long run.

### 2. Congress

Because of the volatility of the courts and the importance of ending inequitable conduct abuse, it may be necessary for Congress to step in. This section will provide an analysis of one idea that could fix inequitable conduct based on 6 factors: 1) uniformity & predictability on materiality; 2) uniformity & predictability on intent; 3) separation of intent and materiality findings; 4) flexibility in sanctions; 5) efficiency at the PTO; and 6) reduced costs to litigation.
Because of inequitable conduct’s legal and policy origins in antitrust law,\textsuperscript{251} it is time to reunite them. The inequitable conduct doctrine is predicated on the fact that a patentee who commits fraud on the Patent Office has been wrongfully granted uncontestable monopoly power for the duration of the patent.\textsuperscript{252} Antitrust law has a long and developed history in dealing with wrongful monopolies. The application of the inequitable conduct doctrine is inconsistent, likely due to the fact that, over time, judges have been too focused on the science and not on the underlying economic principles of patent cases.\textsuperscript{253} This has caused them, at times, to seemingly forget about antitrust issues altogether.

Congress should enact legislation that mandates a return to the original founding principles of the doctrine. In so doing, Congress can also clean up the mess created by years of warped concepts of “inequity.”

Therefore, to greatly reduce uncertainty and reestablish inequitable conduct as a rule against anti-competitiveness, Congress should draft legislation that includes language that establishes the following standards:

1) The \textit{current} objective materiality standard of C.F.R. § 1.56(b) should be the materiality standard for all inequitable conduct proceedings.

2) The standard of proof for intent must be separated from a sliding-scale with materiality and raised to a common law fraud level.

3) A finding of inequitable conduct that does not affect patent validity shall not result in the unenforceability of that patent. Instead, an appropriate fine may be levied.

\textsuperscript{251} Walker Process, 382 U.S. 179-80 (Harlan, J., concurring).
\textsuperscript{252} Id.
4) A finding of inequitable conduct which invalidates one or more claims of a patent shall result in a finding of fraud on the Patent Office and trigger antitrust liability.

In terms of uniformity and predictability on the materiality issue, item 1 solves that by mandating the current objective Patent Office rule. As to uniformity and predictability on intent, by couching this in antitrust terms in item 2, the standard of intent rises to fraud levels which are well defined in antitrust laws and are high enough to avoid the slew of inequitable conduct claims based on mistake or good faith error. Items 3 and 4 are there to provide a court with flexibility when it comes to deciding on a remedy for inequitable conduct. For lesser, but nevertheless purposeful, deceptions against the Patent Office, the court may fine the patentee instead of being forced to strip him of his patent. For example, in the case where inequitable conduct was found because the patentee incorrectly declared himself a small entity, instead of killing the patent, the court could now simply fine the patentee for the difference and even include some punitive amount if it deemed this necessary. Item 4 is meant to provide a bigger stick against those who purposefully deceive the Patent Office into wrongfully granting them a monopoly. In the United States, public policy is currently strongly against monopolies and they are subject to antitrust liability. A wrongfully granted patent should be treated no differently. This provision forces antitrust analysis of all wrongfully granted patents. Given the potential threat of treble damages in this situation, it should serve as an effective deterrent against those who would try to defraud the public. These rules will help increase efficiency at the Patent Office because now applicants will know the exact standard for materiality and not have to fear that their patents will be held unenforceable
due to errors that do not affect validity. They still face the threat of a fine if they lie to the Patent Office, and so this should prevent them from being overly blasé about communications with the Patent Office. At the same time, though, they should now feel comfortable enough to not feel the need to flood the office with anything that might be relevant to anything that they have said to the Patent Office. These provisions will dramatically reduce litigation expenses. By requiring a heightened standard of intent, the inequitable conduct defense will be much harder to plead, given the new particularity requirements.

This solution to inequitable conduct problems in general, should have the effect of stabilizing the doctrine so that, regardless what the ultimate fate of the second sentence of § 103 is, potential patentees can be more sure of their patents and thus more willing to disclose their inventions to the public. Whether it be from *Therasense* or Congressional action, inequitable conduct reform is crucial to the effective implementation and industry support of the Program. Without it, the risk associated with additional disclosure will likely outweigh the benefits of all but the strongest incentives.

VII. Conclusion

As technological ages pass, the patent system endures with the mission of promoting innovation. Every so often, something happens that requires a reexamination of this system to ensure that it is still fulfilling its purpose. The rise of artificial creation systems is such an event.

Not only are the current patent laws ill-equipped to handle the practical problems of evaluating inventions from artificial creation systems, but they were also crafted in an
era where artificial creation was not even a possibility, let alone a concern. This yielded good laws for their simpler time, but that time has passed. With patents potentially being granted for inventions that require neither toiled experimentation nor flashes of creative genius, laws written with only those two inventive processes in mind are obsolete. It may be time to untie the hands of the Patent Office and the courts so they can adapt to this new technology.

The time has come for the United States to decide whether these types of inventions necessitate patent protection for their proliferation. In order to do that, it is important to know what artificial creation technology is actually capable of and how it is actually being used. A question that is often asked regarding potential problems caused by artificial creation systems is “how is their use any different from employing a technician to help or even using a calculator?” Encouraging disclosure of inventive processes now should provide some of these answers. Some of the other solutions would put the United States more in line with international jurisdictions, making this also a good time to reevaluate the United States’ place in the international patent community. The time is ripe and it is best to begin to think about these issues now before larger problems arise.

Advancements from artificial creation technology hold much potential and it should behoove us to promote its use. Like the drafters in 1952, we are unable to see into the future. But with the right kind of forward-thinking, we too should be able to draft a patent law that survives for another half century.
Appendix

In order to understand the legal implications of these emerging technologies, it is important to have a solid grasp on how they work. An intricate knowledge of computer programming is not entirely necessary for this, at least on a theoretical level. A system may be properly classified as an artificial creation system, for the purposes of this article, if it exhibits problem-solving capabilities that yield specific inventive solutions without direct guidance from a human controller. This is a purposefully broad definition because it must incorporate a wide variety of technologies, both existing and future. This section will provide a few examples of the main areas of currently developing technologies and how they are being used for creative problem solving today. Note that there are other cutting-edge technologies not described here, like neural networks and agent-based systems, and that real-world artificial creation systems can utilize any combination of these technologies.

I. “Traditional” Artificial Intelligence

Traditional Artificial Intelligence (AI) may be the most widely known type of these technologies. The goal of traditional AI is to emulate how the human brain solves problems by hardcoding, into a computer program, all the logical steps that a human would follow in attacking a problem. A very rudimentary example of a traditional AI system would be something like a “20 Questions” game where the machine has pre-programmed steps (questions) to follow in order to try to arrive at the solution.

Traditional AI systems have never been successful for three main reasons. First, to achieve something that truly is able to emulate human thought, it has been found to

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\[ ^a \text{NOVA: Smartest Machine on Earth} \] [hereinafter NOVA] (PBS television broadcast Feb. 9, 2011).
require an unfeasibly large program that would be able to account for enough possible contingencies to make it work. Second and highly related to the first, the entirety of the code, processes, and solutions are all human-created, raising the question as to whether there was any artificial intelligence at all. Third, advances in neuroscience, psychology, and other brain sciences have demonstrated that the human brain processes things in a much different and more complex manner than any of these attempts could even begin to approach. For these reasons, the focus has shifted away from traditional AI for inventive problem solving applications. Even so, the description of this technology is included because it is the most familiar, provides a basis for comparison, and the lessons learned from it can still be used in other methods.

II. Knowledge-Based Expert Systems

In February 2011, an IBM computer system known as “Watson” captured the world’s imagination by beating the two most famous human champions on the game show Jeopardy! Watson was a knowledge-based expert system. This means, in essence, that the computer system has a vast library of information at its disposal and has dynamic methods (machine learning, for example) of searching that library for answers. At the outset, this might sound like just a search engine, but it is much more than searching for keywords.

b See id.
d NOVA, supra note a.
f See John R. Koza, Human-Competitive Results Produced by Genetic Programming, 11 Genetic Programming and Evolvable Machines 251, 252 (2010).
Perhaps the best way to explain how a knowledge-based expert system works is to briefly explain how Watson answers *Jeopardy!* questions. Without complicating matters with too much detail, there are two basic interrelated components to Watson’s processes. First, Watson must be able to understand the question that is being asked, which is usually given in a highly-nuanced natural language format common to *Jeopardy!* Once Watson has an idea of what it is looking for, its next task is to search for the answer and, once found, structure it in a way that is responsive to the question. For a human, these are near-instantaneous, natural tasks. Machines, on the other hand, have a very difficult time performing these tasks without the benefit of human experience to provide context and precise instructions.\(^6\)

The first component is known as “natural language processing.” This essentially means that the computer is able to understand what the user wants it to do from normal human speech. This alone is a remarkably complicated process. The English language is rife with ambiguities that we humans may not notice. For example, the question “Where is the White House?” may seem very simple at first glance, but it is the type of question that poses a real challenge for natural language processing.\(^7\)

For a computer to understand this question, first it must determine what kind of answer would be responsive: a location. We know this because of the word “where” in the question. If the question had been worded “What is the location of the White House?” the computer would have to know that this question is equivalent. With little effort, one can come up with a multitude of ways that this same basic question can be asked.

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\(^6\) See *NOVA*, supra note a (citation for entire paragraph).

\(^7\) See id. (citation for entire paragraph).
The term “White House” poses obvious problems too. First, the computer must know that the word “white” is connected with the word “house.” If it figures that out, it must also somehow be able to know that the question is asking about the White House and not some other house that is white, the city of White House, TN, or even the retail store White House | Black Market.

Assuming that the computer is able to understand these basics of the question, it must also be able to figure out how precise the answer needs to be. After all, Washington, D.C., 1600 Pennsylvania Ave., United States, the Universe, 38°53′51.61″N, 77°2′11.58″W and ‘not in Cliff Clavin’s kitchen’ are all technically correct answers.

For a traditional AI system to be able to account for all these possible variations, they would each have to be coded individually, an infeasible task for true natural language processing. This is where machine learning comes in to play. To process the White House question, humans may rely on contextual clues and their own experience. Thus, one method of avoiding the problems of traditional AI is to provide the machine with the ability to learn from experience. The programmers at IBM did this by first coding Watson with basic language rules like ‘every sentence requires a subject and a verb’ and defining what those are and how they work. They added code that enabled Watson to create its own rules based on patterns or other observations that it might make later on. Then, they gave Watson a large database of old Jeopardy! questions, answers, and supporting evidence for the answers and let it figure out the patterns on its own. After many thousands of cycles, Watson began to develop an “intuition” for what each question was getting at, signifying true machine learning. This way, when presented with
a novel question, Watson could apply what it had learned to figure out what the most important parts of the question were.\(^1\)

This leads to the second main component of the Watson system: the search for an answer. Watson had an enormous library of information at its disposal, including all of Wikipedia, the Internet Movie Database, dictionaries, news articles, and even full literary texts like Shakespeare and the Bible. Watson’s search for an answer usually began with what it had determined were key words, phrases, and relationships within a question. Watson would search this library looking for similar patterns to what it had learned previously. If it found something that seemed to match, it would take this answer back to the beginning and create a hypothesis that this was indeed the answer. Watson would then begin the search process again using this hypothesis as part of its search to see if the evidence gathered from this new search continued to pertain to the original question. This process would be repeated enough times for Watson to develop a confidence level for several competing hypotheses. If this confidence level was greater than some value,\(^j\) Watson would attempt to answer the question.\(^k\)

After learning whether it had answered correctly, Watson was able to adjust its searching technique on later questions. If it had answered correctly, it would prioritize the algorithms that led to the correct answer. Conversely, if it answered incorrectly, it was able to not only prioritize the algorithms that yielded the unchosen correct hypotheses, but also to take the correct answer and quickly run the pattern recognition cycle described above to try to learn new patterns on-the-fly. In this way, even in the

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\(^1\) See id. (citation for entire paragraph).
\(^j\) The minimum confidence level was a dynamic value that was dependent on various in-game factors such as value of the question, current score in relation to other players, number of clues left on the board, and many other things.
\(^k\) See NOVA, supra note a (citation for entire paragraph).
most complicated question categories, Watson was able to adapt and correctly answer questions after getting a few wrong. Watson used a massive parallel processing architecture that enabled it to perform the entire search and confidence calculations in less than 3 seconds.¹

Watson was a knowledge-based expert system built for the singular purpose of answering *Jeopardy!* questions, but this same technology can be used for many other things. For example, the Watson system itself is currently being modified to help doctors in making diagnoses.² Watson’s general trivia libraries are being replaced with medical journals and Electronic Medical Records (EMR).³ The thought is that Watson will not only be able to give very quick diagnoses based on the entirety of medical knowledge (an already impossible task for humans), but also be able to suggest treatments that a human doctor could not come up with.⁴ This human limitation is not only due to the fact that it requires the ability to browse all previous medical texts, but also, and more importantly, because Watson does not have any human bias and is not hesitant to suggest things outside of normal medical training.⁵ In other words, Watson does not make any judgments as to the subjective craziness of any proposed treatment, but simply will provide what it deems to be the objectively best treatment based on everything that it has researched. The researchers involved in this project believe that this will be a watershed moment in medicine as many new treatments will be created using this process.⁶

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¹ See *id.* (citation for entire paragraph).
³ *Id.*
⁵ *Id.*
⁶ *Id.*
Knowledge-based expert systems are also being designed for use in business, finance, engineering, and other decision-making applications.¹ This technology is still in early stages of development, but as the search and natural language processing algorithms improve, the effectiveness and creativity of the solutions will also. It is only a matter of time before these systems become a part of everyday research and invention methods.

III. Evolutionary Computing

Even with the development of Watson, the most promising individual field of AI research currently is evolutionary computing. The main premise in evolutionary computing is that, instead of giving the computer huge amounts of program code and libraries of data from which to find and develop solutions, a computer should be able to come up with efficient solutions on its own given only very basic rules and the ability to do extremely large amounts of trial-and-error experimentation.² In a nutshell, evolutionary computing is the application of Darwinian principles and molecular evolutionary mechanics to computer science. While a full description of the mechanics of evolution is well outside of the scope of this article, some of the basics are critical to know in order to understand this technology and to appreciate the issues discussed later on.

A. Natural Evolution

1. Genotype-Phenotype Relationship

Every living organism has two fundamental characteristics: a phenotype and a genotype. The phenotype is the collection of observable characteristics of an organism. In overly simplistic terms, the phenotype is what the organism “looks” like. For example, a turtle with a shell and a turtle without a shell are two different phenotypes. Similarly, a yellow-and-black-striped tiger and a white-and-black-striped tiger are also different phenotypes. An animal with fins and an animal with legs are different phenotypes.

An organism’s genotype is simply its actual genetic code. So, again in overly simplistic terms, an organism with a DNA sequence of AATG has a different genotype from an organism with a DNA sequence of AATC.

To understand evolution, it is critical to understand the relationship between genotype and phenotype. An organism’s genotype may affect its phenotype, but not the other way around. For example, imagine that the 4-letter DNA sequence above is the DNA segment that codes for the wing color of a moth. Now pretend that all moths with the AATG sequence have red wings and all moths with the AATC sequence have black wings. Thus, if a person had a moth embryo with the AATG sequence, he would know that this moth would have red wings when it was fully grown. In this case there is phenotypic variation tied to genotypic variation. If this person were to somehow change the G to a C in the embryo’s DNA, this moth would grow up to have black wings. On the

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2 Id.
3 Id.
4 See id.
other hand, if this person were to paint the wings of a fully grown red-winged moth black, the moth’s DNA sequence would remain AATG.

To complicate matters further, organisms with different phenotypes may nevertheless have the same genotype and vice-versa. In the instance of the painted-winged moth, it now has a different phenotype from its brothers but it still has the same genotype. The other side of this is that not all genetic differences affect the phenotype. In the moth example, imagine a new third type of moth was discovered that looked identical to the red-winged moth but, instead of having AATG, it had ATTG as its wing color sequence. Now there are two genotypes tied to the same phenotype. There could be many reasons for this, and commonly it is simply that the genotypic variation is not in an expressive part of the gene sequence. In any event, it is clear that A->T in the second position has no effect on wing color and it is important to keep in mind that it may be possible that any other variation in the second position also has no effect.

2. Mechanics of Change

Now that the basics of genotype-phenotype relationships have been established, the actual process of evolution will be explained. To start with, it is important to define “evolution.” Evolution is, at its simplest level, genetic change resulting in phenotypic variation that persists though subsequent generations. This is frequently termed “descent with modification.” Going back to the moth hypothetical, if all moths originally had red wings and, at some point, black-winged moths came into existence, reproduced and made more black-winged moths that survived to reproductive age, evolution occurred.


The obvious question here is where did a black-winged moth come from in a world of only red-winged moths? The answer is that something must have caused its DNA to be different from its parents’. This section will describe the two primary ways that gene sequences can change: mutation and recombination.

A mutation is simply some change anywhere in a gene sequence that is not the result of recombination. For the purposes of this article, it is not necessary to know all the ways that mutations can happen. They can be caused by radiation, transcription error, and a variety of other things. Suffice it to say that they happen often and they happen randomly. In the case of the moth, the G could have become a C by simple mutation caused by an error on the part of the cellular machinery. It is important to note at this juncture that a mutation can be much more than simply swapping parts of sequences. There can also be deletions and insertions.²

The effect of a single mutation can be completely undetectable, as in the A→T example above, or be very dramatic. For example, there are small gene segments known as “stop codons” which represent the end of a given gene sequence and act as a signal to the cellular machinery telling it to literally stop reading the sequence at that point, ending the synthesis of whatever protein is encoded in the gene.³ If a mutation were to occur that alters this stop codon, it will completely change whatever that gene was encoding, perhaps rendering it useless or perhaps creating a brand new structure that performs some previously non-existent function.⁴ Without getting into the finer points of molecular biology, again, it is just important to know that a very small change can have a very dramatic effect, even changing the expression of an entire genomic code.

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² See RIDLEY, supra note x, at 27-30 (citation for entire paragraph).
³ See id.
⁴ Id.
No matter if the change is to just a single gene or the entire genome, if the change results in something observable, beyond just a change in DNA sequence, it creates a new phenotype. And, of course, if this phenotype persists as described above, evolution occurred.

The other primary mechanism by which change to a gene sequence can occur is through recombination. Recombination occurs during sexual reproduction. In the human context, when adults mate, they are each bringing in their own distinct DNA sequences, and their child’s DNA will be a combination of both parents’. Each parent’s DNA is distinct because of its own mutations and recombination from its parents. When these distinct DNA sequences combine in the child, this process is done fairly randomly as well. The result is that the child’s phenotype will usually be a combination of both parents’ phenotypes because the child has inherited genotypes for various traits from each parent. Furthermore, the process of recombination could match segments of unexpressed genes from both parents’ DNA (e.g., recessive genes) in a way that the genes are now expressed in the child’s phenotype. Thus, recombination is another significant source of genetic change.

3. Selection

The final component to understand evolution for the purposes of this article is selection. Selection is the force that drives evolution. The term “survival of the fittest” is

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dd Id.


ff See RIDLEY, supra note x, at 34-41.
often attributed to the process of natural selection.\textsuperscript{gg} An organism is more “fit” than other similar organisms if it possesses some phenotypic characteristic that affords it some reproductive advantage.\textsuperscript{hh} This rarely means that it is physically stronger than others, but instead can be the result of a large number of things.\textsuperscript{ii} For example, going back to the moths, the red-winged moth could be more visible to predators while the black-winged moths blend in with their environment better. This would mean that, over the course of time, the number of black moths may continue to increase by passing on their genotype while the red moths’ population begins to dwindle. In this instance, the black moths are more fit than the red moths. Contrariwise, if a mutation in the moth DNA were to create a phenotype of bright green polka dotted wings, making it more visible to predators than even the red moths, this trait would be selected against and moths with this characteristic would likely not survive into subsequent generations. As this process occurs, it is called natural selection. Because the black moths have survived for more than one generation, evolution occurred. Thus, this is an example of evolution by natural selection.

Selection does not need to be natural for evolution to occur, however. Many things that humans encounter in their day-to-day lives were produced through the process of evolution by artificial selection.\textsuperscript{jj} Some examples are domesticated dogs, corn, garden plants, and many other organisms.\textsuperscript{kk} For all of recorded history, humans have exploited the evolutionary process to create these things. They have done this by breeding

\textsuperscript{hh} See RIDLEY, supra note x, at 85-86.
\textsuperscript{ii} See Understanding Evolution, Survival of the Sneakiest, http://evolution.berkeley.edu/evolibrary/article/0_0_0/sneakermales_01 (last visited Apr. 1, 2011) (a humorous comic strip illustrating how being “sneaky” may be more advantageous than being strong).
organisms with favorable phenotypic variations with others to try to get that phenotype to carry over into the next generation. For example, if a human wants cold temperature-resistant dogs to pull a sled in the Arctic, he can take the thickest-coated dogs he has and have them mate. If this is done over and over for many generations, and all new dogs coming from this line have thick coats themselves, this is also due to a genotypic trait that has been passed on.

Lastly, it is critical to understand that there is usually not one single solution that will result from the evolutionary process, especially from natural selection. Because of the randomness of mutation and recombination, organisms can take divergent evolutionary paths. Generally speaking, this is why there is such a high level of biodiversity on this planet. This also leads to one more point which will just be mentioned here to illustrate that there is no one right answer from evolution. The graph below is a simplistic representation of the relative fitness of various hypothetical phenotypes in reference to only two genes.

![Figure 1: Genetic drift example](http://evolution.berkeley.edu/evolibrary/search/imagedetail.php?id=356)

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II See id.
The three peaks in this three-dimensional graph indicate phenotypes with high fitness levels while the valleys represent areas of low fitness. Thus, over time, one would expect an organism’s genotype to settle in an area that corresponds with one of the peaks. This does happen, however, the mechanics of evolution never stop. There is always going to be mutation and recombination occurring. These genetic changes can be enough to push an organism’s phenotype from one peak, through a valley, to another high fitness peak.\textsuperscript{nn} This is called “genetic drift” and is another major contributor to biodiversity. Thus, if given enough time, an already-fit species may nevertheless evolve into another fit species by way of natural selection.

B. Artificial Evolution

1. Process

After that crash course in evolutionary biology, evolutionary computing should now be much simpler to understand. Evolutionary computing is essentially everything that was just described put to work in a computer. Evolutionary computing systems usually solve problems by starting with an extremely simple “attempt” at a solution and, through brute force trial-and-error evolutionary processes, converge on more “fit” solutions.\textsuperscript{oo} In evolutionary computing, the phenotype is the “candidate solution” to a problem while the genotype is the computer code that yields the solution.\textsuperscript{pp} Thus, the evolutionary mechanics of mutation and recombination are performed on the computer code itself.

\textsuperscript{nn} Eiben, supra note s, at 5.
\textsuperscript{oo} Id. at 1.
\textsuperscript{pp} Id. at 18-19.
There are several ways that this process can occur in computers. Generally, there are 6 necessary components for an evolutionary system to function, each corresponding to some aspect of natural evolution. There must be a component that defines individual solutions, a function to determine each solution’s relative fitness, a function to keep track of the population of solutions, a mechanism to select “parent” solutions for recombination, functions to cause the actual variation from recombination and mutation, and a mechanism to select survivors in subsequent generations. For the system to run, there must also be a procedure to initialize it and some condition defined to terminate the process.

Each of these components can be integrated by a computer programmer in a wide variety of ways and so their specific coding details are not important for understanding this technology for the purposes of this article. It is important, however, to see how they interrelate and how an evolutionary system performs its processes from a high level. The basic process is as follows. First, the evolutionary system must be initialized, meaning that not only does it need to start, but it also needs a place to start. This starting place would be the initial candidate solution population. These first candidate solutions are usually randomly generated, extremely simple, and non functional. Before any evolutionary processes begin, the first candidate solutions (generation 0) are evaluated for fitness.

Candidate solutions with high relative fitness are then selected as “parents” for the next generation. The code for each of these solutions is then subjected to recombination.

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89 Id. at 18.
90 Id.
91 Id. at 23.
92 Koza, supra note f, at 271-73.
93 See EIBEN, supra note s, at 17.
and/or mutation to create the new genotypes of the next generation. These new candidate solutions are then evaluated again for relative fitness. Then, the candidates with the highest relative fitness are selected from this new generation and the process begins again.\textsuperscript{vv}

This cycle continues until some termination condition is met.\textsuperscript{ww} This condition can be a certain fitness level, when a specific number of generations has been reached (time), when a specified number of generations has passed without any change in fitness to the candidate solutions, or when the operator tells the machine to stop, among other things.\textsuperscript{xx} If the termination condition is just an arbitrary elapsed time period, the effects of genetic drift need to have special attention paid to them, as the current candidate solution could be residing in one of the “valleys” instead of at a “peak.”\textsuperscript{yy} Similarly, it is to be expected that if enough time has elapsed, more than one highly-fit solution has been represented at some point in the process.\textsuperscript{zz}

When this process is complete, the machine will have created an output solution to whatever the initial problem was. Recalling the necessary randomness of the evolutionary process and the fact that there is usually no single right answer, the output solution will likely be different every time that the system is run.\textsuperscript{aaa} Even if the system does come up with the same solution more than once, the way it got there is often different.

\textsuperscript{vv} See id. (citation for entire paragraph).
\textsuperscript{ww} Id. at 24.
\textsuperscript{xx} See id.
\textsuperscript{yy} See id. at 4-5.
\textsuperscript{zz} See id.
\textsuperscript{aaa} See ROBERT PLOTKIN, THE GENIE IN THE MACHINE 74-76 (2009).
It should be noted at this point that, while this process is often used to generate actual solutions, in the field of developmental genetic programming this process is actually used to generate the computer code itself for the construction of the candidate solutions. This means, essentially, that these programs are not only using brute force trial-and-error to find solutions, but also using brute force trial-and-error to find methods of finding solutions by re-writing themselves. Given this ability, it is possible for an evolutionary system to find effective solutions with only a tiny amount of input. As an example, if a developmental genetic program is used to design an electrical circuit, the initial structure can just be a single wire.

Speaking of the origin of the code, regardless of how much of it is machine-generated, in many cases of “native representation” programming a human programmer need not have any understanding, or even knowledge, of the mathematics or engineering methods of a given field in order to nevertheless successfully program an evolutionary system to solve the problem. Given this, not only may a complete novice-in-the-field programmer be able to construct an evolutionary system that will yield “human-competitive” results, but also that the same evolutionary system designed in this manner for solving problems in one field can readily be used to solve problems in another, vastly different, technical field with little-to-no reprogramming necessary.

bbb Koza, supra note f, at 265-68.
ccc Id. at 266.
ddd Id. at 269.
eee Id. at 270.
2. Results

The potential for evolutionary computing technology is astounding. It enables the user to conduct automatic brute force trial-and-error experimentation for literally millions of prototypes, which would previously be impossible to do in multiple human lifetimes, in a matter of days. Furthermore, an evolutionary system is not limited by human bias, enabling it to arrive at remarkably effective solutions that may never even be considered by a human designer because they often violate traditional design conventions. The following two pictures are an example of this:

![Figure 2: Satellite dish holder boom designs](image)

These are pictures of two different designs for a “satellite dish holder boom” for use on a satellite to hold a dish in place for communication with Earth. Stability and vibration resistance are critical design requirements for this application. The design on the left is the traditional human design for this structure. The design on the right is what an evolutionary computing system found to be the ideal configuration. Note the lack of symmetry and the weird twisted look to the whole thing. Because the computer was not limited by human bias, it was willing to suggest this as a solution. After testing this design, it was found to be 20,000% (twenty thousand) more effective than the human

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iii EIBEN, supra note s, at 10.

iii Id. at 11.
While this dramatic increase in effectiveness may come as a surprise initially, as one becomes more experienced with the use of evolutionary systems, this quickly becomes the expected outcome.

The benefits of using evolutionary computing systems have not gone unnoticed. Many industries have begun using these systems to develop current real-world solutions. Evolutionary systems have recently been used to design circuit boards, antennas, drugs, toothbrushes, and even art. Below is an example of a real world product of evolutionary systems:

![Evolution of X-Band antenna design](image)

This series of images shows the evolutionary process of an X-Band antenna now being used on the International Space Station which NASA engineers have said that they would never have come up with using human techniques.

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**hh** See *id.* at 10. (citation for entire paragraph).

**iii** Koza, *supra* note f, at 269.


**li** See *PLOTKIN*, *supra* note aaa, at 51.


**ooo** *PLOTKIN*, *supra* note aaa, at 1.
Even though the incredible potential for evolutionary computing has become well known, its use and development is still in its infancy. The idea for using natural evolutionary mechanics in a computer program was actually first thought up in 1948 but had been far too impractical for any useful result until very recently.\textsuperscript{ppp} While the increase in processing speeds have driven most other computing advancements, it was not until the advent of high-performance parallel processing that evolutionary systems really began to produce human-competitive results.\textsuperscript{qqq} As of May 25, 2010, there have been 76 known instances of human-competitive results from evolutionary computing systems, the first of which was in 1994.\textsuperscript{rrr} In 2005, the first patent was granted for an invention created by evolutionary computing system.\textsuperscript{sss} This result was obtained by running a 1,000-node Pentium II parallel processing machine for 29 days straight at 30 petacycles ($10^{15}$ cycles) per day.\textsuperscript{ttt} It stands to reason that, as computer technology and processing power continue to improve, more and more human-competitive results will be produced by evolutionary systems.\textsuperscript{uuu} It is probably just a matter of time before the use of these systems becomes widespread across industries and disciplines.\textsuperscript{vvv}

\textsuperscript{ppp} Koza, supra note f, at 252-54.
\textsuperscript{qqq} Id. at 274.
\textsuperscript{rrr} See id. at 254.
\textsuperscript{sss} Id. at 258.
\textsuperscript{ttt} Id. at 274-76.
\textsuperscript{uuu} Id. at 276-77.
\textsuperscript{vvv} Id.