**SYRACUSE JOURNAL OF SCIENCE & TECHNOLOGY LAW**

VOLUME 29 | FALL 2013 | ARTICLE 3, PAGE 113

# Artificial Intelligence and the Patent System: Can a New Tool Render a Once Patentable Idea Obvious?

**William Samore**

## I. Introduction

In the summer of 1956, leaders in the field of computer science met at Dartmouth College and founded the field of Artificial Intelligence.[1] Since then, one branch of Artificial Intelligence—Genetic Programming—has progressed to the point where it could drastically change the way that inventors design and create. Genetic programs (described in more detail in section III.B of this paper) operate by mimicking the biological evolutionary process[2] and have a wide variety of applications.[3] Antenna design, for example, is a field where genetic programming could radically change the nature and pace of innovation.[4] The first antennas were built in the late 1800's by Heinrich Hertz,[5] and an antenna with a specific shape can be designed

[1] *Dartmouth Conferences*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Dartmouth_conference (last visited Oct.23, 2013) (the founders proposed a study which was "to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.").

[2] Anne Eisenberg, What's Next; *When a Gizmo Can Invent a Gizmo*, N.Y. TIMES Nov. 25, 1999 at G9 *available at* http://www.nytimes.com/1999/11/25/technology/what-s-next-when-a-gizmo-can-invent-a-gizmo.html (Stating that genetic programs "solve problems by mimicking the principles of natural biological selection." *Id.*).

[3] *See id.* (listing genetic programming applications such as gas turbine, integrated circuit, and antenna design).

[4] Antenna technology is a good example here not only because of the dramatic ways that the tools that inventors have available to them have changed the way antennas can be designed, but because many antennas are patentable. In fact, the United States Patent and Trademark Office (hereinafter "the PTO"), in its classification system has a class for this: class 343 Communication: Radio Wave Antenna.

[5] *Antenna (radio)*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Antenna(radio) (last visited Oct. 24, 2013).

to emit a desired radiation pattern.[6] As technology progressed, computer programs were designed where an antenna's characteristics could be inputted to the computer program, and the radiation pattern would be calculated and displayed to the user.[7] Now, computer programs have gone one step further, making it possible to do the reverse: input a desired radiation pattern and have the computer program itself design the antenna.[8] The question that this note asks is, can changes in the tools available to inventors render previously patentable ideas obvious and therefore unpatentable?[9] In other words, should an antenna, which could only have been designed by a human at one point but now can be designed by a computer, be patentable?[10]

Part II introduces the reader to patent law. Part II.A discusses patent law in general, and includes an explanation of the derivation of patent rights. Part II.B then explains the legal concept of obviousness—the most relevant concept to patenting a device designed by a genetic program. Part III discusses relevant technological advances, particularly genetic programming. Next, Part IV argues that when genetic programming becomes widespread in a particular field, advances that could be created by the program should be deemed obvious. To provide a practical

[6] *Id*.

[7] A quick Google search of "antenna radiation pattern calculator" reveals a multitude of computer programs which can calculate radiation patterns for antennas.

[8] Anne Eisenberg, *What's Next; When a Gizmo Can Invent a Gizmo*, N.Y. TIMES Nov. 25, 1999 at G9 (satellite communications antenna designed).

[9] A separate very interesting question is: should the program itself, which designed the antenna, be patentable? *See* Peter M. Kohlhepp, *When the Invention Is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes*, 93 MINN. L. REV. 779 (2008) (arguing that a process, such as the computer program that designed the antenna, which produces unpredictable results, is not a process under the meaning of 35 U.S.C. § 101, and therefore is unpatentable.).

[10] It should be noted that genetic programs apply to far more than just antenna technology. *See infra* Part III.B.

application for this argument, Part IV.B sets forth a widespread use test. Part V addresses anticipated contra.

## II. Patent Law & Obviousness

### *A. Patent Law Fundamentals*

The United States Constitution grants Congress the power "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[11] Congress has exercised this power, with respect to technological advances, by enacting patent laws.[12] A patent does not give its owner the right to make or use the patented invention; rather, the patent gives its owner the right to exclude others from making or using the patented invention.[13] This right to exclude provides incentive for inventors to innovate and disclose their ideas to the public.[14]

Bringing ideas to the public domain is patent law's underlying purpose.[15] After an inventor has disclosed his idea to the public in exchange for the right to exclude for a limited time,[16] the patent expires and the public enjoys the benefit of unlimited use of the idea.[17]

---

[11] U.S. CONST. art. I, § 8, cl. 8.

[12] Patent law is governed by Title 35 of The United States Code.

[13] CRAIG A. NARD, THE LAW OF PATENTS 1-2 (2011).

[14] *Id*. at 3 ("[P]atent law can be viewed as a system of laws that offer a potential financial reward as an inducement to invent, to disclose technical information, to invest capital in the innovation process, and to facilitate efficient use and manufacturing of invention through licensing.").

[15] Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989) ("The ultimate goal of the patent system is to bring new designs and technologies into the public domain through disclosure"); Nard, *supra* note 13, at 3.

[16] Nard, *supra* note 13, at 3.

[17] *Bonito Boats*, 489 U.S. at 153 ("[A]n article on which the patent has expired[] is in the public domain and may be made and sold by whoever chooses to do so.").

To be patentable, an invention must be novel,[18] useful,[19] and nonobvious.[20] The novelty requirement precludes patentability when the invention is not new.[21] The utility requirement simply "mandates that the invention be operable to achieve useful results."[22] The nonobviousness requirement prohibits patentability when the "claimed invention as a whole would have been obvious."[23] Nonobviousness is explained in more detail in the following section as this requirement is the primary concern of this paper.[24]

### *B. § 103 obviousness*

Even if an invention is novel, an inventor may not obtain a patent if the invention is obvious.[25] While the obviousness requirement was originally created at common law,[26] it was

---

[18] 35 U.S.C. § 102 (2006).

[19] 35 U.S.C. § 101 (2006).

[20] 35 U.S.C. § 103 (2006).

[21] 35 U.S.C. § 102 (2006); *In re* Schreiber, 128 F.3d 1473, 1477 (Fed. Cir. 1997) ("To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently.").

[22] *In re Swartz*, 232 F.3d 862, 863 (Fed. Cir. 2000).

[23] Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1537 (Fed. Cir. 1983).

[24] Before leaving this section, it would be a mistake not to note that on September 16, 2011 the Leahy-Smith America Invents Act (hereinafter "the AIA") passed into law. *See* Leahy-Smith America Invents Act, H.R. 1249, 112th Cong. (2011) (enacted). While the AIA brought sweeping changes to many areas of patent law (*see Leahy-Smith America Invents Act*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Leahy-Smith_America_Invents_Act (last modified Sept. 22, 2013) (stating that the AIA, among other things, switches the patent system from a "first to invent" system to a "first to file" system, and "revises and expands post-grant procedures")), these changes do not substantially effect this note's topic. The main change from the AIA that does effect this note's topic is that obviousness under 35 U.S.C. § 103 is now determined at the time of filing rather than at the time of invention. This timeframe for obviousness determination will be discussed later in this paper.

[25] 35 U.S.C. § 103 (2006).

eventually codified in 35 U.S.C. § 103 by Congress in 1952.[27] The Supreme Court has expressed the opinion that the statute was intended to codify the existing case law.[28] 35 U.S.C. § 103 governs obviousness, stating:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.[29]

Importantly, the invention as a whole is evaluated for obviousness, not each individual element.

*1. Basic Application of Obviousness*

The Supreme Court established a framework for analyzing obviousness in *Graham v. John Deere Co.*[30] Under this framework, courts are to consider "the scope and content of the prior art,"[31] the "differences between the prior art and the claims at issue,"[32] and "the level of

[26] Hotchkiss v. Greenwood, 52 U.S. 248 (1851); *See* CRAIG A. NARD, THE LAW OF PATENTS 307 (2011) ("The *Hotchkiss* case is widely regarded as creating an additional patentability hurdle, above and beyond novelty and utility. This common law development . . . ").

[27] *See* Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 3 (1966) ("the Congress has for the first time expressly added a third statutory dimension to the two requirements of novelty and utility that had been the sole statutory test since the Patent Act of 1793. This is the test of obviousness . . . ").

[28] *Id*. at 3-4 ("We have concluded that the 1952 Act was intended to codify judicial precedents embracing the principle long ago announced by this Court in *Hotchkiss v. Greenwood* . . . ").

[29] 35 U.S.C. § 103 (1964).

[30] Graham v. John Deere Co. of Kansas City, 383 U.S. at 17 (1966); John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 61 (2007) (Stating that a "significant development in the Graham opinion was the establishment of a four-step framework for analyzing the obviousness question.").

[31] *Graham*, 383 U.S. at 17.

[32] *Id*.

ordinary skill in the pertinent art."[33] Further, the Court stated, "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented."[34] In terms of when to measure obviousness, it is important to note that obviousness is measured "before the effective filing date of the claimed invention."[35] In asking the question of how the tools of invention can affect patentability, the level of ordinary skill is by far the most important component of this analysis, and this will be discussed more fully in the following section. Secondary considerations are also pertinent and will be discussed below in Part II.B.3.

*2. Person Having Ordinary Skill in the Art (hereinafter "PHOSITA")*

Critical to the question of obviousness is how the PHOSITA is construed. There is a true paucity of case law on the topic of how to determine the PHOSITA. Nevertheless, construing the PHOSITA is essential to the question as to whether genetic algorithms can render an invention obvious.

In the 1983 case *Environmental Designs, Ltd. v. Union Oil Co. of California*, the Court of Appeals for the Federal Circuit (hereinafter "the Federal Circuit")[36] stated:

> Factors that may be considered in determining level of ordinary skill in the art include: (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

[33] *Graham*, 383 U.S. at 17.

[34] *Id*. at 17-18.

[35] 35 U.S.C. § 103 (2011).

[36] In patent cases, appeals go to the Federal Circuit rather than the regional circuit courts. *See Court Jurisdiction*, U.S FED. CIR., http://www.cafc.uscourts.gov/the-court/court-jurisdiction.html (last visited Jan. 8, 2013).

> which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.[37]

However, the Federal Circuit in *Environmental Designs* did not apply these factors since the parties did not dispute the PHOSITA's construction.[38] Other Federal Circuit cases mention the importance of determining the level of ordinary skill yet do not shed much light on how to interpret the PHOSITA.[39]

One of the only on-point cases that reasons through its PHOSITA analysis is *Daiichi Sankyo Co., Ltd. v. Apotex, Inc*.[40] In *Apotex*, the plaintiff's patent was "drawn to a method for treating bacterial ear infections by topically administering the antibiotic ofloxacin into the ear."[41] The district court had held that the PHOSITA would have a medical degree and would be either a pediatrician or a general practitioner.[42] However, the Federal Circuit reasoned that none of the

---

[37] Envtl. Designs, Ltd. v. Union Oil Co. of Cal., 713 F.2d 693, 696 (Fed. Cir. 1983) (Citing Orthopedic Equip.Co. v. All Orthopedic Appliances, Inc., 707 F.2d 1376, 1381–82 (Fed.Cir.1983)).

[38] Envtl. Designs, **7**13 F.2d at 697.

[39] *See, e.g.*, Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc., 707 F.2d at 1382 (Upholding the district courts finding that the PHOSITA was "an engineer having at least a few years of design experience working in the field of developing orthopedic soft goods," but not providing any evidence from the particular situation presented why the PHOSITA should be constructed this way.); Orthopedic Equip. Co. v. United States, 702 F.2d 1005 (Fed. Cir. 1983) (Not shedding much light on how to construct the PHOSITA besides listing some of the factors subsequently cited in *Environmental. Designs*, and stating, "[t]he individuals working in the art were of above average intelligence and educational training. Many possessed advanced university degrees."); Jacobson Bros., Inc. v. United States, 512 F.2d. 1065, 1070 (Ct. Cl. Nov. 6, 1974) (Listing some of the factors recited in *Environmental Designs* and stating, "[a] finite quantitative definition of this ordinarily skilled person is difficult at best.").

[40] Daiichi Sanko Co. v. Apotex, Inc., 501 F.3d 1254 (Fed. Cir. 2007).

[41] *Id*. at 1255.

[42] *Id.* at 1256.

inventors of the challenged patent had medical degrees.[43] Instead, they "were specialists in drug and ear treatments"—a research scientist and a university professor.[44] Further, the written description of the patent detailed the inventors' testing of their treatment on guinea pigs, which is not something a pediatrician or general practitioner would do.[45] Therefore, the Federal Circuit found that the district court had committed an error in construing the PHOSITA to be a general practitioner or pediatrician,[46] and instead construed the PHOSITA to be "a person engaged in developing pharmaceutical formulations and treatment methods for the ear."[47] The Federal Circuit found that the district court's use of the incorrect PHOSITA "tainted its obviousness analysis."[48] Based on the new PHOSITA, the Federal Circuit held that the patent was obvious.[49]

The search for additional precedent in constructing the PHOSITA turns up precious little. In *Ex Parte Hiyamizu*, the Board of Patent Appeals and Interferences (hereinafter "the BPAI") reviewed an Examiner's decision to construct a PHOSITA, in relation to a patent application for a semiconductor device, to be a person with a doctoral level degree.[50] The BPAI rejected the use of a degree in constructing the PHOSITA, stating, "[i]t is our view that such a hypothetical person is no more definable by way of credentials than is the hypothetical 'reasonably prudent

---

[43] *Id.* at 1257.

[44] *Id*.

[45] *Id*.

[46] Daiichi Sanko Co. v. Apotex, Inc., 501 F.3d 1254, 1257 (Fed. Cir. 2007).

[47] *Id.* at 1254.

[48] *Id*.

[49] *Id*. at 1259.

[50] Ex Parte Hiyamizu, 10 U.S.P.Q.2d 1393, 1394 (Bd. Pat. App. & Inter. 1988).

man' standard found in laws pertaining to negligence."[51] However, the BPAI did not go on to provide a framework on how to determine the PHOSITA.[52]

In sum, PHOSITA construction is a topic upon which there is a scarcity of case law. However, among what is available, *Apotex* provides the most complete analysis of the *Environmental Designs* factors. Therefore, the PHOSITA for this note's question will be constructed under the *Apotex* and *Environmental Designs* framework. Once the PHOSITA has been constructed, courts proceed to evaluate secondary considerations.

*3. Secondary Considerations*

In determining obviousness, the Supreme Court assesses several secondary considerations such "as commercial success, long felt but unsolved needs, failure of others, etc."[53] Further, courts consider unexpected results as a secondary consideration.[54] Secondary consideration arguments will often be raised in close cases of issues regarding obviousness.

Regarding commercial success, the Federal Circuit has explained: "Commercial success is relevant because the law presumes an idea would successfully have been brought to market sooner, in response to market forces, had the idea been obvious to persons skilled in the art."[55] In other words, if it was obvious, someone else would have already been in the market selling it, and it would have been harder to turn such a profit. However, commercial success may also be

[51] *Id*. at 1394.

[52] *See Id.*

[53] Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17-18 (1966).

[54] *In re* Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990) (Stating that the applicants "argument can consist of a comparison of test data showing that the claimed compositions possess unexpectedly improved properties or properties that the prior art does not have").

[55] Merck & Co., Inc. v. Teva Pharmaceuticals USA, Inc., 395 F.3d 1364, 1376 (Fed. Cir. 2005).

the product of advertising and marketing.[56] Therefore, for commercial success to count as evidence of nonobviousness there must be a nexus between the commercial success and the technical merits of the patented invention.[57] This battle to show a nexus was demonstrated in *J.T. Eaton & Co., Inc. v. Atlantic Paste & Glue Co.*[58] In this case, a patent for a "Stick-Em" glue mousetrap was challenged as obvious.[59] The patentee argued that the patent was not obvious because of commercial success.[60] The Federal Circuit ruled that the patentee had failed to establish the nexus between the patent and the commercial success because the sales data submitted was for a slightly different product than what the patent was directed to.[61] The Federal Circuit remanded the case to the district court to consider only sales data associated with the exact patented product.[62]

Courts also consider "long felt but unsolved needs [and the] failure of others."[63] Courts consider this because "[i]f people are clamoring for a solution, and the best minds do not find it

---

[56] Nard, *supra* note 13, at 375.

[57] *Id.*

[58] J.T. Eaton & Co., Inc. v. Atlantic Paste & Glue Co. 106 F.3d 1563 (Fed. Cir. 1997).

[59] *Id.*

[60] *Id.*

[61] *Id.*

[62] *Id.* (the Federal Circuit further stated, "[i]f a patentee makes the requisite showing of nexus between commercial success and the patented invention, the burden shifts to the challenger to prove that the commercial success is instead due to other factors extraneous to the patented invention, such as advertising or superior workmanship.").

[63] Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17 (1966).

for years, that is practical evidence…of the state of knowledge."[64] In other words, if it was obvious, someone would have already tried it. However, this secondary consideration must be viewed bearing in mind that the failure of others may simply have been due to other research priorities.[65] From a policy perspective, granting a patent for an idea that the marketplace needs furthers patent law's goal of bringing ideas to the marketplace. An example of the long felt need was shown in *Environmental Designs*.[66] In that case, the Federal Circuit considered legislative regulation controlling sulfur dioxide emissions as evidence of a long felt need for technology with reduced sulfur dioxide emissions.[67]

A final secondary consideration is unexpected results.[68] For example, the Federal Circuit considered unexpected results in the case *In re* Merck & Co.[69] There, a patent application for an antidepressant drug with sedative properties had been rejected as obvious by the PTO.[70] The prior art the PTO cited was another antidepressant drug with sedative properties and with only a slight chemical structural difference to the drug in the patent application.[71] The patent applicant argued that even though the chemical difference in the drugs was small, the patent should be

---

[64] *In re* Mahurkar Double Lumen Hemodialysis Catheter Patent Litig., 831 F. Supp. 1354, 1378 (N.D. Ill. 1993).

[65] NARD, *supra* note 13, at 376.

[66] 713 F.2d at 697-98.

[67] *Id.* (stating "the desire of governmental bodies to mandate higher purity standards was frustrated by lack of technology thus dramatizes the need.").

[68] *In re* Dillon, 919 F.2d at 692-93; *In re* Merck & Co., Inc., 800 F.2d 1091, 1098 (Fed. Cir. 1986) ("A prima facie case of obviousness can be rebutted by evidence of unexpected results.").

[69] 800 F.2d at 1098-99.

[70] *Id.* at 1092.

[71] *Id.* at 1096.

granted because there was a difference in sedative properties.[72] As evidence of this, the applicant submitted an article which compared the sedative properties of the two drugs.[73] In weighing all the evidence, the Federal Circuit rejected the applicant's argument because the article characterized the difference as only "somewhat less" sedative.[74]

## III. The Tools of Invention and Genetic Programs

### *A. The Increasing Prevalence of Computers in Research*

Computer programs simulate, among many other things, electronic circuits,[75] rocket propulsion,[76] and reactions in nuclear physics.[77] Scientists and inventors use computers more and more in their research.[78] But thus far, computers have mostly been used only to augment human ingenuity. Genetic programming (described in the following section), a branch of artificial

---

[72] *Id.* at 1098 ("In rebuttal of the PTO's prima facie case appellant has asserted that, as compared to [the prior art drug], [the present invention drug] unexpectedly has a more potent sedative and a stronger anticholingeric effect.").

[73] *In re* Merck Co., Inc., supra note 68, at 1098-99.

[74] *Id.* at 1099.

[75] *See, e.g.*, PARTSIM.COM, http:// www.partsim.com/ (last visited Dec. 7, 2013) (website providing a free circuit simulator).

[76] *See*, Balachandar Ramamurthy, Eliyahu Horowitz & Joseph R. Fragola, *Physical Simulation in Space Launcher Engine Risk Assessment*, Reliability and Maintainability Symposium (RAMS), 2010 Proceedings - Annual, vol., no., pp.1-6, 25-28 Jan. 2010.

[77] *See*, INTERACTIVE SIMULATIONS UNIVERSITY OF COLORADO AT BOULDER, http://phet.colorado.edu/en/simulation/nuclear-fission (last visited Jan. 8, 2013).

[78] George Johnson, *The World: In Silica Fertilization; All Science Is Computer Science*, N.Y. TIMES, Mar. 25 2001, (quoting a Dr. at a research institute as saying, "'Physics is almost entirely computational now.…Nobody would dream of doing these big accelerator experiments without a tremendous amount of computer power to analyze the data.'" And, "'Ten years ago biologists were very dismissive of the need for computation…Now they are aware that you can't really do biology without it.'").

intelligence, brings computers to the next level— one where computers may supplant human creativity and reduce the role that humans play in the invention process.[79]

### *B. Genetic Programs*

Genetic programming brings major changes to the future of invention.[80] Genetic programs operate by mimicking the evolutionary process.[81] For a simple genetic program, a user inputs a set of desired criteria. The genetic program then generates a random population of samples and selects some of the samples with criteria closest to the user's criteria. The program then randomly generates changes to these samples to create a new population and further selects the samples from the new population that are closest to the user's criteria. The procedure iterates until the desired criteria is reached.[82] To illustrate, if a genetic program is designing an antenna, the user would input a desired radiation pattern. The genetic program would then randomly generate ten antennas and select the antenna with the radiation pattern closest to the desired pattern. Using this antenna, the program would randomly generate slight changes in the antenna's shape and size to create a new population of ten antennas. From this new population, the

---

[79] *See, e.g.*, Liza Vertinsky & Todd M. Rice, *Thinking About Thinking Machines: Implications Of Machine Inventors For Patent Law*, 8 B.U. J. SCI. & TECH L. 574, 587 (2002) (Stating "the human role will increasingly be limited to identifying basic problem structures and evaluation criteria for results, and thinking machines will dominate the rest of the invention process.").

[80] *See* Kenneth Chang, *Hal, Call Your Office: Computers that Act Like Physicists*, N.Y. TIMES, Apr. 7, 2009, at D4; Eisenberg, *supra* note 2.

[81] *Genetic programming*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Genetic_programming (last visited Jan. 8, 2013).

[82] Method & Apparatus For Chem. Genetic Programming, U.S. Patent No. 7,610,154 (filed Jan. 27, 2005) (issued Oct. 27, 2009) ("The conventional genetic programming starts from a program consisting of randomly generated prescribed programming elements, and reproduces over generations a best fit program of each generation through genetic operations, so as to evolve the population."); *see also Genetic programming*, *supra* note 81.

program would then select the next antenna with a radiation pattern closest to the desired radiation pattern and repeat the process until it found an antenna with the desired pattern.

More advanced genetic programs may mimic additional aspects of the evolutionary process.[83] For example, in biological evolution, a newborn will have characteristics of both parents.[84] This is caused by a process called chromosomal crossover.[85] More advanced genetic programs can mimic this process.[86] Some genetic programs even generate populations with "offspring" based on three "parents."[87] Further, there are other biological evolutionary processes that genetic programs have imitated.[88] It is important to note that since genetic programs use random process (e.g. in selecting a first population and in mutating subsequent populations) the genetic program could make different designs using the same inputs each time it is run.[89]

---

[83] *See Genetic programming*, *supra* note 81.

[84] *See Chromosomal crossover*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Chromosomal_crossover (last visited Jan. 8, 2013).

[85] *Id.*

[86] *E.g.*, Zakir H. Ahmed, *Genetic Algorithm for the Traveling Salesman Problem Using Sequential Constructive Crossover Operator*, 3.6 International Journal of Biometric and Bioinformatics 96 (2010).

[87] *Crossover (genetic algorithm)*, WIKIPEDIA.ORG, http://en.wikipedia.org/wiki/Crossover_%28genetic_algorithm%29 (last visited Dec. 7, 2013).

[88] *See* Method and Apparatus for Automatic Synthesis, Placement & Routing of Complex Structures, U.S. Patent No. 6,424,959 (filed June 17, 1999)(a program mimicking s biological process that performs genetic operations on DNA) ("The present invention uses a population of entities which are evolved over a series of generations by an iterative process involving the application of operations, such as mutation, crossover, reproduction, and architecture-altering operations."); *Genetic programming*, *supra* note 81.

[89] *See* Kohlhepp, *supra* note 9, at 812 (Noting that when a genetic algorithm is used, for example to design a roof truss, that "[i]f the algorithm is run ten times, however, it will yield ten different roof truss designs.").

Genetic programming has been applied to solve many different kinds of problems. Jet engines[90] and antennas[91] have been designed by genetic programs. Fuel emissions for diesel engines have been optimized with genetic programming.[92] Classical music has been composed by a genetic program.[93] On the more theoretical side, scientists are using genetic programs to sift through data to discover fundamental laws of nature.[94]

The functionality of patented devices has been duplicated by devices designed by genetic programs.[95] For instance, a team lead by John Koza browsed patents and selected five patents on various electronic circuits issued after January 1, 2000.[96] They then used genetic programming to

---

[90] Ray Kurzweil, *The Virtual Thomas Edison*, TIME, Dec. 4, 2000, at 114.

[91] Anne Eisenberg, *What's Next*; *When a Gizmo Can Invent a Gizmo*, N.Y. TIMES, Nov. 25, 1999, at G9 (satellite communications antenna designed); Jonathon Keats, *John Koza Has Built an Invention Machine*, POPULAR SCI., May 1, 2006, at 72, 92 (antenna designed that looked like "bent paperclip").

[92] *Diesel Breeding: Looking Into Engines Helps Cross the Best with the Best*, 124 MECHANICAL ENGINEERING 53, Sept. 1, 2002, at 53 (Stating that using a genetic program to optimize engine design "resulted in a design that consumed 15 percent less fuel than a standard diesel engine while producing one-third the amount of nitrogen oxide and half the soot.").

[93] *See* Alasdair Wilkins, *This Classical Music was Created by a Supercomputer in Less than a second*, IO9.COM (Jan. 6, 2013, 3:00 PM), http://io9.com/5973551/this-classical-music-was-created-by-a-supercomputer-in-less-than-a-second.

[94] Kenneth Chang, *Hal, Call Your Office: Computers that Act Like Physicists*, N.Y. TIMES, Apr. 7, 2009, at D4.

[95] J. R. Koza et al., *Routine Automated Synthesis of Five Patented Analog Circuits Using Genetic Programming*, 8 SOFT COMPUTING 318, 318 (2004).

[96] *Id.* at 318-19.

successfully design circuits which duplicated the functionality of the patented circuits.[97] John Koza has also received a patent on a circuit designed by his genetic program.[98]

This rise of genetic programs illustrates that the way many inventors do their work may change as genetic programs become more widespread. Because a genetic program may simply be able to design what an inventor tells it to, the role of the inventor will change once genetic programs are brought to that inventor's field. In the view of one scientist, people will "become managers, directing the machines toward interesting problems and opportunities . . . . The creative act will be in mentioning the right problems."[99] As developed in Part IV, this major change in the inventor's role leads to some situations where widespread use of genetic programs should render some ideas obvious.

## IV. The Situation Where Genetic Programming Should Render an Idea Obvious

The remainder of this paper argues that before genetic programming becomes widespread in its application to the design of a particular device, designs that could be created by the genetic program should be patentable. However, once genetic programming becomes widespread in its application to the design of a particular device, designs that could be created by the genetic

[97] *Id*. at 322-24.

[98] Kohlhepp, *supra* note 9, at 786; Keats, *supra* note 91, at 68 ("An invention-machine creation has earned a patent; the examiner did not know it was the work of a computer."); *see also* Apparatus For Improved General-Purpose PID and Non-PID Controllers, U.S. Patent No. 6,847,851 (filed July 12, 2002) (issued Jan. 25, 2005).

[99] Eisenberg, *supra* note 2. Further, although not within the scope of this note's topic, the above quote raises another separate and interesting question: if a device designed by a genetic program is patentable, *who* should get the patent on the device? Is it the person who coded the genetic program, the person who "mentioned the right problems" to the genetic program, or the person who built the device?

program should be held to be obvious because it would be obvious to an inventor to simply use a genetic program to design the device in question.

Let us return to the example of an antenna. In constructing the PHOSITA for this example, the factors from *Environmental Designs*[100] would be considered. First, the educational level of the inventor varies widely in antenna design. One inventor might be a professor with a Ph.D., while the next might be an undergraduate student. This criterion is not particularly useful here. Second, the type of problem encountered in the art is how to design an antenna that emits a desired radiation pattern.[101] Third, the prior art solution to this problem would be to design an antenna and then use a computer program to simulate the antenna design to determine if the antenna produced the desired radiation pattern. Fourth, the rapidity with which innovations are made in this field is directly linked to how antennas are designed, and is therefore linked to whether genetic programs are in widespread use in antenna design. Fifth, antenna technology and the tools used to design antennas can range from very basic to very sophisticated; so, this factor is also not very helpful. Sixth, the educational level of active workers in the field would likely be deemed to be an engineer with a few years of antenna design experience.

In view of the above, the question the court should ask is: would an engineer with a few years of experience, who sought to design an antenna emitting a particular radiation pattern, use a genetic program to design the antenna?

[100] Environmental Designs, LTD. And The Trentham Corp. v. Union Oil Co. of Cal. And Ralph M. Parsons Co., 713 F.2d 693, 696 (Fed. Cir. 1983); *see* discussion *supra* Part II.B.2.

[101] *See, e.g.*, U.S. Patent Appl. Pub. No. 2011/0276519 (filed July 22, 2011) (Describing an antenna in a parking meter, used e.g. to communicate with law enforcement officers or to provide credit card information, and showing the radiation patterns that will be emitted from the parking meter when different kinds of antennas are used).

Central to this question is whether the PHOSITA would have access to a genetic program. To illustrate, when John Koza used a genetic program to design an antenna he ran the program on his "invention machine," which is 1000 computers networked together[102]—hardly a tool that an ordinary antenna designer would have access to. The PTO should consider that even if an ordinary antenna designer knew that it was possible to design an antenna with a genetic program, he may not have access to a genetic program in his work. This leads to the conclusion that it would not be obvious to a PHOSITA to use the genetic program since he would not have access to it.

Further, 35 U.S.C. § 103 commands that obviousness be measured "before the effective filing date of the claimed invention."[103] This is important because the tools that the PHOSITA has available can easily change with time. It could be, for example, that at one point in time no antenna designers use genetic programs; yet, in the future, genetic programs become widespread in antenna design. In this situation, we must re-ask the question: would an engineer with a few years of experience, who sought to design an antenna emitting a particular radiation pattern, use a genetic program to design the antenna? At this later point in time, the answer is different than before—now a PHOSITA would use a genetic program to design the antenna.

In this post-spread of genetic programming situation, an antenna that could be designed by a genetic program should be held obvious. This is because any PHOSITA could easily plug the parameters into a genetic program, read the antenna design from the program, and bring the antenna into the public sphere. The public, in this situation, would gain nothing by this disclosure, since any PHOSITA could simply run the genetic program to design the antenna at

---

[102] Keats, s*upra* note 91, at 68-70.

[103] 35 U.S.C. § 103 (2013).

any time. Further, granting a patent on a particular antenna design would be useless for the inventor because the genetic program could potentially design a different antenna that emits the same radiation pattern the next time the genetic program is run.[104]

The above argument logically demonstrates why developments designed by genetic programs in fields where genetic programming is widespread should be held obvious. Nevertheless, just because something is logical does not make it good law or policy. Would holding such developments obvious make good policy? The following section explores this question.

### *A. Policy*

Part II.A states patent law's goals of providing incentive for innovation and disclosure of ideas to the public.[105] Still, patents are not granted if an idea is obvious.[106] One reason for this is that obvious inventions may be brought into the public sphere without the incentive of a reward by a patent.[107] Once genetic programming has become widespread in a field, inventors working in the field can easily use a genetic program to design a device. Since the device may be developed and brought to the marketplace with such little cost, there is no need for the grant of a patent to incentivize an inventor to bring the device to the marketplace.[108] Another reason for not

---

[104] *See supra* note 89 and accompanying text.

[105] NARD, *supra* note 13, at 3 ("[P]atent law can be viewed as a system of laws that offer a potential financial reward as an inducement to invent, to disclose technical information, to invest capital in the innovation process . . . .").

[106] 35 U.S.C. § 103 (2013).

[107] *See* Duffy, *supra* note 30, at 11 ("For these [obvious] inventions, the rewards of the patent system are assumed to be largely unnecessary.").

[108] *Id.* (Stating that for obvious developments "enough incentive to create them is provided even by being the first to market the innovation . . . .").

granting a patent to an obvious development is to avoid granting a patent to a development "achieved through some cause not attributable to the patent applicant's efforts."[109] Once a genetic program has become widespread in a field, the advances created by a genetic program are not achieved through the patent applicant's efforts—the advances are instead created by the "efforts" of the genetic program.

Further, as a practical matter, let us return to the example of a genetic program designing an antenna, and let us assume that genetic programming has become widespread in this field. Allowing patents for antennas designed by genetic programs would allow companies to build a thicket of patents by repeatedly patenting designs created by the genetic program. Each time the genetic program is run, it would design a different antenna, since the program uses random processes.[110] If a company ran the program ten times, it could patent ten different antenna designs. If it did so, a competing company would have to go through the costly process of searching through the thicket of trivial patents. This competing company would have to shift investment dollars away from antenna research to searching though the thicket of patents.

Simply obtaining such a thicket of trivial patents would be very costly for a company. Therefore, it could be argued that companies would likely not pursue obtaining this thicket of trivial patents because of the high cost.[111] However, this high cost is much more of a burden to smaller companies than to large ones. In other words, a large, well-funded corporation could still obtain a thicket of patents and use it effectively against a smaller company that could not afford

[109] Duffy, *supra* note 30, at 12.

[110] Kohlhepp, *supra* note 9, at 812.

[111] *See* Duffy, *supra* note 30, at 12 (trivial patents can be discouraged by charging sufficient fees for obtaining or maintaining each patent).

the cost of sifting through a forest of patents. Holding devices obvious in fields where the use of genetic programs is widespread would disallow a large corporation from simply paying money to obtain a thicket of patents and using it to crush smaller, less well-funded companies.

Still, it is not enough to reach the conclusion that once genetic programming is widespread in a particular field, designs created by genetic programs should be held obvious. In order to have practical application, courts must know how to determine when genetic programming has become widespread in a field.

### *B. A Widespread Use Test Proposal*

This note proposes a four-factor test to determine if genetic programming is widespread in a field, which evaluates: 1) whether the invention was actually designed with a genetic program, 2) the proportion of PHOSITAs in the field having access to genetic programs, 3) the cost associated with the use of a genetic program for this type of design, and 4) the amount of time and effort required to operate the necessary genetic program.

Because of the dynamic nature of genetic programming and artificial intelligence, the approach taken in applying the widespread use test must be flexible. In some situations, one or more factors may predominate; in others, all factors may apply equally. This flexible approach is in accordance with factor tests for other legal concepts.[112]

[112] *See, e.g.,* Playboy Enters., Inc. v. Netscape Commc'nsCorp., 354 F.3d 1020, 1026 (9th Cir. 2004) (analyzing, in a trademark dispute, likelihood of confusion factors and stating "courts must be flexible in applying the factors, as some may not apply. Moreover, some factors are more important than others.").

It is important to bear in mind that 35 U.S.C. § 103 orders that obviousness is measured "before the effective filing date of the claimed invention."[113] Therefore, the widespread use test would be applied at different times for different inventions.

*1. Factor One: If the Invention was Actually Designed by a Genetic Program*

At the onset, it is important to know if the invention was designed with the use of a genetic program. At a minimum, if the invention was designed by a genetic program, it shows that the technology exists and is available to at least one inventor in the field. Further, it shows that the inventor chose to design with a genetic program, which is evidence that genetic programming simplifies the task in this context.

One may question how the PTO or court is to know if an invention has been designed with a genetic program. However, "[e]ach individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the [PTO], which *includes a duty to disclose to the [PTO] all information known to that individual to be material to patentability* . . . ."[114] Therefore, the inventor and the attorney prosecuting the patent application both have a duty to disclose whether the invention was designed with a genetic program.

But, showing that the inventor alone had access to a genetic program is not sufficient to show widespread use. Therefore, we must look to see if other inventors in the field had access to applicable genetic programs.

[113] 35 U.S.C. § 103.

[114] 37 C.F.R. § 1.56 (emphasis added).

### 2. *Factor Two: The Proportion of PHOSITAs in the Field Having Access to Genetic Programs*

The proportion of PHOSITAs in the field having access to genetic programs is arguably the most important factor. If a high proportion of PHOSITAs have access to genetic programs, it demonstrates that more inventors are able to implement genetic programs to bring new designs to the market place. This in itself is evidence that patent law's goal of bringing new ideas to the market place[115] is being facilitated.

One issue in analyzing this factor will be how to determine the relevant market. For example, in the domestic market for diesel powered locomotive engines, there are only two major manufacturers—General Electric Co., and Electro-Motive Diesel Inc. (now owned by Caterpillar Inc.).[116] Therefore, when analyzing this market, courts will have to determine whether to limit the market to diesel powered locomotive engines (effectively only two companies), or whether to expand the analysis to related fields (e.g. truck diesel powered engines). In this example, it is better to limit the analysis to the exact problem to be solved. This is because even though truck engines and locomotive engines may have much in common, there are enough differences that a completely different genetic program would be required to design each. In selecting fields for determining the proportion of PHOSITAs having access to genetic programs, only fields where the same genetic program could in fact be used to design the invention in question should be considered. This ensures that a PHOSITA would actually be able to use the genetic program to design the invention in question. It may seem, in the diesel

[115] Nard, *supra* note 13, at 3.

[116] Bob Tita, *Caterpillar expected to make Electro-Motive more competitive* (June 4, 2010), http://www.webcitation.org/5trEL4dsG.

powered locomotive example, that this produces a bizarre outcome—that use by only two companies is "widespread." However, this is the correct conclusion. If only two companies produce a product, and both of these companies have access to a genetic program, then by definition every company producing this product has access to a genetic program.

*3. Factor Three: The Financial Cost Associated with Using a Genetic Program for this Type of Design*

In designing his antenna with a genetic program, John Koza ran the genetic program on his "invention machine," which is 1000 computers networked together.[117] The electric bill alone was $3,000 a month.[118] The high cost of gathering and assembling 1000 computers may provide deterrence for many inventors and companies from adopting genetic programs. Therefore, a high cost of running a genetic program would be evidence that genetic programming was not widespread in a field. Alternatively, if a genetic program could be run cheaply, this would show that companies could easily adopt them and that use was becoming widespread.

*4. Factor Four: The Amount of Time and Effort Required to Operate the Necessary Genetic Program*

Along with financial cost, the time and effort required to operate the genetic program should also be considered.[119] The time and effort necessary to network enough computers together to provide the computing capability needed to run some genetic programs could

[117] Keats, s*upra* note 91, at 68-70.

[118] *Id.* at 69.

[119] Although a high financial cost of running a genetic program will often go hand in hand with a large requirement of time and effort to run a genetic program, this is not always the case. The two could become especially separated in the future as computer processors improve. For example, if improved computer processors allow a genetic program to run on a PC, but a genetic program software licensor still charges a very high fee for using the genetic program.

preclude some inventors from using genetic programs. Further, at the point in time when John Koza designed his antenna, his system took from one day to one month to create a new invention.[120] A month is quite a long time for a computer program to run. Alternatively, if a genetic program could be run as quickly as an iPhone app, this would be evidence that genetic programming is widespread in a field.

## V. Contra

Above, I argue that when genetic programming becomes widespread with regard to designing a particular product, designs that the genetic program could produce should be obvious and therefore unpatentable. Yet, there are multiple potential counter arguments to this proposal in different directions. It is possible to argue that anything created by a genetic program should be obvious, even before genetic programming has become widespread in a field. Conversely, it is possible to argue that even widespread use of genetic programming should not render an idea obvious. Finally, there is an argument that widespread use of genetic programming should create only a prima facie case of obviousness. The strongest contra is discussed below.

### *A. Argument that Nothing Designed by a Genetic Program Should be Patentable Because it was Designed by a Process of Trial and Error*

One argument is that everything designed by a genetic program should be held obvious because genetic programs (it appears) operate by a process of trial and error. The trial and error argument assumes that if something can be discovered through a simple process of trial and error, it must be obvious.[121] But, genetic programs do not in fact operate by a process of trial and

[120] Keats, s*upra* note 91, at 68.

[121] *See* Cal Crary, *Impact of KSR v. Teleflex on Pharmaceutical Industry*, PATENTLYO.COM (May 3, 2007), http://www.patentlyo.com/patent/2007/05/impact_of_ksr_v.html (commenting that a

error. A process of trial and error would be, for example: ten antennas are created, one antenna with the best radiation pattern is selected, *and the process stops there*. Genetic programs do not stop there. A genetic program would then take the best one, two, or three antennas and merge or mutate them.[122] From this, a new generation of antennas would be created.[123] The additional step of merging and/or mutating removes genetic programs from the category of pure trial and error.

Furthermore, from a policy perspective, it may seem that if all that is required to reach a solution is a process of trial and error, then the solution should be obvious. However, in Canadian patent law for instance, trial and error actually counts as evidence of nonobviousness.[124] This is because "[i]f something requires this kind of research, then it is not obvious because it is not 'plain as day' or 'crystal clear.'"[125] Therefore, even as a policy matter, it is not clear that the use of trial and error should render an idea obvious.

---

Federal Circuit Judge's belief was that "an approach that is obvious to try is also obvious where normal trial and error procedures will lead to the result").

[122] *Crossover (genetic algorithm)*, *supra* note 86.

[123] *Id.*

[124] Donald M. Cameron, *Chapter 7 Obviousness*, 7-27 (May 17, 2010), http://www.jurisdiction.com/patweb07.pdf (Stating "If trial and error are required, it can’t be obvious." And "[f]urthermore, it is not directly leading to the solution; instead it leads to intermediate failures.").

[125] *Id.*

### *B. Argument that Genetic Programming use should not Effect Patentability*

When John Koza designed his five circuits, which mimicked the functionality of recently patented circuits, he expressed the view that the use of a genetic program will not affect an invention's patentability.[126] Further, John Koza received a patent on a circuit designed by his genetic program.[127] Yet, genetic programming is still in its infancy. Because the construction of the PHOSITA can change over time, what satisfied the PTO's requirements at one point in time may not satisfy it at a later point in time. 35 U.S.C. §103 itself addresses this by stating that obviousness is measured "before the effective filing date of the claimed invention."[128] Therefore, it makes perfect sense that before genetic programs became widespread in his field, Koza would be granted a patent on his device. Likewise, it makes perfect sense that after genetic programs became widespread in his field, Koza would be denied a patent on his device.

### *C. Should Widespread use Create only a Prima Facie Case of Obviousness?*

An alternative proposal to the one in this note is that a finding of widespread use should create only a prima facie case of obviousness. The idea is that the prima facie case of obviousness could be rebutted using secondary considerations. As discussed in Part II.B.3, courts

[126] Koza, *supra* note 95, at 324 ("If an automated method were able to duplicate a previously patented human-created invention, the fact that the original human-designed version satisfied the Patent Office’s criteria of patent-worthiness means that the automatically created duplicate would also have satisfied the Patent Office’s criteria.").

[127] Kohlhepp, *supra* note 9, at 786; Keats, *supra* note 91, at 68 ("An invention-machine creation has earned a patent; the examiner did not know it was the work of a computer."); *see also* U.S. Patent No. 6,847,851 (filed July 12, 2002).

[128] 35 U.S.C. § 103 (2013).

analyze secondary considerations when determining obviousness.[129] However, for the reasons that follow, secondary considerations are not very useful to the question of genetic programming.

The secondary consideration of unexpected results is not very relevant here, although it does take a moment to understand why. Unexpected results come into play when a slight difference in design leads to a drastic difference in results. Genetic programs do the opposite of this—genetic programs produce designs that are very different from existing human-created designs.[130] As Popular Science Magazine stated, "[e]very day now, genetic programs continue to create the unexpected, the counterintuitive or the just plain weird."[131] In the antenna context, the antenna that John Koza designed "looks like a mistake, works like a charm."[132] In other words, unexpected results would come into play if the antenna was designed only slightly differently but produced a vastly different radiation pattern. Instead, the antenna's design was not slightly different—it was drastically different.

Further, a long felt need is not particularly relevant here either. The idea behind the long felt need consideration is: if it was obvious, someone would have created it earlier; since no one created it earlier, it must not be obvious.[133] However, in a field with widespread genetic programming, it becomes obvious to use a genetic program to solve a problem even if the problem has been long felt. For example, for an antenna with a particular radiation pattern when

[129] Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 27-28 (1966).

[130] Keats, *supra* note 91, at 72 ("Koza's leap in genetic programming allowed for open-ended evolutions of basic structure and so produced more novel and sophisticated designs").

[131] *Id.*

[132] *Id.* at 70.

[133] Matter of Mahurkar Double Lumen Hemodialysis Catheter Patent Litig., 831 F. Supp. 1354, 1378 (N.D. Ill. 1993).

genetic programming becomes widespread, a PHOSITA would simply use a genetic program to create an antenna with the desired radiation pattern.

Commercial success is also not relevant in the context of widespread genetic programming. The Federal Circuit explains that commercial success "presumes an idea would successfully have been brought to market sooner, in response to market forces, had the idea been obvious to persons skilled in the art."[134] This is less applicable to our question because once genetic programming has become widespread in a field, it becomes obvious for a PHOSITA to use a genetic program to bring a product to market. Therefore, the presumption that a product would have been brought to the market sooner no longer makes any sense where genetic programming has become widespread. A presumption that the product will be designed using a genetic program, and immediately brought to the market makes more sense in this context.

None of the secondary considerations are relevant to the problems posed by widespread genetic programming. Therefore, after finding widespread use, creating a prima facie case of obviousness instead of simply finding obviousness would not be advisable.

## VI. Conclusion

No one knows how genetic programming will affect the future of invention and the patentability of devices designed by genetic programs. Thus far, at least one device that was designed by a genetic program has been patented.[135] This is fine for now, as use of genetic programming is not widespread. In the future, however, as engineers begin to make common use of genetic programming, many designs that were once difficult to create will become trivially

---

[134] Merck & Co., Inc. v. Teva Pharmaceuticals USA, Inc., 395 F.3d 1364, 1376 (Fed. Cir. 2005).

[135] Kohlhepp, *supra* note 9, at 786; Keats, *supra* note 91, at 68, 72; *see also* U.S. Patent No. 6,847,851 (filed July 12, 2002).

simple. Once this happens, designs for a particular device that a genetic program could create should be deemed obvious, and therefore unpatentable.[136] If patents were granted on these designs, the public would gain nothing from these patent grants because a PHOSITA could already easily bring this technology to the marketplace. Because this situation only occurs after genetic program use becomes widespread in a particular field, finding a method to determine widespread use is critically important. This note has proposed a four-factor widespread use test to make this determination. There is no doubt that genetic programs have the potential to change invention and creative thinking as we know it.[137] As this sea change arrives, we must be ready to adapt our patent laws to maintain their underlying purpose.

[136] 35 U.S.C. § 103 (2013).

[137] Chang, *supra* note 80; Eisenberg, *supra* note 2.