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PRINT YOUR OWN PANDORA'S BOX: 3D PRINTING, INTELLECTUAL PROPERTY LAW, AND THE INTERNET FOR LAY-LAWYERS

Adam Lewental*

I. INTRODUCTION

The beginning of 2013 was a dire time for the United States' economy. President Barack Obama entered his second term with the task of shedding the shell of recession from the nation's back. With this in mind, President Obama made his State of the Union Address.

“Our first priority is making America a magnet for new jobs and manufacturing,”¹ he extolled.

Last year, we created our first manufacturing innovation institute in Youngstown, Ohio. A once-shuttered warehouse is now a state-of-the art lab where new workers are mastering the 3D printing that has the potential to

* J.D., Pepperdine School of Law, 2016.

¹ Barack Obama, President of the United States, State of the Union Address (Feb. 12, 2013), <http://www.whitehouse.gov/the-press-office/2013/02/12/remarks-president-state-union-address>).

revolutionize the way we make almost everything. There's no reason this can't happen in other towns.²

The President then outlined his plan to reinvigorate the American manufacturing industry by embracing high technology.³ It was clear when he opened his address by calling on Congress to aid in creating these 3D printing manufacturing hubs, he believed this to be the solution going forward. Congress answered President Obama's call and passed the "Revitalize American Manufacturing and Innovation Act of 2014."⁴

Washington has not been the only place to realize the potential of 3D printing; big business is also taking notice. Coca Cola embraced the power of 3D printing in one of its latest advertising campaigns.⁵ A cottage industry has also sprung up for enthusiasts dedicated to the form. Websites, such as thingiverse.com, allow hobbyists to exchange designs that can be printed at home.⁶

² *Id.*

³ *Id.*

⁴ Revitalize American Manufacturing and Innovation Act of 2014, H.R. 2996, 113th Cong. (passed by the House Sept. 15, 2014), <https://www.congress.gov/bill/113th-congress/house-bill/2996>.

⁵ Brooke Kaelin, *Coca Cola Decides 3d Printing Makes for Great Publicity*, 3D PRINTER WORLD (Aug. 22, 2013), <http://www.3dprinterworld.com/article/coca-cola-decides-3d-printing-makes-for-great-publicity>.

⁶ See, e.g., THINGIVERSE – DIGITAL DESIGNS FOR PHYSICAL OBJECTS www.thingiverse.com (last visited June 19, 2017); BLD3R, www.bld3r.com (last visited

When it comes to internet regulation, famed Harvard professor Lawrence Lessig held that “code is law,”⁷ which is to say that legal limitations can only originate from the Internet’s technical architecture. Due to the difficulty in updating the entire Internet’s protocols, all future issues, such as privacy or financial security, must be well anticipated.⁸ Like any fast-moving technology, 3D printing faces the very real risk of outpacing its legal framework. As of now, 3D printing is primarily used for decorative items with limited functionality.⁹ However, in the near future, these printers will be capable of printing and incorporating microprocessors.¹⁰ The ability to download and print in your own home an electronic device such as an iPod would expose a legal blind spot evocative of the battles over music piracy that had spawned the popular device twenty years ago. Contributing to this problem is the fact that

June 19, 2017); YOUIMAGINE, www.youmagine.com (last visited June 19, 2017); INSTRUCTABLES – DIY HOW TO MAKE INSTRUCTIONS, www.instructables.com (last visited June 19, 2017); *see also* BRIAN EVANS, PRACTICAL 3D PRINTERS: THE SCIENCE AND ART OF 3D PRINTING 75–97 (2012) (summarizing where and how to get a variety of 3D models).

⁷ Lawrence Lessig, *Code is Law: On Liberty in Cyberspace*, HARV. MAG. (Jan. 2000), <http://harvardmagazine.com/2000/01/code-is-law-html>.

⁸ *See* Gary C. Kessler, *An Overview of TCP/IP Protocols and the Internet* (Nov. 13, 2014), <http://www.garykessler.net/library/tcpip.html> (examining in-depth the origins of the Internet and how the protocols work).

⁹ *See infra* PART III.

¹⁰ *Id.*

patents balance precariously between the scientific and legal worlds, leaving both nearly mutually-exclusive communities uncomfortable with its application.¹¹

This comment's main purpose is to explore intellectual property law meant to protect against manufacturing infringement after manufacturing becomes decentralized. Part II glimpses into the applicable 3D printing technology, with a focus on its current capabilities and future application.¹² Part III explores the rift between utility and design intellectual property protection within the framework of intellectual property protection.¹³ Part IV analyzes the overlap of the technology and the law.¹⁴ Part V projects the potential impact of inaction by drawing comparisons to parallel issues,¹⁵ as well as the potential impact of the technology itself. Part VI concludes.¹⁶

¹¹ Timothy R. Holbrook, *Patents, Presumptions, and Public Notice*, 86 IND. L.J. 779, 781–82 (2011). “Patent litigation cases are tried in front of judges and juries who seldom have technical degrees at all, let alone one relevant to the particular patent at issue. Even at the national court of appeals that hears all cases arising under the patent laws, the U.S. Court of Appeals for the Federal Circuit, most of the judges are not technically trained or did not have prior patent experience. The [“person having skill in the art”] construct, rooted in the scientific or technical, can be difficult for the courts to apply.” *Id.*

¹² *See infra* Part II.

¹³ *See infra* Part III.

¹⁴ *See infra* Part IV.

¹⁵ *See infra* Part V.

¹⁶ *See infra* Part VI.

II. WHAT IS 3D PRINTING?

3D printing technology, technically called “additive manufacturing,”¹⁷ has existed in some form since the 1980s,¹⁸ but the expansive size and cost of the machines relegated them to industrial use.¹⁹ However, the last decade has seen the accessibility of 3D printers rise dramatically.²⁰ Several manufacturers offer household printers for under \$500, a steep drop from the \$100,000 price tag two decades ago.²¹ There are various reasons for the rise of 3D printing, including the ease of printing complex shapes and the ability to combine different raw materials.²² Also, many older patents on 3D printing technology are entering into the public domain.²³

¹⁷ HOD LIPSON & MELBA KURMAN, *FABRICATED: THE NEW WORLD OF 3D PRINTING* 11 (2013).

¹⁸ *History of 3D Printing*, 3D PRINTING INDUSTRY, <http://3dprintingindustry.com/3d-printing-basics-free-beginners-guide/history> (last visited June 19, 2017).

¹⁹ *Id.*

²⁰ Wohlers Assoc. Inc., *Wohlers Report 2013 Reveals Continued Growth in 3D Printing and Additive Manufacturing*, WOHLER’S ASSOCIATES, INC. (May 23, 2013), <http://wohlersassociates.com/press59.html>. “Growth of the low-cost (under \$5,000) ‘personal’ 3D printer market segment averaged 346% each year from 2008 through 2011.” <http://wohlersassociates.com/press59.html>. *Id.*

²¹ *History of 3D Printing*, *supra* note 18.

²² See EVANS, *supra* note 6, at 20-23 (“The ten principles of 3D printing”).

²³ See John Hornick & Dan Roland, *Many 3D Printing Patents Are Expiring Soon: Here’s A Round Up & Overview of Them*, 3D PRINTING INDUSTRY (Dec. 29, 2013), <https://3dprintingindustry.com/news/many-3d-printing-patents-expiring-soon-heres-round-overview-21708/>; *but see* John Hornick & Dan Roland, *Yes, Some 3D Printing*

There are currently two competing types of home 3D printers on the market. Most use a process referred to either as filament deposition manufacturing (“FDM”) or fused filament fabrication (“FFM”).²⁴ These printers function similar to typewriters. An arm strategically melts a plastic filament from a spool (“thermoplastic extruder”),²⁵ which has a similar role to ink cartridges in conventional printers, onto the bed of the printer.²⁶ When that layer is complete, the bed lowers a notch, and the printer continues the process of incrementally building the design.²⁷

Some printers’ thermoplastic extruders are attached to motors that allow it to move in all three dimensions to place material.²⁸ Using this method, the printers are able to print in the x-, y-, and z- axes, and thus are known as “Cartesian robots.”²⁹

Patents Are Expiring. So What?, 3D PRINTING INDUSTRY (June 10, 2014), <https://3dprintingindustry.com/news/yes-3d-printing-patents-expiring-28182/>.

²⁴ Richard Baguley, *Best 3D Printers 2017*, TOM’S GUIDE (Jan. 16, 2015), <https://www.tomsguide.com/us/best-3d-printers,review-2236.html>.

²⁵ EVANS, *supra* note 6, at 11.

²⁶ *Id.*

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Id.*

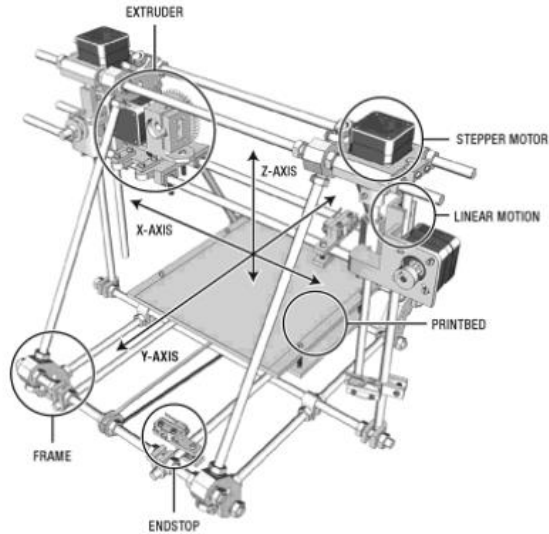


Fig. 1 – A “Cartesian robot” style 3D printer.³⁰

Resin printers are the lesser-used type. They act in a similar manner, except they use lasers to create a mold into which the resin is poured.³¹ This allows for a more accurate design, as well versatility in materials.³² These printers are generally substantially more expensive than FDM printers.³³

³⁰ *Id.*

³¹ Sean Charlesworth, *Bits to Atoms: The State of Resin 3D Printing Technologies*, TESTED (Nov. 13, 2014), <http://www.tested.com/tech/3d-printing/467282-bits-atoms-state-resin-3d-printing-technologies>.

³² *Id.*

³³ *Id.*

Objects usually need a small amount of “post-processing” once printing has completed.³⁴ This consists of removing superfluous resin and/or soaking the pieces to remove water-soluble support items used to stabilize the design while it is in the process of printing.³⁵ The object may also need time to cure in order to achieve its full strength, depending on the type of printer and printing material used.³⁶

The 3D printers utilize a digital blueprint formatted as an .stl file.³⁷ This is the equivalent of a .pdf file for a printed document.³⁸ A designer can create these files with computer aided drafting (“CAD”) software³⁹ or by using a 3D scanner on the original object.⁴⁰

³⁴ Stephanie Crawford, *How 3-D Printing Works*, HOW STUFF WORKS, <http://computer.howstuffworks.com/3-d-printing4.htm> (last visited June 19, 2017).

³⁵ *Id.*

³⁶ *Id.*

³⁷ *Id.* .stl is simultaneously short for stereolithography and Standard Tessellation Language, two terms used to describe the 3D printing process. *Id.* The overwhelming majority of 3D printers currently on the market use this file format. *Id.*

³⁸ Michael Weinberg, *What Lawyers Might Like to Know About 3d Printing and the Law*, 6 LANDSLIDE NO. 4 (2013), http://www.americanbar.org/publications/landslide/2013-14/march_april/what_lawyers_might_to_know_about_3d_printing_and_law.html.

³⁹ *Id.*

⁴⁰ LIPSON & KURMAN, *supra* note 17, at 31. See *Makerbot Digitizer Desktop 3D Scanner*, AMAZON, <https://www.amazon.com/MakerBot-Digitizer-Desktop-3D-Scanner/dp/B00FOUCBOO> (last visited June 19, 2017). “With just two clicks, the MakerBot Digitizer Desktop 3D Scanner’s easy to use, yet sophisticated software creates clean, watertight 3D models that are ready to 3D print. We’ve optimized the whole process to work seamlessly with MakerBot Replicator Desktop 3D Printers, but you get standard design files to use on the 3D printer of your choice. You don’t need any design or 3D modeling skills to get started, and it all happens in just minutes.” *Id.*

Hobbyists have the ability to download and upload designs to depositories, or online digital warehouses. These depositories also serve as a social network where hobbyists can share tips, collaborate on projects, and engage with the larger community.⁴¹ Some hobbyists have even experimented with utilizing exotic building materials for printing, such as clay or chocolate.⁴²

III. CURRENT STATE OF THE LAW

A. INTRODUCTION

Intellectual property law dates back to medieval time, where it was created to allow individual guilds to maintain monopolies in their industry.⁴³ This introduced the tradition of dividing intellectual property

⁴¹ See THINGIVERSE – DIGITAL DESIGNS FOR PHYSICAL OBJECTS, <http://www.thingiverse.com/> (last visited June 19, 2017).

⁴² Te Edwards, *3D Systems Unveils CocoJet Chocolate 3D Printer at 2015 CES*, 3DPRINT (Jan. 6, 2015), <http://3dprint.com/35081/culinary-printing-3d-systems>.

⁴³ See MATT FISHER, FUNDAMENTALS OF PATENT LAW: INTERPRETATION AND SCOPE OF PROTECTION 24 (Mel Hamill eds., HART PUBLISHING, 2007); see also *History of Intellectual Property Law*, NAT'L PARALEGAL COLLEGE, http://nationalparalegal.edu/public_documents/courseware_asp_files/patents/IntroIP/History.asp (last visited June 19, 2017). It is interesting to note that the law started out to limit the dissemination of ideas and carefully cull the progress of science. *Id.* This was due to both the feared effect of the printing press in the hands of religious minorities, *id.*, and as a profitable means of allowing the guilds and government to control marketplace competition. ALAN L. DURHAM, PATENT LAW ESSENTIALS: A CONCISE GUIDE 1 (4th ed. 2013).

protection depending on the purposes of the creation, as copyright protection for artists and patent law for inventors were separate entities.⁴⁴

The Founding Fathers had a different motive for establishing intellectual property protection,⁴⁵ but utilized similar means. Therefore, intellectual property protection in the United States carries the tradition of dividing fairly between functional and aesthetic design. In fact, despite the subject matter overlaps that may occur between the different varieties of intellectual protection, there is no overlap of the legal protections allowed.⁴⁶ Copyright law governing aesthetic design has evolved and expanded in response to the Internet, but patent law governing functional design has remained exposed.

Savvy intellectual property attorneys can breeze through the next several sections arduously outlining the implicated sections of copyright, trademark, and patent law. Discussions include the Digital Media Copyright Act, the doctrine of equivalents, and induced infringement.

⁴⁴ NAT'L PARALEGAL COLLEGE, *supra* note 43.

⁴⁵ To “promote the Progress of Science and useful Arts . . .” U.S. CONST. art I, § 8, cl. 8.

⁴⁶ There may be overlap of protection within utility and design elements separately, but not between the two together. *See infra* Part III.D.

B. *THE COPYRIGHT PARADIGM*

1. *COPYRIGHT LAW*

United States copyright law confers legal protection on the “literary, dramatic, musical, artistic, and certain other intellectual works” for their original authors.⁴⁷ This can also include many decorative items, such as jewelry or sculptures.⁴⁸ The original author has exclusive rights.⁴⁹ These works must be “fixed in a tangible form of expression,” which can include implementation within a machine, such as computer code.⁵⁰

Many works do not qualify for copyright protection, such as “ideas, procedures, methods, systems, processes, concepts, principles, discoveries, or devices, as distinguished from a description, explanation, or illustration.”⁵¹ Additionally, “useful articles,” or “object[s] that ha[ve] an intrinsic utilitarian function that are not merely to portray the

⁴⁷ U.S. COPYRIGHT OFFICE, CIRCULAR 1: COPYRIGHT BASICS 1 (2012), <http://copyright.gov/circs/circ01.pdf>.

⁴⁸ Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, 102 GEO. L.J. 1691, 1713 (2014).

⁴⁹ 17 U.S.C. § 106 (2012). These rights are to: “(1) reproduce the copyrighted work in copies or phonorecords; (2) prepare derivative works based upon the copyrighted work; (3) distribute copies or phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending.” *Id.*

⁵⁰ U.S. COPYRIGHT OFFICE, *supra* note 47, at 3.

⁵¹ 17 U.S.C. § 102 (2012).

appearance of the article or to convey information,” are also exempt from copyright protection.⁵² Various elements within a single article can qualify as either decorative or utilitarian, and can have different standards of copyright protection.⁵³ For example, a shoe may not qualify for copyright, but designs on and within the shoe may, so long as they can be completely separated from the utilitarian aspects of the shoe.⁵⁴ Copyrights can only be given to objects that are meant “merely to portray the appearance of the article or to convey information.”⁵⁵

A copyright manifests the moment the work is created, which means when it is “fixed in a tangible form for the first time.”⁵⁶ In order to qualify for legal remedy against infringement, the creator must register the copyright with the United States Copyright Office.⁵⁷ Registration requires “three essential elements: a completed application form, a nonrefundable filing fee, and a nonreturnable deposit.”⁵⁸

⁵² Daniel A. Tysver, *Works Unprotected By Copyright Law: Useful Articles*, BITLAW, <http://www.bitlaw.com/copyright/unprotected.html> (last visited June 19, 2017).

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ *Id.*

⁵⁶ U.S. COPYRIGHT OFFICE, *supra* note 47, at 1.

⁵⁷ *Id.* at 7.

⁵⁸ *Id.* at 10.

2. COPYRIGHT ENFORCEMENT IN THE DIGITAL AGE

By the late 1990s, it was clear that the Internet was a natural home for copyrighted materials. “[T]he first things that were easy to create and distribute online--articles, pictures, music, movies--also happened to be material protected by copyright.”⁵⁹ Additionally, Congress was faced with the unprecedented globalization of intellectual property that the Internet allowed.⁶⁰

The Digital Media Copyright Act (“DMCA”), a 1996 implementation of two World Intellectual Property Organization (“WIPO”) treaties, was developed to govern digital intellectual property.⁶¹ The DMCA prevents unauthorized use and reproduction of copyrighted works and thus, faces the same restrictions for applicability as copyright protection.⁶² The DMCA allows owners of copyrighted articles to fight infringement on two battlefields: on the Internet and in the courtroom.

⁵⁹ Weinburg, *supra* note 38, at 43.

⁶⁰ DAVID NIMMER, COPYRIGHT: SACRED TEXT, TECHNOLOGY, AND THE DMCA 101–02 (Kluwer Law Int’l 2003).

⁶¹ U.S. COPYRIGHT OFFICE, THE DIGITAL MILLENNIUM COPYRIGHT ACT OF 1998: *COPYRIGHT OFFICE SUMMARY* 1 U.S. COPYRIGHT OFFICE 1 (1998), <http://www.copyright.gov/legislation/dmca.pdf>.

⁶² *Id.* at 2.

The DMCA wields Digital Rights Management (“DRM”) devices as its first line of defense in combatting digital infringement.⁶³ DRM are a wide range of technologies designed to abate infringement.⁶⁴ Some examples of DRM techniques are encryption and single-use licensing.⁶⁵ In order to make DRM devices effective, the DMCA made expressly illegal any devices or services that: “are primarily designed or produced to circumvent [DRM]; have only limited commercially significant purpose or use other than to circumvent; or are marketed for use in circumventing.”⁶⁶

The DMCA has been the prized weapon against all online infringement thus far,⁶⁷ although this is due to the technological circumstance that the Internet tends to consist primarily of copyrightable

⁶³ *Id.* at 3.

⁶⁴ Dan L. Burk, *Legal and Technical Standards in Digital Rights Management Technology*, 74 *FORDHAM L. REV.* 537, 540–44 (2005).

⁶⁵ *Id.* at 560. These devices operate by using advanced mathematics and cryptography to render files uncopyable. *Id.*

⁶⁶ 17 U.S.C. § 1201 (2012).

⁶⁷ The most notable case related to 3D printing has been a Game of Thrones-inspired dock for iPhones offered for sale from an online repository. Nathan Hurst, *HBO Blocks 3-D Printed Game of Thrones iPhone Dock*, *WIRED* (Feb. 13, 2013), <http://www.wired.com/2013/02/got-hbo-cease-and-desist> (stating that HBO, the property owner, sent the alleged infringer a cease-and-desist letter stating, “While we appreciate the enthusiasm for the Series that appears to have inspired your creation of this device, we are also concerned that your iron throne dock will infringe on HBO’s copyright in the Iron Throne.”).

material.⁶⁸ However, because the Act only covers copyrighted works, it offers no protection against trademark or patent infringement; in fact, it offers steep penalties against any party attempting to use the DMCA for purposes other than copyright infringement.⁶⁹

C. *INTELLECTUAL PROPERTY PROTECTION OF PHYSICAL FUNCTIONAL AND AESTHETIC DESIGN*

1. *UTILITY PATENT*

The patenting system serves two core functions: to serve public-notice of the invention and to protect inventors.⁷⁰ The “public-notice” function represents the inventor’s disclosure to the public of how to make and use the state of the art invention.⁷¹ In exchange the inventor is given a

⁶⁸ “It is something of a fluke that copyright law has become so intertwined with our online lives.” Weinberg, *supra* note 39, at 4.

⁶⁹ “Any person who knowingly materially misrepresents under [17 U.S.C. § 12] that material or activity is infringing . . . shall be liable for any damages, including costs and attorneys’ fees, incurred by the alleged infringer . . . who is injured by such misrepresentation, as the result of the service provider relying upon such misrepresentation in removing or disabling access to the material or activity claimed to be infringing.” 17 U.S.C. § 512(f) (2012); *see* Online Policy Group v. Diebold, Inc., 337 F. Supp. 2d 1195, 1202 (N.D. Cal. 2004). (“[A]ny person who sends a Notice Of Claimed Infringement (‘NOCI’) [to an online service provider] with knowledge that claims of infringement are false may be liable for damages.”).

⁷⁰ HERBERT F. SCHWARTZ, *PATENT LAW AND PRACTICE* 2, 3 (6th ed. 2008).

⁷¹ The “public” here is actually measured by a “person of skill in the art,” which parallels tort law’s “reasonable person.” Timothy R. Holbrook, *Patents, Presumptions, and Public Notice*, 86 IND. L.J. 779, 785 (2011).

legal, limited monopoly in order to capitalize on the invention.⁷² This duality of function demonstrates that the patent is simultaneously a technical and a legal document;⁷³ it serves as both a deed and a blueprint.⁷⁴

Consequently, the patent must also stand up to two levels of scrutiny. An examiner in the United States Patent and Trademark Office (“USPTO”), who has a science or engineering degree,⁷⁵ will determine if the patent demonstrates that the applicant actually possessed the invention and set forth the proper steps for recreating it.⁷⁶ Later, during litigation, a judge may examine the patent to determine the validity and extent of the patent.⁷⁷

a. *MECHANICS OF PATENTABILITY*

Although patent law originates from the Constitution’s protection of intellectual property,⁷⁸ the mechanics of this provision are outlined

⁷² Although there are different rationales for why the inventor deserves the monopoly. See MATT FISHER, *FUNDAMENTALS OF PATENT LAW: INTERPRETATION AND SCOPE OF PROTECTION* 137–60 (Mel Hamill ed., 2007).

⁷³ See Holbrook, *supra* note 71, at 785 (“As a result, while the patent is undeniably a legal document (it affords the patentee the right to exclude others from practicing her invention), it is also a technical document (it teaches technical details of the invention to the relevant public).”).

⁷⁴ See *generally id.*

⁷⁵ 37 C.F.R. § 11.7 (2014).

⁷⁶ SCHWARTZ, *supra* note 70, at 19-20.

⁷⁷ See *infra* Part III.B.

⁷⁸ U.S. CONST. art I, § 8, cl. 8.

within the United States Code and the Code of Federal Regulations.⁷⁹ Essentially, when an inventor reduces to practice⁸⁰ any “new and useful process, machine, manufacture, or composition of matter,”⁸¹ they are required to break it down into its key components, or claims.⁸² These claims serve to designate the outer limits of the invention, creating a legal fence around the patent that cannot be traversed.,⁸³ The basic premise of patent protection is often misunderstood; it does not grant the inventor the right to manufacture the claimed invention, it merely allows the inventor to exclude others from manufacturing it.⁸⁴

⁷⁹ U.S. Patent Act, 35 U.S.C. §§ 1–376 (governing the procedures of patents and the patenting system); 37 C.F.R. §§ 1.1–150.6 (covering the operation of patenting and the patent office).

⁸⁰ *E. Rotorcraft Corp. v. U.S.*, 384 F.2d 429, 431 (Ct. Cl. 1967) (citing NASH & LASKEN, *Patent Rights Under Government Contracts*, PATENTS AND TECHNICAL DATA 52, 52):

Reduction to practice occurs when the workability of an invention can be demonstrated. Workability means that a physical form of the invention has been constructed which functions. Nash and Lasken, ‘Patent Rights Under Government Contracts’ in *Patents and Technical Data (Gov’t Contracts Monograph \$10)* 42-52. And this requires testing the invention [I]t is only necessary to show that the invention is able to perform its intended purpose beyond a probability of failure.

Id.

⁸¹ 35 U.S.C. § 101 (2012).

⁸² There are other parts to the patent that are important for evaluating the actual meaning, value, and patentability of the document, such as drawings and specification, but “the claims . . . define what the patent covers and what will infringe.” DURHAM, *supra* note 43, at 22.

⁸³ *Id.*

⁸⁴ 35 U.S.C. § 102 (2012).

Two of the criteria that patent applications are judged on are “novelty”⁸⁵ and “obviousness.”⁸⁶ Novelty, commonly referred to as anticipation, asks whether the invention has previously been invented or disclosed to the public by another,⁸⁷ with some additional caveats.⁸⁸ Obviousness asks whether the average person engaged in the field of practice of the invention would be able to deduce the invention from what

The right conferred by the patent grant is, in the language of the statute and of the grant itself, ‘the right to exclude others from making, using, offering for sale, or selling’ the invention in the United States or ‘importing’ the invention into the United States. What is granted is not the right to make, use, offer for sale, sell or import, but the right to exclude others from making, using, offering for sale, selling or importing the invention. Once a patent is issued, the patentee must enforce the patent without aid of the USPTO.

Id. It is entirely possible for inventor X to patent invention A, and for inventor Y to invent an improvement on or addition to A, called here A.1. X can exclude Y from using any of the elements contained solely within A, and Y can exclude X from using any of the improvements added in A.1. Effectively, the improvement cannot be utilized without infringing the patent of the original inventor.

⁸⁵ *Id.*

⁸⁶ § 103.

⁸⁷ DURHAM, *supra* note 43, at 14. This requirement for the patent law that the invention is new to the field is different from the “originality” concept, *see infra* Part III.C., and absent from copyright law. “To illustrate, assume that two poets, each ignorant of the other, compose identical poems. Neither work is novel, yet both are original and, hence, copyrightable.” *Feist Publications, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 345–46 (1991).

⁸⁸ § 102(b). The patented invention must not have been on sale or in public use by the inventor prior to a year before the filing date, so the inventor is given a one-year grace period between publication or sale and filing. *Id.* The entity filing the patent must be the proper holder of the technology and must not have misappropriated it from the rightful inventor.

is known from prior patents and other public knowledge.⁸⁹ This is a tricky question because it considers the invention as a whole, as opposed to anticipation, which is a rote claim-by-claim comparison of the current application with any prior single source.⁹⁰ For the purposes of this note, only this cursory understanding of obviousness is necessary.

Although it is often said that patents can be granted on “anything under the sun,”⁹¹ there are some substantial limitations.⁹² Patents are reserved strictly for processes,⁹³ machines,⁹⁴ manufactures,⁹⁵ and

⁸⁹ § 103.

⁹⁰ SCHWARTZ, *supra* note 70, at 85.

⁹¹ *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

In choosing such expansive terms as ‘manufacture’ and ‘composition of matter,’ modified by the comprehensive ‘any,’ Congress plainly contemplated that the patent laws would be given wide scope. The relevant legislative history also supports a broad construction. The Patent Act of 1793, authored by Thomas Jefferson, defined statutory subject matter as ‘any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement [thereof].’ Act of Feb. 21, 1793, § 1, 1 Stat. 319. The Act embodied Jefferson’s philosophy that ‘ingenuity should receive a liberal encouragement.’⁵ Writings of Thomas Jefferson 75–76 (Washington ed. 1871). See *Graham v. John Deere Co.*, 383 U.S. 1, 7–10, 86 S.Ct. 684, 688–690, 15 L.Ed.2d 545 (1966). Subsequent patent statutes in 1836, 1870, and 1874 employed this same broad language. In 1952, when the patent laws were recodified, Congress replaced the word ‘art’ with ‘process,’ but otherwise left Jefferson’s language intact.

Id. at 308-09.

⁹² USPTO, INTERIM GUIDELINES FOR EXAMINATION OF PATENT APPLICATIONS FOR PATENT SUBJECT MATTER ELIGIBILITY, 14-15 (2009), http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/guidelines101_20051026.pdf.

⁹³ See *Diamond v. Diehr*, 450 U.S. 175 (1981). See also USPTO, *supra* note 92, at 19-20.

compositions of matter.⁹⁶ Generally, abstract ideas cannot be patented.⁹⁷ This includes the abstract application of computer algorithms,⁹⁸ although software patents with transformative properties may be allowable.⁹⁹ In order for a software patent to be granted, it must be uniquely tied to the

For claims including such excluded subject matter to be eligible, the claim must be for a practical application of the abstract idea, law of nature, or natural phenomenon. . . . The examiner first shall review the claim and determine if it provides a transformation or reduction of an article to a different state or thing. . . . If the examiner determines that the claim does not entail the transformation of an article, then the examiner shall review the claim to determine if the claim provides a practical application that produces a useful, tangible and concrete result.

Id.

⁹⁴ *Burr v. Duryee*, 68 U.S. 531, 570 (1863) (“[A] concrete thing, consisting of parts, or of certain devices and combination of devices.”); *see also* *Corning v. Burden*, 56 U.S. 252, 267 (1854) (“[E]very mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result”).

⁹⁵ *Diamond*, 447 U.S. at 308 (“[T]he production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery.” (quoting *American Fruit Growers, Inc. v. Brogdex Co.*, 283 U.S. 1, 11 (1931))).

⁹⁶ *Id.* (quoting *Shell Dev. Co. v. Watson*, 149 F. Supp. 279, 280 (D.D.C. 1957) (“[A]ll compositions of two or more substances and all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids”).

⁹⁷ *See* DURHAM, *supra* note 43, at 14. This term has a different meaning in copyright law. *Id.* The Supreme Court has not readily defined its use in patent law. Brian Fung, *The Supreme Court’s Decision On Software Patents Still Doesn’t Settle The Bigger Question*, THE WASHINGTON POST (June 20, 2014), <http://www.washingtonpost.com/blogs/the-switch/wp/2014/06/20/the-supreme-courts-decision-on-software-patents-still-doesnt-settle-the-bigger-question>.

⁹⁸ *CLS Bank Int’l v. Alice Corp. Pty.*, 717 F.3d 1269, 1278 (Fed. Cir. 2013).

⁹⁹ *See* Fung, *supra* note 97 (arguing this is still in contention. The Supreme Court recently struck down computer software patents that do not do enough to raise the premise of the patent beyond an abstract idea combined with a computer. *Id.* Some feel that the Supreme Court did not define what would be considered an acceptable software patent, and so the future of these patents is still uncertain).

operation of a specific machine or have some physical impact on the material world,¹⁰⁰ although this is a constantly evolving legal field.¹⁰¹

Patent law covers both what a consumer is allowed to do with a patented object as well as how to repair a patented object. The applicable doctrine is the repair-reconstruction doctrine.¹⁰² A consumer is allowed to repair a patented item to the extent that it makes it usable.¹⁰³ The consumer does not have the right to use unapproved parts for repair.¹⁰⁴ Once it's usable life is spent, the consumer is not allowed to repair it to the point of being usable,¹⁰⁵ and it must be discarded.

b. *TOOLS OF PATENT PROTECTION*

In patent law, there are multiple types of infringements. Literal infringement occurs when “whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the

¹⁰⁰ *Bilski v. Kappos*, 561 U.S. 593, 599 (2010).

¹⁰¹ See generally Ashby Jones, *Courts Nix More Software Patents*, THE WALL STREET JOURNAL (Sept. 21, 2014), <http://www.wsj.com/articles/federal-courts-reject-more-software-patents-after-supreme-court-ruling-1411343300>.

¹⁰² See generally Kelsey B. Wilbanks, *The Challenges of 3d Printing to the Repair-Reconstruction Doctrine in Patent Law*, 20 GEO. MASON L. REV. 1147 (2013).

¹⁰³ *Id.* at 1156.

¹⁰⁴ *Id.*

¹⁰⁵ *Id.*

patent... .”¹⁰⁶ The term “makes” has been construed to refer to “creating an operable assembly of the patented invention.”¹⁰⁷ “Uses” constitutes anything beyond “mere possession.”¹⁰⁸ “Sells” and “offers to sell” are given their ordinary meaning.¹⁰⁹ Literal infringement is the type most often litigated,¹¹⁰ and the most straightforward to prove.¹¹¹

Sometimes judicial determinations of infringement require a deeper look into the patent itself. Arguably the most important aspect of the patent application is the claims.¹¹² These are responsible for defining the parameters of what the patent covers.¹¹³ The claims do not exist in a vacuum, and therefore are subject to interpretation.¹¹⁴ During a case of infringement, the judicial determination of what the claim itself intends to cover is known as “claim construction.”¹¹⁵ The judge looks to the

¹⁰⁶ 35 U.S.C. § 271 (2012).

¹⁰⁷ SCHWARTZ, *supra* note 70, at 160.

¹⁰⁸ *Id.*

¹⁰⁹ *Id.* at 160-61.

¹¹⁰ Univ. of Houston L. Center, *Rulings in 2013*, UNIV. OF HOUSTON LAW CENTER’S INSTITUTE FOR INTELLECTUAL PROPERTY AND INFORMATION LAW, http://patstats.org/2013_Full_Year_Posting.html (last updated 2013).

¹¹¹ *See generally id.*

¹¹² *See infra* Part III.B.

¹¹³ *Id.*

¹¹⁴ *See* SCHWARTZ, *supra* note 70, at 116; *see also* Graver Tank & Mfg. Co. v. Linde Air Products Co., 339 U.S. 605, 609 (1950).

¹¹⁵ *See* SCHWARTZ, *supra* note 70, at 120.

language of the claims, the specification, the prosecution¹¹⁶ history, the common meaning of the language, the meaning within the art, and any other intrinsic and extrinsic evidence to determine the extent of the patent's literal coverage.¹¹⁷ Even though this is a completely separate process from how the patent office examiners evaluate the document, in litigation the judge will still initially make a determination of validity of the patent that is just as binding.¹¹⁸ If the patent is held valid, this construction is then compared against alleged infringers for literal infringement.¹¹⁹ There is no infringement if any element of the patent is absent from the alleged infringer.

The extent of the patent protection “fence” can extend beyond the literal interpretation of the claims, and this is often the issue in litigation.¹²⁰ The “doctrine of equivalents” governs this type of dispute. This doctrine covers infringement that does not explicitly fall within the

¹¹⁶ Prosecution in patent law describes the process of patent application examination by the U.S. Patent Office. *Id.* at 19.

¹¹⁷ *Id.* at 145.

¹¹⁸ *Id.*

¹¹⁹ 35 U.S.C. § 271(a) (2012). “Except as otherwise provided in this title, whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States, or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.” *Id.*

¹²⁰ In 2013, 46 summary judgments were decided on Doctrine of Equivalent grounds for infringement, as opposed to 118 on literal infringement. *Rulings in 2013, supra* note 110.

language of the claims, but performs a similar function with similar operations in a similar manner that make the matter fall under the patent.¹²¹ The intent of the doctrine is to protect the patent holder against a copier who makes an insubstantial change in order to defeat the patent.¹²²

The doctrine of equivalents' principles stem back to the 1853 case of *Winans v. Denmead*,¹²³ which was affirmed and clarified in the 1997 case of *Warner-Jenkinson Company, Inc. v. Hilton Davis Chemical Co.*¹²⁴ In the case, the Supreme Court created the “all elements” inquiry for determining whether an infringing article falls within the bounds of equivalency;¹²⁵ the functionality is compared between the inventions on a claim-by-claim basis, and not between the inventions as a whole, so that each claim of the original invention, or its equivalent, is mirrored in some way in the infringing invention.¹²⁶ Therefore, if elements distinguishing the allegedly infringing invention from the original invention are found to be insubstantial to the function of the invention, there is still

¹²¹ *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608-09 (1950).

¹²² Sun Y. Pae, *Balancing the Public Interest Against That of a Patent Owner: The Doctrine of Equivalents*, 19 DCBA BRIEF 21 (2006). “The essence of the doctrine is that one may not practice a fraud on a patent.” *Graver*, 339 U.S. at 608.

¹²³ *Winans v. Denmead*, 56 U.S. 330, 344 (1853).

¹²⁴ *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 35 (1997).

¹²⁵ *Id.* at 40.

¹²⁶ *Id.*

infringement.¹²⁷ In this way, the doctrine protects the “heart of an invention.”¹²⁸

The “Doctrine of Equivalents” and claim construction doctrine act to “remove [. . .] the unfairness that could result from an overemphasis on the literal language of patent claims, and thereby afford patentees protection accorded to the patent.”¹²⁹ It extends the patent protection to inventions that are not anticipated and not necessarily obvious, but were within the intent of the inventor.¹³⁰ It does not allow the inventor to impermissibly claim beyond what he would’ve obtained during prosecution, as “[t]he doctrine of equivalents exists to prevent a fraud on a patent, not to give a patentee something which he could not lawfully have

¹²⁷ *Id.*

¹²⁸ SCHWARTZ, *supra* note 70, at 177. For example:

The Hollow-rod element in an accused ceiling fan whose blades are attached to a hollow rod that connects with a motor would be an equivalent to the claimed solid-rod element if the hollow rod performs substantially the same function in substantially the same way, and for substantially the same purpose as the solid-rod element claimed in the patented three-bladed ceiling fan. Similarly, the remote-control element of an accused ceiling fan that uses a remote-control unit to turn the fan on and off would be equivalent to the claimed cord element if the differences between the remote-control unit and the cord are insubstantial to one of ordinary skill in the art.

Id.

¹²⁹ Pae, *supra* note 122.

¹³⁰ SCHWARTZ, *supra* note 70, at 180.

obtained from the PTO had he tried.”¹³¹ Additionally, inventors operating in a cutting edge field may be given broader rights than in a clearly established field because there is less prior art to restrict it.¹³²

c. *INDUCED INFRINGEMENT*

The United States Code contains provisions for when one “actively induces infringement,”¹³³ or even attempts to profit from an illegitimately obtained “component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent . . .”¹³⁴

Two cases have created the dividing line for when a provider of infringing material has induced infringement, with *Metro-Goldwyn-Mayer*

¹³¹ The process of claim interpretation includes consideration of the prior art and prosecution history of the patent, and thus will not extend the patent fence to what the inventor has already given up in the filing history or what is disclosed by another within the prior art. *See Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 733-35 (2002) (narrowing of the claims in the prosecution history gives up any future rights to equivalents).

¹³² SCHWARTZ, *supra* note 70, at 180.

¹³³ 35 U.S.C. § 271(b) (2012).

¹³⁴ § 271(c).

*Studios Inc. v. Grokster, Ltd.*¹³⁵ falling on the infringement side and *Sony Corp. of Am. v. Universal City Studios, Inc.*¹³⁶ demonstrating noninfringement. In *Sony Corp.*, the respondent contended that the home video recording machine (“VCR”) that Sony manufactured was being used to record copyrighted television broadcasts, and thus Sony was guilty of contributory infringement.¹³⁷ The Court decided to bridge both patent and copyright law on the matter of contributory infringement, and they set the legal standard on whether the “product is widely used for legitimate, unobjectionable purposes. Indeed, it need merely be capable of substantial noninfringing uses.”¹³⁸

In *Grokster*, the dispute stemmed from a free software application that created an online network to allow users to directly share digital files with each other.¹³⁹ Although the software was used to indiscriminately share billions of files a month, the distributors were aware that copyrighted materials were being downloaded illegally using their

¹³⁵ *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*, 545 U.S. 913, 941 (2005).

¹³⁶ *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 456 (1984).

¹³⁷ *Id.* at 447.

¹³⁸ *Id.* at 442.

¹³⁹ *Grokster*, 545 U.S. at 919-20.

service.¹⁴⁰ The Supreme Court was able to further refine their Sony ruling: “The inducement rule, instead, premises liability on purposeful, culpable expression and conduct, and thus does nothing to compromise legitimate commerce or discourage innovation having a lawful promise.”¹⁴¹ Together, the two cases to create a standard where induced infringement must either show the purpose of inducing the infringement or have notice that a substantial amount of the business activity involves infringing activity.

The Supreme Court has recently adjusted the doctrine to include scenarios where more than one party contributes to the process of infringement,¹⁴² which was previously scattered and dangerously open-ended. Justice Alito set the prerequisite that “liability for inducement must be predicated on direct infringement”; i.e., a method patent “is not infringed unless all the steps are carried out” by one party, which then

¹⁴⁰ *Id.* at 913.

¹⁴¹ *Id.* at 937.

¹⁴² *Limelight Networks, Inc. v. Akamai Technologies, Inc.*, 134 S. Ct. 2111, 2115 (2014) (stating that Akamai has the exclusive license on a method patent for a “tagging” process that occurs on its own servers to increase the speed users can access content. Limelight split up the process so that the tagging occurred on the users’ computers, and then the content was stored on Limelight’s servers).

allows for a determination of inducement.¹⁴³ This allows for situations where multiple parties each take one step in a process toward infringement, also known as divided infringement,¹⁴⁴ unless one party is ultimately directly infringing.¹⁴⁵

¹⁴³ “A method’s steps have not all been performed as claimed by the patent unless they are all attributable to the same defendant, either because the defendant actually performed those steps or because he directed or controlled others who performed them.” MICHAEL J. LENNON, *DRAFTING TECHNOLOGY PATENT LICENSE AGREEMENTS*, 3-272.12 (2d ed. 2017).

¹⁴⁴ [R]espondents . . . criticize our interpretation of § 271(b) as permitting a would-be infringer to evade liability by dividing performance of a method patent’s steps with another whom the defendant neither directs nor controls. We acknowledge this concern. Any such anomaly, however, would result from the Federal Circuit’s interpretation of § 271(a) in *Muniauction*. A desire to avoid *Muniauction*’s natural consequences does not justify fundamentally altering the rules of inducement liability that the text and structure of the Patent Act clearly require — an alteration that would result in its own serious and problematic consequences, namely, creating for § 271(b) purposes some free-floating concept of “infringement” both untethered to the statutory text and difficult for the lower courts to apply consistently.

Limelight, 134 S. Ct. at 2120 (emphasis added). The Supreme Court here resolved the tension between patent rights and cultivating innovation in favor of the latter.

¹⁴⁵ There is also infringement when:

[A] single party representing an alleged infringer exercises control or direction over method steps not directly performed by the alleged infringer . . . [I]t appears that a contract between multiple parties required for performing a patented method would need to mandate one or more steps the contracting party must perform to avoid breach. Thus, if a party (e.g., a customer) has the option of whether or not to perform one or more steps of a patented method while not being in breach of the contract, then there is no direction or control with respect to establishing a direct infringement claim.

Alton Hornsby III, *Divided Infringement for Software Patents in View of Limelight Networks v. Akamai Technologies*, 7 LANDSLIDE 46, 48–49 (2014).

2. *OTHER TYPES OF INTELLECTUAL PROPERTY LACKING DIGITAL PROTECTIONS*

While utility patents protect the function of an invention, a design patent protects its appearance.¹⁴⁶ Specifically, they provide legal protection over the “visual characteristics embodied in or applied to” a manufacture with practical utility.¹⁴⁷ The design must be ornamental and separated from the utility of the device, however.¹⁴⁸ If the design is dictated by the function of the device, then it can only be included in a utility patent.¹⁴⁹ The test for design patent infringement is “substantially similar”;¹⁵⁰ the later design does not have to have the exact same appearance as the patent, but it must appear similar to an ordinary observer.

¹⁴⁶ “In general terms, a ‘utility patent’ protects the way an article is used and works [35 U.S.C. § 101 (2012)], while a ‘design patent’ protects the way an article looks [35 U.S.C. § 171 (2012)].” *A Guide To Filing A Design Patent Application*, U.S. DEPT. OF COMMERCE, PATENT AND TRADEMARK OFFICE,

<http://www.uspto.gov/patents/resources/types/designapp.jsp>.

¹⁴⁷ MANUAL OF PATENT EXAMINING PROCEDURE § 1502 (2014).

¹⁴⁸ Daniel A. Tysver, *Design Patents*, BITLAW,

<http://www.bitlaw.com/patent/design.html>.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

Trademarks can also cover design, but they are more accurately “a symbol of the goodwill of the business with which they are associated.”¹⁵¹ They represent a limited property right for the owner in a word, phrase, or symbol that is inexorably linked with a brand so that the average consumer would have no doubt as to the origin of the product or service.¹⁵²

Trade dress is a branch of trademark law that covers the “total image, design, and appearance of a product and ‘may include features such as size, shape, color, color combinations, texture or graphics.’”¹⁵³ Trade dress may cover the layout, exterior, and image of a restaurant that makes it uniquely identifiable, but does not extend to business practices that make the restaurant uniquely identifiable.¹⁵⁴

There is also a specific branch of law that deals exclusively with semiconductor chips known as mask work.¹⁵⁵ Mask work law was

¹⁵¹ ADAM L. BROOKMAN & BOYLE FREDRICKSON, TRADEMARK LAW: PROTECTION, ENFORCEMENT, AND LICENSING 1-3 (2d ed. 2014).

¹⁵² *Id.* at 1-4.

¹⁵³ *Clicks Billiards, Inc. v. Sixshooters, Inc.*, 251 F.3d 1252, 1257 (9th Cir. 2001) (quoting *Int'l Jensen, Inc. v. Metrosound U.S.A., Inc.*, 4 F.3d 819, 822 (9th Cir. 1993)).

¹⁵⁴ BROOKMAN, *supra* note 152, at 4-8.

¹⁵⁵ Maskwork is defined as:

[A] series of related images, however fixed or encoded, having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product, and in which the relation of the images to one another is such that each image has the pattern of the

developed, primarily at the behest of Intel and the Semiconductor Industry Association, to combat “chip piracy.”¹⁵⁶ Mask work bestows ten years of protection over the layout of an original circuit board design.¹⁵⁷ Although the doctrine stems from copyright law, it operates in a similar manner to patent law.¹⁵⁸ Most importantly, it protects semiconductor chips against rote reproduction.¹⁵⁹

surface of one form of the semiconductor chip product.

Semi-conductor Chip Protection Act, 17 U.S.C.A. § 901 (1984).

¹⁵⁶ Leon Radomsky, *Sixteen Years after the Passage of the U.S. Semiconductor Chip Protection Act: Is International Protection Working*, 15 BERKELEY TECH. L.J. 1049, 1051–52 (2000).

¹⁵⁷ THOMAS F. VILLENEUVE, ROBERT V. GUNDERSON, JR. & COLIN D. CHAPMAN, CORPORATE PARTNERING: STRUCTURING AND NEGOTIATING DOMESTIC AND INTERNATIONAL STRATEGIC ALLIANCES 2–20 (4th ed.2008 Supp.). There are some caveats, such as whether it is the only possible design for that embodiment. *Id.*

¹⁵⁸ “Although the Chip Act is part of the Copyright Law and administered by the Copyright Office, the law embodies both copyright and patent law concepts to provide protection for the physical ‘chips’ upon which computer technology presently depends.” HOWARD B. ROCKMAN, INTELLECTUAL PROPERTY LAW FOR ENGINEERS AND SCIENTISTS 425 (2004).

¹⁵⁹ This protection does not extend to reverse engineering and leaves a questionable gap that may circumvent any protection. *See* Terry Ludlow, *Judicial Support For Semiconductor Reverse Engineering*, INTELLECTUAL PROPERTY LAW NEWSLETTER (Fall 2006),

http://www.americanbar.org/newsletter/publications/gp_solo_magazine_home/gp_solo_magazine_index/intellectprop_judicialsupport.html.

D. *PULLING IT ALL TOGETHER*

1. *DOCTRINE OF CONCEPTUAL SEPARABILITY AND THE OVERLAP OF INTELLECTUAL PROPERTY*

Due to the split in intellectual property between the functional and the aesthetic, infringement does not necessarily fall cleanly into one doctrine. When several elements of one article each qualify for different types of intellectual property protection, but the item itself is physically inseparable, the court must “conceptually separate physically intertwined elements.”¹⁶⁰ Using this technique, known as conceptual separability, the court can artificially assess the viability of a copyright or design patent on the design of a shoe separately from a utility patent on the shoe itself.¹⁶¹

2. *IN SUM*

Patents can only cover an article’s purely functional aspects.¹⁶² A copyright can only cover an article’s aesthetic aspects, so long as there is “at least a small amount of artistic authorship original to the creator.”¹⁶³

Design patents cover the shape or configuration or surface ornamentation

¹⁶⁰ *Id.* at 44.

¹⁶¹ *Id.* at 43.

¹⁶² SCHWARTZ, *supra* note 70, at 72.

¹⁶³ John F. Hornick, *Some Thoughts on Copyright and 3d Printing*, 3D PRINTING INDUSTRY (Sept. 13, 2013), <http://www.finnegan.com/resources/articles/articlesdetail.aspx?news=e2ffa9b0-0020-4d61-89fd-686692934df9>.

of an article.¹⁶⁴ Trademarks can cover only the design elements that make the article uniquely identifiable.¹⁶⁵

Trade dress and design patent overlap in the subject matter of product aesthetic, and either form of protection may be acceptable depending on the circumstances of the property owner.¹⁶⁶ Design patents and copyright may also overlap, and the inventor can secure either or both protections.¹⁶⁷

A good case study for understanding the interactions between design and utility elements is the high-profile case of *Apple, Inc. v. Samsung Electronics*.¹⁶⁸ Apple has several utility and design patents over the iPhone, its smartphone product.¹⁶⁹ There are two design patents that claim:

[A] minimalist design for a rectangular smartphone consisting of a large rectangular display occupying most of

¹⁶⁴ See *supra* Part III.C.

¹⁶⁵ *Id.*

¹⁶⁶ Trade dress is generally more difficult to obtain, while design patents are more expensive. See *Trade Dress v. Design Patents: Clash of the IP Rights*, FOLEY & LARDNER LLP (2008), <http://www.foley.com/files/Event/e31e01ce-b885-4370-b774-f7ebe4e3544d/Presentation/EventAttachment/db37f3cf-0dc9-4caa-915a-f8070f993d61/TradeDress.pdf>.

¹⁶⁷ MANUAL OF PATENT EXAMINING PROCEDURE § 1512. The Supreme Court has not yet made a decision on whether the inventor would have to elect copyright or design patent protection in litigation. *Id.*

¹⁶⁸ *Apple, Inc. v. Samsung Electronics Co.*, 678 F.3d 1314, 1314 (Fed. Cir. 2012).

¹⁶⁹ *Id.* at 1317.

the phone's front face. The corners of the phone are rounded. Aside from a rectangular speaker slot above the display and a circular button below the display claimed in several figures of the patent, the design contains no ornamentation. The D'087 patent claims a bezel surrounding the perimeter of the phone's front face and extending from the front of the phone partway down the phone's side. The parts of the side beyond the bezel, as well as the phone's back, are disclaimed, as indicated by the use of broken lines in the patent figures. The D'677 patent does not claim a bezel but instead shows a black, highly polished, reflective surface over the entire front face of the phone. The D'677 patent disclaims the sides and back of the device.¹⁷⁰

Apple also has a utility patent that covers the software method for scrolling on the screen of the device.¹⁷¹ This does not cover the specific computer code written for executing the method, which could be covered by copyright.¹⁷² Likewise, the copyright would only cover the exact composition of the code and not the executed process.¹⁷³

Hypothetically, Apple could have attained copyright and trade dress protection on the design of the iPhone, but not a utility patent. They could have also obtained utility patents on the functional hardware and

¹⁷⁰ *Id.*

¹⁷¹ *Id.* at 1318.

¹⁷² *But see* HORNICK, *supra* note 163 (suggesting that software copyrights are difficult to uphold in court).

¹⁷³ *See supra* Part III.C.

software elements of the phone, so long as they were not precluded by the prior art,¹⁷⁴ but not copyright, trade dress, or design patents.

IV. ANALYSIS

A. *PERSPECTIVE ON THE ISSUE*

Policymakers have been very eager to laud the potential of 3D printing to advance the American economy¹⁷⁵ but have done little of substance to create a legal framework to allow it to do so. Even the current framework can be defeated with conscious effort.¹⁷⁶ There is danger in waiting; stalling on legislating a solution creates an opportunity for the judiciary to decide issues. The aging Supreme Court¹⁷⁷ is infamous as of late for its mishandling of technological jargon and analogies.¹⁷⁸ This issue is most ripe in patent law, which requires the judiciary whose job

¹⁷⁴ See *supra* Part III.B.

¹⁷⁵ See *supra* Part I.

¹⁷⁶ See *DeepSouth Packing Co. v. Laitram Corp.*, 406 U.S. 518 (1972) (Manufacturer circumvented patent protection by producing components of a patented machine and then exporting those components overseas to be assembled by its foreign customers).

¹⁷⁷ The average age of the Supreme Court Justices as of the April 2014 was 78.7 years old. Jaime Fuller, *Everything You Didn't Even Think You Wanted To Know About Supreme Court Retirements*, THE WASHINGTON POST (Apr. 21, 2014), <http://www.washingtonpost.com/blogs/the-fix/wp/2014/04/21/everything-you-didnt-even-think-you-wanted-to-know-about-supreme-court-retirements>.

¹⁷⁸ Brian Fung, *The Aereo Case is Being Decided By People Who Call iCloud 'The iCloud.'* *Yes, Really*, THE WASHINGTON POST (Apr. 23, 2014), <http://www.washingtonpost.com/blogs/the-switch/wp/2014/04/23/the-aereo-case-is-being-decided-by-people-who-call-icloud-the-icloud-yes-really/>.

requires them to be generalists to interpret a combination of complex legal and technological aspects of the patent that individually would trouble non-domain experts.¹⁷⁹ For instance, there is a huge difference in scope between use of the word “comprising” versus “consisting” within a claim,¹⁸⁰ which can be overlooked by justices attempting to understand if “wifi” is more analogous to phone lines or radio broadcasts.¹⁸¹

The artificial separation between functionality and aesthetic in intellectual property has not previously been an issue, in terms of its interaction with the Internet. Due to copyright doctrine’s sprawling coverage of expression and the Internet’s limitations in regards to physical media, the DMCA has been an effective enough tool to brandish against online infringement.¹⁸² Even considering the current state of 3D printing technology, most items that are able to be printed are more oriented towards the aesthetic than towards the functional, and thus, have fallen

¹⁷⁹ See *supra* Part III.B.

¹⁸⁰ MANUAL OF PATENT EXAMINING PROCEDURE § 2111.

¹⁸¹ *In re Google Inc. Street View Electronic Communications Litigation*, 794 F.Supp.2d 1067, 1081 (N.D. Cal. 2011).

¹⁸² Google reported approximately thirty-four million takedown requests in January 2014 alone. *Transparency Report*, GOOGLE, <http://www.google.com/transparencyreport/removals/copyright> (last visited June 19, 2017). There are services that will police copyrights online and send DMCA takedown notices for a small fee, without the need for a lawyer. See DMCA.COM, <http://www.dmca.com> (last visited June 19, 2017).

under the curtails of the DMCA.¹⁸³ For copyrightable designs and objects, this can include the computer files containing the infringing designs for printing.¹⁸⁴

Surprisingly, despite the fact that patents themselves contain a veritable blueprint for infringement, infringement itself is currently relatively rare.¹⁸⁵ This is attributed to an assortment of factors, including the difficulty of manufacturing and the constant threat of litigation.¹⁸⁶ The future legal issue will likely arise primarily with digital embodiments (read: CAD files) of functional items that have no “purely” aesthetic considerations in the design.¹⁸⁷ The CAD files will not qualify for copyright protection on their own if they do not embody original expression.¹⁸⁸ Additionally, “for CAD files to be copyrightable, they must

¹⁸³ The categories on thingiverse.com comprise: art, fashion, gadgets (mostly accessories), household, and models. MAKERBOT THINGIVERSE, <http://www.thingiverse.com> (last visited June 19, 2017).

¹⁸⁴ See Nathan Hurst, *supra* note 67 (HBO claimed that the offered “iron throne” design would mislead consumers as to its origin); see also Gerrit Coetzee, *Thingiverse Receives First DMCA Takedown*, HACKADAY (Feb. 20, 2011), <http://hackaday.com/2011/02/20/thingiverse-receives-first-dmca-takedown>.

¹⁸⁵ See generally Desai, *supra* note 47.

¹⁸⁶ *Id.*

¹⁸⁷ This could be something as simple as a liquor bottle. See *Ets-Hokin v. Skyy Spirits, Inc.*, 225 F.3d 1068, 1080 (9th Cir. 2000) (“The Skyy vodka bottle, although attractive, has no special design or other features that could exist independently as a work of art. It is essentially a functional bottle without a distinctive shape.”).

¹⁸⁸ Although, to be fair, this is a very low bar:

either be created by a person from scratch, or modified by a person from a pre-existing CAD file.”¹⁸⁹ This would prohibit any recreations arising from 3D scanning.¹⁹⁰

CAD files that are based on copyrighted articles do not necessarily have inherent protection. In some cases, a third party independently creating a CAD file copying the copyrighted design is not per se infringing.¹⁹¹ Even hosting potentially infringing files online does not necessarily trigger legal protection.¹⁹² This is the area of biggest concern,

To be sure, the requisite level of creativity is extremely low; even a slight amount will suffice. The vast majority of works make the grade quite easily, as they possess some creative spark, “no matter how crude, humble or obvious” it might be. *Id.*, § 1.08 [C] [1]. Originality does not signify novelty; a work may be original even though it closely resembles other works so long as the similarity is fortuitous, not the result of copying.

Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991).

¹⁸⁹ *Meshwerks, Inc. v. Toyota Motor Sales U.S.A., Inc.*, 528 F.3d 1258 (10th Cir. 2008). Meshwerks was hired by Toyota to make digital models of its car for display on Toyota's website. *Id.* at 1260. “[T]he vehicles’ data points (measurements) were mapped onto a computerized grid and the modeling software connected the dots to create a ‘wire frame’ of each vehicle.” *Id.*

¹⁹⁰ *See Sparaco v. Lawler, Matusky, Skelly, Engineers LLP*, 303 F.3d 460, 467 (2d Cir. 2002) (denying copyright on blueprints of “the existing physical characteristics of the site, including its shape and dimensions, the grade contours, and the location of existing elements, [as] it sets forth facts; copyright does not bar the copying of such facts.”).

¹⁹¹ *Meshwerks*, 528 F.3d at 1269-70.

¹⁹² The Supreme Court has been reluctant to find contributory infringement for devices that have mainly legitimate purposes. *See infra* Part III.C. The argument may be made that uploading patent-infringing CAD files which the user downloads and prints could allow the user to violate the “make” provision for a sufficient showing of direct infringement to allow contributory infringement. *Id.*

as it is substantially more difficult to institute an effective solution against “downstream” users in their own homes than it is to enforce against “upstream” providers.¹⁹³ Additionally, copyright has some broad exceptions, such as fair use, that may not make it a desirable protection scheme for a manufacturer as compared to patent law.¹⁹⁴

Likewise, no patent protection naturally arises from a patented article to protect a CAD representation of the article.¹⁹⁵ Similarly, there may not even be infringement from downloading the CAD file or from printing it, especially if the components used to form the infringing article come from different sources.¹⁹⁶ In short, patent law does not natively protect against an infringer creating and distributing digital copies of a patented article. Digital embodiments of functional objects seem to fall between the proverbial cracks in intellectual property protection. This is problematic for manufacturers because by the time the consumer is 3D

¹⁹³ Daniel Harris Brean, *Asserting Patents to Combat Infringement Via 3D Printing It's No "Use"*, 23 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 771, 788-790 (2013).

¹⁹⁴ 17 U.S.C.A. § 107 (West).

¹⁹⁵ There is no “make” or “use” here as within the statutory definition of infringement. *See supra* Part III.C.1.

¹⁹⁶ The Supreme Court has considered the induced infringement and divided infringement standards only as they pertain to method and software patents, but not how it would apply to general utility patents. *See supra* Part III.C.

printing the infringing article at home, it is too late to take effective mass legal action.

An optimistic view of 3D printing's potential technological advancement must be tempered with the possibility of significant legal issues. The introduction of in-home circuitry printing, which is not very far-fetched,¹⁹⁷ has the possibility of enabling even the average consumer to print sophisticated electronics when combined with existing 3D printing technology. Complex electronic reproduction in the home will result in mask work protection, a doctrine designed primarily for and to be used against large-scale manufacturers, against in-home 3D printer operators in a way that is unprecedented.¹⁹⁸

A countervailing interest in limiting the scope of intellectual property protection exists so as to provide the widest path for

¹⁹⁷ See John Biggs, *The Voltera V-One Makes Circuit Boards In Minutes*, TECH CRUNCH (Jan. 6, 2015), <http://techcrunch.com/2015/01/06/the-voltera-v-one-makes-circuit-boards-in-minutes> (“The Voltera V-One goes beyond printing single layer circuits on paper. We’re the first to be able to print two layer circuits onto FR4 (the industry standard substrate) with a product of this size and cost. But it doesn’t stop there . . . the printer is also capable of dispensing solder paste and baking the board to attach all the small components.”); see also AgIC, Inc., *AgIC Print - Printing Circuit Boards with Home Printers*, KICKSTARTER, <https://www.kickstarter.com/projects/1597902824/agic-print-printing-circuit-boards-with-home-print> (Fundraising campaign for printer that will be able to print circuit boards with the ease of “a printer using ordinary ink at your home and office.”).

¹⁹⁸ See *supra* Part III.C.2.

innovation.¹⁹⁹ An increase in the breadth of coverage could risk overextending protection, as well as setting off unforeseeable results harmful to this constitutionally mandated purpose.²⁰⁰

A demonstrable difficulty in policing the Internet still exists.²⁰¹ For instance, although the Record Industry Association of America (“RIAA”) was able to take down some file sharing networks in combatting online copyright infringement and illegal music downloading, a significant amount of downloading continues to occur.²⁰²

Thus, a solution would need to: encompass the entirety of the invention; cover infringing digital embodiments; not be over-inclusive so

¹⁹⁹ See e.g., *Graham v. John Deere Co.*, 383 U.S. 1, 5-6 (1966) (“Congress in the exercise of the patent power may not ... enlarge the patent monopoly without regard to the innovation, advancement or social benefit gained thereby.”).

²⁰⁰ See generally Janet Freilich, *The Uninformed Topography of Patent Scope*, 19 STAN. TECH. L. REV. 150, 151 (2015).

²⁰¹ The complete eradication of files once they have appeared online is almost impossible. This has recently been demonstrated within the realm of 3d printing with firearms. Makerbot, a popular repository for user-created 3d printable files removed all firearm components as part of its mission to promote “creative empowerment for products that have a positive impact.” *MakerBot Pulls 3D Gun-Parts Blueprints After Sandy Hook*, BBC (Dec. 20, 2012), <http://www.bbc.com/news/technology-20797207>. The impossibility of stemming the flow of infringement is reflected in the many examples of 3D-printed Game of Thrones replicas and memorabilia can easily be found online. See Hurst, *supra* note 62; see e.g., Scott J. Grunewald, *Someone 3D Printed a Baby-Sized Iron Throne from Game of Thrones and It’s as Awesome as it Sounds*, 3D PRINTING INDUSTRY (June 23, 2014), <https://3dprintingindustry.com/news/3d-printing-iron-throne-game-of-thrones-28696/>.

²⁰² ELECTRONIC FRONTIER FOUNDATION, *RIAA v. The People: Five Years Later* (2008), <https://www.eff.org/wp/riaa-v-people-five-years-later>.

as to have the effect of unconstitutionally limiting future progress of the arts; and be practically enforceable.

B. *PROPOSED EXPANDED DOCTRINE OF EQUIVALENTS*

A possible solution would allow the doctrine of equivalents to encompass digital embodiments of patented inventions, so that a CAD file could infringe a patent if the resulting 3D printout would have been infringed. In this way, the digital file is judged against the patent exclusively on the capability of the physical embodiment, whereas the CAD file would have received no protection unless specifically copyrighted, which could be an arduous process. It would still require a determination of infringement to be made on a case-by-case basis by the judiciary which would not require a shift in existing dogma,²⁰³ but it would frame the question so as to exclude examining multiple levels of technology while simultaneously comparing the infringing device with the patent.

This extension of the doctrine of equivalents may be counter to the doctrine's stated purpose of only protecting the inventor against infringers

²⁰³ See *supra* Part III.C.

who make insubstantial changes to defeat the patent.²⁰⁴ The Supreme Court has previously warned that “[t]here can be no denying that the doctrine of equivalents, when applied broadly, conflicts with the definitional and public-notice functions of the statutory claiming requirement.”²⁰⁵ This is because any extension of non-literal meaning of the claims makes it less likely that the public would be able to understand what the patent actually covers. In fact, any judicial interpretation of the claims are unpredictable.²⁰⁶ Due to this, the public-notice function could easily become a topical issue, as patent infringement would demand the same immediacy of action that digital copyright infringement required two decades go. However, in this instance, the industry would be at arms against metaphorical digital “cover songs” of its patented inventions.

The doctrine of equivalents already has many critics.²⁰⁷ The patent system exists between the legal and scientific worlds, so any shift in balance could have unforeseen repercussions. Some scholars instead

²⁰⁴ *Id.*

²⁰⁵ *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 29 (1997).

²⁰⁶ *See supra* Part III.C.

²⁰⁷ The United States is possibly the only nation in the world to adopt this doctrine, and the World Intellectual Organization has rejected the United States’ efforts to have the organization standardize it internationally. ADAM B. JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS* 116 (2004).

advocate creating DMCA-like regulation for patents.²⁰⁸ However, creating intricate statutory systems of regulation is no easy task. They are difficult to implement in a bipartisan Congress and, perhaps equally important, difficult to fix when broken.²⁰⁹ The judicially operated doctrine of equivalents, on the other hand, can be experimented with, implemented, modified, or discarded as need be. This is a perfect fit for such a rapidly evolving area of technology and law.

V. IMPACT

A. *COST TO THE ECONOMY*

There is reason to believe the proposition that intellectual property misappropriation as relating to goods would be a very costly problem.

²⁰⁸ See Gerard Magliocca, *A Patent DMCA*, CONCURRING OPINIONS (Mar. 6, 2013), <http://concurringopinions.com/archives/2013/03/a-patent-dmca.html>; D'Elia, Salvatore, *Replicant: 3D Printing and the Need for a Digital Millennium Patent Act*, LAW SCHOOL STUDENT SCHOLARSHIP 457 (2014), http://scholarship.shu.edu/student_scholarship/457.

²⁰⁹ The Patent and Trademark Office had a proposal when the DMCA was being debated that is reminiscent to the ongoing "net neutrality" issue:

Patent and Trademark Office, May 1997, began a proposal that went far past the WIPO treaty. One proposal was to restrict lawful fair use copying. The frightening part of this proposal was that it was supposedly to deny the public any new models of VCRs and computers unless we, the consumer, conform to all anti-copy technologies. This was to be imposed upon us, the consumer, without regard for expense, malfunction, inconvenience or consumer fair use.

MARCIA WILBUR, *DMCA: THE DIGITAL MILLENNIUM COPYRIGHT ACT* 11 (Dec. 1, 2000).

There already exists a large market for counterfeit consumer goods within the United States.²¹⁰ The value of the counterfeit and pirated goods seized at borders in 2013 alone measured approximately \$1.74 billion.²¹¹ International trade of counterfeit goods was estimated at \$250 billion worldwide for that timespan.²¹² To contrast this, approximately 55.7 million U.S. jobs are directly or indirectly supported by intellectual property-intensive industries.²¹³

This form of piracy is generally fairly organized, working through established networks and avenues.²¹⁴ It is difficult to imagine the potential impact of an ethereal pirate network, existing solely online and spreading

²¹⁰ *Counterfeiting Adds Ups*, INT'L ANTICOUNTERFEITING COALITION, <http://www.iacc.org/counterfeiting-statistics> (last visited June 19, 2017).

²¹¹ *Id.*

²¹² *Id.*

²¹³ *Id.*

²¹⁴ *See Generally* ADRIAN JOHNS, *PIRACY: THE INTELLECTUAL PROPERTY WARS FROM GUTENBERG TO GATES 1-2* (1998). NEC, a prominent Japanese electronics conglomerate, investigated counterfeit goods to surprising effect:

Two years, half a dozen countries, and several continents later, what International Risk had unveiled shocked even the most jaded experts in today's industrial shenanigans. They revealed not just a few streetwise DVD pirates, but an entire parallel NEC organization. As the real company's senior vice president ruefully remarked, the pirates had 'attempted to completely assume the NEC brand.' Their version, like the original, was multinational and highly professional. Its agents carried business cards. They were even recruiting public by what looked like legitimate advertising . . . [I]t had developed its own sophisticated distribution networks, allowing its products to reach a global market extending at least as far as Africa and Europe.

Id.

through the Internet at the rate of a mouse click, but extending into physical media.²¹⁵

The best parallel would be illegal downloading's effect on the music industry. The first port between the physical and digital music world is actually a result of the Grateful Dead, as fans used the burgeoning Internet to form groups for swapping bootleg concert recordings.²¹⁶

Later, the creation of the MPEG-3 ("MP3") encoding system would allow for audio files themselves to be hosted and shared.²¹⁷ The record companies saw the potential of the digitization of music combined with the social aspect of the Internet as a danger, and thus, were invested

²¹⁵ Although, "home piracy" is not a new concept. *Id.* at 431–63 ("Print pirates worked out of London's houses in the seventeenth century, sheet-music pirates dealt out their copies of popular songs by the thousand from terrace houses in Liverpool and Manchester in the 1900s, and listener pirates could be detected in their homes in the 1920s.").

²¹⁶ JOHN ALDERMAN, *SONIC BOOM: NAPSTER, MP3, AND THE NEW PIONEERS OF MUSIC* 19 (2002). Grateful dead lyricist John Perry Barlow had a large impact on the Internet in his own right. He lobbied for responsible regulation, and helped to popularize several techy terms. *Id.* He even presciently observed in 1994, "This vessel, the accumulated canon of copyright and patent law, was developed to convey forms and methods of expression entirely different from the vaporous cargo it is now being asked to carry." *Id.*

²¹⁷ See generally JONATHAN STERNE, *MP3: THE MEANING OF A FORMAT* 1-2 (2012). MP3s became a staple because they were able to use a mathematical formula to compress a large audio file into a manageable size ("often as small as 12[%] of the original file size") by removing parts of the audio file that can't be heard by human ears. *Id.* "The MP3 carries within it practical and philosophical understandings of what it means to communicate, what it means to listen or speak, how the mind's ear works, and what it means to make music." *Id.* at 2.

in impeding, rather than embracing, the technology.²¹⁸ Napster, a file sharing service, became eponymous with illegal downloading due to its ease of use and enormous user base.²¹⁹ While Napster was at its peak, music industry profits dropped by almost \$1 billion.²²⁰ Despite a legal battle that subsequently ended Napster's illegal operations, more varied and sophisticated services sprung up. As of 2012, the top Internet file sharing services received over 750 million unique visitors every month, with 23.8% of the total bandwidth of the World Wide Web dedicated to unauthorized content.²²¹

The consumer electronics market is projected to reach \$211.3 billion in 2014, representing a 2% increase over 2013 and an upward trend.²²² Ironically, a substantial portion of the growth derives from emerging product categories, which includes 3D printing technology.²²³

²¹⁸ Alderman, *supra* note 216, at 28.

²¹⁹ Napster had 80 million unique users at its peak. David Holmes, Andrew Bean, & Sharon Shattuck, *Who Killed The Music Industry?*, PANDO (Aug. 13, 2013), <http://pando.com/2013/08/05/who-killed-the-music-industry-an-interactive-explainer>.

²²⁰ *Id.*

²²¹ David Price, *Sizing the Piracy Universe*, NET NAMES ENVISIONAL (Sept. 2013).

²²² *Consumer Electronics Industry Revenues to Reach All-Time High in 2014, Projects CEA's Semi-Annual Sales and Forecasts Report*, CONSUMER ELECTRONICS ASSOCIATION (July 15, 2014), <http://www.ce.org/News/News-Releases/Press-Releases/2014/Consumer-Electronics-Industry-Revenues-to-Reach-All.aspx>.

²²³ These categories are projected to grow 242% in 2014 and 108% in 2015. *Id.*

Lack of foresight regarding the patenting system has had an impact on the United States economy in the past. According to one study, patent assertion entities, known commonly as “patent trolls,” cost the economy more than \$29 billion in 2011 alone.²²⁴

B. *LIMITLESS POTENTIAL*

It is impossible to ignore the possibilities that 3D printing opens, especially within the scientific community. For instance, the International Space Station has printed 21 objects using its onboard 3D printer as of the time of writing of this article.²²⁵ NASA recently “emailed” the ISS commander a socket wrench that he was immediately able to utilize.²²⁶ In the past, the station would have had to wait for a basic tool to arrive on the next supply shipment launch from Earth.²²⁷

Congress has recently adopted a first-to-file system, as opposed to the previous first-to-invent system, partially to combat the “patent

²²⁴ *The Case for Change*, THE COALITION FOR PATENT FAIRNESS, <http://www.patentfairness.org/learn>. Patent trolls operate by accruing large amounts of patents with the sole intent to collect licensing fees or sue for infringement with no intent to manufacture. *Id.*

²²⁵ Sarah Anderson, *First Ever Hardware is ‘Emailed’ to Space — Made in Space and NASA Email Wrench to ISS*, 3DPRINT.COM (Dec. 19, 2014), <http://3dprint.com/32269/made-in-space-emails-wrench>.

²²⁶ *Id.*

²²⁷ *Id.*

trolling” phenomenon and partially to align the U.S. patent system with that of the rest of the world.²²⁸ Combined with 3D printing, this may make it more likely that small-time inventors will be able to attain patent protection, as the shorter prototyping time will increase the speed with which they can apply.²²⁹

Some critics of 3D printing doubt whether the technology will ever be accessible enough to the average consumer for these problems to arise on a large enough scale to warrant legal intervention.²³⁰ The average consumer is most likely not sophisticated enough to be able to use the 3D modeling software necessary to create any product of substance. However, these machines are being introduced to children in K-12 classrooms and indoctrination from a young age can increase consumer comfort.²³¹ Similarly, personal computing started out as primarily the realm of hobbyists and now is ubiquitous to the point of unavailability.²³² Some scholars compare the 3D printing market to the growing demand of

²²⁸ Jaffe, *supra* note 207, at 116.

²²⁹ 3D printing would allow the inventor to “reduce to practice” easier, and thus qualify for patenting. See SCHWARTZ, *supra* note 70.

²³⁰ Nick Allen, *Why 3D Printing Is Overhyped (I Should Know, I Do It For a Living)*, GIZMODO (May 17, 2013), <http://gizmodo.com/why-3d-printing-is-overhyped-i-should-know-i-do-it-fo-508176750>.

²³¹ BRIAN EVANS, *supra* note 6, at xxiii.

²³² Desai, *supra* note 47, at 1696.

homemade soda, such as SodaStream.²³³ It allows the users to cultivate a product that is uniquely suited to their own tastes, as opposed to going to the marketplace for limited offerings catered to mass appeal.

There is the possibility that 3D patent infringers will demonstrate demand for innovation until someone takes notice, in the same way that iTunes was born from Napster's demise. If the electronics and manufacturing industries have foresight, they will work to market CAD files for home printing of their most popular devices focused on consumer ease, and thus avoid the need for legal intervention. The decision to use legitimate versus counterfeit goods will depend on a "combination of ease-of-use, pricing and availability on a given market."²³⁴

VI. CONCLUSION

There are always concerns when expanding the broad protection of any laws. In what makes for a cautionary tale, patent law in Elizabethan England created broad, one-sided protection.²³⁵ Patent-holders had the

²³³ *Id.* at 1698.

²³⁴ Frederic Filloux, *The Digital Piracy Problem Is Riddled With Hypocrisy*, THE GUARDIAN (Jan. 23, 2013), <https://gigaom.com/2012/01/23/419-the-digital-piracy-problem-is-riddled-with-hypocrisy>.

²³⁵ Jaffe, *supra* note 207, at 61.

ability to search the property of anyone suspected of infringing.²³⁶ In reality, “patentees would visit factories and warehouses not because infringements were likely there, but because they expected that the owner would be willing to make a payment to avoid the trouble and damage that a search would entail.”²³⁷

Even if the technology of 3D printing does not manifest with the ubiquity the industry has anticipated and this decade does not see a 3D printer in every office, the thought exercise alone is worth the effort. Internet commerce will manifest itself in new and interesting ways, and with less thought for the consequences.²³⁸

Napster destabilized the record industry, but as the silver lining to the “cloud,” it also may have saved the music industry.²³⁹ Steve Jobs recognized the demand for easy access to individual and eclectic songs

²³⁶ *Id.*

²³⁷ *Id.* at 61-62.

²³⁸ Lessig, *supra* note 7.

The most important contexts of regulation in the future will affect Internet commerce: where the architecture does not enable secure transactions; where it makes it very easy to hide the source of interference; where it facilitates the distribution of illegal copies of software and music. In these contexts, commerce at least will not view unregulability as a virtue; unregulability here will interfere with the ability of commerce to flourish.

Id.

²³⁹ Alderman, *supra* note 216, at 29.

that the file-sharing revolution represented and created iTunes as a result.²⁴⁰ Digital song sales have outsold albums ever since.²⁴¹

It is possible that 3D printing could do the same for many industries. Instead of having to “IKEA hack” in order to customize furniture, perhaps in the future one can custom-design, download, and print to their specifications from the IKEA website right in their living room.²⁴² iTunes could sell headphones and replacement parts from its online store. It is even possible that the ability to download and print a microprocessor such as the Raspberry Pi could finally bring widespread computing to previously inaccessible parts of the world, and with it, progress.²⁴³

²⁴⁰ Holmes, *supra* note 217.

²⁴¹ Alderman, *supra* note 216, at 29.

²⁴² IKEA HACKERS, <http://www.ikeahackers.net> (last visited June 19, 2017).

²⁴³ RASPBERRY PI, <http://www.raspberrypi.org> (last visited June 19, 2017). “The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It’s capable of doing everything you’d expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.” *Id.*