

NOTES

WHY MANUFACTURING MATTERS: 3D PRINTING, COMPUTER-AIDED DESIGNS, AND THE RISE OF END-USER PATENT INFRINGEMENT

TABLE OF CONTENTS

INTRODUCTION	1934
I. THE EVOLUTION OF 3D PRINTING	1936
II. HOW 3D PRINTING FITS WITHIN THE PRESENT	
INTELLECTUAL PROPERTY FRAMEWORK	1940
A. <i>The Piracy Problem</i>	1941
1. <i>CADs and the Disclosure Requirement</i>	1944
2. <i>The Futility of Patent-Copyright Crossover</i>	1949
a. <i>CADs as Representations of Facts</i>	1950
b. <i>CADs and Unlimited Customization</i>	1952
III. WHY MANUFACTURING MATTERS	1954
A. <i>Invention or Innovation?</i>	1956
B. <i>Is the Monopoly Always Worth the Embarrassment?</i> ..	1957
C. <i>Reconceptualizing Patent's "Lake"</i>	1959
CONCLUSION	1960

INTRODUCTION

Manufacturers and product developers have used additive manufacturing, a process more commonly known as 3D printing, to create prototypes, mock-ups, and replacement parts for over twenty-five years.¹ Until recently, however, few people outside of those industries had even heard of the technology.² With the size of the printers shrinking and the availability of new source material expanding, manufacturers of 3D printers have begun to explore new avenues for the development of their product that promise to bring widespread use of 3D printers into the home.³ If successful, the transition of manufacturing from the factory to the home will present a novel set of problems for intellectual property owners.

At the most obvious level, end-user appropriation of the manufacturing process has the potential to astronomically increase the instances of patent infringement. This result follows for two reasons. First, patent law strictly defines infringement to include anyone who manufactures an invention without authorization, whether for a commercial or a private purpose.⁴ Second, the 3D printing process's digital nature establishes the technology within a realm already plagued by rampant piracy, where millions of individual violations occur within a single day.⁵

Patent owners then must face the more daunting challenge of asserting their property rights against an international multitude of anonymous infringers. Of course, patent owners could try to prosecute each infringer, assuming they have the ability to track them

1. See, e.g., Nancy Rivera Brooks, *Models of Efficiency: The Rapid-Prototyping Industry Is Changing the Way Manufacturers Create Products*, L.A. TIMES, July 13, 1997, at A1.

2. See Nathan Olivarez-Giles, *These "Printers" Make Real Stuff, Now at Home: The Devices Create Objects at the Touch of a Button*, L.A. TIMES, May 29, 2010, at B1.

3. See Anthony Townsend et al., *Introduction*, THE FUTURE OF OPEN FABRICATION (2011), <http://www.openfabrication.org/>.

4. 35 U.S.C. § 271 (2006) ("Except as otherwise provided in this title, whoever without authority makes ... any patented invention, within the United States ... infringes the patent." (emphasis added)).

5. See generally JOHN GANTZ & JACK B. ROCHESTER, *PIRATES OF THE DIGITAL MILLENNIUM: HOW THE INTELLECTUAL PROPERTY WARS DAMAGE OUR PERSONAL FREEDOMS, OUR JOBS, AND THE WORLD ECONOMY* (2005) (detailing the struggle of copyright holders to assert their privileges in light of the massive, unauthorized diffusion of protected digital material over the Internet).

down, assert jurisdiction, and sufficiently prove the infringing conduct. But this approach would require more time, money, and resources than most patent owners would presumably want to spend. Instead, rights holders will likely try to diminish this new brand of patent infringement at the source: the electronic distribution of Computer-Aided Design Files (CADs).⁶

This effort will mark a dramatic shift in the prosecution of patent infringement cases. Traditionally, manufacturers brought suit for patent infringement against other manufacturers.⁷ The legislature and the courts encapsulated this dynamic in the development of remedies for patent infringement.⁸ After centuries of application, patent law has evolved to create a monopoly right that operates efficiently only in this limited *commercial* context.⁹ If patent owners try to extend the monopoly to address CADs and end-user infringement, courts should approach the matter cautiously before haphazardly expanding the reach of this branch of intellectual property law.

Intellectual property law exists as the result of a “bargain” between innovators and the public.¹⁰ Congress alone shoulders the burden of bringing new technology into harmony with the constitutional mandate to “promote the Progress of Science and [the] useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”¹¹ How Congress navigates this duty in the face of the emergent 3D printing technology will largely depend on which side of the bargain legislators tend to favor: private industry or the advancement of the public store of knowledge.¹²

6. See Clive Thompson, *Clive Thompson on 3-D Printing's Legal Morass*, WIRED (May 30, 2012, 1:43 PM), <http://www.wired.com/design/2012/05/3-d-printing-patent-law/>.

7. See *infra* notes 137-38 and accompanying text.

8. See *infra* notes 137-41 and accompanying text.

9. See *infra* notes 128-41 and accompanying text.

10. See Viva R. Moffat, *Mutant Copyrights and Backdoor Patents: The Problem of Overlapping Intellectual Property Protection*, 19 BERKELEY TECH. L.J. 1473, 1483-88 (2004).

11. U.S. CONST. art. I, § 8; see also *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 429 (1984) (“As the text of the Constitution makes plain, it is Congress that has been assigned the task of defining the scope of the limited monopoly that should be granted to authors or to inventors in order to give the public appropriate access to their work product.”).

12. Compare H.R. REP. NO. 98-857, at 17 (1984) (“Patents are designed to promote innovation by providing the right to exclude others from making, using, or selling an invention. They enable innovators to obtain greater profits than could have been obtained if

This Note will demonstrate how this bargain should be struck by first briefly introducing 3D printing and exploring the technology's development from the mid-1980s until the present, where increased access to the technology has led commentators to speculate about the role of computer-aided design files in what may turn out to be the next wave of digital piracy. Second, this Note will analyze where computer-aided design files containing the schematics for patented inventions fit within the current patent and copyright framework. The result of this effort reveals that the information contained within computer-aided design files is ultimately a product of the public domain and not immediately subject to regulation. Third, this Note will examine the reconfiguration of the "intellectual property bargains" that Congress must assess if, and when, it decides to act upon the changes endemic to the impending "democratization of manufacturing." This analysis will explore the public benefits versus the private incentives that have driven intellectual property law since the founding of the United States and challenge the perception that greater restrictions on the use of 3D printing will be necessary for Congress to successfully fulfill its Article I, Section 8 mandate.

It will be shown that intellectual property law makes sense as it regulates activity only between manufacturers and competitors, not manufacturers and end-users. Ultimately this Note will conclude that, if given the options of accommodating 3D printing by enacting legislation to limit its disruptive effect or allowing market incentives to direct manufacturers' efforts, the constitutional mandate for Congress to "promote ... Science and [the] useful Arts"¹³ is best served by allowing the market to direct producers to the most efficient use of resources.

I. THE EVOLUTION OF 3D PRINTING

Technically speaking, the term "3D printing" is a catchall phrase for the universe of production processes known as "additive manufac-

direct competition existed. These profits act as incentives for innovative activities."), *with Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 148 (1989) ("[F]rom the outset, federal patent law has been about the difficult business 'of drawing a line between the things which are worth to the public *the embarrassment* of an exclusive patent, and those which are not.'" (quoting Thomas Jefferson) (emphasis added)).

13. U.S. CONST. art. I, § 8.

turing.”¹⁴ While each additive manufacturing process employs a different method, they all maintain the distinction of building whole objects from the ground up, layer-by-layer, using only as much material as necessary for the intended purpose.¹⁵ The result is a manufacturing process that avoids much of the waste endemic to traditional reductive methods of manufacturing.¹⁶

Despite the variations in the way 3D objects are created, the general process of 3D printing is fairly uniform. It begins with a computer file known as a CAD. These files are essentially electronic blueprints that contain the exact specifications of an object in the form of a digital 3D model.¹⁷ One popular example of a CAD is a bust of the political satirist Stephen Colbert, which is pictured below.¹⁸



14. See James R. Hagerty & Kate Linebaugh, *Next 3-D Frontier: Printed Plane Parts*, WALL ST. J., July 14, 2012, at B1.

15. Stereolithography, the original additive manufacturing process, uses lasers to harden consecutive layers from a pool of photosensitive liquid polymer; sintering also uses lasers, but melts the layers of source material into place instead; and another process, fused deposition modeling, similarly squirts the layers of source material into place. Townsend et al., *Processes: The Fundamentals of 3D Printing*, *supra* note 3.

16. N.V., *Difference Engine: The PC All Over Again?*, THE ECONOMIST (Sept. 9, 2012, 7:31), <http://www.economist.com/blogs/babbage/2012/09/3d-printing/print>.

17. See MICHAEL WEINBERG, PUBLIC KNOWLEDGE IT WILL BE AWESOME IF THEY DON'T SCREW IT UP: 3D PRINTING, INTELLECTUAL PROPERTY, AND THE FIGHT OVER THE NEXT GREAT DISRUPTIVE TECHNOLOGY 2-3 (2010), available at <http://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf>.

18. *The Head of Stephen Colbert*, MAKERBOT THINGIVERSE (June 8, 2011), <http://www.thingiverse.com/thing:9104/#files>; Gail Shister, *Studying Stephen Colbert. Seriously. Funny*, MEDIABISTRO INC. (July 25, 2012), http://www.mediabistro.com/tvnewser/studying-stephen-colbert-seriously-funny_b138950.

Presently, CADs can be created two ways: by using a dedicated software program to draft a design or by capturing a 3D scan of an already existing object.¹⁹ Using the production processes described above, 3D printers essentially translate an object's digital representation in the CAD file into a tangible artifact.²⁰

The design possibilities for 3D printed artifacts are seemingly limitless. Because the printer builds up the object layer-by-layer, designs may include objects with moving interior parts²¹ and can even incorporate once impossible to manufacture geometric figures.²² Furthermore, the ability to manufacture workable products on-site dramatically reduces the amount of time between the conception and implementation of new design ideas, and at much less cost than previously possible.²³

In light of these distinct advantages, manufacturers in the mid-1980s first employed 3D printing to create prototypes for new products.²⁴ Within a decade the process had completely changed the way major companies approached research and development.²⁵

Today, small companies are purchasing high-quality 3D printers to control every aspect of their operation—from design, to production, to distribution.²⁶ The Internet now hosts an entire online store dedicated to the production of user-submitted CADs.²⁷ Printers now have the ability to create objects from plastic, metal, ceramic, or glass.²⁸

19. WEINBERG, *supra* note 17, at 2-3.

20. *Id.* at 2.

21. *Id.*

22. Peter Hanna, *The Next Napster? Copyright Questions as 3D Printing Comes of Age*, ARS TECHNICA (Apr. 6, 2011, 12:35 AM), <http://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/>.

23. See Townsend et al., *The Foundations of Open Fabrication*, *supra* note 3.

24. See Brooks, *supra* note 1.

25. *Id.*

26. See, e.g., Lee Romney, *A Leg Up for Amputees*, L.A. TIMES, Apr. 4, 2012, at A1.

27. See Ashlee Vance, *The Wow Factor of 3-D Printing*, N.Y. TIMES, Jan. 13, 2011, at B10 (“Shapeways is more or less the Amazon.com of 3-D printing. You go to its Web site and pick objects that other people have designed, tweak these designs or use the company’s Web software to design something from scratch. Then, you simply order the product.”); see, e.g., DEFCAD, <http://www.defcad.com> (last visited Mar. 8, 2014); SHAPEWAYS, INC., <http://www.shapeways.com> (last visited Mar. 8, 2014); MAKERBOT THINGIVERSE, <http://www.thingiverse.com> (last visited Mar. 8, 2014).

28. See Nick Bilton, *Like That Vase? Print It. And No, It’s Not Stealing*, N.Y. TIMES, Nov. 14, 2011, at B8 (“These 3-D printers ... can print objects by spraying layers of plastic, metal,

Each successive advance in 3D printing has resulted in greater accessibility to the technology and more functional applications. Individual hobbyists wishing to purchase their own 3D printer can pick one up for as little as \$500.²⁹ Google offers its patrons access to a rudimentary, but useful, CAD design program at no cost.³⁰ New source materials are being developed that cost a fraction of what previous materials cost³¹ and even further developments may provide for the recycling of previously printed items as a renewable alternative source material.³² While some commentators celebrate the shift in direction from sophisticated national manufacturers to novice individual users, the quiet quickness of the expansion also leaves them concerned that fears of increased end-user access to more powerful technology will eventually entice those sophisticated manufacturers into a stifling intellectual property battle with end-users, much like the digital copyright war that commenced in the 1990s.³³

or ceramics into shapes.”); Townsend et al., *Introduction*, *supra* note 3.

29. See Hagerty & Linebaugh, *supra* note 14 (“[3D] printers, costing as little as about \$500 or up to \$1.2 million, can be set up almost anywhere.”).

30. SKETCHUP, <http://www.sketchup.com> (last visited Mar. 8, 2014); see Townsend et al., *Open Fab Community 1: The Makerbot Thingiverse*, *supra* note 3 (“Using 3D modeling software such as Google’s Sketchup, fabricators ... are able to generate stereolithography files.”).

31. N.V., *Difference Engine: Making It*, THE ECONOMIST (Nov. 25, 2011, 8:27 AM), <http://www.economist.com/blogs/babbage/2011/11/3d-printing/print> (“[A] group at the University of Washington, in Seattle, has come up with a concoction based on artists’ ceramic powder blended with sugar and maltodextrin. The material costs less than \$1 a pound.”).

32. See Townsend et al., *Material Advances: Reusable Feedstocks*, *supra* note 3.

33. Compare Kevin Holmes, *Will 2012 Be the Year 3D Printing Goes Mainstream?*, THE CREATORS PROJECT (Feb. 3, 2012), <http://www.thecreatorsproject.vice.com/blog/will-2012-be-the-year-3d-printing-goes-mainstream> (“[T]his is more than just a printing device—it’s a movement that aims to turn people into makers as opposed to consumers.”), with WEINBERG, *supra* note 17, at 15 (“There will be a time when impacted legacy industries demand some sort of DMCA for 3D printing. If the 3D printing community waits until that day to organize, it will be too late.”).

II. HOW 3D PRINTING FITS WITHIN THE PRESENT INTELLECTUAL PROPERTY FRAMEWORK

The manufacturing sector of the United States' economy encompasses all of the country's most patent-intensive industries.³⁴ This dense concentration of patents in the manufacturing sector follows from the fact that Congress drafted the law of patents to expressly bring "any new and useful ... manufacture, or composition of matter" within the realm of its governance.³⁵ Given these observations, reason suggests that any technology promising to disrupt present notions about the way things are manufactured would likely implicate concerns in the patent realm of intellectual property law.

A patent is considered to embody all of the "attributes of personal property"³⁶ and empowers its owner, generally, to exclude others from "making, using, offering for sale, or selling" the invention described therein.³⁷ The law also provides exclusionary rights for inventions that constitute a new and useful "process."³⁸ Regarding this latter mode of protection, it is unlikely that the use of 3D printing to manufacture products, either as a new method of production generally or as means of manufacturing specific objects, will meet the standards necessary to warrant a patent in most cases.³⁹ Because the act of 3D printing unquestionably implicates a

34. U.S. DEPT OF COMMERCE, INTELLECTUAL PROPERTY AND THE U.S. ECONOMY: INDUSTRIES IN FOCUS vii (2012), available at www.uspto.gov/news/publications/IP_Report_March_2012.pdf.

35. 35 U.S.C. § 101 (2006).

36. See *id.* § 261; see also *Seymour v. Osbourne*, 78 U.S. 516, 533 (1870) ("Inventions secured by letters patent are property in the holder of the patent, and as such are as much entitled to protection as any other property.").

37. 35 U.S.C. § 154.

38. *Id.*

39. Even under the machine or transformation test recognized by the Supreme Court in *Bilski v. Kappos*, 130 S. Ct. 3218, 3225, 3227 (2010), an application for 3D printing as a process for manufacturing would likely fail the novel and nonobvious requirements. See 35 U.S.C. §§ 102-03; see also Hagerty & Linebaugh, *supra* note 14 ("Although such technology, known as 3-D printing or additive manufacturing, has been around for 25 years, it is mainly used for making models, prototypes and smaller items ranging from hearing aids to hip implants and jewelry. Now big manufacturers including Boeing, General Electric Co. and Honeywell Inc. are exploring ways to use it to make bigger pieces in higher volumes.").

form of “making,” and subsequently “using” the article produced,⁴⁰ the discussion of the intersection of 3D printing and patent law will focus primarily on this aspect of the patent owner’s exclusionary right.

A. *The Piracy Problem*

For patent owners whose exclusive interests in the claimed invention have been violated, Congress provided a cause of action in the form of patent infringement.⁴¹ Not surprisingly, patent owners turned to the courts to enforce these rights shortly after patent legislation was first enacted in 1790.⁴² In the past decade alone, over four thousand appeals from patent infringement suits in the U.S. district courts made their way to the United States Court of Appeals for the Federal Circuit.⁴³ An estimate from 2001 suggested that infringement litigation amounted to more than \$7 billion in legal fees each year.⁴⁴ Today, companies involved in patent litigation can expect to spend between \$1 million and more than \$10 million each year.⁴⁵ The prevalence of patent infringement litigation clearly demonstrates an intimate familiarity among rights holders regarding the threat of infringement and the means of enforcement. Accordingly, the advancement of 3D printing technology must present new challenges, apart from the mere act of infringement, to justify concerns about the technology’s disruptive ability to “wreak ... havoc on producers.”⁴⁶

40. See *supra* Part I (discussing the development of 3D printing and its various applications over time).

41. 35 U.S.C. § 271; see also *Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2065 n.2 (2011) (making clear that the violation of this statute is a matter of strict liability).

42. See B. ZORINA KHAN, *THE DEMOCRATIZATION OF INVENTION: PATENTS AND COPYRIGHTS IN AMERICAN ECONOMIC DEVELOPMENT, 1790-1920*, at 57, 100 (2005).

43. *Filings of Patent Infringement Appeals from the U.S. District Courts*, UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT (2011), http://www.ca9c.uscourts.gov/images/stories/the-court/statistics/Caseload_patent_infringe_02-11.pdf.

44. Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1064 (2005).

45. FULBRIGHT & JAWORSKI L.L.P., *FULBRIGHT’S 9TH ANNUAL LITIGATION TRENDS SURVEY REPORT 41* (2012).

46. Rob Cox & Robert Cyran, *A Future Memo from Goldman*, N.Y. TIMES, Dec. 29, 2011, at B2.

To this end, commentators have consistently pointed out 3D printing technology's reliance on CAD files for the proposition that widespread use of 3D printers may ultimately lead to a new wave of digital piracy.⁴⁷ The inspiration for this speculation derives primarily from the massive infringement controversy that culminated in the passage of the Digital Millennium Copyright Act⁴⁸ and the drastic expansion in the privileges of copyright holders.⁴⁹ To the extent that this concern proves meritorious, lessons from the digital copyright battle may provide valuable insights.

The diffusion of information over the Internet happens quickly, and instances of file sharing multiply exponentially. For example, at the earliest stages of digital copyright infringement, the number of active participants engaged in sharing protected material over the Internet consisted of only a "few thousand" obscure "hackers."⁵⁰ Within two years, that number soared upwards of sixty million and extended to members outside of the initial techno-geek community.⁵¹ Today, copyright protected material is accessed on the Internet millions of times in a single day.⁵²

Currently, 3D printing in the consumer realm occupies a similarly obscure section of the population as the original copyright pirates.⁵³ Members of this tiny community actively create, trade, modify, and print CADs on open-access networks like Thingiverse.⁵⁴ Forecasts

47. See WEINBERG, *supra* note 17, at 3-4 ("One person can create a new object, email the design to his friend across the country, and the friend can print out an identical object.... [T]he ability to copy and replicate is the ability to infringe on copyright, patent, and trademark."); Cox & Cyran, *supra* note 46, at B2 ("[A]nything involving just a digital file and a readily available printer will encourage copying and piracy."); Thompson, *supra* note 6 ("[T]he longer-term danger here is that manufacturers will decide the laws aren't powerful enough. Once kids start merrily copying toys, manufacturers will push to hobble 3-D printing with laws similar to the Stop Online Piracy Act.").

48. See WEINBERG, *supra* note 17; *supra* text accompanying note 33.

49. See Digital Millennium Copyright Act, Pub. L. No. 105-304, 112 Stat. 2860 (1998) (adapting copyright law to the digital age and creating new protections for copyright holders); see also U.S. COPYRIGHT OFFICE, THE DIGITAL MILLENNIUM COPYRIGHT ACT OF 1998: U.S. COPYRIGHT OFFICE SUMMARY 2, 8-9 (1998).

50. GANTZ & ROCHESTER, *supra* note 5, at 75.

51. *Id.*

52. See Nick Bilton, *Internet Pirates Will Always Win*, N.Y. TIMES, Aug. 5, 2012, at SR5.

53. See Olivarez-Giles, *supra* note 2, at B1 (describing the current population of 3D printing enthusiasts as "geeks and hobbyists").

54. Melena Ryzik, *3-D Art for All: Ready to Print*, N.Y. TIMES, May 14, 2011, at C1; see also MAKERBOT THINGIVERSE, *supra* note 27.

predicting a consumer-led revolution in 3D printing support the belief that instances of CAD file sharing will also enjoy a significant leap as access to the technology increases.⁵⁵

The ready accessibility of digital matter, coupled with generally unexplored consumer attitudes toward patent rights, creates a situation particularly well suited for massive piracy. For example, a pair of authors researching digital piracy conducted a test that revealed a greater acceptance in American attitudes toward purchasing black-market merchandise than illegally downloading a song.⁵⁶ This finding might reflect an even greater moral ambivalence among the population concerning patent infringement. Consumers may simply be unaware that purchasing black-market merchandise, and perhaps eventually using a downloaded CAD to print an object without authorization, amounts to a violation of the law and intellectual property theft.

Furthermore, law enforcement's attempts to curtail digital copyright piracy have had minimal effect in light of the immense levels of infringement occurring over the Internet.⁵⁷ While organizations contrived to privately prosecute digital copyright infringement have met some success, those pursuits required expending great sums of money and a tremendous investigatory effort.⁵⁸

Given the speed with which digital copyright piracy contaminated the Internet, as well as the ready adaptability of CADs to mass file sharing, patent owners are justified in their concerns. In the latest iteration of digital copyright piracy, collaborators from a BitTorrent piracy website, The Pirate Bay, announced a plan to attach their servers to drones that would fly through the air in an effort to evade law enforcement.⁵⁹ Not surprisingly, that same mentality has already made its way into the world of 3D printing. A new website now promises to provide unfettered access to CADs, from the

55. See WEINBERG, *supra* note 17, at 3-4 (“One person can create a new object, email the design to his friend across the country, and the friend can print out an identical object.... [T]he ability to copy and replicate is the ability to infringe on copyright, patent, and trademark.”).

56. GANTZ & ROCHESTER, *supra* note 5, at 231-32.

57. *Id.* at 207.

58. *Id.* at 103-04, 205-06, 215-16.

59. Bilton, *supra* note 52, at SR5.

mundane to “any controversial object users feel like uploading, including patented ones.”⁶⁰

Members of these communities justify their illicit measures as a means of protecting the right to free information.⁶¹ Although this claimed right has met extreme resistance from legislators and copyright owners,⁶² the claim might have some merit as it pertains to patents and the dissemination of CADs.

1. CADs and the Disclosure Requirement

In response to industry fears that the electronic dispersal of CADs will ultimately result in a tsunami of patent infringement, commentators suspect that rights holders will seek new ways to protect their interests and limit this activity.⁶³ Although such efforts may be of questionable effectiveness as a practical matter,⁶⁴ it also is unclear that any such effort would be legally cognizable.

A patent infringement only occurs when someone “without authority makes, uses, offers to sell, or sells any patented invention.”⁶⁵ Tracking the language of the statute, the element requiring

60. Ricardo Bilton, *Expanding Beyond 3D Printed Guns, DEFCAD Is Officially the Anti-MakerBot*, VENTUREBEAT (Mar. 11, 2013, 1:05 PM), <http://venturebeat.com/2013/03/11/defcad-anti-makerbot/>. According to DEFCAD founder Cody Wilson, the website will take a hardline stance against enforcement efforts by intellectual property owners:

No takedowns. No removals. We'd fight everything to the full extent of the law....
Can 3D printing be subversive? If it can, it will be because it allows us to make the important things—not trinkets, not lawn gnomes, but the things that institutions and industries have an interest in keeping from us. Things like access, medical devices, drugs, goods, guns. DEFCAD will provide access with a view to these things, the important things, and there will be no takedowns — ever.

Id.; see also, DEFCAD, *supra* note 27.

61. See Andrew Beato, *Pirating Movies Using Torrents? You'll Be Spotted Within 3 Hours*, INTENTIONOUS (Sept. 28, 2013, 2:52 PM), <http://intentionous.com/2012/09/17/pirating-movies-on-bittorrent-youll-be-spotted-within-3-hours/>; Bilton, *supra* note 60.

62. See Declan McCullagh, *Congress Readies Broad New Digital Copyright Bill*, CNET (Apr. 22, 2006), http://news.cnet.com/2100-1028_3-6064016.htm/; John Paul Titlow, *Why 3D Printing Will Be The Next Big Copyright Fight*, READWRITE (Sept. 28, 2013, 3:17 PM), <http://readwrite.com/2013/02/20/3d-printing-will-be-the-next-big-copyright-fight#>.

63. See, e.g., WEINBERG, *supra* note 17, at 12 (“[P]atent owners may try to stigmatize CAD filetypes [sic] in much the same way that copyright holders stigmatize the bittorrent [sic] file transfer protocol (or even MP3 files).”).

64. See *infra* Part II.A.2.

65. 35 U.S. § 271(a) (2006) (emphasis added).

an infringer to actually make the protected invention presents the most immediate challenge to patent owners looking to secure CADs within the ambit of the law's protection. It is by the very nature of the 3D printing process that CADs exist at some point before the object actually materializes, or is "made."⁶⁶ To the extent that the physical embodiment of the invention is required, logic suggests that any attempt to secure patent protection for CADs is destined for failure.⁶⁷

However, CADs and 3D printers occupy a realm of emergent technology that courts have not yet had an opportunity to directly examine. Moreover, they also reconfigure the way rights holders view themselves in relation to their inventions and, in turn, how they view themselves in relation to the end-users to whom they market those inventions. With this in mind, it is not inconceivable that patent owners will try to find new ways to stretch old meanings when asserting their rights before a court.

In *Pfaff v. Wells Electronics, Inc.*, the Supreme Court undertook the task of deciding whether an invention can be "on sale" within the meaning of 35 U.S.C. § 102(b)⁶⁸ prior to its reduction to practice.⁶⁹ The patent applicant in that case provided his sketch for a computer chip socket to Texas Instruments and later secured from them a purchase order for several thousand of the sockets.⁷⁰ Up to that point, the sockets had not been manufactured, and the

66. See WEINBERG, *supra* note 17, at 2 (explaining that a 3D printer essentially functions as a machine that turns a blueprint, or CAD, into a physical object).

67. Indeed, one commentator almost dismissed the entire endeavor on this basis alone. The author relied on *Ecodyne Corp. v. Croll-Reynolds Engineering Co.*, 491 F. Supp. 194, 197 (D. Conn. 1979), and *Lang v. Pacific Marine & Supply Co.*, 895 F.2d 761, 765 (Fed. Cir. 1990), to demonstrate that the remaining elements of the statute also would be impossible to satisfy on this basis:

[O]ne cannot "sell" a product that does not yet physically exist in its entirety because any infringement is at that point uncertain or speculative. The sale of a CAD file for use in 3D printing would not be actionable under these cases because it is not the actual patented product being sold.

Daniel Harris Brean, *Asserting Patents to Combat Infringement via 3D Printing: It's No "Use"*, 23 FORDHAM INTELL. PROP. MEDIA & ENT. L. J. 771, 790-92 (2013).

68. 35 U.S.C. § 102(b) (creating a bar to patentability for "invention[s] ... on sale in this country, more than one year prior to the date of the application for patent in the United States").

69. 525 U.S. 55, 57 (1998).

70. *Id.* at 58.

applicant had not created a prototype to test them.⁷¹ One year and one month after this exchange, the applicant filed for a patent to cover the computer chip sockets.⁷²

Interpreting the word “invention” within the meaning of the statute, the Court declared:

The primary meaning of the word "invention" in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea. The statute does not contain any express requirement that an invention must be reduced to practice before it can be patented. Neither the statutory definition of the term in § 100 nor the basic conditions for obtaining a patent set forth in § 101 make any mention of "reduction to practice." The statute's only specific reference to that term is found in § 102(g), which sets forth the standard for resolving priority contests between two competing claimants to a patent.⁷³

The Court further emphasized that an invention may be deemed ready for patenting in two ways: by proof that the invention had been reduced to practice or “by proof that ... the inventor had prepared drawings or other descriptions of the invention that were sufficiently specific to enable a person of ordinary skill in the art to practice the invention.”⁷⁴

Taken literally, the language of the Court’s decision would seem to fit well with the argument that the unauthorized distribution of CADs containing the designs for a patented invention should amount to an act of infringement. According to the Court, the invention to which the Patent Act refers is merely the “conception” or the idea itself,⁷⁵ and the mere expression of that concept—as by diagram or written instructions rather than the reduction to physical form—is enough to satisfy a sale of the invention.⁷⁶ Arguably, under this broad definition, if the “concept” of an invention can be sold without reduction to practice, it is at least

71. *Id.* at 58-59.

72. *Id.* at 57.

73. *Id.* at 60-61.

74. *Id.* at 67-68.

75. *Id.* at 60.

76. *Id.* at 60-61.

conceivable that it can also be infringed without reduction to practice.

Despite the broad implications of the Court's statement, it would be a mistake to read the *Pfaff* opinion as an invitation to expand the meaning of infringement. The Court's opinion was clearly limited to an analysis of the Patent Act's § 102 limitations on patentable inventions.⁷⁷ As Justice Stevens explained, the purpose of § 102 was to "protect the public's right to retain knowledge already in the public domain and the inventor's right to control whether and when he may patent his invention."⁷⁸ The Court was concerned that allowing the applicant to receive a patent an entire year after he explained the product and arranged for its sale to a commercial distributor would impermissibly extend the period over which the applicant could exclude the public from practicing the invention.⁷⁹

Thus, principles of disclosure decided the case. When the applicant in *Pfaff* provided Texas Instruments with drawings sufficient to demonstrate his inventions and arranged for the sale of the computer chip sockets, he removed the invention from the safety of "experimental use" and exposed it to the public.⁸⁰ At that point, the clock started to run on the invention's period of patentability and the inventor's right to exclude.⁸¹

Under the current patent regime, successful applicants are entitled to exercise exclusive rights over the claimed invention for a period of twenty years.⁸² In exchange for this grant of privileges, the law expects the applicant to fully disclose the invention "in such clear, concise, and exact terms as to enable any person skilled in the art ... to make and use the same."⁸³ In fact, if the applicant fails to fully disclose the invention, the patent examiner can request the production of drawings, request a model demonstrating the

77. *See id.* at 57, 61, 63-64, 66-67.

78. *Id.* at 65.

79. *Id.* at 64 ("Consistent with these ends, § 102 of the Patent Act serves as a limiting provision, both excluding ideas that are in the public domain from patent protection and confining the duration of the monopoly to the statutory term.")

80. *See id.* at 67.

81. *See id.* at 64-65.

82. 35 U.S.C. § 154(a)(2) (2006).

83. *Id.* § 112.

invention, or reject the invention for failure to satisfy the application requirements.⁸⁴

The disclosure requirement is the “quid pro quo of the right to exclude.”⁸⁵ It serves two practical functions: to ensure that the patentee receives all of the protection to which he is entitled and to inform the public as to what innovations are still available to them.⁸⁶ This exchange formulates the basis of the “patent bargain” and the cornerstone of patent law generally.⁸⁷

The existence of the disclosure requirement could obviate any claim of a proprietary interest an inventor might assert in relation to a CAD containing the schematics for his patented creation. Much like the information contained in the patent application itself, a CAD is simply a “data package” describing the object in terms of shape, size, material composition, and fabrication.⁸⁸ In a very real and meaningful sense, the CAD is not the invention itself, but simply information about the invention.⁸⁹

A patentee can have no reasonable expectation that information about the claimed invention will remain confidential.⁹⁰ The information contained within a filed patent application becomes part of the public domain.⁹¹ Congress instructed the director of the United States Patent and Trademark Office to provide copies of all

84. *Id.* §§ 111, 113-14.

85. *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 484 (1974) (emphasis removed).

86. *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 373 (1996) (citing *McClain v. Ortmayer*, 141 U.S. 419, 424 (1891)).

87. *See Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150-51, 161 (1989) (“The federal patent system thus embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years.”); *Seymour v. Osbourne*, 78 U.S. 516, 533 (1870) (“Letters patent are not to be regarded as monopolies, created by the executive authority at the expense and to the prejudice of all the community except the persons therein named as patentees, but as *public franchises* granted to the inventors of new and useful improvements.” (emphasis added)).

88. *See Townsend et al.*, *Accelerating the Flow of Things*, *supra* note 3.

89. *See WEINBERG*, *supra* note 17, at 3 (explaining how a CAD operates simply as a digital alternative to physical *models* and *prototypes*); *cf. Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 450 (2007) (“[I]nformation—a detailed set of instructions— ... might be compared to a blueprint.... A blueprint may contain precise instructions for the construction and combination of the components of a patented device, but it is not itself a combinable component [of that device].”).

90. 35 U.S.C. § 41(I) (2006).

91. *Id.*

patents in physical or electronic form for use by the public.⁹² This mandate is of such importance that only in cases of national security may the Director withhold publication of the patent.⁹³ As a result of the free access to this information, users can conduct searches of over seven million U.S. patents, complete with drawings and schematics, and download them in bulk through online entities like Google.⁹⁴

2. *The Futility of Patent-Copyright Crossover*

If patent owners find themselves frustrated with their inability to control the dissemination of CADs with the tools allotted under patent law, they may seek an alternative route through the use of copyright laws. This pattern of behavior would be consistent with current trends. Professor Viva Moffat recognized that even in the absence of disruptive technology, powerful interest groups have pushed for, and succeeded in obtaining, greater security for their intellectual property by seeking multiple forms of protection for a single creation.⁹⁵ This trend, coupled with the courts' past struggles when facing issues of "digital originality,"⁹⁶ may lead to the further profusion of "backdoor patents" and "mutant copyrights."⁹⁷

At the outset, copyright protection seems like the most logical option for rights holders concerned about the spread of CADs containing detailed schematics of their intellectual property. If successful in their effort to secure protection for the designs of patented objects, rights holders could effectively harness the full breadth of enforcement tools allowed under the DMCA.⁹⁸ However,

92. *Id.*

93. *Id.* § 181.

94. See GOOGLE PATENTS, http://www.google.com/advanced_patent_search (last visited Feb. 25, 2014).

95. See Moffat, *supra* note 10, at 1475, 1496 ("As the scope of intellectual property protection has expanded, the owners of intellectual property have pressed for, and in most cases received, greater protections. This outward pressure has resulted in the availability of multiple forms of protection for certain works.")

96. See Edward Lee, *Digital Originality*, 14 VAND. J. ENT. & TECH. L. 919, 922 (2012).

97. See Moffat, *supra* note 10, at 1475-76, 1502-03 (introducing the concept of mutant copyrights and backdoor patents, and later demonstrating how computer software is the first technology to successfully obtain dual protection).

98. See Brean, *supra* note 67, at 812 ("The DMCA's notice and takedown provisions enable copyright holders to effectively stop distribution of infringing works by online service

unlike computer software that has successfully secured protection under both copyright and patent law in the past,⁹⁹ lower courts should be leery of extending similar protection to CADs.

a. CADs as Representations of Facts

Assigning copyright protection to CADS would seem to immediately run afoul of the Copyright Act's explicit bar on extending protection to "any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."¹⁰⁰ But courts may be persuaded that CADs are less like blueprints and more like computer programs, and therefore, that they should be afforded protection similar to software.¹⁰¹ This possibility might occur in light of the digital nature of CADs and their operation in conjunction with 3D printers, a feature that immediately sets CADs apart from their blueprint counterparts.¹⁰²

The Copyright Act defines a computer program as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."¹⁰³ CADs will not likely qualify as "software" within this definition. To begin with, the design referred to in a CAD is embodied within a stereolithography file.¹⁰⁴ Stereolithography files are created using 3D modeling software, and they are eventually processed by another set of software that prepares the design for printing.¹⁰⁵ The actual patented design within the stereolithography file simply represents

providers ("OSPs") such as Thingiverse, where the OSPs did not themselves create the infringing files and may not even be aware of the contents of the files they distribute."). Two cases have already been reported of CAD creators issuing DMCA takedown notices on websites such as Thingiverse. See Hanna, *supra* note 22; Thompson, *supra* note 6.

99. See Moffat, *supra* note 10, at 1502 n.152.

100. 17 U.S.C. § 102(b) (2006).

101. Following the discussion in Part II.A.1, this strategy also might be applied as a workaround to copyright law's ban on appropriating items from the public domain. See *Computer Assocs. Int'l. v. Altai*, 982 F.2d 693, 710 (2d Cir. 1992).

102. See *supra* Part I (discussing the operation of CADs in relation to 3D printers).

103. 17 U.S.C. § 101. The Supreme Court has used a similar definition to describe the term "software" in the patent context. See *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 447 (2007). The two terms are used interchangeably in this Note.

104. Townsend et al., *Open Fab Community 1: The Makerbot Thingiverse*, *supra* note 3.

105. *Id.*

data that has been collected and supplied to either of those programs. The chosen computer program then uses that data to make decisions and perform tasks in accordance with its design.¹⁰⁶

In this light, CADs containing schematics for patented inventions are best understood as collections of facts. In *Feist Publications, Inc. v. Rural Telephone Service Co.*, the Supreme Court expounded upon the originality requirement for works secured under the Copyright Act¹⁰⁷ as embodying an idea/expression or fact/expression dichotomy.¹⁰⁸ As the Court explained, the line between the expression of an idea and the expression of a fact is “one between creation and discovery,” and the representation of facts are not subject to protection because they do not result from an act of authorship.¹⁰⁹

Applying this logic, the owner of a patented invention may not attempt to seek additional protection for his creation by reducing it to a digital rendering in a CAD file. On the one hand, as explained earlier, the subject of the CAD file is derived wholly from facts existing in the public domain and subject to protection under patent law¹¹⁰—a fact that immediately subjects the work to the § 102(b) ban.¹¹¹ On the other hand, creating a CAD from an existing creation—for example, by taking measurements of the object and building a digital model or making a 3D scan of the item—would also fail for lack of originality.¹¹² The creator of the CAD simply compiled recorded facts about the object without contributing a new work of authorship.¹¹³

106. See *Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc.*, 797 F.2d 1222, 1230-31 (3d Cir. 1986) (explaining how data files are used to interact with the copyrighted computer program).

107. 17 U.S.C. § 102(a).

108. 499 U.S. 340, 347-56 (1991).

109. *Id.* at 347 (providing the example of a census taker, whose recorded data may not be copyrighted and belongs to the public domain).

110. See *supra* Part II.A.1.

111. 17 U.S.C. § 102(b).

112. See *Meshwerks, Inc. v. Toyota Motor Sales U.S.A.*, 528 F.3d 1258, 1270 (10th Cir. 2008).

113. See *id.* at 1265-69 (applying the *Feist* originality requirement and finding that the plaintiffs' 3D models of Toyota's vehicles were merely very good copies of the cars rather than independent creations). *But see* Lee, *supra* note 96, at 944-47 (arguing that the *Meshwerks* court failed to account for the “modicum of creativity” that went into the creation of the 3D models).

b. CADs and Unlimited Customization

The preceding analysis assumed that the rights holder sought copyright protection after the creation had been patented and manufactured. But what if rights holders abandoned patenting and manufacturing the product and simply distributed CADs electronically, much like music and movies are distributed today? In such a scenario, the CADs are much stronger candidates for copyright protection as “pictorial” or “graphic” works¹¹⁴ because they are not derived from patented subject matter and are not merely copies of preexisting physical artifacts. Creators looking to protect the function of the design, however, will find themselves stifled by copyright law’s useful article doctrine,¹¹⁵ lenient fair use defense,¹¹⁶ and the unlimited potential for customization of CAD files.¹¹⁷

As a practical example of this dilemma, consider the Vessel Hull Design Protection Act of 1998 (VHDPA),¹¹⁸ enacted by Congress as part of the DMCA in response to the Supreme Court’s ruling in *Bonito Boats, Inc. v. Thunder Craft Boats*.¹¹⁹ Despite copyright law’s longstanding ban on protecting useful articles,¹²⁰ Congress carved out an exception specifically for the functional elements of a boat hull design.¹²¹ Prior to its amendment in 2008, the VHDPA defined

114. 17 U.S.C. § 102(a)(5).

115. *See, e.g.*, *Mazer v. Stein*, 347 U.S. 201, 217 (1954) (“Unlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea—not the idea itself.”).

116. *See* 17 U.S.C. § 107; *see also* *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 433 (1984) (“Any individual may reproduce a copyrighted work for a ‘fair use’; the copyright owner does not possess the exclusive right to such a use.”); Maureen A. O’Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1187 (2000) (“In copyright law, they have excused infringement as fair often in circumstances where market failures would otherwise render the exclusive rights overbroad and prevent socially efficient and desirable uses of the copyrighted work from occurring.”).

117. *See* Alice Rawsthorn, *In the Shifting World of Product Design, the User Now Has a Voice*, N.Y. TIMES (Sept. 9, 2012), <http://www.nytimes.com/2012/09/10/arts/design/in-the-shifting-world-of-product-design-the-user-now-has-a-voice.html>.

118. Digital Millennium Copyright Act of 1998, Pub. L. No. 105-304, § 501, 112 Stat. 2860 (1998) (codified as amended at 17 U.S.C. §§ 1301-32).

119. 489 U.S. 141 (1989); *see* *Maverick Boat Co. v. Am. Marine Holdings, Inc.*, 418 F.3d 1186, 1191 (2005).

120. *See supra* note 115.

121. *See* Bradley J. Olson, *The Amendments to the Vessel Hull Design Protection Act of 1998: A New Tool for the Boating Industry*, 38 J. MAR. L. & COM. 177, 178 (2007) (explaining that the law was introduced because “[t]he economically significant domestic boat

the hull as “the frame or body of a vessel, including the deck.”¹²² The inclusion of the deck as part of the hull created a “legal loop-hole” for competing manufacturers that allowed them to safely copy the most useful part of a successful boat design—the hull itself—while only making modest changes to the deck.¹²³

The critical lesson to be gleaned from the boat-manufacturing scenario is not Congress’s semantic oversight, but rather the difficulty of trying to tie a creation’s utility to its design—something copyright law was never meant to accomplish.¹²⁴ The only way the VHDPAs could hope to have any efficacy was to narrow its scope to a single, isolated aspect of one particular creation.

Without the ability to secure a design’s useful aspects, inventors will not find any meaningful protection under copyright law alone.¹²⁵ Considering copyright law’s low threshold for originality,¹²⁶ anyone creative and savvy enough to use a 3D modeling program can isolate an article’s protected design elements and alter them in a manner that would render the item entirely unique.¹²⁷

manufacturing industry [had] long been plagued by low-cost boat makers who think nothing of taking a successful competing boat hull design and using it as a ‘plug’ to make a direct-cast mold for their own unauthorized manufacturing use” (footnote omitted); *see also* Vessel Hull Design Protection Amendments of 2008, Pub. L. No. 110-434, 122 Stat. 4972 (2008) (amending the definition of “hull” to exclude the deck).

122. 17 U.S.C. § 1301(b)(4) (2006).

123. *See* Olson, *supra* note 121, at 180.

124. *See* Moffat, *supra* note 10, at 1477 (“[T]he patent bargain is intended to spur the invention of new and useful machines, processes, and products while still providing some benefits to competitors ... and the public.... Copyright law is meant to strike a balance between rights granted to authors and the availability of new, creative materials for others.”); O’Rourke, *supra* note 116, at 1186 (“A copyright primarily grants its owner the exclusive right to reproduce the work in copies, while the patent allows the patentee to prevent any other from making, using, or selling the invention (or its equivalent) in the United States.”).

125. However, there is something to be said about the powerful combination of name brand recognition (trademark) and a popular copyrighted design that might be useful to someone looking for an innovative approach to the world of home manufacturing.

126. *See* Feist Publ’ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991) (“Original, as the term is used in copyright, means only that the work was independently created by the author (as opposed to copied from other works), and that it possesses at least some minimal degree of creativity.”).

127. *See, e.g.,* Townsend et al., *Software Frontiers: Mass Customization*, *supra* note 3 (“One of the key potential applications of digital fabrication is giving users the ability to customize mass products for individual use.”).

III. WHY MANUFACTURING MATTERS

Patent law in the United States developed from the English system¹²⁸ that looked skeptically on the grant of monopoly rights and accordingly limited the protection for patented artifacts.¹²⁹ The United States' system took a different approach, one that attempted to balance the incentive to create with the burden placed on society by limiting its access to useful technologies.¹³⁰ This balancing act is understood as the "patent bargain,"¹³¹ and it presents a controversial dilemma. Which side of the bargain was patent law created to promote: rewarding inventors for their creative activity or continuing to increase the supply in the public store of knowledge?¹³²

History suggests that rewarding inventors for their creative activity assumed the primary function in this realm of intellectual property law. Patent law emerged after a period when manufacturing largely consisted of artisan methods of production, overseen by domineering guilds, and patronized through a series of highly personal manufacturer-to-consumer exchanges.¹³³ The period of industrialization that followed led to the mechanization and mass production of consumer goods.¹³⁴ The once personal relationships that were so essential in the previous era gave way to an impersonal method of distribution that was favored because of the ready availability of information about mass-produced goods and the ability of new manufacturing methods to consistently output products of identical quality.¹³⁵ Production thus became the art of reproduction.¹³⁶

128. See *Bilski v. Kappos*, 130 S. Ct. 3218, 3239-42 (2010).

129. See KHAN, *supra* note 42, at 7, 30-39.

130. See *Graham v. John Deere Co.*, 383 U.S. 1, 10-11 (1966).

131. See *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150-51 (1989).

132. Compare *Pennock v. Dialogue*, 27 U.S. 1, 19 (1829) ("[T]he main object [of patent law] was 'to promote the progress of science and useful arts;' and this could be done best, by giving the public ... a right to ... use ... the thing invented, at as early a period as possible."), with *Patlex Corp. v. Mossinghoff*, 758 F.2d 594, 599-600 (Fed. Cir. 1985) ("The encouragement of investment-based risk is the fundamental purpose of the patent grant.").

133. See Amalia D. Kessler, *Enforcing Virtue: Social Norms and Self-Interest in an Eighteenth-Century Merchant Court*, 22 LAW & HIST. REV. 71, 106-10 (2004).

134. Alan Pottage & Brad Sherman, *Kinds, Clones, and Manufactures*, in MAKING AND UNMAKING INTELLECTUAL PROPERTY: CREATIVE PRODUCTION IN LEGAL AND CULTURAL PERSPECTIVE 269, 270-74 (Mario Biagioli et al. eds., 2011).

135. *Id.*

136. *Id.* at 271 (citing Charles Babbage).

Essentially, industrial manufacturing eradicated many of the transaction costs that necessarily limited the distribution of artisan manufacturers. At the same time, the rise of patent law in industrializing areas allowed inventors to secure a property interest in their ideas and establish a monopoly right over the practice of their inventions.¹³⁷ Shortly thereafter, a new form of anticompetitive activity developed: the patent infringement lawsuit.¹³⁸

The notion that the patent infringement lawsuit exists as a means to curtail competition developed in part from the idea that this particular mode of protection was necessary to encourage investment in manufacturing.¹³⁹ The effects of this anticompetitive mentality are still felt today. For example, damages for lost profits in a patent infringement suit generally allow the harmed party to recover the variable costs of production plus the additional revenue that the patent owner would have accrued absent the infringing conduct.¹⁴⁰ Similarly, damages for royalties reflect the patent owner's right not to exploit their interest directly, but to license the rights to manufacture the artifact to others for a fee.¹⁴¹

Given the emphasis on limiting the profitability of competition, patent law simply does not concern itself with the travails of end-user infringement. Of course, the doctrine of contributory infringement might allow patent owners to sue websites that host the distribution of CADs,¹⁴² but the informative nature of CADs and the ready availability of that information through other unquestionably lawful means¹⁴³ might tip the scale in favor of the websites.

In essence, the technological revolution promised by the rise of 3D printing obviates, at least in some cases, Congress's earlier concerns

137. See KHAN, *supra* note 42, at 19-27.

138. See *id.* at 69-77 (reviewing patent litigation patterns from 1800-1860 and concluding that "litigation was more related to markets and competition than to problems in enforcement").

139. See, e.g., *Patlex Corp. v. Mossinghoff*, 758 F.2d 594, 599-600 (Fed. Cir. 1985) ("The encouragement of investment-based risk is the fundamental purpose of the patent grant.").

140. See MARK S. GURALNICK, FORMULAS FOR CALCULATING DAMAGES 385-98 (2012) (providing an overview of the many methods used to calculate lost profits, all of which presuppose the existence of a chief competing infringer).

141. See, e.g., *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970) (setting a list of fifteen factors to consider when determining a reasonable royalty).

142. See 35 U.S.C. § 271(b) (2006).

143. See *supra* Part II.A.1.

about the need to secure investment in manufacturing. Home manufacturing has the potential to replace the factory, and end-users will then assume a large portion of the costs of production. Congress must then consider the value of the patented ideas themselves and how much protection should be afforded to encourage their continued development.

A. Invention or Innovation?

The distinction between inventive activity and innovative activity might be relevant in helping Congress evaluate the best means of securing the promotion of “Science and [the] useful Arts.”¹⁴⁴ As one economist explained, invention concerns the conception of a new idea, whereas innovation concerns the entrepreneurial application of the idea in a new and practical way.¹⁴⁵

The rise of 3D printing has not had an adverse effect on inventive activity. In fact, observers note that the electronic form of creation promoted by 3D printing actually has resulted in a new open access network of invention over the Internet.¹⁴⁶ One example of the rapidity with which new ideas can flourish in this network occurred when a Thingiverse contributor uploaded a free CAD for a “Lucky Charms Cereal Sifter” that allowed the owner of the printed product to isolate the marshmallows from the grain in a bowl of cereal. Shortly after the CAD was posted, a user on another website offered the physical item for sale for thirty dollars.¹⁴⁷

Of course, one must question the utility of inventions like cereal sifters and other novel oddities. But these inventions reflect 3D printing culture in its infancy, where most contributors are simply hobbyists.¹⁴⁸ What is most important about these observations is the

144. U.S. CONST. art. I, § 8.

145. See KHAN, *supra* note 42, at 183 (citing the economist Joseph Schumpeter).

146. See Harris Kyriakou et al., *Networks of Innovation in 3D Printing* 1, 3 (Aug. 20, 2012) (unpublished manuscript), available at <http://ssrn.com/abstract=2146080> (commenting on the rapid evolution of ideas shared over the Thingiverse website and the resulting novel combinations of the remix network structure).

147. See Nick Bilton, *Disruptions: The 3-D Printing Free-for-All*, BITS BLOG (Nov. 13, 2011, 2:17 PM), bits.blogs.nytimes.com/2011/11/13/disruptions-the-3-d-printing-free-for-all/.

148. See Amy O’Leary, *3-D Printers to Make Things You Need or Like*, N.Y. TIMES (June 19, 2013), http://www.nytimes.com/2013/06/20/technology/personaltech/home-3-d-printers-to-make-things-you-need-or-just-like.html?pagewanted=all&_r=0; Olivarez-Giles, *supra* note 2, at B1; see, e.g., *id.* (describing “grenade containers” that resulted from the unexpected

willingness of participants to contribute their ideas without requiring compensation.¹⁴⁹

But what about innovative activity? Similar to the Thingiverse network, the early era of patent law also saw a surge of inventive activity, but mostly for items of inconsequential usefulness.¹⁵⁰ The great early inventors were also great entrepreneurs, who found ways to capitalize from their creativity.¹⁵¹ Of course, this was accomplished through the patent system's grant of exclusive rights to establish a monopoly over the practice and, to a lesser extent, the power to license the use of their inventions for a fee.¹⁵² All of these inventions were profitable only so long as the innovator, or a licensee, also controlled the means of manufacture.¹⁵³

B. Is the Monopoly Always Worth the Embarrassment?

When contemplating a response to the “democratization of manufacturing,” Congress likely will be driven by a desire to preserve the benefits of patent law’s innovative past. Through the methods described previously, patent owners engaged in the creation of a new economy. The decision to vest ideas with the same qualities as tangible property was remarkable for two reasons. First, intellectual property law artificially introduced scarcity into a domain wholly consisting of nonrivalrous information, meaning that anyone or everyone can utilize it at the same time without depletion or overconsumption.¹⁵⁴ This development is particularly strong in patent law in which, unlike in copyright law, there is no

combination of “a novelty lemon cap and a parametric screwable box”); *supra* note 53 and accompanying text.

149. See Townsend et al., *Open Fabrication Communities*, *supra* note 3.

150. See Edward C. Walterscheid, *Patents and Manufacturing in the Early Republic*, 80 J. PAT. & TRADEMARK OFF. SOC'Y 855, 886 (1998).

151. See KHAN, *supra* note 42, at 202-03 (“The typical great inventor combined ingenuity in both invention and commercial exploitation, proving to be a shrewd entrepreneur who efficiently promoted his inventions, motivated by a desire for profit. Few failed to secure rewards for their inventions.”).

152. See *supra* Part III.

153. See Vincenzo Denicoló, *Do Patents Over-Compensate Innovators?*, 22 ECON. POL'Y 679, 683-84 (2007).

154. See Peter Lee, *The Accession Insight and Patent Infringement Remedies*, 110 MICH. L. REV. 175, 192-93 (2011).

defense of independent creation.¹⁵⁵ As such, there can only be one owner for any patentable idea.

Second, patents allowed their owners to “capitalize” on their exclusive rights. As economist Hernando de Soto explained, “capital” functions on two levels: the physical embodiment of the asset and the asset’s potential to generate surplus value.¹⁵⁶ Just like any other formal property record, patents “represent our shared concept of what is economically meaningful about [the claimed] asset. They capture and organize all the relevant information required to conceptualize the potential value of [the] asset and so allow us to control it.”¹⁵⁷ Patent law made tangible an otherwise intangible asset, thereby setting its owner free to innovate, or secure new methods of deriving value from the exclusive grant.¹⁵⁸

The fact that the establishment of the patent regime has inarguably led to the development of an expansive intellectual property market, currently supporting 35 percent of the United States’ gross domestic product,¹⁵⁹ will likely be the innovation that Congress is most concerned with preserving. In the case of individual manufacturers, it is not clear that any incentive to continue production will persist if home manufacturing becomes widespread. Consider Professor Lemley’s argument that “[c]ompetitive markets work not because producers capture the full social value of their output—they do not, except at the margin—but because they permit producers to make enough money to cover their costs, including a reasonable return on fixed-cost investment.”¹⁶⁰ Again, just as with

155. Compare *Mazer v. Stein*, 347 U.S. 201, 218 (1954) (“Absent copying there can be no infringement of copyright.”), with *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 490 (1974) (“While trade secret law does not forbid the discovery of the trade secret by fair and honest means, e.g., independent creation or reverse engineering, patent law operates ‘against the world,’ forbidding any use of the invention for whatever purpose for a significant length of time.”).

156. See Hernando de Soto, *The Mystery of Capital*, CATO INSTITUTE (Mar. 1, 2001), <http://www.cato.org/publications/commentary/mystery-capital.html>.

157. *Id.*

158. Press Release, U.S. Pat. & Trademark Off., U.S. Commerce Department Releases New Report Showing Intellectual Property-Intensive Industries Contribute \$5 Trillion, 40 Million Jobs to U.S. Economy (Apr. 11, 2012), available at <http://www.uspto.gov/news/pr/2012/12-25.jsp> (“Patents, trademarks, and copyrights are the principal means for establishing ownership rights for inventions and ideas, and provide a legal foundation by which intangible ideas and creations generate tangible benefits to businesses and employees.”).

159. U.S. DEP’T OF COMMERCE, *supra* note 34, at vii.

160. See Lemley, *supra* note 44, at 1032.

damages calculations, the profitability of production is intimately associated with the cost of manufacturing.¹⁶¹

Home manufacturing eliminates fixed costs from the front end and passes them on to the end-user, a cost the end-user has elected to absorb regardless of whether the design was obtained lawfully or not. Should Congress elect to curb the spread of home manufacturing, or 3D printing, it would mark a landmark change in the patent bargain, whereby the incentive for innovation would be displaced by mere social utility. Oddly, and perhaps unworkably, this would balance one public benefit against another public benefit.¹⁶²

C. Reconceptualizing Patent's "Lake"

According to Professor Lemley's explanation, inventors do not actually recover a profit for the time it took to create a new invention.¹⁶³ Innovators, however, do recover a profit from finding efficient ways to manufacture, market, and distribute their inventions. To the extent that technology obviates the necessity for traditional capital investments, strategic marketing, and the development of valuable supply chains, there is no reason to believe that conventional profits could ever be realized under these circumstances, whether piracy existed or not.

Although the patent system has played an essential role in the development of a vibrant economy, Congress should hesitate before taking steps to preserve the old infrastructure at the cost of innovation. Instead, congress should consider the realm of intellectual property like de Soto's lake, where "[t]he challenge for the engineer is finding out how he can create a *process* that allows him to convert and fix [its] potential into a form that can be used to do additional work."¹⁶⁴ Legal means have been employed to instill ideas with most of the same characteristics as tangible property.¹⁶⁵ Like any other property system, values fluctuate and investors respond accordingly.

161. See *supra* Part III.

162. Congress's actions could position contributions to the public store of knowledge against the maintenance of an expansive economy.

163. See Lemley, *supra* note 44, at 1054-55 (using the example of a book publication for the proposition that marginal costs trump the fixed cost of creation).

164. See de Soto, *supra* note 156.

165. See *supra* Part III.B.

The “democratization of manufacturing” involves the creation of a new market for the dissemination and exploitation of ideas. In light of this potential, it would be a mistake for legislators to ignore the emergence of a new market force capable of recalibrating the costs of manufacturing and, ultimately, the incentive to engage in mass production. After all, patent law still will likely play an important role in many areas outside the manufacture of consumer goods.¹⁶⁶ To insist on the artificial suppression of 3D printing would needlessly lead to market inefficiencies and waste.

CONCLUSION

In summary, many challenges and opportunities will accompany the emergence of 3D printing technology. The digital nature of this development will likely tempt rights holders, the judiciary, and the legislature to move quickly to stamp out piracy. However, attempts to mold new patent law in the fashion of the DMCA will prove difficult to police and enforce. Legislators and rights holders should reexamine the incentive structure that undergirds the intellectual property system to determine where new opportunities for innovation actually exist. Slowing the development of 3D printing technology through restrictions on the dissemination of CAD files will not adequately address the real issue: the “democratization of manufacturing” and the rise of end-user production. A successful intellectual property regime will embrace this development, and the ideal rights holder will implement new innovations that will not have the perverse effect of stifling innovation.

*Skyler R. Peacock**

166. See U.S. DEP'T OF COMMERCE, *supra* note 34, at vii (listing all of the patent intensive industries, including aerospace technology, petroleum, pharmaceuticals, and other nonconsumer related industries).

* J.D. Candidate 2014, William & Mary Law School. Special thanks to Victoria Avitto, Harley Avitto, the Peacock Family, the Avitto Family, the Sears Family, Vlada Soshkina, Merideth Snow, Samuel Mann, Janet Sully, Meghan Stubblebine, Cassandra Roeder, Ty Henry, Sarah Beason, Kevin Elliker, Alex Lott, Kylie Madsen, Jenna Poligo, Julie Pasipanki, Lynn Murray, and the rest of the dedicated editors and staff members of the *William and Mary Law Review*.