THE COLUMBIA
SCIENCE & TECHNOLOGY
LAW REVIEW

VOL. XVI STLR.ORG FALL 2014

NOTE

THE LEGAL DIMENSION OF 3D PRINTING: ANALYZING SECONDARY LIABILITY IN ADDITIVE LAYER MANUFACTURING†

Preeta Reddy*

Additive manufacturing, commonly known as 3D printing, allows for the construction of highly-customizable, detailed, three-dimensional objects using a different mechanism than traditional manufacturing. This technology has already yielded innovative developments in medicine, fashion, art, manufacturing, and several other fields. However, 3D printing is not without controversy. As 3D printers and compatible designs become more publicly accessible, users can engage in illegal activity such as copyright, trademark, patent infringement, or printing of contraband and otherwise-regulated materials such as drugs or weapons. This Note addresses these legal issues in the context of analogous technologies, focusing especially on copyright issues. The Note then advocates for direct regulation of 3D printing.

TABLE OF CONTENTS

* Preeta Reddy is a 3L at Columbia Law School. She received a B.A. in Psychology from Johns Hopkins University. She will begin work at Willkie Farr & Gallagher in the fall of 2015.

I. INTRODUCTION

In May 2013, Cody Wilson and his team at Defense Distributed successfully manufactured and fired the first 3D printed gun.[1] Shortly thereafter, they released the designs for each piece of the gun online, where other users with 3D printers could download them and print the guns themselves.[2] The blueprints were downloaded over 100,000 times in two days[3] before the State Department intervened, ordering Defense Distributed to remove the files from the Internet.[4] Concerns have arisen about whether the further advancement of this technology and its increased availability to the general public will result in a slew of legal problems. The State Department's intervention was not the first setback that Defense Distributed suffered. The company raised revenue for its project on Indiegogo.com, a crowd-funding site,[5] but Indiegogo suspended the campaign after Defense Distributed had raised just under $2000 of its $20,000 goal.[6] The company

1. Lee Hutchinson, *The first entirely 3D-printed handgun is here*, ARSTECHNICA.COM (May 3, 2013, 4:00 PM), http://arstechnica.com/gadgets/2013/05/the-first-entirely-3d-printed-handgun-is-here.

2. *3D printed gun blueprints pulled from internet*, CBSNEWS (May 10, 2013, 10:26 AM), http://www.cbsnews.com/news/3d-printed-gun-blueprints-pulled-from-internet-at-request-of-state-department.

3. *Id.*

4. *Id.*

5. Andy Greenberg, *'Wiki Weapon Project' aims to create a gun anyone can 3D print at home*, FORBES (Aug. 23, 2012, 9:00 AM), http://www.forbes.com/sites/andygreenberg/2012/08/23/wiki-weapon-project-aims-to-create-a-gun-anyone-can-3d-print-at-home.

6. Jessica Roy, *Indiegogo suspends campaign to build blueprints for 3D printed guns*, BETABEAT (Aug. 23, 2012, 1:21 PM), http://betabeat.com/2012/08/indiegogo-suspends-campaign-to-build-blueprints-for-3d-printed-gun.

continued fundraising on its personal website.[7] Additionally, upon discovery of Defense Distributed's plans, Stratasys reclaimed the printer it had leased to the company.[8] Despite the setbacks, Wilson, hailed as a staunch "crypto-anarchist," was determined to go forward with the project.[9] All of this has been brought to a standstill as the State Department evaluates the legality of 3D printed firearms per the International Traffic in Arms Regulation.[10]

However, as the State Department deliberates this issue, the technology is rapidly improving and more devices are being tailored for personal use. Part I of this Note covers the history of 3D printing, the way the technology works, and its myriad applications in society. Part IIA discusses potentially infringing uses and parties that might be found liable for illegal activity resulting from 3D printers. Part IIB of this Note discusses the current legal landscape related to this field, and Part III argues for direct regulation of 3D printing. Part IV concludes.

II. FORM AND FUNCTION OF 3D PRINTING

In 1984, Charles Hull developed the first functional 3D printer.[11] This technology helped realize the concept of additive layer manufacturing, commonly known as 3D printing. This type of manufacturing involves a process by which three-dimensional objects can be printed in sequential layers[12] based on a computer-aided design (CAD) model.[13] The use of CAD and the precision of the printers allow users to easily manipulate designs to high degrees of specificity and customization.[14] Additive manufacturing

---

7. Andy Greenberg, *3D printed gun project hits its fundraising goal*, FORBES (Sept. 20, 2012, 9:49 AM), http://www.forbes.com/sites/andygreenberg/2012/09/20/3d-printed-gun-project-hits-its-fundraising-goal-despite-being-booted-off-indiegogo.

8. Robert Beckhusen, *3D printer company seizes machine from desktop gunsmith*, WIRED (Oct. 1, 2012, 2:06 PM), http://www.wired.com/dangerroom/2012/10/3d-gun-blocked.

9. Jeremy Unger, *First fully 3D printed gun created*, BETABEAT (May 3, 2013, 2:22 PM), http://betabeat.com/2013/05/first-fully-3d-printed-gun-created.

10. International Traffic in Arms Regulation, 22 C.F.R. § 120.2 (2013).

11. Kyle Maxey, *Infographic: The History of 3D Printing*, ENGINEERING (Sept. 3, 2013), http://www.engineering.com/3DPrinting/3DPrintingArticles/ArticleID/6262/Infographic-The-History-of-3D-Printing.aspx.

12. Margaret Rouse, *CAD (computer-aided design)*, WHATIS (Mar. 2011), http://whatis.techtarget.com/definition/CAD-computer-aided-design.

13. Jon Excell, *The rise of additive manufacturing*, THEENGINEER (May 24, 2010), http://www.theengineer.co.uk/in-depth/the-big-story/the-rise-of-additive-manufacturing/1002560.article.

14. *Id.*

differs from traditional manufacturing, which entails carving a finished product from a larger block of material.[15] Thus, 3D printing uses a fraction of the material that traditional manufacturing uses.[16] While manufacturing (casting, machining, assembling) can result in wastage of up to 90% of materials, 3D printing employs 90% or more material utilization.[17]

Three-dimensional printers use materials that are reduced to powder or liquid form and are then fused into 3D objects using lasers.[18] Different materials that can be used are plastics, polyamides, epoxy resins, wax, polycarbonates, food byproducts, and various metals.[19] A blade within the printing chamber reads the CAD model and spreads even layers of powder on the surface of the chamber.[20] Then a laser scans across the powder, melting and fusing it to form the first layer of the object. This process is repeated until the object is completely built.[21] Customization and a high level of precision are possible because the layers can essentially be broken down to the micron level.[22] In the years since Charles Hull built the first of such printers, 3D printing technology has advanced significantly. Initially, the printers were used exclusively to create rough prototypes before manufacturers invested resources into the creation of final products.[23] Not only has it become much more cost-effective to make 3D printers,[24] but the technology is allowing for the printing of increasingly complex and intricate objects.[25]

This section of the Note will discuss increased public access to 3D printing technology as well as the many applications of 3D printing. With regard to public access, the Note will describe the growing affordability of personal 3D printers and how users can

---

15. *Id.*

16. *Print me a Stradivarius*, THE ECONOMIST (Feb. 10, 2011), http://www.economist.com/node/18114327?story_id=18114327.

17. Anthony Vicari, *Efficiencies of improved 3D printing inspire innovation*, E&P (Jan. 2, 2014), http://www.epmag.com/item/Efficiencies-improved-3-D-printing-inspire-innovation_127238.

18. *Id.*

19. 3DERS.ORG, http://www.3ders.org/3d-printing-basics.html#materials (last visited Dec. 20, 2013).

20. *Id.*

21. *Id.*

22. *Id.*

23. *Id.*

24. Aubrey Bloomfield, *How Much Does a 3D Printer Cost?,* POLICYMIC (May 10, 2013), http://www.policymic.com/articles/41111/how-much-does-a-3d-printer-cost-still-expensive-but-becoming-more-affordable.

25. Vicari, *supra* note 17.

upload and download object designs found on public websites to print items at home. Next, the Note will address applications of 3D printing in a number of varied fields such as medicine, manufacturing, and art.

A. Accessibility to the Public

As 3D printing technology has improved and become less expensive to create, more 3D printing devices have become accessible to the public. Some of the more popular makers of 3D printers include Stratasys and 3D Systems.[26] In June 2013, Stratasys acquired MakerBot in a deal that bolstered their chances of dominating the 3D printing industry.[27] Stratasys, a more industrially-focused company, has already received some press for making the printer used by Defense Distributed to develop the first 3D printed gun.[28] The company sells different lines of printers marketed to a range of users – from "individuals and small teams" to large-scale manufacturers[29] – but with the acquisition of MakerBot, Stratasys has greatly expanded its reach into the desktop 3D printing market. MakerBot's website pitches its Replicator 2 printer model as the "standard in desktop 3D printing" and emphasizes the ease with which users can pursue their personal projects.[30] Co-founded by Charles Hull, 3D Systems strives toward "understanding and eliminating barriers to [the] broad utilization" of 3D printing technology.[31] The Cube, 3D System's basic personal printing option, retails at $999.00.[32] Part of the company's line of personal printers, Cubes are intended to

---

26. Bruce Kennedy, *The 5 Most Influential Companies In 3D Printing*, *Benzinga* (Sept. 4, 2014), http://www.benzinga.com/news/14/09/4824108/the-5-most-influential-companies-in-3d-printing.

27. Darrell Etherington, *Stratasys Acquiring MakerBot Will Likely Dominate 3D Printing Industry*, TECHCRUNCH (June 19, 2013), http://techcrunch.com/2013/06/19/stratasys-acquiring-makerbot-combined-company-will-likely-dominate-3d-printing-industry.

28. Andy Greenberg, *Meet the 'Liberator,'* FORBES (May 5, 2013, 5:30 PM), http://www.forbes.com/sites/andygreenberg/2013/05/05/meet-the-liberator-test-firing-the-worlds-first-fully-3d-printed-gun.

29. *3D Printers*, STRATASYS, http://www.stratasys.com/3d-printers (last visited Jan. 10, 2015).

30. *Store*, MAKERBOT, http://store.makerbot.com/replicator2 (last visited Jan. 10, 2015).

31. *Overview*, 3DSYSTEMS, http://www.3dsystems.com/3d-printers/personal/overview (last visited Dec. 20, 2013).

32. CUBIFY, http://cubify.com/cube/index.aspx (last visited Dec. 20, 2013).

"democratize access and accelerate the adoption of 3D printing by the student, the hobbyist and the consumer."[33]

Another major development in personal 3D printing is the creation of websites that allow the public to upload and share designs, like Thingiverse and Shapeways. On Thingiverse, a product of MakerBot founded in 2008,[34] users can view and modify a collection of community submitted designs.[35] Shapeways, on the other hand, is a 3D printing service that allows users to browse through designs and select them for purchase. Upon selection, Shapeways prints objects and sends them to the purchasers.[36] The designs range from purely decorative items, such as holiday ornaments and picture frames, to household tools and electronic accessories.[37] These sites are probably only the beginning. As 3D printers become more affordable and widespread, similar websites are likely to form and become popular.

B. Applications of 3D Printing

Additive manufacturing is applied in several fields beyond those discussed above. Historically, one of the main uses for 3D printers was prototyping. The improvements in 3D printing technology correspond to improvements in the quality of prototypes, which have begun to approximate market-ready products.[38] RedEye, a Minnesota company, now uses 3D printers in its factories because "with only a tweak of software each item can be different, without the need for costly retooling of machines."[39] While 3D printers are not quite able to replace traditional manufacturing, they can already be used to print specialty items, like rare spare parts for the airline industry.[40]

The medical field is also reaping the benefits of 3D printing. In July 2013, NovaCopy designed and printed a

33. *Overview*, 3DSYSTEMS, *supra* note 31.

34. *Newest*, Makerbot, http://www.thingiverse.com/newest (last visited Dec. 20, 2013).

35. *About*, MAKERBOT, http://www.thingiverse.com/about (last visited Dec. 20, 2013).

36. SHAPEWAYS, http://www.shapeways.com (last visited Dec. 20, 2013).

37. *Id.*

38. *3D Printing Scales Up*, THE ECONOMIST (Sept. 5, 2013, 3:00 PM), http://www.economist.com/news/technology-quarterly/21584447-digital-manufacturing-there-lot-hype-around-3d-printing-it-fast.

39. *Id.*

40. *Id.*

prosthetic limb for a duck born with a deformed left foot.[41] Scientists are also pursuing more complicated medical projects, such as printing cells, tissues, and even organs.[42] In 2012, a team of scientists from the University of Pennsylvania and the Massachusetts Institute of Technology used sugar as the printing material for a synthetic liver structure.[43] The scientists hope this research will eventually enable them to create a full organ.[44] The technology has already been used to replicate bone: earlier this year, 75% of a man's skull was replaced with an implant printed from a 3D printing device.[45] Similarly, in the pharmaceutical industry, scientists are developing methods to print "individualized medications, tailored to specific patients."[46]

Advancements have also been made in the fashion industry. A company called Continuum Fashion is already selling 3D printed swimwear.[47] The advantages of printing clothing are manifold. First, clothing manufacturers do not have to worry about overproducing an item of clothing; they can simply print each item as it is ordered.[48] Second, as the technology develops, people can ostensibly recycle their old clothing and reuse the material to produce new items.[49] Third, clothing can be tailored to fit individuals exactly.[50] The same idea has been applied to footwear. New Balance has used 3D printers to custom fit shoes to individuals, and is looking to make the process more mainstream.[51] Nike, on the other hand, is using 3D printing technology to improve the functionality of the shoes themselves – the company

41. Vignesh Ramachandran, *3D Printed Duck Foot*, MASHABLE (July 2, 2013), http://mashable.com/2013/07/02/3d-printed-duck-foot.

42. Emily Mullin, *3D printing creates living tissue cells*, FIERCEBIOTECH (Aug. 23, 2013), http://www.fiercebiotech.com/story/3-d-printing-creates-living-tissue-cells-holds-promise-medical-research/2013-08-23.

43. *3D-printed sugar network to help grow artificial liver*, BBC (July 2, 2012), http://www.bbc.co.uk/news/technology-18677627.

44. *Id.*

45. *3D Printed Skull*, HUFFINGTON POST (Mar. 21, 2013, 7:53 PM), http://www.huffingtonpost.com/2013/03/21/3d-printed-skull_n_2868406.html.

46. Eileen Oldfield, *3-Dimensional Printing: Potential in the Pharmacy*, PHARMACY TIMES (Aug. 6, 2013), http://www.pharmacytimes.com/publications/issue/2013/August2013/3-Dimensional-Drug-Printing-Potential-in-the-Pharmacy.

47. *3D Printed Clothing Becoming a Reality*, RESINS ONLINE (June 17, 2013), http://www.resins-online.com/blog/3d-printed-clothing/.

48. *Id.*

49. *Id.*

50. *Id.*

51. Michael Fitzgerald, *With 3D Printing, the Shoe Really Fits*, MIT SLOAN MANAGEMENT REVIEW (May 15, 2013), http://sloanreview.mit.edu/article/with-3-d-printing-the-shoe-really-fits/.

has printed a plate that attaches to football cleats, intended to increase acceleration for the wearer.[52]

NASA is working on using 3D printers to print food for astronauts to consume while in space.[53] When missions take longer than expected, 3D printing could ensure that the crew has enough nutritious, safe, and varied food options.[54] On a more aesthetic level, the Cornell Creative Machines Lab at Cornell University is partnering with the International Culinary Center to create "scallop nuggets in novelty shapes [and] cakes with messages printed inside," among other food items.[55]

The creation of electronic products more closely tracks one of 3D printing's original applications – mass customization. In November 2013, Motorola signed a deal with 3D Systems to "build cellular phone parts that can be functionally and aesthetically customized for owners."[56] On a much larger scale, Dutch architect Janjaap Ruijssenaars has demonstrated interest in building a 3D printed home.[57] He plans to print and assemble the frame, piece by piece, and fill it with fiber-reinforced concrete.[58] This type of application has broad implications in the field of construction, especially in expanding the ability to customize structures and minimize costs.

Art is yet another area influenced by 3D printing. Three-dimensional printers can precisely replicate famous sculptures, and various pieces of art can be copied and arranged to form new works.[59] Users have uploaded models of famous artworks to sites like Thingiverse, where others can download the models and print

---

52. *Id.*

53. *3D Printing: Food in Space*, NASA, http://www.nasa.gov/directorates/spacetech/home/feature_3d_food_prt.htm.

54. *Id.*

55. Lakshmi Sandhana, *Ramen by HP? The Wild Possibilities of Printing Food,* FAST COMPANY (Sept. 11, 2011), http://www.fastcompany.com/1778661/ramen-hp-wild-possibilities-printing-food.

56. Lucas Mearian, *Motorola inks 3D printing deal for customizable smartphone parts*, COMPUTER WORLD (Nov. 22, 2013, 5:14 PM), http://www.computerworld.com.au/article/532649/motorola_inks_3d_printing_deal_customizable_smartphone_parts/.

57. Jordan Crook, *The World's First 3D-Printed Building Will Arrive in 2014*, TECH CRUNCH (Jan. 20, 2013), http://techcrunch.com/2013/01/20/the-worlds-first-3d-printed-building-will-arrive-in-2014-and-it-looks-awesome/.

58. *Id.*

59. *How the world of decorative art is being revolutionized by 3D printing*, THE INDEPENDENT (Aug. 28, 2011), http://www.independent.co.uk/arts-entertainment/art/features/object-lesson-how-the-world-of-decorative-art-is-being-revolutionised-by-3d-printing-2342500.html.

versions of the works for themselves.[60] Questions have been raised about whether this violates copyright law, depending on whether the replica is used, for example, for education purposes or for commercial sale.[61]

The fabrication of guns is a controversial issue that has been tied to 3D printing since 3D printers have become available to the public. The actions of Defense Distributed were discussed in the introduction of this Note. All but one piece of the gun – dubbed "the Liberator" – were printed on a Stratasys machine, and each of the printed pieces is plastic. Since the Liberator was printed, numerous other 3D printed guns have emerged, including one that is metal instead of plastic.[62] Though this particular metal gun was printed on a million-dollar machine and would be prohibitively expensive for the general public to create,[63] the long-term concern is that, with technological improvements, guns will be manufactured and distributed without regulation. This Note explores the issues of liability in illegal applications of 3D printing, including those issues raised by replication of copyrighted material, as well as the printing of contraband or regulated materials.

III. CURRENT LEGAL ISSUES IN 3D PRINTING

As discussed above, the primary potential infringing uses of 3D printing involve intellectual property, contraband materials, and at-home printing of regulated items like prescription drugs, guns, and other weapons. Of these violations, intellectual property infringement is already widespread on sites like Thingiverse and Shapeways. Violations involving guns and weapons are just beginning to occur, with the first guns being printed in mid-2013.[64] Similarly, the issues stemming from drug printing are still hypothetical, as scientists are perfecting the technology. However, for the purposes of this Note, discussion of weapons and

60. Laura Sydell, *3-D Printing A Masterwork For Your Living Room*, NPR (Oct. 11, 2013, 2:57 AM), http://www.npr.org/blogs/alltechconsidered/2013/10/11/231450884/3-d-printing-a-masterwork-for-your-living-room.

61. *Id.*

62. Barbara Hollingsworth, *World's First 3D Printed Metal Gun Successfully Fires 600+ Rounds*, CNSNEWS (Nov. 13, 2013, 2:14 PM), http://www.cnsnews.com/news/article/barbara-hollingsworth/world-s-first-3d-printed-metal-gun-successfully-fires-600-rounds.

63. *Id.*

64. Jeremy Unger, *First fully 3D printed gun created*, BETABEAT (May 3, 2013, 2:22 PM), http://betabeat.com/2013/05/first-fully-3d-printed-gun-created/.

contraband drugs assumes that these applications will become a reality.

A. Potential Infringing Uses of 3D Printing

Intellectual property includes patents, copyrights, and trademarks. All of these fields are vulnerable to infringements caused by 3D printers. Patent infringement is especially widespread because many of the designs distributed on Thingiverse, Shapeways, and similar sites are for useful, patentable objects, rendering them protectable under patent law.[65] Items that are independently invented may also infringe existing patents, albeit not willfully.[66] Trademarks are also vulnerable to infringement on websites that encourage design sharing. For example, the Shapeways site contains a Memorabilia section that "[gives] anyone the ability to quickly and affordably turn ideas from digital designs into real products," including copyrighted fan art.[67] Many designs, such as a model of Batman from the Christopher Nolan Batman series, infringe on registered trademarks.[68] However, this Note focuses exclusively on copyright infringement by examining historical cases that demonstrate the delay between copyright law and technological advancements.

This section explores the various types of liability for potential defendants resulting from 3D printing, including both primary and secondary liability. Primary liability concerns any party that can be directly associated with the illegal act, while secondary liability allows for an indirect connection to the illegal act. The next portion of this section sets the stage for legal liability thus far in matters related to 3D printing, and the last portion of this section describes prior technological developments that may be analogized with 3D printing. These comparisons will inform how the legal system can handle issues arising from the technology.

---

65. *See* 35 U.S.C.A. § 101 (2012) ("Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.").

66. *See* Davis Doherty, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J.L. & TECH. 353, 359 (2012).

67. *About*, SHAPEWAYS, http://www.shapeways.com/about?li=footer (last visited Oct. 30, 2014).

68. THE DARK KNIGHT, Registration No. 3,680,539.

B. Theories of Liability and Potential Defendants

There are several categories of liability that can be associated with 3D printing. First is direct liability. Also known as primary liability, direct liability arises when a party is directly responsible for a legal harm or damage to another party.[69] In the case of 3D printing, primary liability refers to the liability of individuals who upload infringing designs to sites like Thingiverse or Shapeways, individuals who download and print infringing materials from such sites, or individuals who print and traffic in contraband or regulated goods. Users of design-sharing sites may even face tort liability for uploading faulty designs or for making defective modifications to other users' designs.[70]

Secondary liability, on the other hand, is more nebulous. It applies to third parties that facilitate the use of 3D printing technology, and which may be liable for the contributory infringement of parties that employ their services or platforms.[71] For example, on the Thingiverse site, users can upload original designs and modify other users' designs. While Thingiverse does not engage in direct infringement, it may still be liable for contributory copyright infringement by providing this service. Conversely, Shapeways is more likely to be found directly liable for copyright infringement. On Shapeways, users purchase designs from the Shapeways site, and Shapeways prints the items and ships them to the purchaser.[72]

In addition, printer manufacturers and sellers could face secondary liability and product liability in tort. They could be considered secondarily liable for failing to monitor or prevent illegal uses of their devices, such as the printing of unregulated, entirely plastic firearms.[73] Finally, product liability issues might arise if an item is incorrectly printed as a result of a printer defect, and subsequently causes harm.[74]

C. Current Landscape of Liability

This section describes the legal issues related to liability that have emerged in the relatively short lifespan of 3D printing

---

69. 17 U.S.C.A. § 501 (2012).

70. Nora Freeman Engstorm, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PA L. REV. 35, 37 (2013).

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

72. *About*, SHAPEWAYS, *supra* note 67, at 11.

73. Engstorm, *supra* note 70, at 37.

74. *Id.*

technology. First, the section analyzes Defense Distributed and the ramifications of designing a functional plastic gun that can be printed almost entirely with a 3D printer. The section then addresses potential future government action to deal with the lack of regulation of home-printed 3D weapons. Finally, this section explores the legal issues encountered as a result of copyright infringement.

Thus far, no cases have arisen regarding 3D printing issues. In the wake of the first 3D printed gun, the controversy surrounding 3D printers centered on illegal weapons activity.[75] The actions taken against Defense Distributed were discussed earlier in this Note. Namely, the State Department prevented Defense Distributed from sharing designs for "the Liberator" in order to evaluate its legality.[76] The Undetectable Firearms Act[77] was scheduled to expire on December 9, 2013,[78] but the House of Representatives voted to extend the act for an additional ten years.[79] The Act makes it illegal to manufacture or carry any firearm that can escape detection – for example, in an airport scanner – and has been renewed twice since its creation in 1988.[80] The Liberator's design instructed users who printed the gun to include a small but detectable block of steel.[81] However, users could easily omit the steel piece, rendering the gun undetectable.[82] In addition, users are developing means of designing 3D printed bullets, which would also escape detection.[83]

The 2013 version of the Undetectable Firearms Act does not address the legality of 3D printing. A failure to expand the Act's scope indicates that 3D printed firearms are not illegal unless undetectable. Senator Chuck Schumer has attempted to pass a bill

---

75. Unger, *supra* note 64, at 11.

76. Sarah Parnass, *State Department Orders 3D Gun Plans Offline*, ABC NEWS (May 10, 2013, 2:19 PM), http://abcnews.go.com/blogs/politics/2013/05/state-department-orders-3d-gun-plans-offline/.

77. Undetectable Firearms Act of 1988, 18 U.S.C.A. § 922(p)(1) (2012).

78. John Parkinson, *House Extends Ban on Plastic 3D Printed Guns*, ABC NEWS (Dec. 3, 2013, 4:51 PM), http://abcnews.go.com/blogs/politics/2013/12/house-extends-ban-on-plastic-3-d-printed-guns-and-other-undetectable-firearms/.

79. *Id.*

80. 18 U.S.C.A. § 922(p)(1) (1988).

81. John Biggs, *What You Need To Know About The Liberator 3D-Printed Pistol*, TECH CRUNCH (May 6, 2013), http://techcrunch.com/2013/05/06/what-you-need-to-know-about-the-liberator-3d-printed-pistol/.

82. *Id.*

83. Rebecca Leber, *House To Vote On Undetectable Gun Ban Extension*, THINKPROGRESS (Dec. 3, 2013, 1:27 PM), http://thinkprogress.org/justice/2013/12/03/3011101/house-undetectable-guns-ban/.

renewing the Act for a single year, giving Congress time to expand its protections to account for 3D printed guns.[84] While such regulations are faltering at the federal level, local governments are taking action. In late November 2013, Philadelphia became the first city to ban the manufacturing of 3D printed guns.[85] The ban prohibits any person from using a 3D printer "to create any firearm, or any piece or part thereof, unless such person possesses a license to manufacture firearms under Federal Law."[86] This ban is preemptive, and not the result of any documented 3D printed guns.[87]

Regarding copyright infringement, Dr. Ulrich Schwanitz issued the first Digital Millennium Copyright Act (DMCA) complaint against Artur Tchoukanov in 2011. Schwanitz created a design for a 3D model of the impossible[88] Penrose Triangle[89] which he then claimed was infringed upon by Tchoukanov.[90] The complaint was not in compliance with the DMCA nor was it likely to have a strong chance of succeeding, as the Penrose Triangle is in the public domain. Regardless, so far, this has been the most significant copyright infringement action related to 3D printing.

D. Analogous Technologies and Copyright Analyses

Copyright law has been faced with many new technologies, some of which have raised similar questions to those now created by 3D printers. Before discussing these cases and analogous technologies, it is important to lay the foundation for the different

---

84. Jacob Kastrenakes, *Schumer Pushes Undetectable Firearm Act Extension*, THE VERGE (Nov. 18, 2013, 12:32 PM), http://www.theverge.com/2013/11/18/5117990/schumer-pushes-undetectable-firearm-act-extension-3d-printed-gun-warning.

85. Simon van Zuylen-Wood, *Philly Becomes First City to Ban 3-D gun Printing*, PHILLY MAG (Nov. 21, 2013, 3:36 PM), http://www.phillymag.com/news/2013/11/21/philly-becomes-first-city-ban-3-d-gun-printing/.

86. Alexis Kleinman, *Philadelphia Is The First U.S. City To Ban 3D-Printed Guns*, HUFFINGTON POST (Nov. 26, 2013, 2:49 PM), http://www.huffingtonpost.com/2013/11/26/3d-gun-philadelphia_n_4344733.html.

87. *Id.*

88. Suzanne Labarre, *Impossible Penrose Triangle Now Possible With 3D Printing?*, FASTCODESIGN (Feb. 14, 2011), http://www.fastcodesign.com/1663226/impossible-penrose-triangle-now-possible-with-3-d-printing-updated.

89. WOLFRAM MATH WORLD, http://mathworld.wolfram.com/PenroseTriangle.html (last visited Oct. 13, 2014).

90. Peter Hanna, *The Next Napster? Copyright Questions as 3D Printing Comes of Age*, ARSTECHNICA (Apr. 06, 2011), http://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/.

types of liability, both primary and secondary. Secondary liability cannot be found without a finding of underlying primary infringement, so this Note will first discuss primary liability and its application to users of 3D printing technology.

1. Primary Liability

Copyright owners possess several exclusive rights: reproduction, preparation of derivative works, distribution, public performance (with the exception of sound recordings), and public display.[91] Alleged infringers have several defenses available to them: authorized use, independent generation, copyright expiration (entrance into public domain), and fair use. The former three defenses are fairly objective in nature, while fair use is more fact-specific, and therefore subjective.[92]

Fair use, outlined in the United States Code, specifies that certain uses of copyrighted works do not constitute infringement.[93] Determining which works qualify as fair use depends on many factors, four of which are codified in the description of fair use. The first factor involves "the purpose and character of the use"[94] of the copyrighted work by the alleged infringer. The second factor considers "the nature of the copyrighted work."[95] Typically this is a determination of whether the work is more creative or more factual in nature. For example, a novel is rather creative, while an encyclopedia entry is largely factual. The third factor evaluates "the amount and substantiality of the portion [of the copyrighted work] used in relation to the copyrighted work as a whole."[96] Finally, the fourth factor explores "the effect of the use upon the potential market for or value of the copyrighted work."[97]

These four factors will serve as guideposts in determining whether users of 3D printers are infringing. As described in section I.B of this Note, 3D printing has various non-infringing uses. The question of legality arises when copyrighted or contraband materials are printed without authorization or regulation.

91. 17 U.S.C.A. § 106 (2012).

92. Harper & Row Publishers v. Nation Enters., 471 U.S. 539, 595 n.19 (1985) (acknowledging "Congress' repeated methodological prescription that definite rules are inappropriate and fact-specific analysis is required").

93. 17 U.S.C.A. § 107 (2012).

94. 17 U.S.C.A. § 107(1) (2012).

95. 17 U.S.C.A. § 107(2) (2012).

96. 17 U.S.C.A. § 107(3) (2012).

97. 17 U.S.C.A. § 107(4) (2012).

Therefore, the following fair use analysis is an evaluation of printed works based on copyrighted works.

In evaluating the first factor, courts will consider the use of the allegedly infringing work, and assess whether the user seeks to exploit the work for commercial gain. Section 17 lists categorical exceptions to copyright infringement, including "criticism, comment, news reporting, teaching, scholarship, or research."[98] Users can also claim fair use under the four factor test detailed above. If a user modifies an original work with new "expression, meaning, or message,"[99] the first factor is likely to weigh in favor of the user.[100] This can be true even if the work is of a commercial nature.[101] Fair use analysis is case-by-case, but because 3D printing technology places a premium on precision and customization, creation of exact replicas could become very widespread. For example, Tulips[102] by Jeff Koons is a sculpture constructed with high chromium stainless steel and transparent color coating. This work has not yet fallen into the public domain. If this work is printed in plastic using a 3D printer, the medium has changed but otherwise, an exact replica of the original work has been created. This is not a transformation of the work itself, so there is a high chance that infringement would be found.

The second factor in fair use analysis requires courts to consider whether the work is creative or factual, and whether the work is published or unpublished.[103] Facts are not copyrightable,[104] and therefore factual works tend to enjoy thinner or no copyright protection, which covers only the original expression of the facts.[105] This distinction between underlying ideas or facts and the expression of these facts is known as the idea-expression dichotomy. The right of first publication will likely cause courts to rule in favor of the copyright owner of an unpublished work which has been copied.[106] The idea-expression

98. 17 U.S.C.A. § 107 (2012).

99. Campbell v. Acuff-Rose Music, 510 U.S. 569, 569 (1994) (where "transformative" is defined as "altering the original with new expression, meaning, or message").

100. Blanch v. Koons, 467 F.3d 244, 251 (2d Cir. 2006).

101. SunTrust Bank v. Houghton Mifflin Co., 268 F.3d 1257, 1269 (11th Cir. 2001).

102. *Jeff Koons Tulips*, GUGGENHEIM BILBAO, http://www.guggenheim-bilbao.es/en/works/tulips/ (last visited Nov. 30, 2014).

103. Harper & Row, 471 U.S. 539, 595 (1985).

104. 17 U.S.C.A. § 102(b) (2012).

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

106. Harper & Row, 471 U.S. at 595.

dichotomy may be dispositive in some cases involving 3D printing. If, for example, someone printed a copyrighted model of a plant cell, a plaintiff asserting infringement is less likely to succeed with regard to the second factor. Even if the original plant cell model is expressed creatively with a variety of materials, textures and colors, plant cells are factual in nature. If, however, the expression of the plaintiff's structure has been copied, the work may be considered creative in nature, and the second factor may weigh in favor of the plaintiff.

The third fair use factor requires courts to conduct both quantitative and qualitative analyses of what was copied from the original work. There is a distinction between quantity and quality here because it is possible for a work to take only a very small sample or portion of the original work. If that portion is considered the "heart of the original [work],"[107] it is more likely that infringement has occurred. However, if alleged infringers can demonstrate that "no more was taken than necessary,"[108] then a significant quantity can be taken as long as it is furthering a transformative purpose (per the first factor). If an exact 3D printed replica of a copyrighted work is made, the copier must demonstrate that the entire work had to be copied in order to fulfill his fair use purpose.[109] Even though the third factor calls for an analysis of how much is taken in comparison with the original work, courts may also scrutinize how much was added to the work that was copied.[110] For example, if a 3D printed design incorporates a copied element that is the "heart of the [original] work," but is only a minor element of the allegedly infringing work, some courts may find the third factor in favor of the defendant.[111]

Finally, in assessing the fourth factor, courts consider the effect the copied work has on the current or future markets for the original work.[112] This factor is especially important for 3D printing. As 3D printing technology continues to improve, users will be able to print exact replicas of copyrighted artworks. This directly interferes with copyright owners' right to sell original works and

107. Campbell, 510 U.S. at 589.

108. *Id.* at 587.

109. *Id.* at 590 ("Fair use is an affirmative defense . . . .").

110. Bill Graham Archives v. Dorling Kindersley Ltd., 448 F.3d 605, 613 (2d Cir. 2006).

111. *Id.*

112. Perfect 10, Inc. v. Amazon, Inc., 508 F.3d 1146, 1168 (9th Cir. 2007) (clarifying that current or future harm to a market cannot be purely hypothetical).

derivative works, such as t-shirts or postcards. This also has the potential to diminish artists' incentives to create works, especially if these works can so easily be replicated and their value diluted. Since a significant purpose of 3D printing is replication, it seems more likely that courts will decide this factor in favor of the copyright owner.

Because fair use analyses are fact specific, discussing Gorilla[113] by Jeff Koons might prove valuable. This sculpture, made of black granite and protected by copyright, is being sold on Thingiverse's website.[114] The first fair use factor, purpose and character of use, would tend to cut against fair use because the statue is an exact replica and serves a commercial purpose by being sold. The second factor, the nature of the copyrighted work, would likely cut against fair use, as Gorilla is a creative work. However, it is possible that Gorilla, which Koons based upon a souvenir he purchased at a zoo,[115] does not meet the minimum copyright requirements of originality. In that case, a factfinder might determine that a miniature copy of Gorilla is fair use because Koons does not have a copyright in the work. The amount and substantiality of use is also likely to cut against fair use, as the entirety of the work is being used. The final factor, the effect of the use on the market, is less likely to cut against fair use in the instance of a Gorilla replica, as the experience of seeing or holding a 3D printed Gorilla miniature is unlikely to replace the experience of seeing or owning Jeff Koons' Gorilla. In this particular instance, it seems as though fair use would not be a successful argument for those who infringe copyright in this way.

2. Secondary Liability

As discussed above, the fair use defense complicates the direct liability analysis. The fair use defense also applies to secondary liability, as there can be no secondary liability without underlying infringement. Once infringement is found, the analyses for determining vicarious and contributory liability are even more complex. This section details the context and development of the

---

113. *Gorilla*, JEFFKOONS.COM, http://www.jeffkoons.com/artwork/hulk-elvis/gorilla (last visited Nov. 30, 2014).

114. *Jeff Koons Gorilla*, THINGIVERSE, http://www.thingiverse.com/thing:107335 (last visited Nov. 30, 2014).

115. Tracy Zwick, *Double-Barrel Frieze-Week Jeff Koons at Gagosian and Zwirner*, ARTINAMERICA (May 10, 2013), http://www.artinamericamagazine.com/news-features/previews/double-barrel-frieze-week-jeff-koons-at-gagosian-and-zwirner/.

secondary liability doctrine, and specifically, its application to new technologies.

In *Shapiro, Bernstein & Co. v. H. L. Green Co.*,[116] the court stated that:

> [w]hen the right and ability to supervise coalesce with an obvious and direct financial interest in the exploitation of copyrighted materials – even in the absence of actual knowledge that the copyright monopoly is being impaired . . . the purposes of copyright law may be best effectuated by the imposition of liability on the beneficiary of that exploitation.[117]

Therefore, a party that both receives direct financial benefit from infringement and has the ability to supervise whether or not infringement occurs can be considered vicariously liable. Determining what benefits are considered "direct" and what constitutes an "ability to supervise" in order to satisfy the vicarious liability test is a fact-dependent process.[118] It is also important to note that a party can be secondarily liable even without specific knowledge of infringement.[119]

If the *Shapiro, Bernstein & Co.* test were applied to Thingiverse, the court would have to evaluate whether Thingiverse achieves a direct financial benefit from allowing users to post infringing designs on its site, and also whether Thingiverse can supervise the posted content. Arguably, Thingiverse receives a direct financial benefit from user-uploaded designs, because increased content attracts more users to the site, which results in increased advertising revenue. However, monitoring user-uploaded designs may be unfeasible based on sheer volume.

The other branch of secondary liability, contributory liability, is discussed in *Gershwin Publishing Corp. v. Columbia Artists Management, Inc.*[120] The court found Columbia Artists

---

116. Shapiro, Bernstein & Co. v. H. L. Green Co., 316 F.2d 304 (2d Cir. 1963) (where a record store situated within defendant's chain store sold records infringing on plaintiff's copyright, and defendant was found vicariously liable because defendant (1) had a direct financial interest in the sale of the infringing materials and (2) had the ability to supervise the infringer).

117. *Id.* at 307.

118. *Id.* at 308.

119. *Id.* at 307.

120. Gershwin Publ'g Corp. v. Columbia Artists Mgmt., Inc., 443 F.2d 1159 (2d Cir. 1971) (concert manager organized concerts for artists, and knew that artists performed copyrighted compositions, for which copyright license were not

Management, Inc. (CAMI) contributorily liable for copyright infringement because CAMI both had knowledge of the infringement and materially contributed to it.[121] However, Thingiverse would have a stronger defense against contributory liability than CAMI if it could demonstrate that it did not have knowledge of specific instances of infringement, and that it did not attempt to encourage its users to post infringing designs on its site. Thingiverse is unlikely to successfully argue this, as Thingiverse's Art webpage[122] is replete with designs for models of copyrighted works, including designated sections for "Scans & Replicas"[123] as well as "Signs & Logos."[124] Users are able to access models for Darth Vader, characters from Disney Pixar's Monsters, Inc., DreamWorks' Kung Fu Panda, Princess Mononoke, Batman, and other copyrighted works on these pages.[125]

In 1984, *Sony Corp. of Am. v. Universal City Studios, Inc.* (the "*Betamax*" case)[126] changed the face of secondary liability. The case dealt with Sony's new product, the Betamax: a device which allowed users to record televised programs on Betamax tapes and view them at a later time ("time-shifting").[127] Universal Studios, and many other studios, sued Sony for creating a device which enabled users to engage in alleged copyright infringement. The Supreme Court reversed the Ninth Circuit's decision, holding that the sale of this device was not a contributory infringement by Sony on the studios' copyrights.[128] The decision hinged on the notion that the Betamax recording device was capable of

---

secured. "One who, with knowledge of the infringing activity, induces, causes or materially contributes to the infringing conduct of another, may be held liable as a 'contributory' infringer.").

121. *Id.* at 1162.

122. *Art*, THINGIVERSE, http://www.thingiverse.com/explore/newest (last visited Nov. 30, 2014).

123. *Scans & Replicas*, THINGIVERSE, http://www.thingiverse.com/explore/newest/art/scans-and-replicas (last visited Nov. 30, 2014).

124. *Signs & Logos*, THINGIVERSE, http://www.thingiverse.com/explore/newest/art/signs-and-logos (last visited Nov. 30, 2014).

125. *Scans & Replicas*, THINGIVERSE, http://www.thingiverse.com/explore/newest/art/scans-and-replicas (last visited Nov. 30, 2014).

126. Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417 (1984) (where Sony manufactured home video tape recorders ("VTRs") with which users could record free television broadcasts and which various television studios believed enabled copyright infringement; the Court found that the VTRs were capable of substantial noninfringing uses and therefore Sony's manufacture and sale of these devices did not constitute contributory infringement).

127. *Id.* at 420–21.

128. *Id.* at 417.

"substantial noninfringing uses," namely, "private, noncommercial time-shifting."[129]

The Court stated that if a device was equipped with the capacity to be used for "substantial noninfringing uses," it was permissible, even if the device was not actually used for those noninfringing purposes. This decision set a very low threshold for new technologies which had the potential to enable infringement. Justice Blackmun's dissent illustrated the significance of this holding, explaining that:

> [o]nly the most unimaginative manufacturer would be unable to demonstrate that an image-duplicating product is "capable" of substantial noninfringing uses. Surely Congress desired to prevent the sale of products that are used almost exclusively to infringe copyrights; the fact that noninfringing uses exist presumably would have little bearing on that desire.[130]

Since the *Betamax* case, many other cases have addressed contributory liability in new technologies. The advent of the Internet posed many novel copyright law questions. In 1998, Congress amended[131] the Copyright Act of 1976, implementing the Digital Millennium Copyright Act (DMCA).[132] The DMCA was intended to limit the creation of technologies, devices, and other methods by which users could circumvent "a technological measure that effectively controls access to a work protected under [copyright law]."[133]

Part of this act, the Online Copyright Infringement Liability Limitation Act (OCILLA), created a "safe harbor" for Online Service Providers (OSPs).[134] If the OSPs meet the conditions of OCILLA and qualify for the safe harbor, they are shielded from liability for the infringement of other parties who use their services. The conditions are as follows: that the OSP does not have actual knowledge of infringement, does not know of any facts or circumstances which would make infringement apparent, does not receive any direct financial benefit in relation to infringement, and

---

129. *Id.* at 418.

130. *Id.* at 498–99.

131. Online Service Providers, COPYRIGHT, http://www.copyright.gov/onlinesp/.

132. Digital Millennium Copyright Act, COPYRIGHT, http://www.copyright.gov/legislation/dmca.pdf.

133. 17 U.S.C.A. § 1201 (effective Nov. 29, 1999).

134. 17 U.S.C.A. § 512 (effective Dec. 9, 2010).

once notified of infringement, acts expeditiously to remove the allegedly infringing material.[135] The DMCA serves as a means to preserve the interests of copyright holders while still encouraging technological innovation.

After the DMCA was implemented, courts were faced with a litany of cases wherein judges attempted to interpret the new provisions. In 2001, the Ninth Circuit heard *A&M Records, Inc. v. Napster, Inc*.[136] The case dealt with Napster's peer-to-peer file sharing technology; the court had to decide, based on both the DMCA and the *Betamax* case, whether Napster was contributorily liable for copyright infringement. The court held that because Napster "had knowledge, both actual and constructive, of direct infringement,"[137] it was not eligible for the safe harbor protections of OCILLA. This decision was somewhat controversial because the court failed to address the fact that Napster met the *Betamax* minimum threshold of being "capable of substantial noninfringing uses."

After Napster, the Supreme Court continued to avoid addressing "substantial noninfringing uses," instead focusing on DMCA requirements.[138] In 2005, the Supreme Court decided *MGM Studios, Inc. v. Grokster, Ltd*.[139] regarding Grokster, a peer-to-peer sharing software program similar to Napster. The Court unanimously held that the Ninth Circuit erred in granting summary judgment in favor of Grokster.[140] Once again, the decision avoided speaking directly to the precedent set in the *Betamax* case. Instead, the Court used a different test, finding that other contributory elements could only be considered once the defendant was found to have induced its users.[141]

Justice Ginsburg's concurrence in *Grokster* stated that the reasoning of *Grokster* was consistent with the *Betamax* case, and that the denial of summary judgment was fittingly based on insufficient evidence of non-infringing uses; therefore, Grokster did not meet the still-viable *Betamax* test.[142] Justice Breyer's concurrence, on the other hand, claimed that the ruling in *Grokster* was inconsistent with the *Betamax* test, and in fact, the

---

135. *Id.*

136. A&M Records, Inc. v. Napster, Inc., 239 F.3d 1004 (9th Cir. 2001).

137. *Id.* at 1020.

138. In re Aimster Copyright Litig., 334 F.3d 643 (7th Cir. 2003).

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

140. *Id.* at 941.

141. *Id.* at 940.

142. *Id.* at 949.

Betamax standard needed to be revised. While in agreement with regards to Grokster's liability, Justice Breyer limited the basis of his agreement to the fact that Grokster had induced users to engage in illegal activities. He emphasized, however, that without this inducement, Grokster would have met the *Betamax* test.[143] *Grokster* seems representative of courts trending away from the minimum threshold delineated in the *Betamax* case despite the Supreme Court's refusal to officially revise its holding.

3. DMCA Analysis

The cases above are directly relevant to 3D printing. Like the Sony Betamax, 3D printing is a new technology which enables users to engage in copyright infringement with ease. The *Betamax* case discussed both primary liability for the users as well as secondary liability for Sony as the manufacturer of the device. The *Betamax* test required nothing more than potential non-infringing uses. Justice Ginsburg's *Grokster* concurrence, however, specifies that the number of non-infringing uses of the technology was insufficient.[144] This reasoning indicates that non-infringing uses must be more than merely speculative for courts to tolerate the existence of potentially infringing technologies.

As discussed earlier, there are two main possible defendants for secondary liability suits: printer manufacturers and OSPs, such as Shapeways and Thingiverse, which provide platforms for users to upload and download 3D print designs. However, the DMCA is unlikely to apply to printer manufacturers. OCILLA defines an OSP as "a provider of online services or network access, or the operator of facilities therefor."[145] A printer manufacturer provides a tangible good (the 3D printer itself), but does not provide online services or network access, and does not operate facilities that provide access, therefore failing the OCILLA definition of service provider.

Additionally, websites like Shapeways may be eligible for DMCA safe harbor protections. A design-hosting site is eligible if it has

> adopted and reasonably implemented, and informs subscribers and account holders of the service provider's system or network of, a policy that provides for the

143. *Id.* at 963.
144. *Id.* at 949.
145. 17 U.S.C.A. § 512 (2012).

> termination in appropriate circumstances of subscribers and account holders of the service provider's system or network who are repeat infringers; and . . . accommodates and does not interfere with standard technical measures.[146]

The site must also comply with the aforementioned conditions: lack of actual knowledge of infringement, unawareness of facts or circumstances that would make infringement apparent, and expeditious removal once knowledge of such infringement is obtained.[147] Moreover, the OSP should not "receive a financial benefit directly attributable to the infringing activity" if the OSP hopes to avoid liability.[148] If a site meets all these conditions, it is eligible for safe harbor protection under the DMCA and cannot be held secondarily liable for hosting or transmitting infringing material. However, as discussed above, sites like Shapeways and Thingiverse currently contain infringing models and designs available for download.[149] This would likely make it difficult for the sites to meet the criteria for safe harbor protections.

IV. ARGUMENT FOR DIRECT REGULATION

The issues posed by the increasingly widespread availability of 3D printers are serious and imminent; therefore, this Note argues that 3D printing should be directly regulated. The DMCA was passed in 1998 to respond to technological advancements that posed novel questions of copyright law. It strikes a balance between protecting the ideals of free speech and the interests of copyright owners. Because there is arguably little difference between a replica 3D model of a sculpture and a recording of a TV program, the DMCA, which protects the rights in a TV program, can also be understood to adequately protect copyright owners of works infringed upon by 3D printing.

However, when the DMCA was drafted nearly two decades ago, its proponents understandably lacked the foresight to respond to an invention like 3D printing, which would allow for the wholesale replication of both works of art and useful articles. Thus, direct regulation of manufacturing methods for useful articles is required in the context of 3D printing.

---

146. *Id.*

147. *Id.*

148. *Id.*

149. *Jeff Koons Gorilla*, THINGIVERSE, http://www.thingiverse.com/thing:107335 (last visited Nov. 30, 2014).

Manufacturers of 3D printers and OSPs should be subjected to direct regulation because 3D printing technology poses a significant threat regarding the unregulated creation of firearms and other contraband materials. Undetectable and unregulated firearms have already been created and it is unclear what other illicit uses 3D printers may have in the future. Copyright owners already have many avenues to pursue protection against infringing works created with 3D printers. OSPs could even introduce recognition software that allows copyright owners to track their work and file takedown notices upon discovering infringement, which would further protect their creative and pragmatic interests.[150] Yet the law has not responded adequately to protect potential victims of gun violence and drug trafficking stemming from the use of 3D printing technology printers.

In the past, victims of gun violence attempted to sue the gun industry for contributory and vicarious liability under tort law. As discussed earlier in this Note, the severity of the consequences of enabling users to print weapons without regulation is a major concern. Suits were previously brought "against wholesale distributors and manufacturers for injuries caused by misuse of a gun that could have been prevented by equipping [the] gun with [a] safety device."[151] Another possible claim is "against wholesale distributors and manufacturers for injuries caused by criminal use of gun[s] that could have been prevented by more restrictive marketing and sales practices."[152] Hesitant to legislate from the bench, courts have often dismissed these types of claims.[153]

In the United States, the manufacture, purchase, and use of guns are heavily regulated on both the federal and state level.[154] For example, California requires manufacturers of firearms to be licensed,[155] prohibits possession of assault weapons,[156] issues carry permits,[157] and imposes a waiting period for firearm purchases.[158] Similarly, the new 3D printing regulations could require OSPs to monitor their websites. In particular, OSPs would look out for

150. *How Content ID works*, GOOGLE, https://support.google.com/youtube/answer/2797370?hl=en (last visited Dec. 1, 2014).

151. SUING THE GUN INDUSTRY: A BATTLE AT THE CROSSROADS OF GUN CONTROL AND MASS TORTS 5 (Tymothy D. Lytton ed., 2005).

152. *Id.*

153. *Id.* at 3.

154. *See, e.g.*, 18 U.S.C.A. § 922 (2012), N.Y. Penal Law § 265.45.

155. Cal. Penal Code § 26500.

156. Cal. Penal Code § 30605.

157. Cal. Penal Code § 25400.

158. Cal. Penal Code § 28255.

designs that enable users to print objects that are contraband or otherwise regulated, such as drugs or guns. Manufacturers of 3D printers would then be required to create screening mechanisms or built-in software elements that limit the ability of the user to develop and print contraband objects.[159]

Manufacturers could also be required to ensure that printers sold to the public are only equipped to print items using certain materials. For example, publicly-targeted printers should not be able to employ materials used to generate pharmaceuticals or other regulated drugs. Members of the general public who wish to print items using regulated materials would be required to obtain a license. The license could limit the amount of the regulated material they could purchase, as well as require the licensed individual to report on the item that is eventually printed with this material. These limitations mirror a similar model used in the regulation of radioactive materials.[160] However, regulations concerning 3D printers could go beyond the regulations governing radioactive materials. In addition to requiring licensees to report on the materials created by 3D printers, the relevant regulation might also require licensees to report specifically on any unused materials. This would require licensees to be accountable for unused materials, hampering their ability to potentially sell this material or use it for illegal purposes.

Furthermore, regulations should be put in place to facilitate tracing infringing items after they have been printed. OSPs could require that all users who upload designs include one piece containing a serial number.[161] In items with multiple pieces, this serial number would necessarily exist on an external piece so the serial number is easily visible. These numbers would also ideally tie the resultant item to the printer that generated it, enabling copyright owners or law enforcement to narrow down the potential infringers or violators.

Overall, 3D printing poses important public policy questions. Direct regulation must balance the risks with the obvious benefits of the technology. Legislators must conduct a cost-benefit analysis, weighing the costs of preventing or overregulating the technology and causing a chilling effect on service providers and distributors – which current law seems to strongly disfavor –

---

159. Liat Clark, *Disarming Corruptor distorts 3D printing files for sharing of banned items*, WIRED.COM (Nov. 5, 2013), http://www.wired.co.uk/news/archive/2013-11/05/disarming-corruptor.

160. 10 C.F.R. § 37.3 (2013).

161. *See, e.g.*, 18 U.S.C.A § 923 (2012).

against the cost of the significant potential for the unregulated creation of contraband items. There are options for prevention which can be unilaterally imposed on all manufacturers of 3D printers and upon OSPs. [162] Incorporating such a provision alongside the DMCA is an appropriate step towards regulating 3D printing.

V. CONCLUSION

Three-dimensional printing technology is on the precipice of revolutionizing the way our world functions. The benefits of this technology are broad in scope and significance, ranging from lengthier space missions to customizable healthcare. As the technology becomes more inexpensive and therefore more widespread, its power is taken out of the hands of institutions and research labs and placed in the hands of individuals. Ordinary citizens can now create a currently unregulated range of objects. Controlling the manufacture and sale of printers, as well as the content of free design websites is likely to be costly and complicated. However, without such regulations, the consequences of 3D printing may be severe. Direct regulation will allow research and innovations to continue and hopefully serve to significantly limit the negative impacts of this technology.

162. Liat Clark, *Disarming Corruptor distorts 3D printing files for sharing of banned items*, WIRED.COM (Nov. 5, 2013), http://www.wired.co.uk/news/archive/2013-11/05/disarming-corruptor.