

Comments

Five Stages of Patent Grief to Achieve 3D Printing Acceptance

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Introduction

TRADITIONALLY, THERE ARE three ways to make solid objects: (1) cutting shapes out of a block of material; (2) adding material in steps to build shapes; and (3) molding material that is liquid or plastic into the desired shapes that then set.¹ Over time, there have been many variations and improvements on these three basic processes, as the industrial revolution and automation eliminated the need for human intervention in the building process.² However, until the 1970s, the majority of the automated developments focused on cutting as opposed to additive machines.³ The emergence of three-dimensional (3D) printing changed this landscape. 3D printing builds up parts, layer by layer, continuously keeping a flat-topped surface that enables a laser (or other solidifying or depositing mechanism) to

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1. Simon Bradshaw, Adrian Bowyer & Patrick Haufe, *The Intellectual Property Implications of Low-Cost 3D Printing*, 7 SCRIPTED 5, 6 (2010), available at <http://www2.law.ed.ac.uk/ahrc/script-ed/vol7-1/bradshaw.pdf>.

2. See, e.g., Haresh Khemani, *What is Numerical Control Machine?*, BRIGHT HUB ENGINEERING, <http://www.brighthubengineering.com/manufacturing-technology/55670-what-is-numerical-control-machine/> (last updated Nov. 12, 2009) (“The [numerical control] technology . . . [is] prominently used for various metal machining processes.”).

3. Bradshaw, Bowyer & Haufe, *supra* note 1, at 7. Additive manufacturing is a process by which digital 3D design data is used to build up a component in layers by depositing material. *For Technology-Interested*, EOS E-MANUFACTURING SOLUTIONS, http://www.eos.info/additive_manufacturing/for_technology_interested (last visited Apr. 19, 2015).

build upon.⁴ This layer-by-layer procedure allows for 3D printing to manufacture more complicated and intricate structures that would be nearly impossible for a designer using a cutting method.⁵ The potential applications for 3D printing continue to grow as technology becomes more advanced. And the size of possible objects is only limited by the size and capability of the printers making them.⁶ A few years ago, 3D printing was limited to certain kinds of plastics.⁷ Now, 3D printers have already been used to make human tissues, working guns, automobile parts, toys, board games, and component parts using an array of plastics, metals, and other materials.⁸ On a larger scale, engineers and architects are working to perfect a 3D printer that can print a 2,500-square-foot house in as little as twenty hours, and one company in China has even printed a five-story apartment building.⁹ As 3D printing enters into the mainstream, its ease and accessibility will change the way society thinks about physical objects just as radically as computers changed the concept of developing and expressing ideas.¹⁰ Everything will change when you can make anything.

3D printing presents unique implications for intellectual property holders. Patent law grants an exclusive right to inventors for a limited time in exchange for a detailed public disclosure of an invention.¹¹ The underlying goal behind this statutory deal “is to bring new

4. Bradshaw, Bowyer & Haufe, *supra* note 1, at 8; Michael Weinberg, *It Will Be Awesome If They Don't Screw It Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology*, PUB. KNOWLEDGE 2 (Nov. 2010), <http://publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf>.

5. Weinberg, *supra* note 4, at 2 (“[A] 3D printer [enables a designer] to create structures that would be impossible if the designer needed to find a way to insert a cutting tool into a solid block of material.”).

6. Peter Hanna, *The Next Napster? Copyright Questions as 3D Printing Comes of Age*, ARS TECHNICA (Apr. 5, 2011), <http://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/>.

7. See Dana Goldberg, *History of 3D Printing: It's Older Than You Are (That is, If You're Under 30)*, LINE SHAPE SPACE (Sept. 5, 2014), <http://lineshapespace.com/history-of-3d-printing/>.

8. Kelsey B. Wilbanks, Comment, *The Challenges of 3D Printing to the Repair-Reconstruction Doctrine in Patent Law*, 20 GEO. MASON L. REV. 1147, 1155 (2013); Lauren Murrow, *The 3-D Printed Universe*, S.F. MAG. (Feb. 21, 2014), <http://www.modernluxury.com/san-francisco/story/the-3-d-printed-universe>.

9. Kathleen Miles, *This 3D Printer, Capable of Building a House in a Day, Could Change Construction Forever*, HUFFINGTON POST, http://www.huffingtonpost.com/2014/01/21/3d-printer-house-mars-slums_n_4639046.html (last updated Jan. 25, 2014); Michelle Starr, *World's First 3D-Printed Apartment Building Constructed in China*, CNET (Jan. 19, 2015), <http://www.cnet.com/news/worlds-first-3d-printed-apartment-building-constructed-in-china/>.

10. Weinberg, *supra* note 4, at 15.

11. *Patent*, LEGAL INFO. INST., <http://www.law.cornell.edu/wex/patent> (last visited Apr. 19, 2015).

designs and technologies into the public domain through disclosure.”¹² The paradox of the patent system is that the disclosure requirement arguably enables infringement, yet infringement is not common.¹³ Until now, the patent system’s stability was able to rely on physical limitations that made wide-scale infringement of physical goods infeasible.¹⁴ 3D printing challenges the profitability of companies that depend on patents to protect their non-rivalrous goods,¹⁵ as the overhead required to reproduce such goods is minimized.¹⁶ Intellectual property holders will inevitably be intimidated by the development of 3D printing and will want to protect themselves by slowing its expansion or limiting their own exposure to risk. Since intellectual property and digitization were the same major components of the Napster disaster that befell the copyright industry,¹⁷ strong parallels exist between the likely future battles in 3D printing and the previous copyright wars against duplication technologies.

Using the reaction of the copyright stakeholders for guidance, this Comment speculates as to patent holders’ reactions to the impact of 3D printing on the patent industry. This Comment argues that, to

12. *Bonito Boats v. Thunder-Craft Boats*, 489 U.S. 141, 151 (1989).

13. Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, 102 GEO. L.J. 1691, 1703 (2014).

14. *Id.* at 1703 (explaining that the core foundations behind IP may no longer exist due to the collapsed physical barriers to infringement).

15. See *Rival Goods*, INVESTOPEDIA, http://www.investopedia.com/terms/r/rival_good.asp (last visited Apr. 19, 2015) (“[Non-rival goods] allow consumption or possession to multiple users. National parks, roads and the Internet are examples of non-rival goods.”).

16. Desai & Magliocca, *supra* note 13, at 1697.

17. See *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004, 1014 (9th Cir. 2001) (finding that Napster users infringed copyright holders’ reproduction rights by downloading files that contained copyrighted music and their distribution rights by uploading file names to the search index for others to copy). Between the late 1990s and 2008, the Recording Industry Association of America (“RIAA”) brought multiple lawsuits against companies and individuals it claimed were either infringing or helping others infringe on copyrights for songs. Peer-to-peer (“P2P”) file-sharing networks such as Napster enabled individuals to transfer and share copies of music without the approval of the record companies. See *RIAA v. The People: Five Years Later*, ELEC. FRONTIER FOUND. (Sept. 30, 2008), <https://www.eff.org/wp/riaa-v-people-five-years-later>. Napster threatened the record labels’ control of distribution and their business model of selling albums rather than individual songs, and the RIAA moved quickly to shut it down. See WILLIAM PATRY, *MORAL PANICS AND THE COPYRIGHT WARS I* (2009). After successfully shutting down Napster, the recording industry continued on its quest to use legal action to not only intimidate P2P technology companies but also individuals. See *RIAA v. The People: Five Years Later*, *supra*. “Napster really did leave a bad taste in everyone’s mouth. It was such an oversimplified and Draconian reaction [by the music industry].” Lucas Mearian, *Will 3D Printing Kill IP?*, COMPUTERWORLD (Sept. 19, 2013), http://www.computerworld.com/s/article/9242519/Will_3D_printing_kill_IP?pageNumber=1 (quoting Melba Kurman, an author on 3D printing and a technology analyst).

stifle the economic shake-up brought by 3D printing, it is necessary for intellectual property holders to begin strategizing on how to approach foreseeable business and legal issues.¹⁸

Part I begins by discussing the background and current state of 3D printing technology. Next, Part I describes the similarities between the past hardships peer-to-peer file sharing brought upon the copyright industry and current challenges that 3D printing presents to the patent industry.

Part II categorizes the patent industry's potential reactions to such issues into the Kübler-Ross five stages of grief, working through denial, anger, bargaining, depression, and acceptance.¹⁹ At the conclusion of each stage, this Comment addresses the proposed reactionary measures, and explains why they are insufficient for solving the patent industry's problems. Appropriate solutions for patent stakeholders are presented in the acceptance portion of Part II.

This Comment concludes by urging Congress not to be blindsided by the initial backlash that the patent industry will undoubtedly have against 3D printing. Additionally, this Comment asserts that the technology should be lightly regulated because it enables the kind of creation and progress of the useful arts and sciences, which intellectual property law is intended to foster.²⁰

I. The Advancement of 3D Printing Technology and Its Ability to Shake-Up Patent Law

A. The Mechanics of 3D Printing

A 3D printer is a machine that turns a digital blueprint into a physical object.²¹ The process of 3D printing begins with a digital blueprint that is typically created by a computer aided design (CAD) program, which displays a virtual model of an object on a user's computer.²² Currently, there are multiple ways to acquire CAD files. First, a user can produce a design from scratch using modeling software to

18. Nicole Syzdek, *Preventing the "Napsterization" of 3-D Printing*, INTELL. PROP. BULL. BLOG (Feb. 25, 2014), <http://lawblog.usfca.edu/iplb/preventing-the-napsterization-of-3-d-printing/>.

19. Julie Axelrod, *The 5 Stages of Loss and Grief*, PSYCH CENTRAL, <http://psychcentral.com/lib/the-5-stages-of-loss-and-grief/000617> (last visited Apr. 19, 2015).

20. See U.S. CONST. art I, § 8, cl. 8. The goal of the copyright and patent system is to "promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." *Id.*

21. Weinberg, *supra* note 4, at 2.

22. *Id.*

draw what they wish to print.²³ Alternatively, a 3D scanner can instantly create a CAD design by using lasers and cameras to scan the contours of an object.²⁴ 3D scanning technology is quickly advancing as companies try to develop applications for tablets and smartphones that allow users to generate instant CAD files whenever and wherever they desire.²⁵ If a user neither wishes to make his or her own design nor has access to a 3D scanner, open-source downloading²⁶ of CAD files presents a third option.²⁷ Once created, a CAD file can be widely distributed like any other computer file,²⁸ and, as 3D printing becomes more mainstream, the number of CAD file-sharing platforms will undoubtedly increase in response.

When a CAD file is sent for printing, the 3D printing software “slices” the file’s contents and sends descriptions of the slices to the printer.²⁹ The 3D printer reads the descriptions and begins constructing the object by adding successive thin layers, building upward until the object is created.³⁰ Depending on the printer, the layers can come together in different ways. Some printers use an inkjet head to spray thin layers of liquid plastic on a build tray, after which an ultraviolet light hardens the layers.³¹ Other printers use a fused deposition modeling method, which involves “melting plastic in an extrusion head to deposit a thin filament of material to build the layers.”³² Finally, some systems use powders that are spread on the print tray and solidified, or

23. Desai & Magliocca, *supra* note 13, at 1696.

24. *Id.* (identifying MakerBot’s Digitizer Desktop 3D Scanner as an example of a currently available 3D scanner); Weinberg, *supra* note 4, at 3.

25. See, e.g., Joseph Flaherty, *How an iPad and a 3-D Printer Can Fix Your Sweaty, Messed Up Feet*, WIRE (Feb. 25, 2014), <http://www.wired.com/design/2014/02/sols-3-d-printed-orthotics/>; Jesse Emspak, *Use Your Smartphone as a 3-D Scanner*, DISCOVERY NEWS (Feb. 24, 2013), <http://news.discovery.com/tech/apps/smartphone-3d-scanner-130224.htm>; Hugh Evans, *3D Printing is a Game Changer*, POPULAR SCI. (Aug. 27, 2012), <http://www.popsci.com/sponsored-article-t-rowe-price> (“[P]icture yourself walking down the street, point, click, get a CAD file, and click again, and it’s printed out an hour later.”).

26. See Vangie Beal, *Open Source*, WEBOPEDIA, http://www.webopedia.com/TERM/O/open_source.html (last visited Apr. 19, 2015) (defining “open source” products as those that are accessible for public use or modification).

27. See, e.g., MAKERBOT THINGIVERSE, <http://www.thingiverse.com/> (last visited Apr. 19, 2015). *Thingiverse* is a website that allows people to post and share designs for 3D printers. See *id.*

28. Weinberg, *supra* note 4, at 3.

29. *Layer by Layer: How 3D Printers Work*, ECONOMIST (Apr. 21, 2012), available at <http://www.economist.com/node/21552903>.

30. *Id.*

31. *Id.*

32. *Id.*

are melted into the designed patterns with a laser.³³ These techniques are only some of the variations current 3D printers use.

Today, the basic elements of the 3D printing era are just starting to emerge: 3D scanners and accessible CAD files, computers that easily facilitate CAD file-sharing, and 3D printers that bring those designs to life.³⁴

B. The Benefits of 3D Printing

As any new technology progresses, the costs associated with purchasing it inevitably decline. 3D printing developers are working on reducing the cost of at-home 3D printing systems, attempting to further the wave of mass consumer distribution. Home versions of 3D printers can now be purchased for as low as approximately \$350.³⁵ Plastic materials used for 3D printer “ink” for at-home printers are also relatively affordable, going for about \$50 per spool.³⁶ For consumers who do not want to possess their own 3D printer, they can submit their CAD designs to online services such as Shapeways,³⁷ Sculpteo,³⁸ and i.materialize,³⁹ which then print and ship the objects. Society’s fascination with customized or do-it-yourself (DIY) type goods supports the projected success of home 3D printing. For example, the growing popularity of Etsy,⁴⁰ an e-commerce website that sells handmade or vintage items,⁴¹ evidences an already established DIY community.⁴² The public good is furthered through 3D printing by empowering the DIY community to produce goods in the form of digital designs to upload and share.⁴³

33. *Id.* (describing the latter process as “laser sintering”).

34. Weinberg, *supra* note 4, at 15.

35. Peter Jensen-Haxel, Comment, *3D Printers, Obsolete Firearm Supply Controls, and the Right To Build Self-Defense Weapons Under Heller*, 42 GOLDEN GATE U. L. REV. 447, 452, n.40 (2012); see, e.g., *2014 Best 3D Printers Under \$2000*, iREVIEWS, <http://3d-printers.ireviews.com/2014-best-3d-printers-under-2000-review> (last visited Apr. 19, 2015).

36. Rich Brown, *You Don't Bring a 3D Printer to a Gun Fight—Yet*, CNET (Sept. 6, 2012, 4:00 AM), <http://www.cnet.com/news/you-dont-bring-a-3d-printer-to-a-gun-fight-yet/>.

37. *How Shapeways 3D Printing Works*, SHAPEWAYS, <http://www.shapeways.com/how-shapeways-works> (last visited Apr. 19, 2015).

38. *About Sculpteo and 3D Printing*, SCULPTEO, <http://www.sculpteo.com/en/about/> (last visited Apr. 19, 2015).

39. I.MATERIALISE, <http://i.materialise.com/> (last visited Apr. 19, 2015).

40. ETSY, <https://www.etsy.com/> (last visited Apr. 19, 2015).

41. *About*, ETSY, <https://www.etsy.com/about> (last visited Apr. 19, 2015).

42. See Desai & Magliocca, *supra* note 13, at 1698.

43. Davis Doherty, Note, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J.L. & TECH. 353, 354 (2012).

In addition to the benefits 3D printing brings on a micro level, macro or business level 3D printing enables companies to lower production costs, which allows manufacturing to come back on domestic shores.⁴⁴ Bringing manufacturing back to the United States not only benefits the national employment rate, but also permits businesses to “hold lower inventories, reduce shipping and environmental costs, and avoid other risks that are endemic to work done offshore.”⁴⁵ Additionally, industrial companies can use 3D printing to quickly create prototypes of potential products, thus encouraging more efficient use of materials.⁴⁶ The potential benefits of 3D printing are great, but the rate at which they are introduced depends on whether laws harmfully restrict the progress of the technology.

C. The 3D Patent Problem: Déjà Vu of the Napster Copyright Disaster

It would seem that the bulk of intellectual property concerns related to 3D printing would lie with copyright law because copyrights protect artistic creations, such as sculptures, paintings, and architectural works⁴⁷—but many printable objects are useful, and thus potentially patented or patentable. Although patents protect fewer objects for a shorter duration than copyrights, patents offer stronger and more comprehensive protection.⁴⁸ Patent law does not provide for independent invention or reverse engineering as a defense to liability,⁴⁹ and thus a user would be liable for independently creating and printing a design for a patented item, or scanning a patented item and sending it to print from the generated CAD design.⁵⁰ And although sharing digital designs on the Internet is beneficial to the public, it enables widespread patent infringement in the form of digital downloads for those printing from premade CAD designs.⁵¹

44. Mearian, *supra* note 17; Desai & Magliocca, *supra* note 13, at 1699 (discussing 3D printing’s ability to do work currently performed by low-skilled workers).

45. Desai & Magliocca, *supra* note 13, at 1699.

46. See Doherty, *supra* note 43, at 356–57.

47. See 17 U.S.C. § 102 (2012) (defining the range of works copyright law protects).

48. Weinberg, *supra* note 4, at 8.

49. See Robert P. Merges, *Second Thoughts About Independent Invention: Searching for Kind Words About Absolute Liability in Patent Law*, MEDIA INST. (Feb. 15, 2014), <http://www.mediainstitute.org/IPI/2014/021514.php>; Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1584 (2002).

50. See, e.g., *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 142 (1989) (“[T]he right to prohibit a form of reverse engineering of a product . . . is one of the rights granted to the federal patent holder.”).

51. Doherty, *supra* note 43, at 359.

The current regulatory structure for intellectual property does not cope well with the digital revolution, as evidenced by the copyright industry's reaction to the emergence of peer-to-peer digital file sharing. Napster, founded in 1999, was a major peer-to-peer music file-sharing site that allowed users to share mp3 files⁵² for free.⁵³ Attempting to combat the new technology, the copyright owners that formed the Recording Industry Association of America (RIAA)⁵⁴ immediately flocked to the courts, contending that Napster's file-sharing platform infringed on their copyrights.⁵⁵ In 2001, the United States Court of Appeals for the Ninth Circuit found that those who uploaded music onto the Napster system violated copyright holders' right of distribution, and those who downloaded music files from other computers infringed the right of reproduction.⁵⁶ This ruling essentially forced Napster to shutdown. Prior to the court's holding, copyright owners lobbied Congress to expand their enforcement rights against digital pirates.⁵⁷ This lobbying resulted in the passage of the Digital Millennium Copyright Act (DMCA).⁵⁸ This new law allowed copyright holders to prosecute against anyone who used the new digital technology to infringe a copyright.⁵⁹

Sharing CAD designs that depict patented objects on peer-to-peer platforms directly mirrors the problem of sharing digital copyrighted music and movie files. The CEO of MakerBot,⁶⁰ one of the leading 3D printer manufacturers, recognizes this issue and discourages users from sharing CAD files, despite the lack of digital rights management

52. *MP3 Definition*, DICTIONARY.COM, <http://dictionary.reference.com/browse/MP3> (last visited Apr. 19, 2015) (“[T]he file extension for MPEG Audio Layer-3, a set of standards for compressing and downloading audio files from the Internet.”).

53. Mearian, *supra* note 17.

54. *Who We Are*, RIAA, http://www.riaa.com/aboutus.php?content_selector=about-who-we-are-riaa (last visited Apr. 19, 2015).

55. *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004, 1013 (9th Cir. 2001); *see* Mearian, *supra* note 17.

56. *Napster*, 239 F.3d at 1014 (interpreting 17 U.S.C. §§ 106(1), (3)).

57. Neil W. Netanel, *Why has Copyright Expanded? Analysis and Critique*, in 6 *NEW DIRECTIONS IN COPYRIGHT LAW* 3, 8 (Fiona Macmillan ed., 2007).

58. Digital Millennium Copyright Act, 17 U.S.C. §§ 1201 et seq. (2012).

59. *See* Desai & Magliocca, *supra* note 13, at 1719; *How Napster Changed Music Piracy*, PBWORKS, <http://dmca.pbworks.com/w/page/17963772/How%20Napster%20Changed%20Music%20Piracy> (last visited Apr. 19, 2015) (“The corporate-lobbied DMCA passed in response to Napster’s formidable capabilities gives media giants the ability to go after these law breakers”); JESSICA LITMAN, *DIGITAL COPYRIGHT* 14 (2001) (“In 1998, copyright owners persuaded Congress to enhance their rights with a sheaf of new legal and technological controls.”).

60. MAKERBOT, <https://www.makerbot.com/> (last visited Apr. 19, 2015).

preventing it.⁶¹ When 3D printing begins to threaten the strength and scope of patent holders' rights, it can be assumed that those who hold a large stake in keeping the current regime functioning will proceed with actions similar to those of the music and entertainment copyright industries. Since copyright stakeholders now realize they must embrace the digital era to maintain a profitable business model,⁶² it is instructive to simulate the similar combative actions patent holders could take on the way to achieving 3D printing acceptance.

II. Five Stages of Patent Grief

The Kübler-Ross model was developed by Elisabeth Kübler-Ross in her 1969 book, *On Death and Dying*, as applied to the stages of people suffering from terminal illness.⁶³ As the model became more accepted, it was applied to any sort of disastrous loss or significant life-changing event.⁶⁴ This Part analogizes the potential reactions of the major patent stakeholders to an individual going through Kübler-Ross's five stages of grief. The analysis in each section will demonstrate that until the patent industry enters the acceptance stage, it will be unable to attain an optimal solution that both preserves patents as a worthwhile form of intellectual property protection and simultaneously allows 3D printing technology to flourish.

A. Denial: "I Feel Fine"

The first stage of the Kübler-Ross model is denial, which is perceived as a temporary defense brought by the shock of bad news.⁶⁵ When the 3D printing wave hits, it may take patent holders longer than holders of other forms of intellectual property to realize the

61. Wilson Rothman, *MakerBot Unveils a 3-D Printer Nearer to \$1,000*, WALL ST. J. (Jan. 6, 2014), <http://online.wsj.com/news/articles/SB10001424052702304617404579305282190444544> (indicating it would undermine MakerBot's ability to sell authorized CAD files in the future in a model similar to iTunes).

62. See Jay Spillane, *Hollywood Meets Silicon Valley*, SPILLANE TRIAL GROUP PLC (July 22, 2013), http://www.spillanepc.com/blog/entry/hollywood_meets_silicon_valley ("Hollywood could not simply litigate file sharing services out of existence. What was required was a partnership between Hollywood and Silicon Valley that steered consumers into lawful distribution channels, redirecting revenues lost from piracy back to content owners. . . . iTunes was an early example of success in creating new partnerships.").

63. *The Kübler-Ross Model*, HUNTINGTON'S DISEASE SOC'Y OF AM., <http://hdsa.org/wp-content/uploads/2015/02/13080.pdf> (last visited Apr. 19, 2015). See ELISABETH KÜBLER-ROSS, *ON DEATH AND DYING: WHAT THE DYING HAVE TO TEACH DOCTORS, NURSES, CLERGY & THEIR OWN FAMILIES* (Scribner 2014) (1969).

64. *The Kübler-Ross Model*, *supra* note 63.

65. *Id.*; Vincent van Vliet, *Five Stages of Loss and Grief (Kubler-Ross)*, TOOLSHERO (Dec. 24, 2013), <http://www.toolshero.com/5-stages-of-loss-and-grief-kubler/>.

scope of the technology's impact. Due to the current infancy of 3D printing technology, the first industries to be affected by 3D printing are likely those that deal in consumer goods.⁶⁶ Businesses producing consumer goods, like toys and jewelry, tend to be more aesthetically focused and are more likely to rely on copyright protection instead of patent protection.⁶⁷ Patent holders are unlikely to feel immediately threatened by personal 3D printing, despite CAD file-sharing Internet platforms increasing the likelihood of someone copying a patented object or process. This is because patents do not cover most physical objects in the world.⁶⁸ And, although patent holders of small, easily replicated replacement parts for products may be swept under the initial 3D printing wave, they may fail to assess the potential scope of infringement, viewing it as a problem left for copyright and trademark law to handle. However, as 3D printing by consumers becomes more widespread, patent holders will see a decline in physical product sales and a fundamental shift in methods of distribution that current patent infringement law is unfit to serve.⁶⁹ Due to the exponential growth rate of technology,⁷⁰ the denial stage is not likely to last long.

Some psychologists believe that the people who greatly resist death are more likely to remain in the denial stage.⁷¹ By recalling the RIAA's struggle to fight the death of the traditional copyright regime, patent holders should be inspired to quickly move out of the denial stage and swiftly through the other stages. Once patent holders conclude the denial stage, they will begin the anger stage, where they will search for facts, truth, or someone to blame.⁷²

B. Anger: "Who Is to Blame?"

In the anger stage, the individual realizes that denial cannot continue, and replaces shock with feelings of anger or resentment, typi-

66. Daniel Harris Brean, *Asserting Patents to Combat Infringement Via 3D Printing: It's No "Use,"* 23 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 771, 813 (2013).

67. *Id.* (explaining that copyright protection for these products is more likely due to their technological simplicity and/or lack of novelty which would render them ineligible subject matter for utility patent protection).

68. Weinberg, *supra* note 4, at 6.

69. Brean, *supra* note 66, at 813; *see also infra* Part II.B-C (discussing the inability of the current infringement doctrines to provide substantial enforcement remedies for patent holders).

70. Vivek Wadhwa, *Why I Believe That This Will Be the Most Innovative Decade in History*, FORBES (June 15, 2012), <http://www.forbes.com/sites/singularity/2012/06/25/most-innovative-decade-in-history/>.

71. *The Kübler-Ross Model*, *supra* note 63.

72. *See* Vliet, *supra* note 65.

cally directed at his or her environment.⁷³ Similar to the copyright industry's reaction to Napster's file-sharing software, patent holders will direct their anger towards the relevant legislative regulatory environment, and search for someone to blame out of the individual users, technology developers, and/or intermediaries.

1. Lobbying for Legislation to Smother 3D Printing Development

When technology makes infringement easy, industry incumbents typically seek enhanced protection from the law, claiming that innovation will be hindered without greater protection.⁷⁴ Currently, it may be easy for enraged patent holders to persuade policymakers and judges to impose limits on the growth of 3D printing technology due to the unknowing nature of the developing technology.⁷⁵

One tactic may be for patent-dependent businesses to go to Congress or the courts and point to "easily understood injuries to existing business models," such as lost sales, lower profits, and reduced employment, regardless of whether these effects were entirely caused by 3D printing.⁷⁶ This strategy may be successful because it will be difficult for decisionmakers to appropriately weigh measurable losses against the future unquantifiable benefits of the technology.⁷⁷

Additionally, incumbent patentees may lobby Congress to pass legislation that will cripple the 3D industry by playing off of the public's fear of guns.⁷⁸ Instigating legislation that is purported to solve the problem of printing functional guns, patent holders could ensure that any resulting bills extend restrictions beyond what is necessary to remedy the limited issue. However, there is persuasive academic scholarship proposing remedies for regulating the printing of guns without smothering the innovative capabilities brought with 3D printing technology.⁷⁹ Thus, the printable gun dilemma should not cause undue alarm.

73. *Id.*; *The Kübler-Ross Model*, *supra* note 63.

74. Desai & Magliocca, *supra* note 13, at 1704–05.

75. Weinberg, *supra* note 4, at 15 (“[T]he unknowable nature of 3D printing’s future . . . works against it.”).

76. *Id.*

77. *Id.*

78. Desai & Magliocca, *supra* note 13, at 1702.

79. *See id.* (“One source of regulation involves the material used to make the gun. If only a particular blend of plastic or metal can be shaped into reliable guns, then the solution is to restrict purchases of that material. If guns can be made from a common material, then the answer would be to alert law enforcement authorities when someone buys an unusually large amount of that input, much as some states do with fertilizer because terrorists can make bombs out of that. . . . [P]olicy levers other than legal restrictions on the

Attempts to oppress the development of 3D printing by using decisionmakers' uncertainty about the benefits of the technology or the public's fear of printable guns will not dispose of the impending problem. Rather, the 3D printing community can track lobbying efforts by incumbent patentees and band together to educate policymakers about the benefits of widespread 3D printing, effectively combating the issue of decisionmaker apprehension.⁸⁰ Such aggressive educational programs ensure that the patent holders' assertions will be ignored.⁸¹

2. Suing Rampage

Patent holders may try to teach the public about the illegality of infringement through litigation. During the copyright wars,⁸² when the RIAA witnessed shrinking profits allegedly caused by peer-to-peer file sharing, the association resorted to suing home users for direct infringement and peer-to-peer platform providers for contributory infringement.⁸³ Patent holders reacting to 3D printing may default to the RIAA's strategy, recognizing the long-term benefits of litigation. For the RIAA these benefits included decreased file sharing online, deterrence of casual downloading, altered public perception about downloading, and growth of legal downloading sites.⁸⁴ In order to be successful, however, patent holders must be able to prove infringement.⁸⁵ The following sections demonstrate that the current law governing patent infringement is not supportive of incumbent patentees in 3D printing litigation.

a. Direct Infringement

Direct infringement is the unauthorized making, using, selling, offering for sale, or importing of a patented invention.⁸⁶ Litigating under the theory of direct infringement may sound simple given the ease at which infringement is made possible by 3D printing. For exam-

technology itself can handle the challenges posed by the fact that 3D printers make it easier to produce guns.”).

80. See Weinberg, *supra* note 4, at 15.

81. *Id.*

82. See *supra* note 17 (describing the extensive legal work that arose around the recording industry, Napster, and subsequent peer-to-peer file-sharing platforms).

83. Wilbanks, *supra* note 8, at 1168–69.

84. *Id.* at 1169.

85. *Medtronic, Inc. v. Mirowski Family Ventures, LLC*, 134 S. Ct. 843, 846 (2014) (“A patentee ordinarily bears the burden of proving infringement.”). See 35 U.S.C. § 271 (2012).

86. 35 U.S.C. § 271(a) (2012).

ple, simply printing a patented item would be an act of direct infringement. Incumbent patentees may exercise their rights against infringers by seeking injunctive relief, damages, or both.⁸⁷ Targeting direct infringers makes economic sense for companies because it stops the party most responsible for the infringement. Further, by cutting off those who print the infringing products, patent holders are able to prevent further dissemination to downstream consumers.⁸⁸

However, it may be difficult for patent holders to identify direct infringement. Creating, downloading, or uploading a CAD file of an infringing item does not guarantee that the object will not be altered or that it will even be printed. A user's actions fail to trigger direct infringement under 35 U.S.C. § 271(a) unless the physical patented product is, in fact, printed.⁸⁹ Additionally, individuals merely selling CAD files of patented objects do not implicate § 271(a) since the statute excludes sales of a thing that has not fully come into existence.⁹⁰ Proving infringement against users during the CAD file's point of sale is uncertain and speculative at best.

The prior analysis assumes that patent holders are first able to identify the source of claimed infringement. Online anonymity potentially presents a major hurdle for patent holders attempting to strictly enforce their rights.⁹¹ During the copyright wars, the RIAA used private investigators to combat this problem.⁹² The investigators identified the infringers by obtaining their Internet Protocol (IP) addresses.⁹³ The RIAA took the IP addresses to court in order to com-

87. 35 U.S.C. §§ 283–84 (2012).

88. Brean, *supra* note 66, at 786.

89. *DeepSouth Packing Co. v. Laltram Corp.*, 406 U.S. 518, 528 (1971) (holding that the making of an invention under § 271(a) requires that the “operable assembly of the whole” be constructed).

90. *See Ecodyne Corp. v. Croll-Reynolds Engineering Co., Inc.*, 491 F. Supp. 194, 197 (D. Conn. 1979) (“When the thing in question is an apparatus and the issue is patent infringement by sale, partial delivery will not suffice; in order for there to have been a sale within the meaning of 35 U.S.C. § 271(a), the entire apparatus must have been constructed and ready for use.”).

91. *See* Lucas S. Osborn, *Regulating Three-Dimensional Printing: The Converging Worlds of Bits and Atoms*, 51 SAN DIEGO L. REV. 553, 616 (2014) (indicating a user may employ “code-based avoidance strategies” including Internet anonymity to avoid detection).

92. Catherine Rampell, *How It Does It: The RIAA Explains How It Catches Alleged Music Pirates*, CHRON. HIGHER EDUC. (May 13, 2008), <http://chronicle.com/article/How-It-Does-It-The-RIAA-Ex/786/>.

93. John Schwartz, *Music Industry Returns to Court, Altering Tactics on File Sharing*, N.Y. TIMES (Jan. 22, 2004), <http://www.nytimes.com/2004/01/22/business/media/22music.html>; *see also* IP Address—Internet Protocol (IP) Address, WEBOPEDIA, http://www.webopedia.com/TERM/I/IP_address.html (last visited Apr. 19, 2015) (“An IP address is an identifier for a computer device on a TCP/IP network.”).

pel the relevant Internet service providers to disclose identifying information associated with each address.⁹⁴ Some incumbent patentees may not have the resources to employ investigative techniques to identify infringers, and thus many direct infringers would remain shielded by online anonymity.

Holding individuals strictly liable for infringement would have a chilling effect on 3D printing growth. Despite the low chances that individuals will be sued for direct infringement, those who are risk-averse or believe it is immoral to engage in illegal conduct may opt out of using the technology unless there is a way to ensure they are not infringing on intellectual property rights.⁹⁵ Based on the challenges in establishing infringement under § 271(a) and identifying anonymous users, direct infringement is not the optimal solution for patent holders.

b. Indirect Infringement Under Active Inducement

Another theory of infringement patent holders may pursue against alleged 3D printing infringers is active inducement. Active inducement under § 271(b) occurs when one encourages another to engage in infringing activity with “knowledge that the induced acts constitute patent infringement.”⁹⁶ The knowledge requirement is the largest obstacle for patentees obtaining relief under this section. The United States Supreme Court in *Global-Tech Appliances, Inc. v. SEB S.A.* explicitly rejected “deliberate indifference to a known risk”⁹⁷ as the standard for knowledge, and imposed a two-prong, “willful blindness” standard requiring that “(1) the defendant must subjectively believe that there is a high probability that a fact [i.e., infringement] exists and (2) the defendant must take deliberate actions to avoid learning of that fact.”⁹⁸

This doctrine is most applicable to distributors of CAD files. Under the willful blindness standard, any distributor of a CAD file who has actual knowledge of or is willfully blind to a digital file displaying a patented product is liable for active inducement of infringement.⁹⁹ However, there is no other rational purpose for uploading CAD files other than to allow another person to easily download and

94. *Id.*

95. Desai & Magliocca, *supra* note 13, at 1716.

96. *Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2068 (2011); *see* 35 U.S.C. § 271(b) (2012).

97. *Id.*

98. *Id.* at 2070.

99. Brean, *supra* note 66, at 795-96.

print the digital object. Because of this underlying purpose, there is no question that those who upload CAD files intend for others to print the object—transitively intending the end user to directly infringe. Thus, distributors with knowledge that the files they share are of patented objects are the most culpable.

Patent holders may struggle to prove the requisite knowledge to successfully assert a claim under active inducement even though direct evidence of intent is not required.¹⁰⁰ One solution, albeit extremely laborious, could be for patentees to police CAD file-sharing sites and submit notice-and-take-down requests, enclosing a copy of the asserted infringed patent. Notice-and-take-down procedures are currently required by the DMCA for copyrighted works.¹⁰¹ As applied to copyrighted works, however, notice-and-take-down procedures continue to receive criticism because of the availability of the fair use defense.¹⁰² Such provisions for patented items would not receive the same backlash due to the absence of a fair use requirement for patents.¹⁰³ Placing CAD file distributors on notice of patents and of any claimed or foreseeable infringement would provide some evidence for a potential active inducement claim.

Suing under active inducement may be more viable for large corporations with ample resources to police their patents.¹⁰⁴ But constantly searching CAD file distributor databases is not likely to be a practical option for most patent holders. Thus, for the majority of patentees, active inducement will not provide redress.

100. See *Water Technologies Corp. v. Calico, Ltd.*, 850 F.2d 660, 668 (“While proof of intent is necessary, direct evidence is not required; rather, circumstantial evidence may suffice.”); Weinberg, *supra* note 4, at 13.

101. 17 U.S.C. § 512(c)(1)(C) (2012) (“A service provider shall not be liable . . . if the service provider . . . upon notification of claimed infringement . . . responds expeditiously to remove, or disable access to, the material that is claimed to be infringing or to be the subject of infringing activity.”).

102. See Paul Sieminski, *Corporations Abusing Copyright Laws are Ruining the Web for Everyone*, WIRED (Jan. 17, 2014), <http://www.wired.com/2014/01/internet-companies-care-fair-use/>.

103. Desai & Magliocca, *supra* note 13, at 1718-19; see 17 U.S.C. § 107 (2012) (“In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include—(1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; (2) the nature of the copyrighted work; (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and (4) the effect of the use upon the potential market for or value of the copyrighted work.”).

104. See Editorial, *3-D Printing: The Ultimate Intellectual-Property Threat?*, BLOOMBERG, May 15, 2013, <http://www.bloomberg.com/news/2013-05-15/3-d-printing-the-ultimate-intellectual-property-threat.html>.

c. Contributory Infringement

Following in the RIAA's footsteps, patent holders may turn to the doctrine of contributory infringement to assert their rights. Under § 271(c), a party commits contributory infringement if it provides material components that are incorporated into a composition protected by a patent, knowing "that the combination for which [the] component was especially designed was both patented and infringing."¹⁰⁵ This allows patent holders to sue any entity that enables individuals to copy patented items, such as manufacturers of 3D printers or hosts of CAD file-sharing platforms, without having to identify individual direct infringers.¹⁰⁶

Patent holders would face many hurdles in establishing a prima facie case of contributory infringement. First, like active inducement, patentees must show that the entity had knowledge or the intent to cause another to infringe the patent.¹⁰⁷ As previously mentioned, this could be combated through active monitoring of CAD file distribution sites and issuance of notice-and-take-down letters.¹⁰⁸

Second, patentees must prove that a downloader actually used the entity's product or service to infringe.¹⁰⁹ It is insufficient to show that infringement is merely possible or likely.¹¹⁰ This difficulty mirrors the challenge in proving direct infringement, since many users are anonymous or can alter CAD design files prior to printing.¹¹¹

Third, under the "staple article of commerce" doctrine, distribution of a component that can be used to infringe on a patent will not be an infringement if the component is capable of "substantial noninfringing use[s]."¹¹² Even if knowledge of actual infringement is proven, targeting 3D printer manufacturers would prove unsuccessful

105. *Global-Tech Appliances, Inc. v. SEB S.A.*, 131 S. Ct. 2060, 2067 (2011) (quoting *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 488 (1964)); see 35 U.S.C. § 271(c) (2012).

106. Weinberg, *supra* note 4, at 12.

107. Doherty, *supra* note 43, at 361; see *Global-Tech Appliances, Inc.*, 131 S. Ct. at 2068.

108. See *supra* Part II.B.2.b.

109. Weinberg, *supra* note 4, at 13.

110. See *id.*

111. See *supra* Part II.B.2.a.

112. 35 U.S.C. § 271(c) (2012) ("Whoever offers to sell or sells . . . a component of a patented . . . combination . . . for use in practicing a patented process . . . and not a *staple article or commodity of commerce* suitable for substantial noninfringing use, shall be liable as a contributory infringer.") (emphasis added). See *Metro-Goldwyn-Mayer Studios Inc. v. Gorkster, Ltd.*, 545 U.S. 913, 931-32 (2005) ("[B]ecause the VCR was 'capable of commercially significant noninfringing uses,' we held the manufacturer could not be faulted solely on the basis of its distribution. . . . This analysis reflected patent law's traditional staple article of commerce doctrine."); *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417,

under this theory. 3D printers are unquestionably capable of substantial noninfringing uses since many objects not protected by patents can be printed.¹¹³ Scanning hardware used in connection with 3D printers and raw material inputs are also undoubtedly capable of noninfringing uses.¹¹⁴ Most physical items are not covered by patents, a situation which differs from all songs being copyrightable. Thus, patent holders will have more difficulty than the recording industry in convincing courts that manufacturers of 3D printer components and CAD file-sharing platforms should be held liable for contributory infringement. CAD file-sharing platforms cannot be viewed as having the same toxicity as Napster due to the potentially large amounts of uploaded, noninfringing files, which is contrary to Napster's overwhelming database of copyright-protected music files.

Finally, contributory infringement is unlikely to succeed against the software provided by CAD file distributors because CAD files are not components of a patented product. In *Microsoft Corp. v. AT&T Corp.*,¹¹⁵ the Supreme Court adopted a restrictive view of the word "component" in relation to software. The Court viewed software merely as information and detailed instructions, stating that it "might be compared to a blueprint," but is not itself incorporated into an object.¹¹⁶ The Court further stated that "Congress, of course, might have included . . . not only combinable 'components' of a patented invention, but also 'information, instructions, or tools from which those components readily may be generated.' It did not."¹¹⁷ Due to the Supreme Court's restrictive interpretation of "component," CAD files will not be considered components of subsequently printed patented objects, squashing any contributory infringement claims.

Once patent holders realize that finding someone to blame through aggressive litigation and bombarding Congress are unsuccessful, they will successfully transition into the bargaining stage of 3D patent grief.

442 (1984) ("The question is thus whether the Betamax is capable of commercially significant noninfringing uses.").

113. See Joseph Citelli, *3D Printer Manufacturers Likely Immune From Liability*, CYBERBEAR TRACKS (Dec. 1, 2013), <http://cyberbeartracks.com/?p=295> ("3D printer users can create exact copies of many real world items.").

114. Desai & Magliocca, *supra* note 13, at 1714.

115. 550 U.S. 437 (2007).

116. *Id.* at 438.

117. *Id.* at 451.

C. Bargaining: “What Can I Do Differently”

The bargaining stage involves the individual trying to evade or postpone the truth.¹¹⁸ Usually, bargaining is made with a higher power.¹¹⁹ Congress and the courts represent the higher power for patent holders. Attempting to postpone the harmful impact of widespread 3D printing, incumbent patentees may try to bargain with Congress to extend the scope of the types of patent-eligible subject matter included in 35 U.S.C. § 101¹²⁰ to cover a CAD file within a patent’s claims. Manufacturers of replacement parts may also attempt to bargain with the courts by requesting clarification of the patent repair and reconstruction doctrine.¹²¹ The repair and reconstruction doctrine distinguishes between a permissible repair of a patented product, which gives the owner the right to preserve the utility of the product, and an impermissible reconstruction, which constitutes patent infringement.¹²² While users fight to maintain their right to repair, patent holders may try to defend themselves, claiming that the harm caused by 3D printing requires courts to grant some protection for unpatented elements of component parts.¹²³ Neither of these attempts will likely be successful, but they are possible arguments patent holders could make on the journey through the bargaining stage.

1. Potential Patent Protection for CAD Files

Under the traditional printed matter doctrine, printed matter by itself does not constitute a “manufacture” and does not qualify as patentable subject matter.¹²⁴ This doctrine arose during a time “when printing was the primary means for recording and communicating in-

118. Vliet, *supra* note 65; *The Kübler-Ross Model*, *supra* note 63.

119. *The Kübler-Ross Model*, *supra* note 63.

120. 35 U.S.C. § 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 therefore.”).

121. *See* *Aro Mfg. Co., Inc. v. Convertible Top Replacement Co., Inc.*, 365 U.S. 336, 346 (1961) (“The decisions of this Court require the conclusion that reconstruction of a patented entity, comprised of unpatented elements, is limited to such a true reconstruction of the entity as to ‘in fact make a new article,’ after the entity, viewed as a whole, has become spent. In order to call the monopoly, conferred by the patent grant, into play for a second time, it must, indeed, be a second creation of the patented entity Mere replacement of individual unpatented parts, one at a time, whether of the same part repeatedly or different parts successively, is no more than the lawful right of the owner to repair his property.”) (citation omitted).

122. *Id.*; *see infra* Part II.C.2.

123. *See* Weinberg, *supra* note 4, at 13-14.

124. *Kimberly-Clark, Inc. v. First Quality Baby Products, LLC*, 900 F. Supp. 2d 919, 924 (E.D. Wis. 2012); 1 DONALD S. CHISUM, *CHISUM ON PATENTS* § 1.02[4] (2014).

formation.”¹²⁵ The doctrine prohibits patenting recorded information that has no functional relationship to a physical composition, and would thus be considered an abstract collection of information falling outside the scope of patentable subject matter.¹²⁶

One exception to the doctrine is the *Beauregard*¹²⁷ claim. The Federal Circuit explained in *CyberSource, Corp. v. Retail Decisions, Inc.*¹²⁸ that this type of claim stands for the notion that a “computer readable medium . . . containing program instructions for a computer to perform a particular process” is patent-eligible subject matter.¹²⁹ Drafting patent claims covering the underlying CAD file as the computer readable medium, instead of referencing it as merely the instructions to print the physical object, could allow patent holders to seemingly extend rights to CAD files. However, in *CyberSource*, the Federal Circuit limited the viability of claims by patentees who assert protection for CAD files using a *Beauregard* theory. The court held that “[r]egardless of what statutory category . . . a claim’s language is crafted to literally invoke, we look to the underlying invention for patent-eligibility purposes.”¹³⁰

Even if patentees argue under *Beauregard* that the CAD file is not merely an abstract idea, but rather patent-eligible subject matter, the CAD file is not the actual invention. The CAD file digitally represents the novel invention patented or seeking patent protection. Since CAD files are already used in connection with 3D printing, the format of the CAD file itself would be included in the prior art. Thus, claims covering the CAD file would fail under the nonobviousness¹³¹ requirement and could not be protected under the patent.¹³² Accordingly, bargaining to secure patent protection for CAD files of physical objects is unlikely to succeed.

125. 1 CHISUM, *supra* note 124.

126. *See id.*

127. *In re Beauregard*, 53 F.3d 1583 (Fed. Cir. 1995).

128. 654 F.3d 1366 (Fed. Cir. 2011).

129. *Id.* at 1373; *see also In re Beauregard*, 53 F.3d at 1584 (“[C]omputer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101.”).

130. *CyberSource*, 654 F.3d at 1374.

131. *See* 35 U.S.C. § 103 (2012) (“A patent for a claimed invention may not be obtained . . . if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.”).

132. *See* Brean, *supra* note 66, at 807 (“Absent a newly invented CAD file format or printing method to accompany a newly created digital product, there can be no meaningful patent protection secured for a CAD file to help combat 3D printing infringement.”).

2. Push to Clarify the Distinction Between a Lawful Repair and Unlawful Reconstruction

The doctrine of permissible repair was derived from the principle of first sale exhaustion, which holds that the purchaser of a patented product may use that product “free of control by the patent owner,” and can “make repairs on the product necessary for continued use.”¹³³ However, the right to make repairs does not include a complete reconstruction of worn-out products.¹³⁴ Many objects protected by patent law are considered “combination patents,” meaning the new object combines previously existing objects in a new and novel way.¹³⁵ If the individual elements within the combination are not patented, a purchaser of the original device has the right to manufacture the unpatented replacement parts.¹³⁶ Though repairing individual parts is legal, the line between repair and reconstruction blurs when the purchaser replaces several parts simultaneously or makes multiple repairs.¹³⁷ Recognizing the courts’ struggle to draw a clear line between permissible repair and impermissible reconstruction, patentees may seek to capitalize on this opportunity and bargain with the courts to impose tighter restrictions on unpatented component parts.¹³⁸

When the ability to print replacement parts becomes widespread, patent holders may assert lost profits as a bargaining tool to argue that ambiguous interpretations and loose restrictions of permissible repair cause harm. One proposed solution could be to stamp into patented goods “For Single Use Only,” or brand CAD files with watermarks stating “Do Not Manufacture.”¹³⁹ Warning notices may be permissible if courts assume users will obtain CAD files and immediately print the object thereafter. However, problems arise if the warnings deter consumers from using the CAD design of a patented object simply as a base on which to alter and expand because it thwarts permissible innovation and improvement upon the existing product. Also, aggressive warnings may stigmatize the ability of consumers to make lawful repairs.

133. 5 DONALD S. CHISUM, CHISUM ON PATENTS § 16.03[3] (2014). See *Anton/Bauer, Inc. v. PAG, Ltd.*, No. Civ. A. 3:01CV577(CFD), 2002 WL 1359673, at *4 (D. Conn. June 13, 2002) (ruling on motion for preliminary injunction).

134. 5 CHISUM, *supra* note 133.

135. Weinberg, *supra* note 4, at 9.

136. *Id.*

137. Wilbanks, *supra* note 8, at 1158.

138. See *id.* at 1166.

139. *Id.*

Patent holders may alternatively attempt to expand the scope of patent protection by bargaining for laws requiring licenses, or laws that grant enhanced protections for unpatented parts of combination patents.¹⁴⁰ It seems feasible that the courts or Congress will respond favorably to patent holders because the disruptive potential of 3D printing is akin to the circumstances that authors of printed text confronted after the invention of the printing press.¹⁴¹ Patent holders rely on the cost of manufacturing physical products to deter infringement prior to 3D printing in the same way authors relied on the high cost of replicating books prior to the printing press.¹⁴² The printing press provided individuals easy access to text in ways not previously contemplated, and eventually led to the passage of copyrights and laws regulating published works.¹⁴³ However, in the 3D printing context, bargaining to expand protection to cover unpatented replacement parts is unlikely to succeed due to potential conflicts with antitrust principles.¹⁴⁴

D. Depression: “What is the Point?”

During the fourth stage, the individual feels helpless, is withdrawn, and avoids communication.¹⁴⁵ This stage does not warrant much discussion, as it may be short and lacking in outward activity. However, in an effort to preserve profitability, patent holders will nevertheless progress through this stage after the previously described attempts to protect themselves from the impact of 3D printing technology fail.¹⁴⁶ Individual inventors and small business patent owners will likely advance to this stage sooner due to the lack of fighting resources that larger corporations have to bring into battle.¹⁴⁷ As the next section describes, however, businesses that embrace a digital dis-

140. *Id.*

141. Hanna, *supra* note 6.

142. See 21ST CENTURY FLUENCY PROJECT, THE AGE OF DISRUPTIVE INNOVATION 6, available at <http://www.mufsd.com/files/562889/adi%5Fperspective.pdf> (last visited Apr. 19, 2015).

143. *Id.*; Wilbanks, *supra* note 8, at 1157.

144. See *Ill. Tool Works, Inc. v. Indep. Ink, Inc.*, 547 U.S. 28, 31 (2006) (discussing that the sale of a patented product that is conditioned on the sale of an unpatented product will be scrutinized under antitrust laws to determine if an unlawful “tying” arrangement exists).

145. Vliet, *supra* note 65; *The Kübler-Ross Model*, *supra* note 63.

146. See *supra* Part II.A-C.

147. “Fighting resources” refers to investigators to discover IP addresses of potential direct infringers, money for attorney’s fees associated with bringing multiple infringement suits, and time and/or personnel to police CAD file distribution platforms to send notice-and-take-down requests for infringing designs. See *supra* Part. II.A-C.

tribution model earlier than others similarly affected by 3D printing may gain first-mover advantages,¹⁴⁸ and thus they may position themselves ahead of the larger corporations.¹⁴⁹

E. Acceptance: “I Can’t Fight It; I Might as Well Prepare for It”

When it is clear that there is no more hope, the individual comes to terms with the bad news, recovers from the previous stages, and accepts grief.¹⁵⁰ In this stage patent holders will realize that the best approach is not to try to fit the new digital era within the boundaries of the existing patent regime, but rather to optimize the compatibility of their own business models and digitization.¹⁵¹

One solution is for patent holders to adopt a system that makes it easy and affordable for users of 3D printers to access legally licensed CAD design files.¹⁵² A licensing model for CAD files similar to that of iTunes¹⁵³ or the Amazon Digital Music Store¹⁵⁴ for copyrighted music would give patent holders an alternative path for generating profit.¹⁵⁵ Creating quality CAD files from scratch is not easy.¹⁵⁶ Instead of sifting through a user-uploaded CAD file-sharing platform, hoping to find a decent submission, it is likely that many users would not object to purchasing an authorized design file that guarantees a quality printed product.¹⁵⁷

In order for the proposed CAD file licensing model to succeed, certain changes would need to be implemented to reflect the differences between copyright and patent law. The ability to save copyrighted music files on a computer hard drive poses a problem in the patent context. Unlike permissible, repeated listening to a

148. See *First Mover Definition*, INVESTOPEDIA, <http://www.investopedia.com/terms/f/firstmover.asp> (last visited Apr. 19, 2015) (“A form of competitive advantage that a company earns by being the first to enter a specific market or industry.”).

149. See Brean, *supra* note 66, at 781.

150. Vliet, *supra* note 65; *The Kübler-Ross Model*, *supra* note 63.

151. See Syzdek, *supra* note 18.

152. Gary Shapiro, *3D Printers Will Soon Change the World, If It’s Not Strangled in a Lawyered Up World*, FORBES (Jan. 17, 2014), <http://www.forbes.com/sites/realspin/2014/01/17/3d-printers-will-soon-change-the-world-if-its-not-strangled-in-a-lawyered-up-world/>.

153. *Licensed Application End User License Agreement*, APPLE, <https://www.apple.com/legal/internet-services/itunes/appstore/dev/stdeula/> (last visited Apr. 19, 2015).

154. *Amazon Music Terms of Use*, AMAZON, <https://www.amazon.com/gp/help/customer/display.html?nodeId=200154280> (last updated June. 11, 2014).

155. See Shapiro, *supra* note 152.

156. See Elizabeth Ferrill & E. Robert Yoches, *IP Law and 3D Printing: Designers Can Work Around Lack of Cover*, WIRED (Sept. 25, 2013), <http://www.wired.com/insights/2013/09/ip-law-and-3d-printing-designers-can-work-around-lack-of-cover/>.

157. See *id.*

downloaded song, patent infringement occurs every time a user prints the object represented in the file. To remedy this problem, prior to accessing the licensing platform, users would be required to create an account and register their printer in a similar manner as creating an iTunes account. Purchasers of CAD files would only be able to print the design once from the licensing platform; before buying the file, purchasers would be required to input a unique printer identification number¹⁵⁸ for the printer intended to make the object. Unlike mp3 files, purchasers would not be able to save or keep the file after the one-time print option expires. Critics of a one-time print option may argue that it fails to account for printer malfunctions, which robs consumers of the desired object. However, if the user inputs the unique printer identification key prior to purchase and the printer malfunctions during the printing process, the printers could be designed to alert the licensing platform of the problem, which would automatically grant the user access to the file again. This approach balances the requirement for restrictive access to CAD designs of patented products and the purchaser's interest to easily and legally make the object.

Another potential criticism of the proposed CAD file-licensing model could be that it does not account for the ability to scan the object printed from the purchased file and subsequently share the scan-generated file.¹⁵⁹ However, this problem is similar to that posed by websites such as YouTube-mp3.org,¹⁶⁰ which converts the audio tracks from online videos into mp3 files. However, music artists frequently post their music videos online and are not deterred by these converter websites, even though they allow individuals to obtain the music for free. The advancement in quality of object scanners will be the determining factor in assessing the potential harm caused by rescanning objects printed using the CAD file-licensing platform. As the quality and capabilities of object scanners advances, so will the likelihood that users will rely on free CAD file-sharing sites as opposed to purchasing an authorized file.

The proposed CAD file-licensing solution does not assume that profits for patentees can remain unscathed. Using the impact on the RIAA as guidance, this Comment acknowledges that profits will proba-

158. The serial number of the printer could serve as the unique printer identification number.

159. See Desai & Magliocca, *supra* note 13, at 1716 n.125.

160. YOUTUBE MP3, <http://www.youtube-mp3.org/> (last visited Apr. 19, 2015).

bly decline.¹⁶¹ However, it is untrue that patent holders are out of options. In order to realign profits, patent holders need to continuously assess weaknesses in their business models to reduce susceptibility to rent-seeking behaviors.¹⁶²

Conclusion

The Kübler-Ross stages of grief do not necessarily come in the order described above, nor are all stages experienced.¹⁶³ Kübler-Ross thought that, at a minimum, an individual will experience at least two stages, and that, often, “people will experience several stages in a ‘roller coaster effect’—switching between two or more stages, returning to one or more several times before working through it.”¹⁶⁴ Patent holders may switch between bargaining and anger before fully reaching acceptance based on the multiple potential courses of action within each stage.

The patent holder’s interest heightens when infringement threatens the holder’s market position.¹⁶⁵ Because 3D printing can turn the home into a personal factory, many individuals, not just manufacturing giants, can test a patent holder’s market dominance. However, the largest threat does not come from the advancement of 3D printing technology, but from uncertainties within the law.¹⁶⁶ Patent law should be adapted to ensure that consumers can easily predict the lawfulness of their 3D printing activities.¹⁶⁷ Thus, reliable standards need to be created pertaining to the repair and reconstruction doc-

161. Eric Pfanner, *Music Industry Sales Rise, and Digital Revenue Gets the Credit*, N.Y. TIMES (Feb. 26, 2013), <http://www.nytimes.com/2013/02/27/technology/music-industry-records-first-revenue-increase-since-1999.html> (stating that in 2012 the revenue of music industry was \$16.5 billion, down from the \$38 billion the industry made more than ten years prior).

162. See Desai & Magliocca, *supra* note 13, at 1719-20 n.139 (“The best questions here are what is a reasonable profit and what rent extraction may have been reduced. It is one thing to show that an industry cannot make any profit. It is another to show that profits realigned.”). See generally David John Marotta, *What is Rent-Seeking Behavior*, FORBES (Feb. 24, 2013), <http://www.forbes.com/sites/davidmarotta/2013/02/24/what-is-rent-seeking-behavior/> (“Rent-seeking doesn’t add any national value. It is coerced trade and benefits only one side. Rent-seeking can include piracy, lobbying the government or even just giving away money.”).

163. *The Kübler-Ross Model*, *supra* note 63.

164. *Id.*

165. See Geraldine Szott Moohr, *The Crime of Copyright Infringement: An Inquiry Based on Morality, Harm, and Criminal Theory*, 83 B.U. L. REV. 731, 780 (2003) (stating this notion as pertaining to copyright holders).

166. Desai & Magliocca, *supra* note 13, at 1720.

167. Wilbanks, *supra* note 8, at 1181.

trine.¹⁶⁸ One solution is to create a framework where reconstruction is only found where an entire device is copied.¹⁶⁹ Locke's labor-mixing theory supports this solution because the consumer mixes labor with the patented object, resulting in a modification and acquisition of an ownership interest in the new, different object.¹⁷⁰

A criticism of this bright-line approach could be that it unjustly enriches those who make insignificant modifications, allowing them to escape patent infringement. Thus, a flexible, yet defined, system to examine whether the object is, in fact, a reconstruction should govern. The system should balance factors such as the intent of the patent holder and user, cost of the repair, importance of the repair to the functionality of the object, and the useful life of the part replaced in relation to the patented object as a whole.¹⁷¹ Clarity within patent law gives patent holders clear licensing expectations and is the first step in securing the formation and success of partnerships, like those of record executives and iTunes,¹⁷² that are needed to implement an efficient CAD file-licensing system.¹⁷³

New technology always raises questions about the current law's effectiveness in promoting its intended goals. 3D printing will inevitably test the success of patent law's ability to promote innovation, but it is important to remember that "[t]he nation has benefitted from the adaptability of the patent system to new technologies."¹⁷⁴ Creation in 3D printing does not simply refer to replication. Rather, creation encompasses taking ideas and altering them to make something better.¹⁷⁵ 3D printing promotes building upon ideas, which is directly in

168. See *supra* Part II.C.2.

169. Wilbanks, *supra* note 8, at 1174.

170. JOHN LOCKE, TWO TREATISES OF GOVERNMENT 134 (Thomas I. Cook ed., Hafner Publ'g Co. 1947) (1690) (reasoning that each person has property rights in his own body, thus any labor exerted from the body and the "work of his hands" removes something from the common state of nature and is property owned by the person).

171. See *Aro Mfg. Co., Inc. v. Convertible Top Replacement Co., Inc.*, 365 U.S. 336, 363–64 (1961) (Brennan, J., concurring).

172. Spillane, *supra* note 62.

173. See Wilbanks, *supra* note 8, at 1181.

174. *In re Schrader*, 22 F.3d 290, 297 (Fed. Cir. 1994) (Newman, J., dissenting) ("The nation has benefitted from the adaptability of the patent system to new technologies, as was recognized in *Diamond v. Chakrabarty*, 447 U.S. 303, 316 . . . (1980) ('Mr. Justice Douglas reminded that the inventions most benefiting mankind are those which "push back the frontiers of chemistry, physics and the like."')").

175. Shapiro, *supra* note 152.

line with patent law's enablement requirement.¹⁷⁶ The enablement requirement recognizes that smaller inventions serve an extremely important purpose in the overall scheme to promote the progress of the useful arts.¹⁷⁷ As 3D printing technology accelerates, it is critical for innovation that those who fear change do not stop those who are inspired.

176. 35 U.S.C. § 112(a) (2012) (requiring the patent to describe how to make and use the invention such that one skilled in the art is enabled to make and use the invention that is defined by the claims).

177. *See generally* CURTIS R. CARLSON & WILLIAM W. WILMOT, INNOVATION: THE FIVE DISCIPLINES FOR CREATING WHAT CUSTOMERS WANT 40 (2006) (discussing the importance of incremental improvements of existing products in furthering innovation).