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3D PRINTING AND IP RIGHTS: THE ELEPHANT IN THE ROOM

John Hornick*

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I. WHAT’S DIFFERENT ABOUT 3D PRINTING?

People who write about 3D printing often say that it raises unique intellectual property issues, but then stop there. But what is different about 3D printing from an IP perspective? IP legal principles apply to 3D printing no differently than they apply to any other technology. Yet there is an elephant in the 3D printed room because the difference is really an order of magnitude: 3D printing may involve all types of IP rights and most products, so the scale and scope of potential infringement and the pool of potential infringers is much larger.

The Gartner research firm predicts full consumer adoption of 3D printing by around 2023, though I believe 2025 is

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probably more likely.¹ The McKinsey consulting firm seems to agree: “We estimate that consumer use of 3D printing could have potential economic impact of \$100 billion to \$300 billion per year by 2025.”² Gartner also predicts that “by 2018, 3D printing will result in the loss of at least \$100 billion per year in intellectual property globally.”³ The potential result may be two-way disruption: IP may disrupt the growth and progress of 3D printing, but more importantly, 3D printing may relegate some IP rights to the scrap heap.

But why? Three reasons. The first is that 3D printing has the potential to democratize manufacturing, meaning that almost anyone may be able to make almost anything. The second is that a growing number of people simply do not like intellectual property. In the Spring of 2013, I wrote an article about how the Electronic Frontier Foundation was using the Internet to crowdsource prior art to challenge 3D printing-related patent applications using pre-issuance submissions to the U.S. Patent and Trademark Office.⁴ That article generated a lot of buzz from the anti-IP community. One of the kinder responses was from an academic whose work I respect, Dr. Joshua Pearce, Professor of Materials Science at Michigan Tech: “There is a persistent widespread belief that intellectual property law (and patents in particular) encourage [sic] innovation. This is intuitive, however, the evidence to the contrary is now overwhelming and the unavoidable conclusion

1. Michael Molitch-Hou, *Consumer 3D Printing More than 5 Years Away from Mainstream Adoption, Says Gartner*, 3D PRINTING INDUSTRY NEWS (Aug. 20, 2014) http://3dprintingindustry.com/2014/08/20/consumer-3d-printing-5-years-away-mainstream-adoption-says-gartner/?utm_source=3D+Printing+Industry+Update&utm_medium=email&utm_campaign=899ff4ba4a-RSS_EMAIL_CAMPAIGN&utm_term=0_695d5c73dc-899ff4ba4a-60484669; Betsy Burton & David A. Willis, *Gartner's Hype Cycle Special Report for 2014*, GARTNER, Aug. 6, 2014, <https://www.gartner.com/doc/2816917>.

2. James Manyika et al., *Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy*, MCKINSEY GLOBAL INSTITUTE, May 2013, at 110.

3. *Gartner Reveals Top Predictions for IT Organizations and Users for 2014 and Beyond*, (Oct. 8, 2013), <http://www.gartner.com/newsroom/id/2603215>.

4. John Hornick & Anita Bhushan *Crowdsourcing Prior Art to Defeat 3D Printing Patent Applications*, 3D PRINTING INDUSTRY NEWS (May 17, 2013) http://3dprintingindustry.com/2013/05/17/crowdsourcing-prior-art-to-defeat-3d-printing-patent-applications/?utm_source=3D+Printing+Industry+Update&utm_medium=email&utm_campaign=4134896bc9-RSS_EMAIL_CAMPAIGN&utm_term=0_695d5c73dc-4134896bc9-60484669. (The U.S. Patent and Trademark Office allows third parties to submit prior art references that may be potentially relevant to the examination of any pending patent application).

is that intellectual property actually stifles innovation.”⁵

The cadre of people who agree with Dr. Pearce, who I call the “squeaky wheels,” is growing and should not be ignored.

The third reason is what I call 3D printing “away from control,” which means the ability to make almost anything without anyone knowing about it or being able to control it. Each of these reasons is explored below.

II. DEMOCRATIZATION OF MANUFACTURING

3D printers eliminate barriers to entry in manufacturing because they have the potential to enable anyone to make almost anything. This means that small companies may be able to compete with big ones in niche markets. It also means that people and companies that have always been customers can become competitors, making the products they formerly bought. As democratized manufacturing increases and the once clear line between manufacturer and customer blurs, demand for physical products drops if customers make such products themselves. Gartner’s prediction of \$100 billion per year in worldwide 3D printing-related IP losses seems to be based not only on IP infringement, but also on IP that will never be bought (Gartner seems to be using the term “IP” to mean not just IP rights, but IP in the broad sense, meaning the fruit of human creativity).

3D printing may result in widespread copying, especially of consumer products. Perhaps more importantly, though, companies that formerly bought replacement or spare parts may start making or repairing the parts themselves. According to an IBM 3D printing study: “The competitive advantage from both proprietary design and parts production is expected to erode as basic design blueprints become widely available via open source. . . . And the service parts business will lead the digital transformation, leaving companies unable to generate profits from selling spares.”⁶

As demand for physical products drops and customers 3D print their own products, the data needed to make such products becomes more valuable, or at least a tradable

5. Joshua Pearce, *3-D Printing Materials You Can’t Patent*, THINGVERSE INSTRUCTIONS (April 13, 2013), <http://www.thingiverse.com/thing:73427>.

6. Paul Brody and Veena Pureswaran, *The New Software-Defined Supply Chain: Preparing for the Disruptive Transformation of Electronics Design and Manufacturing*, IBM INSTITUTE FOR BUSINESS VALUE, at 11 (July 2013).

commodity: digital blueprints of products replace the products themselves. Unlike physical products, digital blueprints are infinitely malleable. So as digital blueprints become the currency of commerce, mass customization may replace mass production. In a world of mass-customized products, IP rights become less effective because traditional forms of IP rights—particularly patents and copyrights—are inappropriate or inadequate for protecting such products. However, companies may be able to maintain the competitive edge formerly provided by such IP rights through a combination of software-driven, customization-enabling infrastructure and value-added services. Although patents and copyrights may have little application to highly customized products, copyrights and trade secrets may become the IP rights of choice, protecting the software and infrastructure supporting such customization and services.

III. AWAY FROM CONTROL

3D printing away from control means making things without anyone knowing about it or being able to control it. The democratization of manufacturing naturally leads to the ability to 3D print away from control. 3D printing's ultimate disruption will happen when it is possible to make things with virtually any functionality away from control.

On the industrial side of 3D printing, customers' ability to make their own parts is not entirely away from control. If a customer stops buying parts and starts making them, the supplier may notice the lost sales. However, the supplier will have no way of knowing the extent of the customer's in-house parts printing and customization. More importantly, the customer can make parts away from control because the supplier has no way to stop or control the customer's in-house parts making.

On the consumer side, away from control means the ability to 3D print at home or in any other way that is not controlled and cannot be controlled, such as 3D printing at home from blueprints obtained peer-to-peer on the Internet, 3D scanning and printing anything, printing or buying 3D printed products on the black market, obtaining pirated proprietary blueprints from an internet website, such as Pirate Bay, or having personal blueprints printed at uncontrolled local shops or by

Internet-based fabricators.⁷

Some 3D printing away from control may violate intellectual property rights. But as 3D printing commentator Michael Weinberg of Public Knowledge said, “most of the physical [sic] world is not protected by any type of intellectual property.”⁸ Most 3D printing away from control will be perfectly legal.

3D printing things with almost any functionality away from control is where the real disruption will happen. Anyone may be able to bypass the traditional supply chain and self-manufacture. Presently, the things that can be self-manufactured are limited, but this is a time problem: given enough of it, anyone may be able to make almost anything, away from control.

Making things of almost any functionality away from control will change everything. You will no longer need most manufacturers’ products because you will be able to make them yourself. Manufacturers will probably realize that it is no longer profitable to continue to mass-produce their products, and will be forced to sell blueprints and customized products instead. Retail outlets that formerly sold mass-produced products will vanish, just like camera stores vanished when photography went digital. Without product sales, states will be unable to collect sales taxes, and the federal government may be unable to collect customs duties or enforce embargoes. Governments will be unable to control product safety. These are just a few of the effects of widespread 3D printing of products with almost any functionality, away from control.

IV. THE 5 “I”S

IP rights and rights holders have the most to lose from widespread 3D printing away from control. Although IP principles apply to 3D printing in the same as they apply to any other technology, 3D printing has the unique potential to threaten the value of IP rights and their ability to give companies a competitive edge. Combined with democratized manufacturing, 3D printing has the power to make IP rights

7. Pirate Bay, <http://thepiratebay.se/browse> (last visited Feb. 12, 2015).

8. Michael Weinberg, *What’s the Deal With Copyright and 3D Printing?*, PUBLIC KNOWLEDGE 3 (Jan. 2013), https://www.publicknowledge.org/files/What%20the%20Deal%20with%20Copyright_%20Final%20version2.pdf.

irrelevant. Impotent may be a better word.

As powerful personal 3D printers become common, as more and more independent fabricators open their doors and buy better and better printers, and as industrial customers begin to realize they can make their own replacement and spare parts and other products, the democratization of manufacturing will increase away from control. When anyone can 3D print things with virtually any functionality, away from control, IP rights will suffer the dreaded Five Is (pronounced “five eyes”):

Infringement: When anyone can 3D print things with virtually any functionality, the risk of IP infringement away from control will become increasingly high.

Identification: Infringement away from control will be increasingly difficult to identify.

Impractical or Impossible: It will be increasingly impractical or impossible to enforce IP rights against infringement away from control, or there may be no effective IP protection for the product in question.

Irrelevant (or Impotent): IP rights will become increasingly irrelevant; they will exist and be enforceable for 3D printing infringement within control, but will be largely impotent for 3D printing infringement away from control.

The risk to IP rights posed by 3D printing depends on the degree of democratization of manufacturing. For products that are unlikely to be 3D printed away from control, IP rights will probably continue to work effectively, much as they do today for traditional manufacturing methods. But as the democratization of manufacturing increases away from control, IP rights are likely to become increasingly irrelevant. The companies most at risk from democratized 3D printing away from control are any that make replacement or spare parts, or consumer products.

V. IP STRATEGIES FOR TODAY

A. *Utility Patents: Claiming Strategies*

Regardless of what a 3D printed future holds for IP rights, the big issues for companies that rely on utility patents today are:

- How to protect products and processes?
- How to protect digital blueprints?
- Who is an infringer?

Regarding protection, companies like Nike have started to adopt patent method claiming strategies with 3D printing in mind. For example, Nike's US Pub. 2014/0020191⁹ claims:

A method of direct three-dimensional printing onto an article of apparel, comprising:

designing a three-dimensional pattern for printing onto the article;

positioning at least a portion of the article on a tray in a three-dimensional printing system . . .

printing a three-dimensional material directly onto the article using the designed pattern;

removing the article from the three-dimensional printing system,

Nike's US Pub. 2014/0020192¹⁰ claims: "A method of three-dimensional printing and assembly of an article of apparel, comprising . . ."

Apple's US Pub. 2013/0306198¹¹ claims:

"A method comprising:producing a molten alloy . . .depositing the molten alloy to selected positions on a platen or a workpiece; andforming a solid layer-by-layer construction of the . . ."

Similarly, Apple's US Pub. 2013/0309121¹² claims: "A method comprising: fusing a layer of bulk metallic glass (BMG) powder to a layer below by heating the layer of BMG powder . . .; andforming a solid layer-by-layer construction of the BMG, wherein . . ."

Companies like Gillette have started to adopt product-by-process claiming strategies. Gillette's US Pub. 2014/0033538¹³ claims:

"A razor cartridge comprising:a) a housing . . .;b) a metal insert located within the housing; andc) one or more blade assemblies . . ."wherein said razor cartridge is formed by rapid prototyping such that said razor cartridge can be used for repeated shaving."

Of course product-by-process patents are valid only if the product itself is patentable, regardless of what process is used to make it. Unfortunately, a product that is either

9. U.S. Patent App. No. 20140020191 (filed July 19, 2012).

10. U.S. Patent App. No. 20140020192 (filed July 19, 2012).

11. U.S. Patent App. No. 20130306198 (filed May 16, 2012).

12. U.S. Patent App. No. 20130309121 (filed May 16, 2012).

13. U.S. Patent App. 20140033538 (Oct. 16, 2013).

unpatentable or whose patent has expired does not become patentable by 3D printing it.¹⁴ Similarly, if an old product is covered by a product-by-process patent for a traditional manufacturing process, the patent is not infringed if the product is made by a different process, such as 3D printing.¹⁵ Thus, product-by-process patents are likely to be valuable in the 3D printing space for new products, not old ones.

If the democratization of manufacturing shifts commerce from selling products to selling digital designs, rights holders will shift their interest from protecting things and processes to protecting digital blueprints. One potential claiming strategy for doing so is the so-called *Beauregard* claim.¹⁶ Such a claim might read something like this:

A computer-readable medium storing instructions that, when executed by at least one processor of a printing device, cause the printing device to generate a three-dimensional object, comprising . . .

However, at least one commentator has questioned the validity of such claims. In his excellent article entitled “Asserting Patents to Combat Infringement Via 3D Printing: It’s No ‘Use’,” Daniel Harris Brean wrote:

At first glance, a *Beauregard* claim could conceivably encompass a CAD file containing the software instructions for computer-implemented printing of a 3D product. However, the Federal Circuit’s recent pronouncement in *CyberSource, Inc. v. Retail Decisions, Inc.* imposed serious limitations on *Beauregard* claims that preclude this option as a viable theory. *CyberSource* held that “[r]egardless of what statutory category (‘process, machine, manufacture, or composition of matter,’ 35 U.S.C. § 101) a claim’s language is crafted to literally invoke, we look to the underlying invention for patent-eligibility purposes.” On this reasoning, the Federal Circuit invalidated a claim drawn to “[a] computer readable medium containing program instructions for detecting fraud in a credit card

14. In *re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985) (“[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.”); *see also* *Amgen Inc. v. F. Hoffman-La Roche Ltd.*, 580 F.3d 1340, 1370 n.14 (Fed. Cir. 2009).

15. *Abbot Labs v. Sandoz, Inc.*, 566 F.3d 1282, 1292 (Fed. Cir. 2009).

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

transaction,” finding that the invention was not the medium but the method for detecting fraud, which is unpatentable as an abstract idea.¹⁷

This analysis suggests that Beauregard claims may be valuable only if the invention is the medium itself, which would mean that such claims for 3D printable digital blueprints may not be patentable in most cases because they are a medium for the invention, not the invention itself. Perhaps more importantly, it may not matter if such claims are not patentable because computer-readable media are going the way of the brontosaurus, as data moves from physical media to intangible forms.

Another possibility is claiming the digital model itself, for example: a computer-readable model of a three-dimensional object for use in manufacturing a three-dimensional object, namely, a . . .

However, such claims may not be patentable under 35 U.S.C. § 101 under the so-called Printed Matter Doctrine.¹⁸ Owners of digital models currently pin their patent hopes on a recent ITC decision in which the judge ruled that digital models for creating dental appliances are articles under Section 337(a)(1)(B).¹⁹ The unanswered question is whether the Federal Circuit would agree that digital models are patentable.

Many parts manufacturers fear that the spare and replacement parts on which their profits depend—many of which may not be patented—will be 3D scanned, then 3D printed, by pirates, competitors, independent fabricators, or customers. Thus, another possible claiming strategy relates to the method by which many 3D printable digital blueprints will be created: 3D scanning. Such a claim may read something like this: “A method of creating a computer-readable model of a three-dimensional object for use in manufacturing a three-dimensional object, namely, a _____, said method comprising: scanning step 1, scanning step 2, etc.”

17. Daniel Harris Brean, *Asserting Patents to Combat Infringement Via 3D Printing: It's No 'Use'*, 23 FORDHAM INTELL. PROP. MEDIA & ENT. L.J., 771, 806 (Apr. 17, 2013).

18. *Id.* at 805

19. Eric Schweibenz, *ITC Issues Public Version of Opinion In Certain Digital Models, Digital Data, And Treatment Plans For Use In Making Incremental Dental Positioning Adjustment Appliances (337-TA-833)*, OBLON, (Apr. 10, 2014), <http://www.oblon.com/itc-issues-public-version-opinion-certain-digital-models-digital-data-and-treatments-plans-use-makin>.

Of course such claims cover the method of scanning the parts, not the parts themselves.

B. Utility Patents: Who May Infringe?

Compared to traditional manufacturing methods, 3D printing may involve a much larger and more diverse pool of potential infringers, each of which could be a direct, contributory, or inducing infringer. The following chart illustrates who may be an infringer, and who may not.

Who Infringes?

	Direct	Contributory	Induced
3D Printer Makers	No	No (substantial noninfringing uses)	Unlikely
Blueprint Creators (scratch, scan, derivative)	No	No (not components of patented product)	Possibly, if knowledge/willful blindness
3D Printed Product Fabricators	Yes	Yes	Yes
Commissioning Party	No	No	Possibly, . . .
Distributors: Designs	No	No (not components of patented product)	Possibly, . . .
Distributors: Products	Yes	Yes	Yes

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As the chart illustrates, the only clear infringers are fabricators and distributors of 3D printed parts and products. Under current law, it is unclear if induced infringement claims are likely to succeed against people who create digital blueprints from scratch, from scans, or from existing digital blueprints (or a combination of these sources), people who distribute digital designs, or people who commission designs or products. But as law professors Deven Desai and Gerard Magliocca predict, induced infringement claims may not “make a dent in infringement by 3D printers.”²⁰

C. Design Patents

Design patents have long been a neglected sister of IP law, but 3D printing could make them the Cinderella of IP rights. They may be a good tool to buttress utility patents for products and parts, and they are less expensive and quicker to obtain

20. Deven R. Desai & Gerard Magliocca, *Patents, Meet Napster: 3D Printing and the Digitalization of Things*, 102 GEO. L.J. 1691, 1715 n.121 (2013).

than utility patents.

However, because it may be fairly easy to design around a design patent, such patents will probably be most useful for products for which customers are unlikely to accept a substitute with a different design. For example, car owners may want to replace a bumper only with a bumper for their car's model, so it may be worthwhile to patent the bumper's design. But this may only be true of new cars or certain models. Owners may not care if a replacement bumper is authentic to their model if the car is old or inexpensive. If the design of a part is not important to the customer, he may not care that a replacement part looks different from the original.

D. Copyrights

Copyrights have three main potential applications for 3D printing: things, software, and the compilations of data in digital blueprints. The big issues for companies that rely on copyrights are:

- What is copyrightable?
- Who is an infringer?

The big copyright winner in 3D printing could be software, including software for design, scanning, manufacturing and machine control, streaming of digital blueprints, file authentication and security, digital rights management (DRM), and file management. Although the courts have tended for many years to lean against strong copyright for software (infringers seem to fair better in litigation than software copyright owners), 3D printing-related software is likely to provide a substantial economic benefit to the U.S. economy if the courts favor its protection. Of course proponents of open innovation believe the economy may benefit from such software even without copyright protection, but that is a topic for another day.

3D printed objects are copyrightable to the same extent as their counterparts made by traditional methods. Only the nonfunctional and original aspects of an object can be copyrighted. If the object has at least a small amount of artistic authorship original to the creator, that authorship is copyrightable. The originality requirement is low but not nonexistent, and probably must come from a human creator, not a machine. This means that creative objects, such as action figures, sculptures, and some toys, are copyrightable. This probably also means that for digital blueprints to be

copyrightable, they must either be created by a person from scratch, or modified by a person from a pre-existing digital blueprint. This also means that digital blueprints created by 3D scanners probably are not copyrightable.²¹ This is probably true of scans of functional objects and may also be true of scans of copyrighted objects, but this is less certain. In my view, just as a photo of a copyrighted object may be copyrightable, a digital blueprint could be too. No one will really be certain until courts address these issues.

The following chart illustrates what may and may not be copyrightable in a 3D printed world.

What's Copyrightable?

	Digital Blueprints	Unmodified Scans	Nontrivial Modified Scans	3D Printable Objects
Public Domain Objects	Maybe (<i>Feist</i>)	No (<i>Feist</i>)	Maybe (<i>Feist</i>)	No
Functional Objects	Maybe (<i>Feist</i>)	No (Meshworks)	Maybe	No
Nonfunctional Objects	Yes	Maybe/Maybe Not	Probably	Yes

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As the chart illustrates, the U.S. Supreme Court's landmark *Feist* decision may substantially limit the copyrightability of 3D printed objects.²² The only objects and digital blueprints that are clearly copyrightable are the same types of objects and blueprints that have always been copyrightable: nonfunctional objects and their digital files.

Copyright infringement principles also apply to 3D printing just as they apply elsewhere. However, the success of such lawsuits will depend on copyrightability, as illustrated above. An infringement-fighting tool available to copyright owners that is not available to patent owners is the Digital Millennium Copyright Act's takedown procedures. If copies of copyrighted digital blueprints are posted online, copyright

21. See *Meshworks, Inc. v. Toyota Motor Sales USA, Inc.*, 528 F.3d 1258 (10th Cir. 2008).

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

owners may issue DMCA takedown notices and the host will probably comply. However, the potential for abuse by copyright owners may be higher for 3D printable digital blueprints because there will be so many of them.

E. Trademarks

Counterfeiting is expected to be a \$1.7 trillion threat to world economies in the near term.²³ 325% more counterfeit goods were confiscated from 2002 to 2012 than in the previous decade.²⁴ NASA says counterfeiting is one of its biggest challenges. 3D printers are a counterfeiter's dream machine, to copy products or to affix trademarks to fake products.²⁵ The democratization of manufacturing driven by 3D printing could lead to counterfeiting on steroids because copies of genuine products can be made by professional counterfeiters or by well-meaning people who print things away from control. As 3D printers get better and better, faster and faster, and more and more consumer friendly, anyone will be able to make copies of genuine products. And counterfeiters will always invent ingenious ways to make products that appear to be genuine.

Even if people want to buy the genuine product, how will they know it is genuine in a 3D printed world? If a bicyclist cracks his head using a 3D printed bicycle helmet, or a child chokes on a 3D printed toy part, how will the company or the victim know if it was genuine, or a perfect knock-off? How will they know who to sue, or if anyone should be sued? In a world where companies sell 3D printed products or blueprints, or both, where such products are bought and resold, where blueprints can be obtained from many sources, and modified and remixed, where such blueprints are printed away from control, and where the products of printing away from control are sold and resold, how will you know if a product is genuine? How will you know if a blueprint is the real deal? In a 3D printed world, what does "genuine" even mean? As Connor

23. Steve Hargreaves, *Counterfeit Goods Becoming More Dangerous*, CNN MONEY, (Sept. 27, 2012), <http://money.cnn.com/2012/09/27/news/economy/counterfeitgoods/>.

24. Jayne O'Donnell, *Counterfeit Products Are a Growing, and Dangerous, Problem*, USA TODAY, (June 6, 2012), <http://usatoday30.usatoday.com/money/perfi/columnist/odonnell/story/20120601/confidentconsumerjayneodonnell/55406774/1>.

25. *NASA Identifies Counterfeiting as One of Greatest Challenges*, PCB DESIGN 007, Nov. 6, 2012), <http://www.pcbdesign007.com/pages/zone.cgi?a=87719&artpg=1>.

McNulty, Neyla Arnas, and Thomas Campbell observed in their white paper on 3D printing and national security, “the distinction between original idea and physical product becomes blurred.”²⁶

Trademarks carry with them an implied guarantee of consistent quality and that the product originates from a single source. You can walk into any McDonald’s in the world and the name itself guarantees that the quality of the food will be consistent. 3D printing away from control eliminates the trademark owner’s ability to control the quality of things bearing its trademark, and even eliminates the implied guarantee that a trademark-bearing product was made or authorized by the trademark owner. In a 3D printed world, there may be no reason to assume that a branded product is authentic. Thus, the presence of a brand name on a product may be no guarantee of anything.

Perhaps more significantly, the ability to 3D print things with virtually any functionality may substantially reduce the need and demand for branded products. Why print a trademarked product when you can print a generic substitute, especially if the blueprint for the generic is free? And if you can print the generic, why buy the brand? Although it will always be possible to enforce trademarks infringed within control, 3D printing—both within control and away from control—may erode the number of branded products, and therefore the need to enforce trademarks within control or the brand owners’ ability to do so.

Some commentators, such as Melba Kurman and law professors Desai and Magliocca, view the brand as a savior. They believe the value-added that brand owners will be forced to provide (to survive) will lead consumers to continue to want, and even demand, authentic branded products.²⁷

VI. REACTIONS AND SOLUTIONS

As 3D printing away from control erodes IP rights, rights owners will react, drawing from their traditional arsenal, by filing patent applications, licensing digital blueprints, filing IP

26. CONNOR M. MCNULTY ET AL., TOWARD THE PRINTED WORLD: ADDITIVE MANUFACTURING AND IMPLICATIONS FOR NATIONAL SECURITY 10 (2012).

27. Melba Kurman, *Carrots, Not Sticks: Rethinking Enforcement of Intellectual Property Rights for 3D-Printed Manufacturing*, 1 3D PRINTING AND ADDITIVE MANUFACTURING 1, 49 (2014).

lawsuits, lobbying Congress to change the law, and employing DRM. Although such reactions may have varying degrees of success in the short term, I question their long-term effectiveness as it becomes increasingly possible to 3D print things of almost any functionality away from control.

Commentators have suggested various solutions.

Professors Desai and Magliocca, along with Davis Doherty and Carlos Rosario, have suggested an exemption from patent infringement liability for personal manufacturing or personal use. As Desai and Magliocca wrote, “It is unclear why personal 3D printing should be unlawful, especially given the futility of enforcement.”²⁸ They do not seem to realize that the enactment of such a law could sound the death knell for any company that sells products that can be made away from control. When consumers start making patented products instead of buying them, a personal exemption from patent infringement may excuse most infringing manufacturing. Although patent owners’ ability to enforce their patents would be subject to the 5 Is, the potential to enforce in appropriate situations would be better than having no right to do so because of a personal exemption from infringement. However, such an exemption may not be necessary. If infringement away from control becomes common, it will be impractical or impossible to sue infringers. As MIT’s Neil Gershenfeld said, “You can’t sue the human race.”²⁹

Desai and Magliocca also suggest increasing the jurisdictional amount to shield personal 3D printing.³⁰ 3D printing away from control will be mostly small potatoes, and therefore this suggestion would eliminate most IP lawsuits involving 3D printing away from control. But because the aggregate of all of those small potatoes may be quite a mountain of spuds, such a solution may write patent protection out of the law for any product that can be 3D printed away from control.

28. Desai & Magliocca, *supra* note 20, at 1719; Davis Doherty, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J. L. & TECH. 353, 365 (2012) (suggesting “innocent independent inventor” patent defense); Carlos J. Rosario, *3D Printing: Are We Prepared to Tackle the Inevitable Intellectual Property Challenges*, 21 No. 7 WESTLAW J. OF INTELL. PROP. 1, 3 (2014) (suggesting that “Congress must create a framework such that individuals are at least somewhat immune from the present IP laws”).

29. HOD LIPSON & MELBA KURMAN, *FABRICATED: THE NEW WORLD OF 3D PRINTING* 229 (2013).

30. Desai & Magliocca, *supra* note 20, at 1719.

Doherty, Desai, and Magliocca have also suggested the enactment of a Digital Millennium Patent Act.³¹ Although such a law may provide patent owners with a way to fight some patent infringement within control, it will have little or no effect on infringement away from control. Such suggestions also raise troublesome questions:

- Is such a system unfairly slanted toward patent owners?
- How can abuse by patent owners be prevented?
- How can inconsistent application of the law be prevented?
- Who interprets patent claims?

DRM is another possible solution, but probably not a good one. As Hod Lipson and Melba Kurman said, “DRM technologies may be a futile attempt to stem the tide. DRM technologies create an ongoing arms race between consumers and companies.”³² And as Melba Kurman observed, “Pirates bent on IP infringement will likely remain one step ahead of any technological solution.”³³ DRM also does not prevent 3D scanning products with ever-more-sophisticated 3D scanners, tweaking the resulting blueprints, and 3D printing such things away from control.

VII. THE RISE OF NON-IP-RIGHTS-BASED BUSINESS MODELS

Although businesses have long relied on IP rights to secure a competitive edge, the era of IP-rights-based business models may be coming to an end, at least for products that can be 3D printed away from control. As businesses innovate to protect their profitability in a world where digital blueprints for reasonable substitutes for parts and products are widely available or are easily created, and where such blueprints can easily be 3D printed away from control, IP-rights based business models may be replaced by business models that do not rely on IP rights and enforcement, except in extreme circumstances.

This is what happened in the music industry. The ability to share music on the internet was an incredible technological

31. *Id.* at 1714; Davis Doherty, *supra* note 28, at 365-68; LIPSON & KURMAN, *supra* note 29 at 229; Deven R. Desai & Gerard Magliocca, *supra* note 20, at 1719.

32. LIPSON & KURMAN, *supra* note 29 at 229.

33. LIPSON & KURMAN, *supra* note 29, at 49.

innovation, but it clashed with the traditional method of protecting music owners' rights: copyrights. The ease of downloading songs changed the way that industry operates. After a dark period of suing students and single mothers, the music industry shifted to business models that no longer rely on copyright infringement lawsuits to prevent people from trading in illegal copies of songs. The same may happen to traditional manufacturers of things when it becomes possible to 3D print things with virtually any functionality away from control.

VIII. AN UNLIKELY SCENARIO

The basis for the U.S. patent and copyright laws is found in Article 1, Section 8 of the U.S. Constitution, in which Congress is given the power: "To promote the progress of Science and the useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

The purpose of this power is to incentivize innovation. Importantly, the Constitution does not require Congress to exercise this power. The Constitution gives Congress the power to grant patent and copyright rights, but does not guarantee such rights to the people.

Congress's exercise of such power is based on two assumptions: (1) that granting such exclusive IP rights will accomplish the Constitutional purpose, namely, to incentivize innovation; and (2) the exclusivity of patent and copyright rights will be sufficiently enforceable to justify exercising the power.

The first assumption has always been assumed to be true. Recently, this assumption has been questioned and the number of people who question it is growing: "There is a persistent widespread belief that intellectual property law (and patents in particular) encourages [sic] innovation. This is intuitive, however, the evidence to the contrary is now overwhelming and the unavoidable conclusion is that intellectual property actually stifles innovation."³⁴

The second assumption was based on the fact that infringement has never been easy enough to be commonplace.

34. Joshua Pearce, *3-D Printing Materials You Can't Patent*, MAKERBOT THINGIVERSE, (Apr. 13, 2013), <http://www.thingiverse.com/thing:73427/#instructions>.

Infringement has always been the exception, not the rule. As professors Desai and Magliocca said, IP rights are for “tamping down massive infringement,” not for “thwarting all infringement.”³⁵

What if these assumptions fail? What if the exclusivity of patent and copyright rights does not—or no longer— incentivizes innovation, as some squeaky wheels believe? What if such rights are not sufficiently enforceable to justify Congress’s exercise of the power, in a world where things of almost any functionality can be 3D printed away from control? The answer is that Congress could be led by the squeaky wheels to narrow or even eliminate such rights.

This is probably an unlikely scenario. But so was the ratification of the 18th Amendment.

IX. WHAT WILL REALLY HAPPEN?

Experts, industry observers, and analysts differ about the extent to which 3D printing will be adopted and change the world. Some believe almost every home will have a 3D printer. Others disagree. Some believe independent fabricators will 3D print most of what we want or need and others believe large companies will use 3D printers to do so. Some believe 3D printers will replace mass production and others believe they will simply be one more machine on factory floors. Some believe companies will start selling designs rather than products and others believe companies will make mass-customized products or send their designs to their own local factories 3D printing. Some believe 3D printers will create jobs and others believe they will destroy them.

My view is that everything will happen. A world full of 3D printers that can make almost anything, within control and away from control, will be an almost inconceivably complex place, where products and blueprints are designed, scanned, customized, made, and sold by an uncountable number of companies and home printers offering a dizzying array of products and services. It is impossible to predict exactly what this will mean for IP rights, but they will probably play a very different role in such a world than they do today.

35. Desai & Magliocca, *supra* note 20, at 1704.