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An Introduction to the Intellectual Property Law Implications of 3D Printing

Michael Rimock[*]

INTRODUCTION

Marshall McLuhan, one of the pre-eminent scholars in communications studies, famously described all media as: "Extensions of some human faculty — psychic or physical."[1] Examples of this are the wheel as an extension of the foot, glasses as an extension of the eyes, and the Internet as an extension of the mind. 3D printing can be understood as a simultaneous extension of the creator's hands and mind. Its value and uniqueness is largely a result of that double extension. It is a medium where ideas and imagination intersect with physical objects.

Put simply, 3D printing allows people to print physical objects that are scanned, downloaded, or created digitally. There are an astonishing number of uses, benefits, and advantages associated with 3D printing. However, as with any new technology with so much potential, 3D printing presents a number of threats and challenges to many who benefit from the way manufacturing currently operates. While 3D printers will likely have a tremendous economic and socio-cultural impact, the following will provide an overview of some of its implications relating to intellectual property law. I will begin by briefly discussing the history of 3D printing and explain how it works. Next, I describe how and why 3D printing could drastically change the world we live in by outlining its advantages over previous manufacturing methods, listing some of its possible uses, and exploring the economic impact it might have.

The next section of this article will focus on 3D printing's relationship with intellectual property law. This new technology is of particular interest because it encompasses copyright, patent, trademark, and industrial design laws. I will generally discuss some of the challenges 3D printing presents in each of those areas, outline how the current regime might deal with those challenges, and provide some suggestions. There are a number of approaches that could be taken with regards to 3D printing. Some might involve tightening intellectual property law in order to protect rights-holders, while other approaches could focus on loosening the current regime in order to foster innovation and allow 3D printing to develop to its full potential. I will ultimately suggest that rushing new legislation or altering current legislation could have unintended consequences. Instead, the current system should be left alone, as it has not yet proven to be significantly detrimental to the development of 3D printing or to rights-holders. That being said, the current system does have its shortcomings. Reform could be

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[1] *The Medium is the Massage* (New York: Bantam Books, 1967) at 26 [McLuhan].

considered over time in order to ensure that our laws take into consideration the particularities of 3D printing.

(a) History of 3D Printing

Since 3D printing is essentially about producing physical objects, it is important to consider how physical objects have been manufactured throughout history in order to understand the significance of this groundbreaking new technology. Generally speaking there are three ways to make a physical object.[2] The first method, often referred to as the "subtractive" method, involves starting with a piece of material and cutting it down to form whatever is desired.[3] The disadvantage of this method is that it creates waste since you need to work with more material than you actually need.[4] The second approach involves shaping a malleable or liquid material and allowing it to set.[5] Such a method prevents the use of excess material, but complex objects require detailed and expensive molds. Any alteration made to the object's design means having to alter the mold. Since the industrial revolution, the preceding two approaches have received the greatest deal of attention in manufacturing.[6] Sophisticated lathes and milling machines were developed for cutting and trimming down objects, while injection-molding and die casting machines were created to form liquid hot metals and other resilient materials.[7] Furthermore, the invention of the numerical control in the 1940s has allowed manufacturing to become an automated process where human intervention is only necessary in relation to programming the machine.[8] The development of the micro-computer in the 1970s has widened the availability of numerically controlled machines; however, many of them are only cutting machines and are difficult to program.[9]

The third "additive" approach has, until relatively recently, received the least attention.[10] It involves adding material to create items.[11] While bricklaying is a traditional embodiment of the additive approach, 3D printing also belongs to this general category.[12] 3D printing is prefaced on the idea of "printing" an object layer by layer under the guidance of a computer program.[13] The father of

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2 Simon Bradshaw, Adrian Bowyer & Patric Haufe, "The Intellectual Property Implications of Low-Cost 3D Printing" (2010) 7:1 SCRIPTed 5 at 6 (Edinburgh School of Law).

3 *Ibid.*

4 Jason King, "The Future of 3D Metal Printing" (3 March 2013), online: 3D Print Headquarters <http://www.3dprinthq.com>.

5 Bradshaw, *supra* note 2.

6 Bradshaw, *supra* note 2.

7 *Ibid.*

8 *Ibid* at 7.

9 *Ibid.*

10 *Ibid.*

11 *Ibid.*

12 *Ibid* at 6.

3D printing, Charles W. Hull, created and patented its earliest incarnation in 1984.[14] His invention, stereolithography, involved: "[Slicing] a computer-aided design ('CAD') file into two-dimensional cross-sections and used an ultraviolet laser to 'print' the cross-sections layer by layer in a photosensitive resin."[15] Over time, developers have made 3D printing more user-friendly and thus more appealing for home use.[16]

In 2004, Adrian Bowyer started the RepRap project, an ongoing online community initiative relying on open source design to create affordable 3D printers that could print nearly all the parts required to self-replicate.[17] Creating a machine that could self-replicate is obviously antithetical to conventional industry.[18] However, it is of great value to the average consumer who could produce objects and also print another 3D printer for a friend.[19] It is of particular value in the developing world, where the savings associated with printing household items, as well as the small business opportunities, could have a tremendous impact. Bradshaw, Bowyer, and Haufe note that: "This is an interesting example of a failure of the market: such a self-replicating machine is an object that people would value, but it is in no one's interest to sell."[20] Since the beginning of RepRap, the designs for a number of printers that could print most parts have been released online.[21] Crowdfunding initiatives have helped produce models like the SeeMeCNC H1, which is: "The first DIY-type 3D printer to use injection molded plastic parts,"[22] and can be made for a few hundred dollars.

The RepRap project has also led to a number of start-ups around the world which build affordable machines based on RepRap technology.[23] MakerBot is one of the most recognized names in the commercial 3D printer industry.[24] Its most advanced printer, the MakerBot Replicator 2X is currently being sold for $2,799.[25] MakerBot models can print using PLA (Polyactic acid), the first

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13 Davis Doherty, "Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution" (2012) 26 Harvard Journal of Law and Technology 353 at 356 (Harvard JOLT).

14 U.S. Patent 4,575,330 (Aug 8, 1984) ("Apparatus for Production of Three-Dimensional Objects by Stereolithography), online: <http://www.google.com/patents/US4575330>.

15 Doherty, *supra* note 13.

16 *Ibid* at 357.

17 *Ibid.*

18 Bradshaw, *supra* note 2 at 9.

19 *Ibid.*

20 *Ibid.*

21 "RepRap" (14 February 2015), online: RepRap <http://reprap.org>.

22 "SeeMeCNC H1," online RepRap <http://www.reprap.org>.

23 Bradshaw, *supra* note 2 at 10.

24 *Ibid.*

25 MakerBot Official Website <http://www.makerbot.com>.

biodegradable synthetic polymer, which is made from cornstarch, or ABS plastic (the material used to make Legos).[26] What is particularly significant about MakerBot is that it created and operates Thingiverse, a website where users can share and download designs for 3D printing. There are currently over 100,000 designs available and Thingiverse encourages users to share and remix those designs. "In the spirit of maintaining an open platform," it writes, "all designs are encouraged to be licensed under a Creative Commons license, meaning that anyone can use or alter any design."[27]

MakerBot faces competition from a number of companies, including 3D Systems, which sells its Cube printer for $1,299.[28] As 3D printers become more popular, it is also likely that tech giants will start to produce their own models.[29] Fortunately, competition often leads to innovation.[30] Furthermore, companies with different business models are beginning to appear. Consumers who are not interested in owning their own 3D printers can upload their designs to a website like Shapeways, which will then print and ship the design.[31]

According to Chris Anderson, 3D printing has now reached the point where its use is moving from sophisticated early adopters to the average consumer. "Soon," he writes, "probably in the next few years, the market will be ready for a mainstream 3-D printer sold by the millions at Walmart and Costco. At that point, the incredible economies of scale that an HP or Epson can bring to bear will kick in. A 3-D printer will cost $99, and everyone will be able to buy one."[32] While the price point remains somewhat higher at $1599, Staples is now already selling 3D printers across Canada.[33]

(b) The Significance of 3D Printing

Before delving into the intellectual property law issues surrounding 3D printing, it is important to assess whether 3D printing is simply a DIY hobbyist fad or a technology that will truly change the world as we know it. The following will look at the advantages of 3D printing, its possible uses, and the economic impact it may have, in order to prove that although it is not yet clear *how* exactly 3D printing will change the world, it is clear that it will.

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[26] Flynn Martin, "Makerbot Replicator 2X — The Unofficial Manual," online: DataPro <http://www.datapro.net>.

[27] Thingiverse <http://www.thingiverse.com>.

[28] Cubify <http://cubify.com/cube>.

[29] Chris Anderson, "The New MakerBot Replicator Might Just Change Your World" (9 September 2012), online: Wired <http://www.wired.com>.

[30] Aghion et al, "The causal Effects of Competition on Innovation: Experimental Evidence" (20 February 2014), online: Scholars at Harvard <http://www.scholar.harvard.edu>.

[31] Doherty, *supra* note 13 at 357.

[32] Anderson, *supra* note 29.

[33] Staples <http://www.staples.ca>.

(i) Advantages of 3D Printing

Compared to traditional manufacturing, 3D printing can cut costs in a number of ways. First, it reduces the amount of material required to create an item. Rather than subtracting from an excessive amount of material, it only uses what it needs.[34] Environmentally speaking, this reduction of waste on a mass scale should not be undervalued.

3D printing also allows for mass customization.[35] The cost of a product becomes solely dependent on the cost of the raw materials. Therefore, printing one hundred different versions of a product could cost the same as printing one hundred identical products.[36] Likewise, complexity is free in 3D printing. Printing a plastic cube costs as much as printing an object with a complex, intricate design.[37] This facilitation of mass-customization allows companies to produce more unique, one-off designs, which they would otherwise be unable to bring to market using traditional manufacturing methods.[38] These advantages also benefit designers working on prototypes since altering designs would not require retooling. Instead, only the design file would need to be altered.[39]

Perhaps most significantly, 3D printing: "Enables things to be produced where they are needed, rather than assembled in a single factory and shipped around the world."[40] Over time, the average consumer could begin to print household items without leaving his or her home. Products that previously needed to be built in large factories to be affordable could be produced locally.[41] "Even if the per-unit production cost is higher," D'Aveni writes, "it will more than offset by the elimination of shipping and of buffer inventories."[42]

Finally, 3D printers could be very useful for small, isolated communities and developing countries. 3D printers could potentially create equal access to a wide range of commodities by giving people across the world the same access to the same items, all at the cost of raw materials. In fact, there are already initiatives in place to distribute 3D printers to developing communities around the world to help them make bicycles and other economical necessities.[43] By printing items on a need basis, waste and gaps between supply and demand could be reduced.

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[34] "Print Me a Stradivarius" (10 February 2011), online: The Economist <http://www.economist.com> [Stradivarius].

[35] Spencer Thompson, "3D Printing is Coming — So Let's Not Strangle the Industry at Birth" (16 October 2012), online: The Guardian <http://www.theguardian.com/uk>.

[36] Anderson, *supra* note 29.

[37] *Ibid.*

[38] Doherty, *supra* note 13.

[39] Stradivarius, *supra* note 34.

[40] Thompson, *supra* note 35.

[41] Richard A D'Aveni, "3-D Printing Will Change the World" (March 2013), online: Harvard Business Review <http://www.hbr.org>.

[42] *Ibid.*

(ii) Possible Uses

Perhaps the greatest advantage of the 3D printer is its versatility. 3D printing might seem like a technology that mostly benefits artists and techno-centric DIY enthusiasts. However, current uses of 3D printing give us a better idea of its potential.

3D printing *usually* involves two kinds of materials: plastics and metals. Prototypes, homemade toys, jewelry, and figurines often come to mind; but a number of functional items are possible as well. Home printers could easily print many small replacement parts, which otherwise might be expensive and/or difficult to come by.[44]

The opportunities in education are also seemingly endless. For instance, teachers often need small specialist components to demonstrate or conduct experiments.[45] Teachers across the world could design and share material through websites like Thingiverse in order to enrich their students' learning experiences. Furthermore, teaching students how to use 3D printers early on would provide them with tremendous advantages in the future. Anderson points out that: "Much as the first generation of software entrepreneurs were kids like the young Bill Gates, who grew up with the first machines and intuitively grasped their potential, so the next generation of 3D-printing innovators may be children. High schools would be smart to bring back shop class but rename it design class, a shift that really would entail just adding a few MakerBots to the school's existing computer labs."[46]

In the medical field, 3D printing has already been used to print an implant that replaced 75% of a man's skull and a replica that replaced a woman's jaw.[47] Prosthetic body parts are already being created with 3D printers with more speed and precision than ever before.[48] There is also active research regarding: "The possible use of the technology in tissue engineering applications, where organs and various body parts (including prosthetic heart valves) are built using inkjet techniques."[49] Custom dental fittings are also being produced with 3D printers to replace braces; and crowns are being designed, printed, and fitted all in one visit to the dentist thanks to 3D printing technology.[50]

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43 Mary Gehl, "The Implications of 3D Printing" (September 2012), online: Koinonia House < http://www.khouse.org > .

44 Bradshaw, *supra* note 2 at 11.

45 *Ibid* at 12.

46 Anderson, *supra* note 29.

47 Kevin Lee, "Doctors Replace Most of a Man's Skull with a 3D-printed Implant" (8 March 2013), online: TechHive < http://www.techhive.com > .

48 Sandra Bassendowski, "3D Printing: Potential and Possibilities" (5 June 2013), online: Canadian Journal of Nursing Informatics < http://cjni.net > .

49 Gehl, *supra* note 43.

50 Anderson, *supra* note 29.

The use of 3D printing in chemistry is also quite remarkable. A team of researchers at the University of Glasgow has been experimenting with chemical materials and a 3D printer that is currently on the market for $2000. The team has managed to engineer a selection of chemicals and is working on a kit to print ibuprofen.[51] These developments bring up concerns about people producing illegal substances or homemade pharmaceuticals with adverse effects. While there should be focus on reducing those risks, they should not completely overshadow the potential for good use. 3D printing technology could allow developing communities to have the tools to cheaply produce necessary drugs or detergents. Furthermore, chemical formulations (i.e. for niche drugs that are not profitable enough for pharmaceutical companies) and research could be shared through a platform like Thingiverse. Cronin, the head of the team at Glasgow, has described 3D printing as: "A way of democratizing chemistry [and bringing it] to the masses."[52]

Space exploration could also greatly benefit from 3D printing. In rocketry and space travel, reducing weight from a spacecraft is one of the engineers' greatest challenges. Rather than bringing a large number of items that *might* be needed, 3D printing could save space and weight by allowing astronauts to simply bring raw materials and print items on a need basis.[53] 3D printing in space would also be beneficial since it would allow space travelers to easily produce customized one-off designs in a relatively short amount of time.[54] NASA is also already exploring the viability of using 3D printers to print food on deep space missions.[55]

Unfortunately, 3D printing technology has already been used to produce a fully functioning plastic gun.[56] The design file to create that gun, known as "The Liberator," has been removed, but can be found online relatively easily. The major concerns are that anyone could potentially produce an unregistered firearm "off the radar" and that the gun would not be detectable by a metal detector.[57] Some, however, have pointed out that the gun is very expensive to produce and is very fragile (almost disposable), and it would actually be easier to acquire an illegal gun on the black market.[58] That being said, the capability of 3D printers to produce firearms, illegal drugs, and chemical weapons (i.e. ricin or

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[51] Gehl, *supra* note 43.

[52] *Ibid.*

[53] "Made in Space 3D Printing Lab & On-going Research" (2015), online: Made in Space < http://www.madeinspace.us > .

[54] *Ibid.*

[55] "3D Printing: Food in Space" online: NASA < http://www.nasa.gov > .

[56] Cory Doctorow, "3D Printed Guns are Going to Create Big Legal Precedents" (13 May 2013), online: The Guardian < http://www.theguardian.com > .

[57] Oliver Herzfeld, "Protecting 3D Printing Designs and Objects" (29 May 2013), online: Forbes < http://www.forbes.com > .

[58] Doctorow, *supra* note 56.

chlorine gas) have led some, like Senator Charles E. Schumer, to call for new legislation.[59]

(iii) Economic Impact

The fundamental economic change that could result from the widespread use of 3D printing is the undermining of economies of a scale that began with the mass production of goods during the industrial revolution.[60] Consumers would no longer save money by purchasing items produced in bulk because the cost of producing an item with a 3D printer remains the same no matter how many are printed. Doherty writes that 3D printing may: ''Have as profound an impact on the world as the coming of the factory did,''[61] while The Economist has referred to 3D printing potentially bringing us into the third industrial revolution.[62]

3D printing could potentially destroy the current economics of manufacturing. It could: ''Decentralize the business completely, reversing the urbanization that accompanies industrialization. There will be no need for factories, goes the logic, when every village has a fabricator that can produce items when needed.''[63] That being said, cities offer far more, socially and economically, than manufacturing.

For better or for worse (and there are many arguments on both sides), 3D printing could make China lose its position as the workforce of the world.[64] 3D printing would reduce the need for low-wage foreign factory workers and enhance the benefits (i.e. lower shipping costs) of manufacturing locally. The prevalence of 3D printing: ''Will cause business all along the supply, manufacturing, and retailing chains to rethink their strategies and operations.''[65] Spencer Thompson views the changes related to 3D printing as a good opportunity for the UK economy. He argues that being able to print items locally would put a stronger emphasis on design and could: ''Lead to a great many manufacturing jobs being 're-shored' to the UK.''[66]

(iv) Fostering Innovation

As designing and manufacturing items moves away from large industries and into the hands of the average consumer (who might be less concerned about competition and profit), innovation could potentially grow tremendously. ''Just as computers have allowed us to become makers of movies, writers of articles, and creators of music, 3D printers allow everyone to become creators of

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[59] Herzfeld, *supra* note 57.

[60] Bradshaw, *supra* note 2 at 11.

[61] Stradivarius, *supra* note 34.

[62] Doherty, *supra* note 13 at 357.

[63] Stradivarius, *supra* note 34.

[64] D'Aveni, *supra* note 41.

[65] *Ibid.*

[66] Thompson, *supra* note 35.

things."[67] 3D printing greatly lowers the barriers to entry for manufacturing.[68] It may: "Change the prevalent economic models of consumerisms as the focus shifts from the manufacturing of goods towards a more knowledge-based economy with a high value assigned to 3D blueprints."[69]

An inventor could design her idea digitally and turn it into a physical object at home. She could then test the market with a few homemade "prints" and make modifications based on early feedback of customers. Finally, she could improve the product based on that feedback (as well as feedback from the online community of designers and inventors) and begin selling it on a larger scale.[70] The Economist predicts that: "There will be a boon to inventors and start-ups, because trying out new products will become less risky and expensive. And just as open-source programmers collaborate by sharing software code, engineers are already starting to collaborate on open-source designs for objects and hardware."[71]

The preceding has hopefully shown that 3D printing is a technology that has the potential to enhance the world we live in through the promotion of creativity and innovation, not only in large industries, but also with the average consumer. While I have listed a number of ways 3D printers have already been used, as well as some predictions about future use, it might be wise to remember the following:

> Just as nobody could have predicted the impact of the steam engine in 1750 — or the printing press in 1450, or the transistor in 1950 — it is impossible to foresee the long-term impact of 3D printing. But the technology is coming, and is likely to disrupt every field it touches. Companies, regulators, and entrepreneurs should start thinking about it now. One thing, at least, seems clear: although 3D printing will create winners and losers in the short term, in the long run it will expand the realm of industry — and imagination.[72]

I. INTELLECTUAL PROPERTY LAW CONCERNS

3D printing brings up many concerns in relation to intellectual property law. "Like the Internet before it," Rimmer writes, "3D printing has the potential to be a revolutionary, disruptive technology. . . [But because] it allows people to create, copy, and modify objects, it will also have a large impact on our existing IP laws."[73]

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67 Michael Weinberg, "What's the Deal with Copyright and 3D Printing?" (January 2013), online: Public Knowledge <http://www.publicknowledge.org> [Weinberg, "What's the Deal"].

68 Stradivarius, *supra* note 34.

69 Gehl, *supra* note 43.

70 Stradivarius, *supra* note 34.

71 *Ibid.*

72 *Ibid.*

It is a particularly complex issue because a 3D-printed item could potentially infringe on all four major kinds of intellectual property. If, for example, an individual creates a design file for an iPhone case that can also be used as a credit card, it might infringe on existing patent protection for that function. If that case is also designed to look like a popular Ralph Lauren wallet, it might also infringe on: a copyright (for the artistic design), a trademark (for the brand's logo), and/or a design protection. Additionally, intellectual property law does not only deal with physical objects, so the CAD file itself can also infringe on rights. Therefore, 3D printing is a particularly complex production method since it can help create new and innovative products, but can also be affected by various forms of intellectual property protection.

There are two main groups of people who are particularly threatened by 3D printing and might rely on intellectual property law to protect themselves. The first is manufacturers who would have a hard time enforcing IP laws on private users.[74] Hornick argues that: "3D printing could bring the 'demise of intellectual property' for companies that sell unique, manufactured objects that can easily be reproduced in a 3D printer."[75] For example, a toy manufacturer today might be the only one who is able to print his toy at an affordable cost. However, with 3D printing technology, I could buy a toy, scan it, share the CAD file with others, print it and sell as many copies of it as I want. This could potentially create a bootleg market for physical objects, in the same way that there is currently a bootleg market for music, movies, and software.[76] Furthermore, 3D printers could be used offline, which makes finding infringers particularly challenging for those manufacturers.

Artists are another group who face significant threats from 3D printing. They may: "See a new forum for infringement of works previously difficult to copy."[77] Printing a copy of an artist's painting or drawing has been possible for a long time, but a flat, 2-dimensional copy obviously is quite different from an original hand-painted work of art. With 3D printing, though, exact replicas could be created in CAD files and printed to be close to identical to the original work. Sculptural work, which has been somewhat immune to copying and infringement, will also be a new target.

This brings to mind some of the ideas of Walter Benjamin. Benjamin wrote about how the mechanical reproduction of a work of art makes it lose its "aura."[78] For example, when you see the Mona Lisa in real life, there is an aura about it because of its authenticity. You begin to think about where it came from

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[73] Matthew Rimmer, "Inventing the Future: Intellectual Property and 3D Printing" (18 October 2012), online: Elgar Blog < http://elgarblog.wordpress.com > .

[74] Bradshaw, *supra* note 2 at 13.

[75] Colin Neagle, "3D Printing Could Trigger Intellectual Property Wars, legal expert says: If consumers have 3D printers in their homes, what will stop them from violating copyright?" (16 July 2013), online: Network World < http://www.networkworld.com > .

[76] *Ibid.*

[77] Bradshaw, supra *note* 2 at 13.

and how da Vinci himself created all the unique brush strokes. When it is mechanically reproduced (i.e. as a poster, t-shirt, or on a coffee mug), the aura is gone. However, Benjamin also promoted the idea that mechanical reproduction is a way of getting art to the masses.[79] Not everyone can afford to fly to Paris and see the Mona Lisa in the Louvre, but mechanical reproduction makes it so that anyone could see and admire da Vinci's work. Digital reproduction has expanded the scope of that idea. Access to music and movies has subsequently been democratized through technology. In traditional distribution models, people around the world do not have equal access to music, movies, and art; but digitization and the Internet make them more widely available than ever before. While artists might have some valid concerns about what they have to lose, the value of 3D printing in the realm of art is astounding and could be of great public value.

Incumbents of 3D printing are sure to call restrictions on the use of 3D printers.[80] In fact, there have already been several disputes involving copyright infringement, which will be discussed later on. As Lawrence points out: "Due to the creative destruction that new technologies such as 3D printing may wreak on 'traditional' manufacturing industry, and despite its potential economic, environmental, and social benefits, we are likely to see pushback and lobbying from incumbent manufacturers and their masters to strengthen intellectual property law and enforcement in the same way as happened for digitized content."[81]

We are at a crucial time where legislators need to start thinking about whether IP laws should now be tightened to protect rights-holders and the current way of doing things, or whether they should be loosened in order to promote innovation. Considering IP law is often justified as fostering creative activity and promoting the arts and sciences,[82] it should support rather than impede 3D printing technology. Over time, intellectual property law reform should be considered in order to meet that goal. In particular: "We should classify the objects of [protection] and decide the length or protection necessary to balance fairly all the competing interests found in the particular context of that particular object."[83]

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78 Walter Benjamin, *The Work of Art in the Age of Mechanical Reproduction* (London: Penguin Books, 2008).

79 *Ibid.*

80 Stradivarius, *supra* note 34.

81 Jon Lawrence, "3D Printing: Legal and Regulatory Issues" (8 August 2013), online: Electronic Frontiers Australia < http://www.efa.org.au > .

82 For example, in the US Constitution, Article 1, Section 8, which states that Congress has the power 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."

83 David Lametti, "Coming to Terms with Copyright" in Michael Geist, ed, *In the Public Interest: The Future of Canadian Copyright* (Toronto: Irwin Law, 2005) 480 at 516.

That being said, history shows us that rushing legislation for new technology can have unintended consequences that stifle early development. As such, it is not the time for *sui generis* legislation concerning 3D printing. Instead, the current system should be left alone while we wait and see how exactly 3D printing is going to be used. The following will look at how the current regimes of copyright, patent law, trade-mark, and industrial design protection each might govern 3D printing. It will also consider some of the challenges the current system presents, and discuss possible solutions.

(a) Copyright

The goals of copyright are both individual and collective. In *Théberge*, one of the leading Canadian copyright cases, Justice Binnie confirmed that: "The Copyright Act is usually presented as a balance between promoting the public interest in the encouragement and dissemination of works of the arts and intellect and obtaining a just reward for the creator (or, more accurately, to prevent someone other than the creator from appropriating whatever benefits may be generated.")[84] Copyright is meant to foster creative self-expression and promote the advancement of artistic and educational discourses.[85]

Copyright covers creative works, but not functional objects. Therefore, in my iPhone case example, the technology used to have the case function as a credit card would not be covered by copyright. Many products created with 3D printing involve functionality, but there are a number of purely creative works that could be produced with a 3D printer. In fact, recent disputes in relation to 3D printing have focused on the alleged copyright infringement of characters and objects.

There is no doubt that 3D printing will be used for copying. Weinberg points out that: "3D printing is a tool and, like any tool, can be used for productive and not-so-productive purposes. Making unauthorized copies of physical objects protected by copyright is copyright infringement, whether those copies are made with a 3D printer or a whittling knife. It will happen."[86] However, it should be noted that copying is not always wrong. Copying can be useful in learning and can be the foundation of a new work with its own value. Furthermore, copying does not always constitute infringement.

A key requirement in establishing copyright infringement is proving that the original work is copyrighted. Moreover, unauthorized use of copyrighted material is not always illegal. In order for something to be copyrightable, it must meet several requirements. First, it must fall under one of the categories of works listed in the Canadian *Copyright Act*. Non-functional printed objects could potentially infringe on architectural works (i.e. models of buildings or

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[84] *Galerie d'art du Petit Champlain inc. c. Théberge*, 2002 CarswellQue 306, 2002 CarswellQue 307, [2002] 2 S.C.R. 336 (S.C.C.) at para. 30 [*Théberge*].

[85] Lametti, *supra* note 83 at 491.

[86] "What's the Deal," *supra* note 67.

structures) and artistic works (particularly sculptures).[87] Since characters are also subject to copyright (so long as they are exact incarnations, rather than a unique expression of an archetypal character), it comes as no surprise that companies have already attempted to preclude the production of figurine replicas of their characters.

Earlier this year, HBO sent a cease and desist letter to Fernando Sosa for attempting to sell an iPhone dock based on the Iron Throne from Game of Thrones. HBO alleged that it had rights to the inanimate throne from the series and that Sosa's replica (which he spent months designing from scratch in Autodesk Maya) constituted a copyright infringement.[88] The incident never made its way to court as Sosa decided to cease production of the iPhone dock. Unfortunately, that means we still do not know how courts will interpret the copyright issues relating to printing independently designed replicas.

Likewise, Square Enix, the company behind the Final Fantasy video-game series, stopped the sale of Joaquin Baldwin's 3D printed character figurines by sending a DMCA takedown notice to Shapeways, who was printing and shipping the figurines. Rather than pitting themselves against fans, companies like HBO and Square Enix should find ways to embrace and adapt to the changes that will arise from 3D printing.[89] Companies like Coca-Cola and Nokia, for instance, have already implemented the new technology in their marketing.[90]

In an even more striking example, Games Workshop, the producer of the *Warhammer 40,000* tabletop miniature war-game, sent a take-down notice to Thingiverse to remove Thomas Valenty's CAD file. Unlike Sosa or Baldwin's figurines, which were respectively based on an existing object and characters, Thomas Valenty's *Warhammer 40,000* figurine was only *inspired* by the came. Games Workshop alleged that it had a copyright to the style of the game.[91] While this kind of situation probably does not constitute a copyright violation (style cannot be copyrighted, and it would meet the Canadian fair dealing requirement since it was non-commercial), it goes to show how large companies can illegitimately use the copyright system to intimidate amateur creators.

Jason Mazonne has noted these kinds of "copyfraud" cases are common and that users often abstain from using works available in the public domain because of illegitimate and intimidating use of copyright. In other cases, users end up paying for licences and rights to use works that they can use freely.[92]

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87 *Copyright Act*, RSC 1985, C. C-42 at s 2 [*Copyright Act*].

88 John Paul Titlow, "Why 3D Printing Will be the Next Big Copyright Fight" (20 February 2013), online: ReadWrite < http://readwrite.com > .

89 Misa Breschneider, "Will the Explosion of 3D Printing Mark the Implosion of Copyright Law?" (26 August 2013), online: Washington Journal of Law, Technology & Arts Blog, < http://wjlta.wordpress.com > .

90 *Ibid.*

91 Rimmer, "Inventing," *supra* note 73.

92 Jason Mazonne, "Copyfraud" (2006) 81 New York University Law Review 1026 at 1026 (SSRN).

Unfortunately, it is rare for "copyfrauders" to be reprimanded in any way and: "These circumstances have produced fraud on an untold scale, with millions of works in the public domain deemed copyrighted, and countless dollars paid out every year in licensing fees to make copies that could be made for free. Copyfraud stifles valid forms of reproduction and undermines free speech."[93]

On the other hand, the current system does allow legitimate rights-holders to protect their copyrighted works. For example, Paramount Pictures had already licensed its design of the Cube (essentially a sculpture) from the movie Super 8 to another company when designer Todd Blatt made his own design online.[94] In that case, "Paramount was probably well within its rights to request that Blatt take the model down."[95]

One of the most complex issues relating to copyright and 3D printing is that many items (like the iPhone credit card case) have some functional elements and some creative or decorative elements. "Objects with inseparable creative and utilitarian elements are not copyrightable."[96] American courts have: "Established that the test for separability may be met by showing either physical or conceptual separability. A design element is considered physically separable when it can be removed from an object and sold separately, [and] conceptually separable when it compromises artistic features that do not contribute to the utilitarian aspect of the object and such features invoke an idea separate from the functionality of the object."[97] While the iPhone case example would probably be considered separable, there is no universal test to determine separability. Future legislation and/or court decisions should consider 3D printing in defining those lines.

CAD files may also be subject to copyright since literary works also include computer programs.[98] The Canadian *Copyright Act* defines "Computer Program" as: "A set of instructions of statements, expressed, fixed, embodied or stored in any manner, that is to be used directly or indirectly in a computer in order to bring about a specific result."[99] Therefore, unauthorized reproduction of a copyrighted CAD file could constitute copyright infringement. However, given that a computer program (and thus a CAD file) has a functional element, some believe that it should be patentable rather than copyrightable. In fact, the United States Patent Office has begun to give out some patents on software. Given that copyright affords longer protection, rights-holders may seek to ensure that computer programs remain within the scope of copyright.

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93 *Ibid.*

94 Weinberg, "What's the Deal," *supra* note 67.

95 *Ibid.*

96 Breschneider, *supra* note 89.

97 Herzfeld, *supra* note 57.

98 *Copyright Act*, *supra* note 87.

99 *Ibid.*

A work must also be original in order for someone to have copyright over an expression. Copyright is not provided for an idea; it is provided for the fixed expression of an idea. Physical objects like sculptures are clearly fixed expressions, but the expression of how something can be built (i.e. a CAD file) can also be subject to copyright. In the same way that a recipe or song has to be written down or fixed in some way, a CAD file (as opposed to an idea for a CAD) can be protected. Original work must be more than a mere copy of another work. It does not, however, need to be creative, novel, or unique. It requires an exercise of skill (''use of one's knowledge, developed aptitude, or practiced ability'') and judgment.[100] The expression must also be different enough from other incarnations of the idea in order to be copyrightable. For example, a cube or the CAD file for a cube cannot be copyrighted, but a cube with a unique design on each face could be.

Copyright infringement involves three main requirements: the copyright must be valid; there must be access; and a substantial part of the work must be copied. The first requirement is particularly noteworthy in relation to 3D printing. A user might assume that an item is subject to copyright because it is not part of the Creative Commons or a similar institution. But, in the case of 3D printing, many items that can be printed are functional and are therefore subject to patent law rather than copyright law.

Unauthorized reproduction of a copyrighted work does not necessarily constitute infringement. The Canadian *Copyright Act* states that: ''Fair dealing for the purpose of research, private study, education, parody or satire does not infringe copyright.''[101] While case law has provided some more specifications about what constitutes fair dealing, educational settings are typically afforded legal access to reproductions of copyrighted work. Bradshaw, Bowyer, and Haufe note that while 3D printers are now being primarily viewed as a technology that will be used in homes: ''They may appear first in commercial or educational settings such as copy bureaus or schools, just as photocopiers were more common in such venues [before] the home. These different forms of use are very significant as there are exemptions against infringement of some IP rights for personal or non-commercial use.''[102] The education exception, which is further laid out in the *Copyright Act*,[103] means that students could legally learn how to design, reproduce, and remix copyrighted works in an educational setting. The entire learning process therefore remains unstifled by the current regime.

Additionally, reproduction for private purposes is not an infringement of copyright so long as: the copy is made from a non-infringing copy; the original

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[100] *CCH Canadian Ltd. v. Law Society of Upper Canada*, 2004 CarswellNat 446, 2004 CarswellNat 447, [2004] 1 S.C.R. 339 (S.C.C.) at para. 16.

[101] *Copyright Act*, *supra* note 87 at s 29.

[102] *Supra* note 2 at 12.

[103] *Supra* note 87 at s 29.4(1).

copy is legally owned by the individual who is reproducing it; no technological protection measures have been circumvented; and the copy is only used for private purposes.[104] This means an individual can purchase an item, scan it, and legally print as many copies as he or she would like. The only real restriction is that the individual cannot give any of the copies away. Furthermore, section 29.24 of the C*opyright Act* also permits reproducing backup copies of work.[105] These provisions are fairly generous to consumers. Therefore, these may be exceptions that incumbents in the traditional manufacturing industry may target first.

There are also concerns about the liability of Internet Service Providers (ISP). In Canada, secondary liability is largely based on the concept of authorization. A party must grant, or purport to grant, expressly or impliedly, the right to produce or reproduce. Canadian courts have already decided that ISPs cannot be liable if they only act as conduits.[106] There are already some suggestions that ISPs should be the gatekeepers of copyright infringement in 3D printing, but having the ISP be the judge and jury in regards to an alleged infringer is not in the public's best interest.

The notice and notice system, which is implemented in Canada, is a good balance and prevents the worst effects of the American DMCA's "notice and takedown" policy. The American approach makes ISPs immediately remove users' files, which the copyright owner alleges is an infringement. However, many uses (i.e. fair use/fair dealing) allow users to access that kind of work. While users can contest "notice and takedown requests," the time it might take for web host to re-upload the file (if ever) can be crucial.[107] The Canadian "notice-and-notice" approach allows the user to decide whether or not to remove the file. If he or she believes the use is legitimate, the file can remain where it is.

While Thingiverse and similar websites contain terms and conditions that prohibit the sharing of unauthorized material, their secondary or contributory liability could begin to come into question (particularly if they begin to profit from primarily illegal file transferring). Rimmer notes that: "Developers of 3D printing will need to take care to ensure that they do not 'authorize' copyright infringement [...] or 'induce' copyright infringement [and] there is a need to ensure that the net of secondary copyright liability is not cast too widely and indiscriminately."[108] This idea is reinforced by Justice Breyer's decision in *Grokster*, which holds that: "Copyright laws are not intended to discourage or control the emergence of new technologies, including (perhaps especially) those

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[104] *Ibid* at s 29.22(1).

[105] *Ibid*.

[106] See *Society of Composers, Authors & Music Publishers of Canada v. Canadian Assn. of Internet Providers*, 2004 CarswellNat 1919, 2004 CarswellNat 1920, [2004] 2 S.C.R. 427 (S.C.C.).

[107] Weinberg, "What's the Deal," *supra* note 67.

[108] *Supra* note 73.

that help disseminate information and ideas more broadly or more efficiently."[109]

One of the greatest advantages of 3D printing is the opportunity it provides for worldwide collaborative innovation. Whereas remix culture has up until now focused primarily on music, art, and video, 3D printing may create a new culture based on remixing physical objects. The new "mash-up exception" in the Canadian *Copyright Act* actually permits altering copyrighted material and remixing it for non-commercial purposes.[110] The *Act* even authorizes a user to disseminate the new work (so long as it is for non-commercial purposes).[111] This seems to be a fair balance between encouraging creativity/innovation, and protecting the economic rights of original creators. If remixing a copyrighted work leads to a product that the remixer would like to distribute commercially, a licensing agreement could be made with the original creator.

While some of the Bill C-11 amendments to the Canadian *Copyright Act* might, in many ways, encourage the development and evolution of 3D printing, its provisions regarding technological protection measures (aka digital locks) are somewhat problematic. The *Act* states that circumventing digital locks attached to a copyrighted work (even if that work can be legally acquired) would override all the fair dealing and educational exceptions.[112] This essentially allows the owners of copyrighted works with pockets deep enough to install digital locks with the power to deny legal access to their works, which otherwise could be accessed under the fair dealing or the educational exceptions.

As more and more items are created through 3D printing that are both functional and aesthetic, it will become more important to have a universal approach. One solution involves restricting or eliminating the severability test and preventing even semi-functional items from being protected by copyright.[113] Since copyright proves stronger and longer rights terms, 3D printing could lead manufacturers to seek copyright protection for their functional objects, and essentially create what Weinberg calls a "Quasi-patent system, without the requirement for novelty or the strictly limited period of protection."[114] He writes that: "Useful objects could be protected for decades after creation. Mechanical and functional innovation could be frozen by fears of massive copyright infringement lawsuits. [And], articles that the public is free to recreate and

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[109] *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*, 545 U.S. 913 (U.S., 2005) at p. 957 [*Grokster*].

[110] Supra *note* 87 at s 29.21(1).

[111] *Ibid.*

[112] *Ibid* at 41.1.

[113] 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" (November 2010), online: Public Knowledge <http://www.publicknowledge.org> [Weinberg, "It Will Be"].

[114] *Ibid.*

improve upon today (such as a simple mug or bookend) would become subject to inaccessible and restrictive licensing agreements."[115]

Although the American DMCA notice-and-takedown system is not part of the Canadian regime, it does affect Canadians since it shapes what is available online. The system presumes that the copyright owner's right has been violated since once a web host receives a takedown notice, the allegedly infringing file is often removed until the dispute is resolved.[116] However, "Simply recognizing that an uploaded file matches a file protected by copyright is merely the first of many steps to identifying infringement. This is a process better left to courts, not private companies."[117] Private companies are not likely copyright experts and might be intimidated about DMCA takedown notices.

The first take-down request of a 3D printed object's design file demonstrates one of the key flaws with the current regime's protection against copyright infringement. In 2011, Ulrich Schwanitz created a 3D model for the Penrose Triangle, a well-known optical illusion. He began selling printed versions of it through Shapeways' website and claimed that his design was a massive achievement. Shortly thereafter, another designer, Artur83, uploaded another fully functioning Penrose Triangle design to the free, open-source Thingiverse website. Schwanitz tried to get Thingiverse to remove Artur83's file, but was eventually dissuaded by public outcry for him to allow it to remain in the public domain. What's noteworthy about this case is that in reality, Schwanitz never had a copyright in the Penrose Triangle for a number of reasons, including the fact that optical illusions can be patented but not copyrighted.[118] Weinberg points out that: "As 3D printing and modeling grow in popularity, it is likely that we will see more companies and individuals assuming that they have a copyright for a design or object and demanding removal of unauthorized work."[119] As such, as the 3D printing revolution begins, it will become more and more important to inform the general public about some basic copyright and patent principles.

Internet Blueprint provides a number of useful suggestions for copyright reform that could help with the development of 3D printing. These include: shortening copyright terms; strengthening fair use rights; reducing copyright abuse and overreach; and curbing abuses of copyright takedowns.[120] Others suggest that we should: "Vary the terms of copyright as between different kinds of works according to the context of the right and the resource protected by copyright."[121] Any of the aforementioned ideas should be considered in an effort

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[115] *Ibid.*

[116] Weinberg, "What's the Deal," *supra* note 67 at p 5.

[117] *Ibid.*

[118] "What's the Deal," *supra* note 67.

[119] *Ibid.*

[120] Internet Blueprint < http://internetblueprint.org > .

[121] Lametti, *supra* note 83 at 482.

to ensure that 3D printing is regulated fairly and in a way that encourages its development.

Finally, Weinberg suggests that there are three places to look for reasonable and workable rules. The first is the legislature, which: "May take steps to legislate against an imagined dystopic future that would probably never come, cutting off unanticipated positive developments in the process. . .but both [the legislature] can take steps to protect innovation [and] say no when incumbents try to push laws designed to criminalize a new technology."[122] The second place to look is the courts. They can: "React to the unknown by expanding the scope of intellectual property rights and infringement liability in counterproductive ways. . .[but they] can [also] protect legally defensible, but culturally novel, ways of doing business. After all, it was the Supreme Court's refusal to hold the creator of the Betamax liable for copyright infringement that gave us VCRs, DVRs, MP3 players, and more."[123] And the third and most important place to develop rules is the community itself:

> Community norms matter. This is especially true when it's unclear exactly how traditional IP laws apply — if at all. Developing a way to recognize and reward true innovators without relying on costly drawn-out legal battles is the most effective way to stave off the creep of copyright expansion. If there is a system that already works, most people will not need to grasp for novel copyright theories. . .The burden is on the community and the organizations that host the community not to blindly assume that copyright covers everything. . .Until there is better legal clarity, cultural clarity is the best way to protect the development of 3D printing.[124]

In sum, copyright laws affect and will continue to affect the development and potential of 3D printing. Since the technology is still in its infancy and has yet to be adopted by the masses, now is the time for legislators and courts to consider the preceding suggestions and strive to achieve a balance between protecting rights-holders and allowing the technology to flourish.

(b) Patent Law

Since 3D printers can produce functional objects (like the iPhone credit card case), 3D printing can lead to the infringement of patents and is: "Bound to draw the attention of patentees who perceive a real competitive threat to their inventions."[125] While up until now the majority of available CAD designs have been for decorations, games, or pop culture references,[126] which could be subject to copyright law, the widespread availability of 3D printers may lead to more

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[122] "What's the Deal," *supra* note 67.

[123] *Ibid.*

[124] *Ibid.*

[125] Doherty, *supra* note 13 at 355.

[126] *Ibid* at 358.

and more functional and patented items being produced and copied. As such, it is important to consider the current regime of patent law and consider what works and what should be re-evaluated.

There is nothing in the *Patent Act*, which states that downloading, creating, or sharing the design of a patented object constitutes patent infringement. This is quite different from the copyright regime, where simply having a copy of the copyrighted work could constitute infringement.[127] However, unlike the copyright regime, there is no fair dealing provision that permits the unauthorized reproduction or copying of the work. Therefore, using, selling, or even just creating a patented item with a 3D printer could constitute infringement since "making" and "constructing" the invention are exclusive rights of the patentee.[128]

There are a few minor exceptions, which allow users to use patented works without infringing. For example, the *Patent Act* states that a patented invention can be used with regulatory approval.[129] Of course, this would not be particularly useful in the majority of 3D printing cases. More significantly though, there is an exception: "In respect of any use, manufacture, construction or sale of the patented invention solely for the purpose of experiments that relate to the subject-matter of the patent."[130] This provision might help protect users of 3D printing technology who experiment with patented products. Finally, the court in *MacLennan* held that repairing a patented item that you own is not an infringing use.[131] Likewise, "By selling the patented article that he made, the patentee impliedly renounces, with respect to that article, to his exclusive right under the patent of using and selling the invention. After the sale, therefore, the purchaser may do what he likes with the patented article without fear of infringing his vendor's patent."[132] Although this may serve as a defense to patent infringement in some cases, its scope is not equivalent to that of fair dealing in copyright.

The lack of fair dealing patent law has a number of repercussions for the 3D printing community. The following example will demonstrate some of them. Imagine that Alex independently creates a design, which infringes on a patent held by Bob. Even if Alex does not know about the existing patent, he infringes it when he prints the object. While copyright law would allow Alex to print a copyrighted object under certain circumstances (i.e. for educational purposes),

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[127] See *Copyright Act*, *supra* note 87 at s 24(2)(d).

[128] *Patent Act*, RSC 1985, c. P-4 at s 42.

[129] *Ibid* at s 55.2(1).

[130] *Ibid* at s 55.2(6).

[131] *MacLennan c. Gilbert Tech Inc.*, 2008 FCA 35, 2008 CarswellNat 196, 2008 CarswellNat 2435 (F.C.A.) at para. 14 [*MacLennan*].

[132] *Eli Lilly & Co. v. Novopharm Ltd.*, 1998 CarswellNat 1061, 1998 CarswellNat 1062, [1998] 2 S.C.R. 129 (S.C.C.) at para. 99.

patent law generally prohibits Alex from printing a patented object without Bob's authorization.

The fact that sharing files over the Internet is both easy and popular: "Empowers the DIY community to create general public goods in the form of useful things, freely available to anyone with access to a 3D printer,"[133] but it also creates a new set of challenges. In fact, the dissemination of popular or even viral design files could lead to mass patent infringement, much in the same way that the digitization of music and video files have led to mass copyright infringement.[134] Suppose Alex uploads the design to Thingiverse and Shapeways. Uploading the file to those websites would be within Alex's rights, Thingiverse and Shapeways could legally host the files, and anyone could download the designs. Once again, patent infringement only occurs when someone prints the item. If Charles uploads the file to Shapeways and pays them to print him a copy, Shapeways would be infringing on Bob's patent. Interestingly, though, Shapeways' terms and conditions state that the uploader of the infringing design would be liable to Shapeways for any legal costs and judgments that Shapeways would face as a result of the infringing design. Therefore, if Bob is able to successfully sue Shapeways, Shapeways could in turn seek compensation from Alex for initially uploading the design file for the patented object.[135]

These scenarios bring up a number of interesting issues. First, in relation to the remix culture of 3D printing, current patent law actually allows users to tinker with patented design, share them, and collaborate with other designers. However, there is virtually no practical use (other than educational) in designing those files if they cannot legally print them. They could attempt to purchase a permissive license from the patent owner, but that could be an expensive and unfeasible solution for the average user.

While the preceding example involves an undisputed patent on Bob's object, many physical, functional objects are not patented. This is due to a number of reasons. First, an individual must meet many requirements for a patent to be granted. The object must be new,[136] useful,[137] and non-obvious.[138] Each of those requirements breaks down into a number of tests that have been established through Canadian and international case law. In conjunction, those elements already exclude many items from patent protection.

Secondly, the patents on many functional objects have already expired. Weinberg points out that: "There is an entire universe of items that can be freely replicated in a 3D printer."[139] Many previously patented items are now part of

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[133] Doherty, *supra* note 13 at 354.

[134] *Ibid.*

[135] Doherty, *supra* note 7 at 360.

[136] *Patent Act*, *supra* 128 at ss 2 ("invention"), 27(1).

[137] *Ibid.*

[138] *Ibid* at s 28.3.

[139] "It Will Be," *supra* note 113.

the public domain. For instance, the patent for Legos has already expired. This means that anyone can design and print their own pieces, which could be used interchangeably with Lego's official pieces. These can lead to thousands of variations by designers, which could legally be shared with the online global community. In *Kirbi*, for example, a company called Mega Bloks took advantage of the fact that Lego's patent had expired and created similar pieces without including any of Lego's logos. Lego tried to claim a trademark violation, but the court held that the blocks were functional, and therefore only subject to patent, and not trademark.[140] This makes designing and selling Lego-like pieces fair game.

Third, unlike copyright, patent rights do not arise automatically. Instead, people must register their creations, pass the "new and useful" test, and incur a considerable expense doing so. Furthermore, a patent can protect the formulation of many component parts into one functional object, but it does not grant patent rights over each of those components. "It would be illogical," Weinberg notes, "if, by patenting the new combination of old inventions, the patent holder acquired a patent on the old inventions as well. . .Copying unpatented parts of a patented invention is not a violation of the larger patent."[141] That means that the repertoire of available components for designers of 3D printed objects is vast, unless the part itself has a patent.

This also means that many replacement parts of patented items could be printed without infringing patent rights. Since patents can be expensive to acquire, large companies will rarely patent all of their components. Some may be patented, but not all. Replacement parts and 3D printing go together particularly well because if something breaks, it can be hard to find the replacement piece. In a world that incorporates 3D printing, you might be able to go on the manufacturer's website and download (for free or for a fee) a design file for the replacement part. Conversely, if the broken part is used somewhere else in the machine, you could scan it and print a double. "Many objects protected by patent are, in fact, 'combination patents.' Combination patents combine existing objects (some patented, some not) in a new way. Although the new combination is protected by patent, the individual elements (assuming they are not individually protected by patent) are free to be reproduced at will.[142]

In relation to patent law, it is especially important to know whether or not an item is protected. Matthew Rimmer notes that while: "Patent protects fewer objects [than copyright], and protects them for a shorter amount of time, in many ways it protects them more completely [since] there is no exception for independent creation in patent law."[143] Conversely, in the copyright realm,

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[140] *Kirkbi AG v. Ritvik Holdings Inc. / Gestions Ritvik Inc.*, 2005 SCC 65, 2005 CarswellNat 3631, 2005 CarswellNat 3632 (S.C.C.) [*Kirkbi*].

[141] "It Will Be," *supra* note 113.

[142] *Ibid.*

[143] *Supra* note 73.

proving independent creation means there is no infringement. The lack of this exclusion of liability in patent law makes it especially important for users of 3D printers to know whether or not an object is patented.

Infringement implies that there is a valid patent over the object in question. However, determining whether or not an item is subject to a patent is both complex and costly. In fact, some companies hire lawyers and spend thousands of dollars to perform patent searches. Considering the 3D printing community currently primarily consists of DIY enthusiasts and hobbyists, it is unrealistic to expect them to know what is subject to a patent, particularly since the boundaries are not always clear.

A fair dealing component in patent law could enumerate specific situations in which non-commercial printing of patented objects could be acceptable. Up until now, such a provision may not have made sense, but the increasing prevalence of 3D printing and its potential public benefits over time may change that. Unlike copyright, where the accidental reproduction of a particular expression of a work (i.e. a song or a painting) is relatively rare, the race for patents tells a different story. When there is a problem, many individuals or companies may seek a solution. There may only be one or a few, so the likelihood of independent, simultaneous creation of a functional object is more likely. ''For patents to be worthwhile,'' Weinberg notes, ''they had to cover all identical devices, no matter how they were developed. It was assumed that parties vying for a patent were sophisticated and would do a patent search before trying to solve a problem.''[144] However, 3D printing may lead to an environment in which designing and manufacturing shift from large companies to private citizens.[145] Those private citizens would therefore be less sophisticated and less equipped to figure out whether or not their inventions are already subject to patents. A fair dealing provision in patent law would help protect those citizens from being punished for unknowingly infringing on someone else's rights.

On the other hand, there needs to be some balance in order to ensure that legitimate patent owners are protected. Perhaps legislators should consider implementing a notice system for patent infringements, similar to the ''notice-and-notice'' approach used in copyright law.[146] This could reduce the amount of files that could produce patent-infringing objects available on databases like Thingiverse. It would also help prevent users from downloading and subsequently printing protected works, and give patent owners a chance to prevent the unauthorized reproduction of their work.

Another challenge that arises in the area of patent law is that detecting infringement is very difficult. While simple possession or distribution of a copyrighted file could be traced online and could constitute infringement, patent infringement only occurs when the object is printed. When that is done in the

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[144] ''It Will Be,'' *supra* note 113.

[145] *Ibid.*

[146] *Ibid.*

privacy of someone's own home, using a 3D printer that is not connected to the Internet, it can be close to impossible to detect. That aspect is a clear example of how the current patent law system does not align neatly with the increasing use of 3D printing.

So, what might patent owners do to protect their rights if detecting individual use is too difficult? Weinberg suggests that they will likely begin to focus on secondary or contributory infringers with deeper pockets who enable people to reproduce patented work.[147] While it is well established that Internet Service Providers (ISPs) are not liable when they merely act as conduits, *Grokster* has shown us that a company who knowingly (and for its own commercial benefit) promotes the reproduction of protected work could be found liable for inducement. Patent owners might also focus their attention on the manufacturers of 3D printers. Without 3D printers, the argument would go, there could be no reproduction.[148]

Canadian patent legislation does not explicitly discuss what Americans would refer to as contributory, secondary, or induced patent infringement; but Canadian case law has provided some guiding principles. In *MacLennan* the court held that: "First, there must be an act of infringement by the direct infringer. Second, the act must be influenced by the seller to the point where, without this influence, infringement by the buyer would not otherwise take place. [And last], the influence must be knowingly exercised by the seller (i.e. the seller knows that this influence will result in the completion of the act of infringement)."[149] Based on this criteria, it does not appear as though Thingiverse and other current web hosts would be in danger. Thingiverse and most of the other current online databases focus on promoting open-source designs and collaboration and strictly prohibit the use of infringing material through their terms and conditions. However, The Pirate Bay, which consists of *mostly* copyright-infringing material already has a section devoted to sharing 3D design files or "physibles."[150] As the use of 3D printers becomes more widespread, so too will the distribution of files that could produce patent-infringing objects. As such, legislators should begin to consider more specific guidelines concerning contributory infringement.

New legislation should likewise discourage and prohibit patent owners from going after the manufacturers of 3D printers. Affordable home 3D printers are currently relatively basic. Most are quite small and can only use a narrow range of materials. There are certainly a lot of ways the home 3D printer could (and likely will) evolve in the coming years in order to achieve its full potential. Putting undue pressure on manufacturers by leaving open the question of their

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147 *Ibid.*

148 *Ibid.*

149 *MacLennan*, *supra* note 131 at para 13.

150 Evolution: New Category (23 January 2012), online: The Pirate Bay <http://thepiratebay.sx>.

contributory liability could discourage manufacturers from improving their products, and discourage new players from starting their own 3D printing manufacturing businesses.

Finally, it should also be noted that the granting of certain patents could threaten the development of 3D printing. For instance, Intellectual Ventures has already secured a patent for a "manufacturing control system" that would essentially put digital locks on 3D printing files. Paul Marks has noted that: "One of the greatest benefits of 3D printing technology — the ability to make replacement or parts for household object like toys, utensils, and gadgets — may be denied to US citizens thanks to the granting of a sweeping patent that prevents the printing of unauthorized 3D designs."[151] Likewise, Ian Thomson points out that: "The patent could throw a spanner into what is still largely an open source movement, particularly as its language is broad enough not to cover just printing, but also 'painting, engraving, and/or tattooing by the manufacturing machine."[152] Therefore the Canadian Intellectual Property Office may play a significant role in determining how well 3D printing evolves over the coming years and should remain diligent in preventing patents from passing that are too broad and could too harshly impede 3D printing technology's capability to grow.

In sum, while the current copyright system seems relatively well equipped to deal with some of the challenges presented by 3D printing, amendments to patent law should be strongly considered in light of the increasing use of 3D printing. What is needed is: "A remedy that allows legitimate good faith patentees to assert their rights while preserving the benefits that accrue to the public from freely shared designs."[153] Legislators should consider a fair dealing provision as well as a notice system to enable users to have a better of idea of whether they are creating, collaborating, and innovating through 3D printing technology within the bounds of the law. The key problem with the current system is that people could be expected to pay up in remedies for unintentionally infringing someone else's patent rights. This uncertainty would, over time, greatly decrease motivation to create and innovate.

(c) Registered Trademark and Passing Off

3D printing could also lead to the infringement of a third kind of intellectual property. If, in the iPhone credit card case example, the case is sold with Ralph Lauren's trademarked logo on it, that could constitute a trademark infringement. Considering that 3D printing could create a whole new market of counterfeit products, it is important to understand trademark law's relationship with the new technology.

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[151] Rimmer, "Inventing," supra note 73.

[152] *Ibid.*

[153] Weinberg, "It Will Be," *supra* note 113.

Trademark could cover words, logos, graphics, shapes and colour combinations. Therefore, if the iPhone case is shaped exactly like a Coca Cola bottle rather than a Ralph Lauren wallet, that could also constitute infringement. However, trademark cannot cover broad (i.e. descriptive) words or images that would greatly diminish what is available in the public domain, nor can it protect functional or utilitarian features.[154] The *Trade-marks Act* provides that the owner of a trademark has exclusive use over the mark throughout Canada.[155] It also states that a person who is not authorized to use the mark is prohibited from selling, distributing, or advertising wares (i.e. printed publications) or services associated with a confusing trade-mark or trade-name.[156] The protection generally lasts fifteen years.[157] However, unlike copyright and patent protection, trademark protection can be renewed indefinitely, making it potentially the longest-lasting right.[158] That being said, an owner can lose the trademark if it is not used for longer than three years.[159] Even though trademark protects the association between the object and its source, rather than the object itself, trademark can have significant economic value since branding holds strong market value.

Trademark encompasses two regimes: the common law tort of passing off (unregistered trademarks), which has been codified in the *Trademarks Act*;[160] and the statutory regime for registered trademarks in that same *Act*. In order for someone to infringe upon that unregistered trademark, he or she would need to meet three requirements described in the Supreme Court's decision in *Kirkbi*. First, the plaintiff must establish the reputation (or goodwill) in respect of the distinctiveness of the product. Second, the defendant must have created willful, negligent, or careless misrepresentation, which made the public believe that the defendant's item came from the plaintiff. And third, there must be resulting or likely damage to the plaintiff by means of that representation.[161] Registering a trademark adds further protection. However, in order to be registered, the mark must meet the criteria enumerated in section 12 of the *Act*.[162] Unlike unregistered trademarks, registration protects against confusion *and* dilution or depreciation. Moreover, registered trademarks provide protection in Canada, whereas the scope of an unregistered mark may be wider since there is common law protection. With the increase in international e-transactions, passing off can provide a significant source of protection.

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[154] *Trade-marks Act*, RSC 1985, c T-13 at s 13(2).

[155] *Ibid* at s 19.

[156] *Ibid* at s 20.

[157] *Ibid* at s 46.

[158] *Ibid* at s 47.

[159] *Ibid* at s 45(3).

[160] *Ibid* at s 7(b).

[161] *Supra* note 140 at paras 67-68.

[162] *Supra* note 154.

The goals of trademark protection are quite different from those of copyright and patent law. Trademark primarily exists to protect consumers from confusion by: "Giving them confidence that a product marked with a manufacturer's symbol was actually made and backed by that manufacturer."[163] It also, in some situations, helps protect brand equity by preventing the dilution of a company's reputation.

Preventing confusion in the marketplace might be important if and when 3D printing becomes more present in our society. 3D printed reproductions of certain products can be made relatively easily and with great accuracy. As more and more well-made bootlegged physical items reach the marketplace, knowing what is authentic versus inauthentic may be more important than ever before. That being said, the technology is nowhere near being able to produce certain items with the same quality as the originals. Therefore, it might be decades before consumers can actually be confused about the authenticity of their products.

The subsidiary goal of trademark protection can be more problematic with regards to 3D printing. The regime of registered trademarks also prohibits a non-owner from using a registered mark in any way that dilutes or depreciates the value or reputation associated with the mark.[164] The easy distribution of designs that may include a trademarked element can lead to many items inside and outside the marketplace, which may be seen as diluting a brand's goodwill. Trademark owners may seek to expand the protection of trademark in order to prevent such a thing from happening. And, from the user's perspective, there may be concerns about inadvertently creating designs with trademarked elements and being potentially liable for infringement, even if the product was not designed for commercial use. "Unlike traditional trademark," Weinberg writes, "A use that dilutes a 'famous mark' does not need to be in commerce, confuse consumers, or cause direct economic harm to the markholder."[165] Arguably though, some reproductions of a mark (i.e. in counterfeit products) might not actually dilute or depreciate certain kinds of brands. For example, some studies show that a counterfeit market for very high end products can entice people to buy it, and can essentially amount to free advertising. Therefore, as rights-holders may seek to expand the scope of confusion and dilution/depreciation, the reproduction of marks through 3D printing technology might not actually have a negative impact on their brands.

Finally, there are concerns about trademark covering too much and thus creating more inadvertent infringers. Trademarks have in some cases been used to protect shapes (for instance the Coca Cola bottle and many Apple products), colour combinations, and even the distinct look and feel of a product. The more trademark covers, the more infringement is possible.[166] 3D printing creates new

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[163] Weinberg, "It Will Be," *supra* note 113.

[164] *Trade-mark Act*, *supra* note 154 at s 22.

[165] "It Will Be," *supra* note 113.

[166] Bradshaw, *supra* note 2 at 28.

and exciting opportunities for artists who may wish to create sculptures, for instance, which re-appropriate famous trade-marks. Concerns about infringement could therefore prevent free speech and free expression. Trademark law must maintain a balance between those values and the protection of trademark owners' goodwill.

The current system benefits the 3D printing community in several ways. First, because functional features are not covered by trademark, many functional objects that are not subject to patents could be reproduced. Furthermore, an individual who does not care about brands could easily remove a trademarked design or feature from a CAD file and print the item without it. If the original item was only protected by trademark, the copier could even reproduce and sell it.[167]

Trademark protection often takes force in a commercial setting and could protect rights-holders by preventing third parties from profiting off their goodwill by copying and selling illegitimate versions of their products. It can also, in some cases, protect the public by helping people sift the authentic from the inauthentic. However, the fact that trademark protection involves the longest term amongst the major intellectual property regimes means owners may seek to expand its scope in order to protect against 3D printing. It would therefore be wise to ensure that the trademark regime continues to be selective insofar as what is protected and what is not. It is also important to ensure that when someone is accused of infringing, there really is confusion or depreciation.

(d) Industrial Design Protection

Finally, it is worth briefly noting 3D printing's relationship with another important form of intellectual property protection: industrial design. It is well established that the visual appearance of a product can have a significant impact on its success. Industry Canada notes that: "Manufacturers invest a great deal of money and know-how in industrial design and [therefore] original design is considered valuable intellectual property."[168] However, the *Copyright Act* states that (in the absence of some significant exceptions[169]), visual designs (artistic works) applied to useful items of which more than fifty copies are made are not subject to copyright protection.[170] This is done to prevent the lengthy protection of copyright from stifling innovation. [171] Nevertheless, the *Industrial Design Act* seeks a balance by providing an alternate way to protect the designs of mass-produced items.[172]

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[167] Weinberg, "It Will Be," *supra* note 113.

[168] "A Guide to Industrial Designs," online: Canadian Intellectual Property Office < http://www.cipo.ic.gc.ca > ["A Guide"].

[169] See *Copyright Act*, *supra* note 87 at s 64(3) for the exceptions.

[170] *Ibid* at s 64(1).

[171] Hagen et al, *Canadian Intellectual Property Law: Cases and Materials* (Toronto: Emond Montgomery Publications, 2013) at 305 [Hagen].

Industrial design law protects the appearance of products produced on a large scale.[173] "Designs" or "industrial designs" include: "Features of shape, configuration, pattern or ornament and any combination of those features that, in a finished article, appeal to and are judged solely by the eye."[174] No protection is given to any useful articles or methods of manufacturing/construction.[175] For example, the visual features and shape of a perfume bottle (but not its utilitarian functions) or a design on a t-shirt can be protected, but the design for a camera cannot. If the design is inseparable from the product's utilitarian function, industrial design protection is not possible.[176]

In Canada, registered industrial designs are protected for ten years, but must be renewed after the first five.[177] Unlike trademark, unregistered designs are not afforded any protection. Furthermore, a design can be registered any time as long as it has not been published or made public. If it has, then registration must be filed within a year.[178] Finally, the design must be substantially original and already applied to a finished product.[179]

As previously stated, shapes can be protected by trademark law (which offers better and longer protection) as a distinguishing guise. But that shape generally needs to be associated with the product and brand. The advantage of industrial design protection with 3D printing is that when an individual begins producing a new product with artistic features, industrial design protection can give that individual the time needed to get that reputation and make the design a distinguishing guise. Once that happens, it can be protected by trademark.[180] Hagen et al write that: "The monopoly available through industrial design protection can allow for the shape or configuration of packaging to acquire distinctiveness within the marketplace because the industrial design owner can prevent others from making use of the design. As a result, such a design might eventually acquire a protection under trademark law that will continue long after the expiration of the industrial design registration."[181] This is particularly useful for someone planning on selling 3D-printed products on a relatively large scale. If his design is not eligible for copyright or trademark protection, industrial design law can help him develop the distinctiveness required to eventually acquire trademark protection.

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[172] *Ibid.*

[173] Rimmer, "Inventing," *supra* note 73.

[174] *Industrial Design Act*, RSC 1985, c I-9 at s 2.

[175] *Ibid* at s 5.1.

[176] Hagen, *supra* note 171 at 306.

[177] *Industrial Design Act*, *supra* note 174 at s 10(1).

[178] "A Guide," *supra* note 168.

[179] *Ibid.*

[180] Hagen, *supra* note 171 at 307.

[181] *Ibid.*

Infringement of a design can be easy to determine when it is an exact copy, however, differences between the original and the allegedly infringing work can be challenging.[182] Furthermore, simply making (i.e. printing) a protected design would constitute infringement,[183] but there is no statutory provision barring having or sharing a design. Moreover, if the defendant could establish that he did not know and could not reasonably have known that the design was registered when he infringed, he could be exculpated. Home or non-commercial use would probably not attract the attention of the owner of a design right. In sum, users of 3D printing do not have much to fear in terms of industrial design law. Protection is relatively short, and is only given out when a number of conditions are met. On the other hand, users of 3D printing technology have a lot to gain from the protection afforded by the *Industrial Design Act*.

III. CONCLUSION

It is important to understand that 3D printing will not change the world tomorrow, next week, or even next year. It will take many years before we really understand the effect it will have on our society, but based on what 3D printers can already do, it is clear they will have a disruptive effect on a wide range of industries. It is also clear that those industries will try to control 3D printing through intellectual property laws.

The preceding analysis of copyright, patent, trademark, and industrial design protection have led me to the conclusion that while some amendments should be considered over time (particularly in relation to patent law), the current Canadian intellectual property law should not, for now, be amended in light of the emergence of 3D printing. We are currently at a moment in time where the decisions we start making in relation to intellectual property rights will shape the world we live in tomorrow. Any small mistakes we make now could cost us much more later.

That is not to say that we should sit back and play a passive role. Instead: "The [3D printing] community must work to educate policy makers and the public about the benefits of widespread access. That way, when legacy industries portray 3D printing as a hobby for pirates and scofflaws, their claims will fall on ears too wise to destroy the new thing."[184] Likewise, companies should accept the coming changes and understand that the effects and benefits of 3D printing should be embraced and not ignored. The most innovative companies will figure out new business models and harness the potential of 3D printing.

We also need to turn mistakes from the past into solutions for the future. We know, for example, that the more digital locks we create, the more keys will be created to open them. We also know that going after every individual infringer will not work. There will be too many people to sue, and many will not even

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[182] *Ibid* at 311.

[183] *Industrial Design Act*, *supra* note 174 at s 11(1)(a).

[184] Weinberg, "It Will Be," *supra* note 113.

know that they were infringing. We also know that going after the manufacturers of 3D printers will fail because initiatives like RepRap are making it easy to build our own printers off the radar. And finally, we know that going after websites like Thingiverse and Shapeways will strangle the industry at birth and discourage the Internet's global village from developing a rich eco-system of open-source design files that could benefit people all over the world.