Intellectual Property Theory

Professor Friedman

*Qing Wen – LLM*

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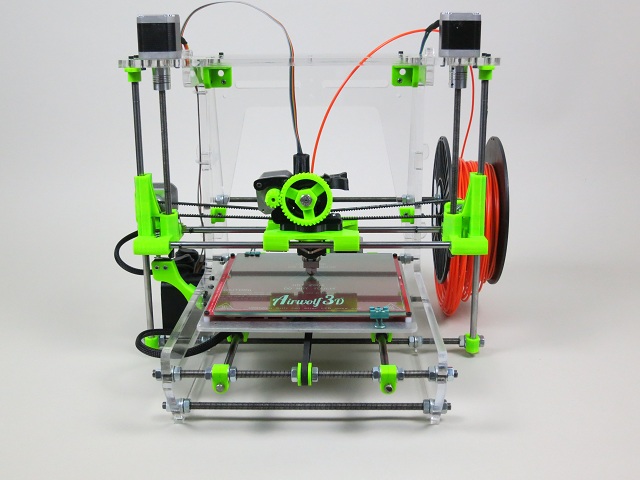
3D Printing Technology – New Challenges to Patents

1. **Introduction**

3D scanning and printing technology has been used for about 20 years. 3D printers have amazing ways to create three-dimensional solid objects from digital data by building them up in layers. The first 3D printer was created in 1984, and since that time various 3D printing technologies have been used in industry to create rapid prototypes and mold masters. Today, 3D printers are also starting to be used in the direct digital manufacturing (DDM) of end-use components and final products. As the availability and ease of use 3D printing technology increases, and the price drops, the technology will gain wider use, and the prospects of disruption will increase. This revolutionary invention, like photo copy machines or the first generation of home used VCR, offers the opportunities to accelerate new applications, but also threats the inventor’s intellectual property (IP) rights, and poses many challenges for the people in the manufacturing chain and small design business.

This paper explores how 3D printing technology will disrupt patents owners’ right. By understanding how patent law relates to 3D printing, it also proposes some solutions to solve the current legal issues and in the same time protect the new 3D printing technologies.

**II. 3D Printing Technology**

  [[1]](#footnote-1)

Airwolf 3D printer $1,695.00 MakerBot Replicator 3D Printer $2899.00

3D printers can make solid objects rapidly and precisely from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process, an object is created by laying down successive layers of material until the entire object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. It starts with making a virtual design in a Computer Aided Design (ACD) file either by using a 3D modeling software to create a brand new object or by using a 3D scanner to gain the CAD files from copying an existing object.

3D printing mainly used for rapid prototyping, manufacturing, modeling and customized products or components by reducing the new product development time, testing and costs significantly. Currently the printing materials offered rang from paper, plastic, metal, ceramics, was, etc. The 3D printing technology has been used in the manufacture of jewelry, footwear, furniture, weapons, spare parts, and even food, as well as in architecture, civil engineering, construction, motor vehicle, aircraft, aerospace, dental and medical industries[[2]](#footnote-2). With the world first 3D nanoscaled printer was invented in Australia announced recently[[3]](#footnote-3), the capabilities of 3D printers are far beyond our imagination.

This rapid technology not only benefits our lives, but it also brings us privacy, moral, ethic, safety, legal related issues and concerns. Same as 2D printing, 3D printing may be misused and infringe IP rights such as copyright, trademark or trade dress. Additionally, 3D printing also challenges people’s patent rights. The world of intellectual property, primarily with respect to patent, is now spinning with speculation and concern about the impact of 3D printers.

**III. Patent and 3D printing**

The promise of 3D printing is that people will be free to make almost anything they want themselves, which opens the door to a new wave of innovation from the home, the start-up, and large firms. [[4]](#footnote-4) The 3D technology provides faster and easier way to design the prototype or invent new objects. For example, your son can make a new toy himself at home, or you can make a customized tool that you cannot find at any store at an affordable price. More and more patents have been created by 3D printers have kept the Patent and Trademark Office (PTO) busy. During the last decade, it (PTO) has received more than 6,800 patent applications related to 3D printing (also known as additive manufacturing). Since 2007, about 680 patents a year have been filed—39.6 percent more than 2002, when 487 patents were filed. Since 2003, the office has granted 3,500 patents related to 3D printing. [[5]](#footnote-5)

Patent law relies, in part, on the premise that the cost of infringement is relatively high, but 3D printing challenges that assumption.[[6]](#footnote-6) Analyst group Gartner recently projected that, by 2018, 3D printing will result in global annual IP losses of approximately $100 billion. Made during the October Gartner Symposium/IT Expo 2013, the forecast was one of ten “Top Predictions for 2014” Gartner released[[7]](#footnote-7). 3D printing brings the premise and challenge of digitalization to tangible goods[[8]](#footnote-8). This digitalized technology makes infringe patented items much easier and quicker, and also it makes the intellectual property infringing investigation harder.

In the new 3D printing world, who are liable for Patent Infringement?

An inventor who obtains a patent is given exclusive rights to make, use, and sell the invention covered by the patent for twenty years[[9]](#footnote-9). On the contrary, the inventor has to disclose the data and information needed to make the invention. “The ultimate goal of the patent system is to bring new designs and technologies into the public domain through disclosure”[[10]](#footnote-10). Currently Digital CAD files used by 3D printer are often open-source and can be downloaded for free from websites such as Thingiverse.com or Tracepart.com. People also can post the CAD files online free. Then it brings an interesting question: if the patent was purely created by a 3D printer rather than hand-crafted, does the inventor have to disclose the CAD files that print the patent object to the public? The answer could be yes. In this case, patented object’s CAD files are free accessible by public domain.

Even thought the CAD files are free to access, the inventor’s exclusive patent rights are protected by law. From people copy and print a 3D automobile part to people print a LEGO figure or a broken household door hinge, they may not even realize that they infringed someone’s patents. In current U.S. patent law, a “fair use” or “personal use” cannot be excused from the patent infringement liabilities. However, it’s hard and unpractical to locate and sue the direct infringers such as individual home users. Patent owners tend to bring the action against the business or companies rather than the end users to pursue the damages more efficiently.

Then 3D printer operators or shops, may also find they are exposed to joint liability for indirect infringement if they assist others to print patented items. Indirect infringement can be induced infringement or contributory infringement. Induced infringement is, in essence, “aiding and abetting another’s direct infringement”[[11]](#footnote-11) and requires a showing that the defendant had the specific intent to cause another to infringe upon the patent in question[[12]](#footnote-12). Contributory infringement “may include either the sale of a component of a patented machine, manufacture, combination or composition (including a component used in a claimed system), or the sale of a material or apparatus for use in practicing a patented process.[[13]](#footnote-13)” However, according to 35 U.S.C. § 271(b) and (c), both induced and contributory infringement requires proving that the infringer had knowledge of the underlying patent and knowledge that infringement would result from his actions. The burden to prove falls on the patent holder.

Patent owners may also try to sue those manufacturers of 3D scanners or 3D printers for contributory infringement, but those suites are unlikely to succeed because their machines can also be used for many non-infringing purposes such as the case of VCR, which was held to be capable of substantial non-infringing use in the copyright context[[14]](#footnote-14). The doctrine of contributory infringement, in 35 U.S.C. 271(c), imposes patent infringement liability on a company that knowingly sells either a special-purpose component of a patented device or a special-purpose device used to practice a patented method, provided the component or device is not “a staple article or commodity of commerce suitable for substantial non-infringing use.”[[15]](#footnote-15)Same theory applies to those manufactures of the raw materials for feeding the 3D printers. The materials are both infringing and non-infringing articles.

Finally the CAD file hosting websites could be vulnerable to litigation for hosting infringing software. Since inducement infringement and contributory infringement require the existence of the knowledge of the infringement, the patent owners may find it’s extremely difficult to prove the web sites’ “knowledge” of the infringement. It’s easy for hosting sites to shift the burden to the users by requiring the user to acknowledge the “Terms and Conditions” before the download. Unlike inducing infringement, the contributory infringement has a territorial limitation requiring contributory acts to occur in the United States. So the U.S. patent law loses its control over the oversea contributory infringers.

**IV. CAD file protections**

The ease with design CAD files made available via the Internet for file sharing means that the owner’s IP rights can easily be abused, particularly at the consumer end of 3D printing. Protecting the patent CAD files become essential.

A. Centralized CAD banks and CAD file licenses.

The approach is to have centralized CAD bank sites to host CAD files of patented items. The inventors, whose inventions are be easily copied by 3D printers, can choose to upload the CAD files of the invention to certain official websites and sell the license to the users.

Licensing of intellectual property rights is an effective tool for achieving the business goals. The success of media libraries such as 'iTunes' indicates that consumers do purchase authorized digital files provided the service is efficient, convenient and prices are reasonable. Licensing out the CAD file for patent or non-patent protected product is another way to reduce the infringement by 3D printing. Ideally, the license is sold per usage (or number capacity of copies) like Microsoft Windows Server software. The user can choose to print what the number of the copies and purchase the license accordingly.

Of course the license costs money. However, the licensed software offers good quality of the CAD files, the safe and virus-free software, precise materials, and customer support. The CAD files license can also bundle with free updates of the product. The users may be interested in some newer version of the products such as jewelry or toys. The authorized CAD websites may offer rapid and complete updates of the products.

B. DMCA takedown notice.

As wide-scale copyright infringement over the Internet is exponentially increased, Digital Millennium Copyright Act (DMCA) takedown is widely used. DMCA is an amendment to [United States](http://en.wikipedia.org/wiki/United_States) [copyright law](http://en.wikipedia.org/wiki/Copyright_law), passed unanimously on May 14, 1998, which criminalizes the production and dissemination of technology that allows users to circumvent technical copy-restriction methods[[16]](#footnote-16). This Act directly addresses thetake down of copyright infringed content from a website (like YouTube) which is publishing content in violation of copyright protection act or content being used without permission or not in accordance to the sworn statement of the content owner[[17]](#footnote-17). A similar approach should be implemented for patent protection. Once a patent owner discovers infringing designs or CADs on a website such as Shapeways without permission, he can contact website to report the infringement and ask to take down the files. Currently Thingiverse has instituted a policy that provides for the removal of material that infringes on any intellectual property right[[18]](#footnote-18). Shapeways has also implemented a DMCA take down notice for protecting copyright and other intellectual rights (including patent and trademarks). This approach will limit the patent infringement becomes too widespread. However, it has to rely on the intellectual property right owners to police the web site or hire someone to monitor it.

To track who is uploading or downloading the CAD files, the website could have a monitor program running at the background and keep the records such as the person’s IP address etc. However, most websites do not care about illegal download or upload since they have shifted the liability to end users by requiring them to acknowledge the “Terms and Conditions” before the download or upload. It always requires the IP right owner’s proactive monitoring and search to guard their rights. Additionally, in order to prevent the pirate CAD bank sites, the patent holder may demand the ISPs to block the illegal websites.

Once the website that host CAD files shifts the liability to the individual users by letting the downloader or uploader acknowledge the intellectual rights he might be liable for before download or upload the files, there could be a chilling effect on those who are risk averse or think that it is immoral to engage in illegal conduct even when they will never be caught[[19]](#footnote-19).

C. DRM software

Digital Rights Management (DRM) is a class of technologies[[20]](#footnote-20) that are used by hardware manufacturers, publishers, copyright holders, and individuals with the intent to control the use of digital content and devices after sale[[21]](#footnote-21); With first-generation DRM software, the intent is to control copying; with second-generation DRM, the intent is to control executing, viewing, copying, printing, and altering of works or devices. Common Digital Rights Management Techniques include: 1) Restrictive Licensing Agreements: The access to digital materials, copyright and public domain is controlled. Some restrictive licenses are imposed on consumers as a condition of entering a website or when downloading software[[22]](#footnote-22). 2) Encryption, Scrambling of expressive material and embedding of a tag: This technology is designed to control access and reproduction of information. This includes backup copies for personal use.[[23]](#footnote-23) DRM software has already been developed in an attempt to combat 3D CAD file piracy. For example, the software works by sending the purchased CAD file in fragments directly to the consumer's 3D printer. The fragments are then automatically deleted after use, allowing the blueprint to be used only once. Digital locks or encrypted license keys placed in accordance with DRM policies can also restrict users from illegal downloads or making copies.

However, the DRM mechanism still cannot prevent someone gain the CAD file by scanning the patented object and print it. Just like 2D printing situation, no one can stop one from printing other’s published book using home printer. It is hard to detect, prevent or control the end users’ infringement unless they already made the impact to the market. However, once the patent right owners or manufactures adopt new business strategies, the infringing activities could be limited.

**V. New business models**

When the 3D printer enters to consumer’s home at the price of 2D printer’s as nowadays, kids can print “My Little Pony” or toys at home. Consumer can replicate a special designed vase from the one bought from Target. There’s no easy way for the patent holders to go after the end users and get damage awards. How will we protect the designer or inventor’s IP rights?

Because of 3D printing changes the ways people gain access to the real tangible products, the small design business or manufacture may also need to change their marketing strategy accordingly in order to response to these challenges.

1. New sell strategy: easy and cheap licenses

A brand that is able to legitimize and license the use of its products for end consumer has to find a new way to connect to its customers. The companies or vendors need to open their intellectual properties and offer a better way to license their product to customers. As they sell the products, they also sell the 3D CAD file licenses to the consumers. To dissuade illegal file sharing, it is better to make the CAD downloading easy and cheap. The legal version of the CADs should overcome the frustrations such as files appearing empty, files containing virus, failing to make real object in the right size, or leak of the support and potential lawsuit, etc.

Rather than opening a new retail store or market, in some respects, now the new store is in the customer’s garage or kitchen. The method of “buying” is the “press button” of print. So efficient licensing schemes should be widely implemented by the vendors. It should provide the license of making product itself, license of using it, license of the CAD files, license of selling and distributing. Just like people buy things as easy as going online, over smart phone apps, store or making phone calls nowadays, they should be able to buy the patent licenses in the same easy ways.

B. Subscription business model

The brand companies may use the subscription business model to recoup the development costs and offset the consumer’s infringement damages. The companies in fashion, dental, toy or hardware fields can offer the consumer the subscription membership for making their products. For example, if your son is a LEGO fun, your daughter is a DISNEY cartoon fun, and you use a lot of HomeDepot tools at home, you will subscribe LEGO, DISNEY and HomeDepot CAD banks’ memberships, so that you can print the LEGO figures, Mickey Mouse or your customized tools at home nice and handy. The vendors may also provide different levels of the memberships that allow a user to access different class of the resources with allowing a different number of downloads.

1. “Reasonable” product price

The vendor should mark their product at a reasonable price. 3D printing requires certain type of printer, materials, CAD digital files, time and labor to make the object. As long as the price that consumer need to spend for buying the product at the market is about the same as (or lower than) he print one, then most people would not bother to risk the liability of lawsuit and print the object on their own. So the damage of the patent rights would be minimized.

The price of product will be adjusted by the market eventually. For instance, almost everyone has printer at home, and people still buying books at bookstore instead of printing or copy them at home. The Kinkos charges $0.20 per double-sided black and white page for copying that is a standard price as offered at other print shops. However, the 1280-page *Patent Law and Policy* book sold at LexisNexis is only priced at $132. Most people would not choose to use home printer if consider the cost for labor, paper, ink, wear and tear of the printer either. So despite of the risk of infringing the author’s copyright, there’s no benefit of printing the book rather than buying it when the price of the book sold at store is almost the same as printing one. The reason why the book sales at bookstore are impacted is surely not because of the existence of the widely used home printers. It could because that the readers are starting to use different tools or medias such as Kindos, iPad, online ebooks to read now.

D. Free CAD files and right to reproduce

The product can also be sold along with “free” CAD files, just like a lot of books are sold with CDs in the bundle. The sale price of the product could have already leveraged the cost of the patent license. The buyers could be allowed to DIY the product if it’s permitted by the vendor or IP right holder.

Under the “first sale doctrine”, the patent rights will be exhausted once an unrestricted, authorized sale of a patented article occurs, the patent holder’s exclusive rights to control the use and sale of that article are exhausted, and the purchaser is free to use or resell that article without further restraint from patent law. However, under current law, the patent owner retains the right to exclude purchasers of the articles from making the patented invention anew, unless it is specifically authorized by the patentee.[[24]](#footnote-24) Additional to the “first sale doctrine”, the patent owners or vendors could authorize the buyers to reproduce the product in the limited scales. This method may only apply to those patented products that are easy to be printed by home 3D printers and are sold at low prices on the market.

**VI. Conclusion**

The3D printing, like the personal computer, Internet and VCR, changed our life. In the same time, it changes the nature of manufactory economy and brings challenges to our legal system. It shifts the opportunity and responsibility for creating workable solutions. If technology makes infringement easy, industry incumbents often seek greater protection from the law. Without more legal protection, some creations or inventions will not occur. [[25]](#footnote-25) The community and the sites that host the design files can develop their rules to protect intellectual property rights and better support the development of 3D printing. The impacted business owners and manufacturers may also need to find ways to adapt new business models aligning with new 3D technology. We will have a better idea of what needs to be done and what can be done once more legal issues of infringement of IP rights via 3D printing technology arise up. This will only be a matter of time.

1. http://static.dezeen.com/uploads/2012/10/Dezeen\_Cube\_3D\_printer\_creations.jpg [↑](#footnote-ref-1)
2. See Matthew Hall, *3D Printing – Top 10 Challenges*, (May 10, 2013)

   http://www.swaab.com.au/knowledge/publications/3d-printing-top-10-ip-challenges/ [↑](#footnote-ref-2)
3. http://www.zdnet.com [↑](#footnote-ref-3)
4. See Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, (2013), http://georgetownlawjournal.org/files/2013/10/Desai-and-Magliocca-3D-Printing-Draft.pdf [↑](#footnote-ref-4)
5. See Heesun Wee, *The ‘gold rush’ for 3D printing patents*, CNBC (August 15, 2013), http://www.cnbc.com/id/100942655 [↑](#footnote-ref-5)
6. *See* Davis Doherty, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J.L. & TECH 353 (2012); Daniel Harris Brean, *Asserting Patents To Combat Infringement Via 3D Printing: It’s No Use*, 23 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 771 (2013). [↑](#footnote-ref-6)
7. See Brian J. Vogel *IP: Five 3D Printing headlines and the law issues they raise*, (Nov. 2013) http://www.insidecounsel.com/2013/11/12/ip-five-3d-printing-headlines-and-the-law-issues-t [↑](#footnote-ref-7)
8. See Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, (2013), http://georgetownlawjournal.org/files/2013/10/Desai-and-Magliocca-3D-Printing-Draft.pdf [↑](#footnote-ref-8)
9. 35 USC § 154 (2014) [↑](#footnote-ref-9)
10. *Bonito Boats*, 489 U.S. at 151. Also see Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, (2013), http://georgetownlawjournal.org/files/2013/10/Desai-and-Magliocca-3D-Printing-Draft.pdf [↑](#footnote-ref-10)
11. CHISUM, *supra* note 44, § 17.04; *see also* Nat’l Presto Indus., Inc. v. W. Bend Co., 76 F.3d 1185, 1194 (Fed. Cir. 1996) (“The statutory liability for inducement of infringement derives from the common law, wherein acts that the actor knows will lead to the commission of a wrong by another, place shared liability for the wrong on the actor.”). [↑](#footnote-ref-11)
12. *See* Symantec Corp. v. Computer Assocs. Int’l, Inc., 522 F.3d 1279, 1292 (Fed. Cir. 2008). [↑](#footnote-ref-12)
13. See Arris Group, Inc. v. British Telecomms. PLC, 639 F.3d 1368, 1376 (Fed. Cir. 2011) (internal quotation marks omitted). [↑](#footnote-ref-13)
14. *See* Sony Corp. v. Universal City Studios, Inc., 464 U.S. 417 (1984). [↑](#footnote-ref-14)
15. http://www.uspto.gov/web/offices/pac/mpep/documents/appxl\_35\_U\_S\_C\_271.htm [↑](#footnote-ref-15)
16. See Wikipidia *Digital rights management*, http://en.wikipedia.org/wiki/Digital\_rights\_management#cite\_note-Ross-1 [↑](#footnote-ref-16)
17. http://www.dmca.com/FAQ/What-is-a-DMCA-Takedown [↑](#footnote-ref-17)
18. *See Intellectual Property Policy*, THINGIVERSE, http://www.thingiverse.com/legal/ip-policy [↑](#footnote-ref-18)
19. See Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, (2013), http://georgetownlawjournal.org/files/2013/10/Desai-and-Magliocca-3D-Printing-Draft.pdf [↑](#footnote-ref-19)
20. "22: Copyright and DRM". *Security Engineering*. WILEY. [↑](#footnote-ref-20)
21. ["The Changing Attitude Toward DRM"](http://www.giantstepsmts.com/digitalrightsbookpreface.htm). *Digital Rights Management: Business and Technology*. M&T Books. Also see [Digital rights management for content distribution](http://dl.acm.org/citation.cfm?id=827994). Dl.acm.org. Retrieved on 2013-07-29. [↑](#footnote-ref-21)
22. See Wikipidia *Digital rights management*, <http://en.wikipedia.org/wiki/Digital_rights_management#cite_note-Ross-1> [↑](#footnote-ref-22)
23. See Wikipidia *Digital rights management*, http://en.wikipedia.org/wiki/Digital\_rights\_management#cite\_note-Ross-1 [↑](#footnote-ref-23)
24. *See, e.g.*, *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1336 (Fed. Cir. 2006) (holding the patent exhaustion doctrine inapplicable in self-replicating seed case in part because the second generation of seeds were never sold). *See also Aro Mfg. Co. v. Convertible Top Replacement Co.*, 365 U.S. 336 (1961); *Morgan Envelope Co. v. Albany Perforated Wrapping Paper Co.*, 152 U.S. 425 (1894); *Cotton-Tie Co. v. Simmons*, 106 U.S. 89 (1882); *Husky Injection Molding Sys. v. R&D Tool & Eng'g Co.*, 291 F.3d 780 (Fed. Cir. 2002). Also see Wikipedia *Exhaustion Doctrine.* [↑](#footnote-ref-24)
25. See Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, (2013), http://georgetownlawjournal.org/files/2013/10/Desai-and-Magliocca-3D-Printing-Draft.pdf [↑](#footnote-ref-25)