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## **3D Printing and the Future of Intellectual Property**

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June 2014

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Keywords: 3D Printing, 3D Printer, Additive Manufacturing, Intellectual Property, Copyright, Patent, Policy

*Abstract: Provides a brief background of 3D printing, and contributes a focused discussion of the implications of 3D printing technologies in the world of information management and intellectual property, specifically copyright and patent laws and the development of policies to govern this burgeoning domain.*

## Introduction

Sometimes referred to as a “disruptive and transformative technology,”<sup>1</sup> 3D printing is a relatively new additive manufacturing process developed over the past few decades. At its essence, a 3D printer uses a digital model to create a three-dimensional solid object, typically by building up layers of liquid plastic on top of one another<sup>2</sup>. One can imagine the impact this technology would have on the manufacturing industry - enabling more rapid prototyping and increased flexibility in the design process<sup>3</sup>, but as Michael Weinberg, a staff attorney at Public Knowledge<sup>i</sup> and author of several whitepapers on the subject states, “3D printing is a tool and, like any tool, can be used for productive and not-so-productive purposes.”<sup>4</sup>

In recent months, 3D printing has been in the news for a variety of reasons, because of ethical concerns about printing biomedical implements,<sup>5</sup> its use in aerospace and defense technologies,<sup>6</sup> and questions about safety and regulations concerning 3D-printed weapons.<sup>7</sup> Also alarming, the burgeoning stock prices of 3D print companies potentially could indicate the growth of an economic bubble.<sup>8</sup> And finally, there are growing concerns about intellectual property and legal issues.<sup>9,10</sup> Clearly, it is a particularly salient time to discuss 3D printing, at the apparent dawn of its ubiquity in our society; a time when society can still influence policy and reexamine about the approach to this new technology. This research note briefly touches on each of these issues, but primarily focuses on the implications of 3D printing technologies in the world of information management.

Given the potential implications that this technology has on manufacturing processes, it is not surprising that one can barely get through reading the news without seeing some mention of 3D printing. Individuals and businesses are increasingly saving money by making customized designs at lower time and material costs. One designer for a motorsports technology company has been using 3D printing for non-functional prototypes in his company for the past five years, and claims that on one single project, “a total of £80,000 was saved using 3D printing.”<sup>11</sup> There

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<sup>i</sup> Public Knowledge is a non-profit Washington, D.C.-based public interest group that is involved in intellectual property law.

are countless success stories on the web about cost savings achieved by this emergent technology. Though the financial barrier to entry was high in the early days of development,<sup>12</sup> there are now desktop versions of 3D printers that can be obtained by individuals and small businesses. A low-end model on Amazon.com® can be purchased for less than \$400.<sup>13</sup>

Canalys estimates that the global 3D printing industry – including printer sales, materials, and associated services – grew to \$2.5 billion in 2013, and is set to rapidly grow 52.0 percent in 2014 to \$3.8 billion.<sup>14</sup> And the market research firm forecasts that the pace of growth will continue to grow strongly, advancing at a compound annual growth rate of 45.7 percent from 2013 to 2018. Gartner has gone on record to predict, “That by 2015, seven of the 50 largest multinational retailers will sell 3D printers.”<sup>15</sup> Clearly, the market is growing, and has not yet settled - *Forbes* expects that this will almost certainly bring peril upon some investors and companies, but it appears the public’s appetite for 3D printing is here to stay.<sup>16</sup>

Aside from the commercial consumer market, 3D printing technologies have made significant inroads into the biomedical field, from custom-printed eyewear<sup>17</sup> to prosthetic limbs<sup>18</sup>, to printing living organs and tissue<sup>19</sup>. Peter Basiliere, research director at Gartner, makes a good point that,

“These initiatives are well-intentioned, but raise a number of questions that remain unanswered. What happens when complex 'enhanced' organs involving nonhuman cells are made? Who will control the ability to produce them? Who will ensure the quality of the resulting organs?”

In the same way that small-scale manufacturers like the motorsports technology company mentioned above have created demand for 3D printers, there is a great need for this low-cost, accessible technology in geographic locations whose population has poor access to health care,<sup>20</sup> regardless of how global stakeholders choose to answer the “bioethical” questions posed by Basiliere.

Along with these relatively benevolent applications for 3D printing technology comes a darker side - or, what some might consider more morally troubling implications associated with

the freedom to produce any object that can be dreamt up and designed in the privacy of one's home. There have been several recent successful attempts to duplicate and distribute "non-duplicatable" keys typically used by law enforcement personnel for handcuffs and prison doors.<sup>21</sup> Perhaps even more troubling is the case of "The Liberator"—a fully-functioning, plastic, 3D printed gun that was created by Cody Wilson in 2012 and posted to a 3D design file sharing site (more on this site later). Mr. Wilson's pattern for The Liberator was downloaded more than 100K times in two days before the U.S. State Department removed it from the website. Mr. Wilson was a twenty-something law student when he created the pattern and founded an organization called "Defense Distributed," which describes itself as "non-profit anti-monopolist digital publishing."<sup>22</sup> Aside from the thought that anyone with access to a 3D printer and an Internet connection could print off a gun, the plastic nature of The Liberator makes this scenario especially frightening. Plastic weapons are currently not caught by traditional security metal detectors, like those in airports or in other secure locations. Carole Cadwalladr, a reporter for *The Guardian*, stated:

"It's one thing to be pro-Edward Snowden, pro-internet privacy, pro-open source movement. And it's another to be pro-the freedom to print off your own assault weapon. And it's this discomfort that Cody Wilson is reveling in ... In fact, the issues that 3D guns raise are more complicated, sophisticated and ultimately unknowable than might first appear. Wilson and Defense Distributed are pushing at the margins of the internet, the margins of freedom, of what the ramifications of this technology will mean. And it's impossible to know. Technology is changing our relationship with everything."<sup>23</sup>

The type of change that Cadwalladr describes is inherent to technology, and one might ask about the precedent of other, similar technological advancements in the past, like the copy machine, or the printing press. Weinberg suggests, "...computers were not the first time that incumbents welcomed new technologies by attempting to restrict them. The arrival of the printing press resulted in new censorship and licensing laws designed to slow the flow of the spread of information."<sup>24</sup>

Clearly, there are precedents in the realm of information management that we can call upon to guide our policy decisions when we consider how 3D printing impacts intellectual property and vice versa. What is slightly different between 3D printing and printing presses/copy machines of old is perhaps the level of proliferation that 3D printing has, and will have, with the public. As Baase suggests, "... earlier technologies were not nearly as serious a challenge as digital technology."<sup>25</sup> Therefore, it may be more appropriate to look at more recent historical examples for guidance, such as the case of Napster and other peer-to-peer file sharing sites in the 1990s and early 2000s. The distribution model used by Napster, Kazaa, and others is similar to 3D design distribution sites like Thingiverse.com (we will discuss this more later). The Recording Industry Association of America (RIAA) eventually was successful in serving a copyright infringement lawsuit to Napster,<sup>26</sup> but neither the result nor the rules may be as cut and dried for 3D printing. Regardless, there is some evidence that product makers are concerned about their intellectual property, and wonder if "3D printers might hurt the physical product market like digital media hurt the music industry."<sup>27</sup>

Before diving into the intricacies of intellectual property and 3D printing, it will be important to understand how 3D designs are created and distributed. As mentioned above, a file for the design of an object must be created or obtained before a system can print the object. This design file is typically one that is created on a computer with Computer Aided Design (CAD) software, much like the software that architects use to model buildings.<sup>28</sup> Once the CAD design file has been generated, it can be shared in the same way one might share any other document—through email or FTP, over a cloud server, on a portable USB drive, etc. Suppose that someone decided to use a 3D scanner to create a 3D model of a vase they own. If they know their friend Jane loves the vase, they can send Jane a copy of the CAD file. Jane receives the file and prints out her an identical copy of the vase on her 3D printer. The original model owner might also choose to upload the CAD file of the vase to a website like *Thingiverse.com*. On a site like this, anyone can download CAD models to print, or make modifications to the original design, and repost it as their own creations. Is this breaking the law by creating a digital copy of a vase? Did Jane break

the law by infringing upon any copyrights—either the original model designer, or that of the original vase designer? Is *Thingiverse.com* as guilty as Napster of distributing licensed-works? Perhaps not.

In order to answer these questions, let us first review the differences between copyrights, patents, and trademarks. All three are types of intellectual property.<sup>29</sup> As Michael Weinberg simply put it, “Generally speaking, copyright covers creative works, patent covers technical works, and trademark covers the ways in which goods are identified in the marketplace.” Artists or content creators do not have to seek out obtaining a copyright on their work; it is received as soon as the work has been created, and it lasts for the creator’s natural life and protects their work 70 years after their death.<sup>30</sup>

Patents are different from copyrights because a creator or inventor must apply for a patent, it is not granted automatically, as with copyright. Furthermore, the invention must be “new, useful, and non-obvious.” Once a patent is obtained for an object, unauthorized reproduction is not allowed, even if the individual doing the reproduction is not aware of the original.<sup>31</sup> Patented works are only protected for 14 or 20 years (depending on whether it’s a design patent or a utility or plant patent).<sup>32</sup> As stated in U.S. Patent Law (Title 35 U.S. Code, Section 101), “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”<sup>33</sup>

So where does leave 3D printed works, you ask? The answer is, in a very gray area. Weinberg says that:

“the result of all of this is that only a small portion of the objects coming out of a 3D printer will actually be protected by intellectual property: those objects protected by copyright and some number of useful objects protected by an active patent. The rest – those objects that do something but are unprotected by patent – will be free to be used by anyone for any purpose.”<sup>34</sup>

It is possible, however, to protect a useful object with a copyright using the concept of severability. As defined in the legal dictionary, severable refers to, “a contract that can be divided and apportioned into two or more parts that are not necessarily dependent upon each other.”<sup>35</sup> Hence, the intellectual property for an object that has some useful parts as well as some artistic parts can still be protected under copyright. Consider modern video games: most game studios employ designers and artists that produce very distinct visual aesthetics—this intellectual property is copyrightable. The utilitarian aspects of a video game, like the algorithms and code on the back end, are not copyrightable. Weinberg suggests a few rules for finding severability in these cases:

1. Look to see if any potentially severable elements were driven by utilitarian needs,
2. Determine if there are creative elements that were designed without regard for functional requirements,
3. Determine if independent, artistic judgment drove the creation of the non-functional elements.<sup>36</sup>

That said, 3D CAD files are still within the realm of copyrightable work, but the law limits the protection to say, “The design of a useful article ... shall be considered [a work eligible for copyright protection] only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article. 17 U.S.C. § 101.”<sup>37</sup>

Now that it has been established that these designs can be copyrighted, the nature of 3D printing brings us back to questions about copyright infringement when 3D designs are printed, scanned, shared, and/or modified. Theft of intellectual property is a huge concern with this emerging technology. Along with the forecasts for financial gains within this industry, Gartner predicted that on a global scale, 3D printing will be responsible for a loss of “at least \$100 billion per year” by 2018. <sup>5</sup> That doesn’t give us much time for legal precedents (though there have been a few, like the case of Ulrich Schwanitz’s Penrose triangle).<sup>38</sup>

In one of his whitepapers on 3D printing, Weinberg explains that it is legal for someone to use a 3D scanner to scan an object and create a CAD file, even if the object is protected by copyright. This CAD file would not be protected by copyright. If that person wanted to distribute the CAD file, they would need permission from the individual who controls the copyright of the original object. If an individual created a work in a CAD program (read: did not scan an object), that CAD file would be protected by copyright, and the creator would need to provide permission for any printing, copying, or distribution. He suggests that rights-holders distribute their work under something akin to a Creative Commons license:

“Attaching a Creative Commons license is a signal that the creator wants to include her work in an ever-expanding and evolving network of creativity. It gives the rest of the community confidence that they can build on the object ... Every object on Thingiverse lists information about what it’s derived from and what has been derived from it. This has created a rich ecosystem of creation, design and innovation.”<sup>39</sup>

This sense of creative freedom and iterative improvement is deeply engrained within 3D printing; in fact, most 3D printers can print their own replacement parts. Jonathan Palecek, writer for Creative Commons, says,

“A large portion of why the RepRap (Replicating Rapid-prototyper, a low-end 3D printer) is so interesting is that the schematics are released under the GNU GPL copyleft license. This means that anyone can copy and improve the project as long as they share alike their modifications, just as one must with GPL’ed free and open source software.”<sup>40</sup>

It seems that Richard Stallman, creator of the GNU movement, would agree. Baase writes, “[Stallman] points out that the primary purpose of copyright, as stated in the U.S. Constitution, is to promote progress in arts and sciences, not to compensate writers.”<sup>41</sup>

Given Gartner’s projections about monetary losses due to IP theft,<sup>42</sup> it is clear that this is the type of environment where thieves will likely thrive until there are clearer regulations in play. Brianna Ford, from American University’s Washington College of Law *Intellectual Property Brief* surmises that,

“Although there will likely be issues with trade secret if a design is misappropriated, there is no special trade secret issue due to 3D printing that will change the law. However, 3D printing could change the way we view copyright, patent and trademark law because the technology covers all of these at the same time.”<sup>43</sup>

## **Conclusion**

Weinberg suggests that the future may include a kind of “quasi-patent system” where useful 3D printed objects may be protected differently than they are under today’s current laws.<sup>44</sup> As with other emerging information management issues, policy implications surrounding 3D printing are just breaching the surface of public attention, so it is particularly important to discuss them at this time. The development of new 3D printing policy will need to respond and adapt to issues that one might not be able to anticipate now, as this technology is still relatively new. 3D printing allows a reexamination of society’s views on intellectual property in the age of modern technology, and provide an opportunity to make changes where existing systems are not fulfilling current and future needs. The next few years will be interesting to observe, as 3D printing units become less expensive, more widely available to the public, and as the technology improves to use more ubiquitous 3D printing in non-plastic materials (i.e. metal, glass, ceramic, etc.), allowing for expansion into new markets. As Michael Weinberg said, “Just as with the printing press, the copy machine, and the personal computer before it, some people will see 3D printing as a disruptive threat. Similarly ... [others] will see [it] as a groundbreaking tool to spread creativity and knowledge. It is critical that those who fear not stop those who are inspired.”<sup>45</sup>

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