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# Legal and Social Implications of the 3D Printing Revolution

Alexander J. Mendoza  
*Claremont McKenna College*

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**CLAREMONT MCKENNA COLLEGE**

**LEGAL AND SOCIAL IMPLICATIONS OF THE 3D PRINTING REVOLUTION**

SUBMITTED TO

PROFESSOR RALPH A. ROSSUM

AND

DEAN NICHOLAS WARNER

BY

ALEXANDER JORDAN MENDOZA

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ALEXANDER JORDAN MENDOZA

Claremont McKenna College

### ABSTRACT

Emerging 3D printing technologies bring with it the potential to transform everyday consumers into manufacturers of every product imaginable. However, this impending wave of newfound technological capability is bound to crash against our present conventional system of laws and regulations. In this paper, the strengths and weaknesses of our current intellectual property framework are examined, and its ability to tackle the future 3D printing market is assessed. Particular attention is paid to our modern formation of copyright and patent law, including an analysis of the Digital Millennium Copyright Act (DMCA), the Repair-Reconstruction Doctrine and other substantial legal protocol. The legal battle between the Napster file-sharing service and the larger music industry is also explored, as it provides key insight into similar intellectual property divergences that may soon drive a stake between 3D printing businesses and more traditional manufacturers of physical goods. Finally, this paper suggests modifications to be made towards traditional sales models, the Repair-Reconstruction Doctrine, the implementation of the DMCA protections, and our application of the Fair Use Doctrine.

### **Introduction: Expanding the Technological Horizon**

“...Let me whisper in your ear. Let me tell you the thing that I decided while I spent ten years in lockup...I’m going to print more printers. Lots more printers. One for everyone. That’s worth going to jail for. That’s worth anything.”<sup>1</sup>

In Cory Doctorow’s collection of fictional short stories titled *Overclocked*, a world is imaginatively illustrated where 3D printing has not only changed manufacturing of goods, but also “laid waste to every industry” that previously relied on copyright, patents, and other intellectual property protections<sup>2</sup>. The protagonist, who is recently released from prison after extensive “printcrimes”, struggles to cope with a reality where 3D printing of “blenders...pharma[ceuticals]...laptops and designer hats” will continue to run him into legal repercussions<sup>3</sup>. In the short story, 3D printers are feared for their ability to turn individuals, such as the protagonist, into deadly individual mass manufacturers of illegal goods. Only a complete annihilation of the printing technology can spell victory for the “ipolice” who roam the streets in search of illegal underground printing, likely in an attempt to revert to traditional manufacturers as the primary source of trade<sup>4</sup>.

3D printing no longer subsists merely as a science-fiction fantasy; it is quickly becoming the next innovative technology of the modern era, with enough momentum to transform almost every facet of modern culture. The concept of 3D printing (or additive manufacturing), however, has been used for several decades. In the mid-1980’s, Chuck Hill designed and utilized a process of solid imaging, also known as stereolithography,

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<sup>1</sup> Doctorow, Cory. “Printcrime” In *Over Clocked: Stories of the Future Present*, 4. Philadelphia: Running Press, 2005.

<sup>2</sup> Ibid., 1.

<sup>3</sup> Ibid., 3.

<sup>4</sup> Ibid., 2.

which utilized a concentrated stream of ultraviolet light to cure and solidify layers of material to slowly create tangible objects in three-dimensions<sup>5</sup>. Since then, additive manufacturing has evolved into a more efficient process that allows users to create physical objects in hours rather than days. The design of these physical objects, however, begins with a CAD file, or computer-aided design file. CAD files can be created from scratch using simple 3D modeling software available online, or created through complex 3D scanners that record object dimensions from several angles. Simply put, CAD software creates cross-sections of the design object to create more print-accessible components, creating a compressible and downloadable digital blue-print of sorts. CAD files can be distributed and downloaded as complete designs from several online open-source domains such as *Thingiverse* or *Piratebay* that offer these digital renderings of tangible objects for free. Other 3D printing resources, like *Shapeways*, offers a marketplace for consumers to buy and sell objects through the 3D printing capabilities of the company itself, rather than sharing digital files of the objects and designs. Just as an individual could search, locate, and download a contemporary hip/hop song for free online, individuals can now acquire the digital foundations of physical objects with similar ease.

Different models of 3D printers employ different methods to manufacture these physical objects. The MakerBot Replicator 2 model 3D printer, for example, injects bioplastic material heated from a corresponding laser beam that can operate on 3 separate axes to create overlapping layers of resin on the machine baseplate, with this process

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<sup>5</sup> "Stereolithography." Materialize. Accessed September 1, 2014. <http://manufacturing.materialise.com/stereolithography>.

being repeated several times over to create a series of layers, even as thin and delicate as 16 micrometers (.016 millimeters), that eventually combine to create the target design<sup>6</sup>. Though various plastic compounds serve as the primary medium for 3D printing at the commercial level, modern printers can utilize materials such as, but not limited to: gold, bronze, brass, ceramic, wax, steel, synthetic wood resin, sterling silver, nylon and even platinum<sup>7</sup>. Carbomorph, a material that can detect changes in temperature, pressure, and various different forces through differences in electrical resistance, is also emerging as a completely distributable material<sup>8</sup>. Down the road, carbomorph could be used to print products with complex features, such as fully functioning circuit boards<sup>9</sup>. Even today, other advanced printing technologies have allowed for the manipulation of concrete for housing designs, sugar for edible food designs, and even living tissue cells of individuals to create working replacement human organs<sup>10</sup>. 3D printers of the future also maintain the possibility of self-replication, or the ability to print an identical printer. The Reprap, a British designed 3D printer, can already print roughly 50% of it's own structural components; a possible foreshadow of Cory Doctorow's once fictional aspirations of

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<sup>6</sup> Petronzio, Matt. "How 3D Printing Actually Works." Mashable. March 28, 2013. Accessed September 1, 2014. <http://mashable.com/2013/03/28/3d-printing-explained/>.

<sup>7</sup> "3D Printing Materials." Shapeways. Accessed September 1, 2014. <http://www.shapeways.com/materials>.

<sup>8</sup> "3D Printed Carbomorph Circuit Boards." ENGINEERING.com. Accessed November 26, 2014. <http://www.engineering.com/3DPrinting/3DPrintingArticles/ArticleID/7539/3D-Printed-Carbomorph-Circuit-Boards.aspx>.

<sup>9</sup> Ibid.

<sup>10</sup> Desai, Deven. "3D Printing and the Digitization of Things." *Georgetown Law Journal*, 2014.

printing technologies<sup>11</sup>. 3D printing has the potential to both amaze and simplify; from creating objects as complicated as working camera lenses, clothing garments, acoustic guitars, and lethal firearms, to objects as simple and useful as a plastic replacement hinge for baby strollers.

Still, 3D printing is a largely unknown phenomenon within the current social climate. Additive manufacturing, sees most of its use by larger established manufacturing companies, ranging from prototypical aesthetic designs for Ford automobiles, to the construction of lightweight and durable cooling vents and cockpits in the aerospace industry<sup>12</sup>. On the consumer scale, 3D printing has been made relevant by a small but growing population of hobbyists and enthusiasts that continuously push the boundaries for independent creations of work through smaller but still capable printers engineered for home use. Current consumer technology makes the use of printers more a process of trial and error, rather than a one-click process to produce simple objects and designs for personal use. Just as printers of two-dimensional materials often jam or break even with simple tasks, 3D printers and those who wield them often come to manufacturing standstills. Despite current limitations, 3D printers have the potential to completely revolutionize consumer capability and convenience. “Low-cost, easy to use, accessible tools will change the way we think about physical objects just as radically as computers changed the way we think about ideas”<sup>13</sup>.

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<sup>11</sup> *RepRap Open Source Printer*. Youtube, 2014. Film.

<sup>12</sup> "3D Printing Scales up." *The Economist*. September 7, 2013. Accessed November 26, 2014. <http://www.economist.com/news/technology-quarterly/21584447-digital-manufacturing-there-lot-hype-around-3d-printing-it-fast>.

<sup>13</sup> Weinberg, Michael. "IT WILL BE AWESOME IF THEY DONT SCREW IT UP." *Public Knowledge*. November 1, 2010. Accessed November 26, 2014.

### **Printing as the Next Progressive Technology, or Industrial Counter-Revolution**

Just last year during the State of the Union Address in February of 2013, President Obama stated that 3D printers and materials bring the “potential to revolutionize the way we make almost everything”<sup>14</sup>. As made evident by the President, the technology has just recently started to permeate through the imaginations and awareness of the public body. Yet, various predictions of the technology’s growth estimate that the use of printing will spread at an almost unprecedented rate. According to a Wells Fargo wealth management prediction, 3D printing is estimated to grow from a \$288 million market to one worth \$5.7 billion by just 2017, with a compound annual growth rate of almost 82%<sup>15</sup>.

Predictions regarding 3D printing’s impact on the American economy have been chiefly positive; with the potential to help both small business as well as larger enterprises. The streamlined process of additive manufacturing effectively lowers barriers to entry for upcoming businesses or startups, who are now enabled to design, print, and experiment with products in an in-house atmosphere, more free from financial constraints<sup>16</sup>. This blurs any boundaries standing between smaller and larger businesses, as “economies of scale no longer provide a substantial edge” in favor of the larger

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<https://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf>.

<sup>14</sup> Gross, Doug. "Obama's Speech Highlights Rise of 3-D Printing." CNN. February 13, 2013. Accessed November 26, 2014.

<http://www.cnn.com/2013/02/13/tech/innovation/obama-3d-printing/>.

<sup>15</sup> Moskowitz,, Michael J. "Beyond 2014: Evolving Opportunities in Technology." *Wells Fargo*, February 1, 2014, 6.

<sup>16</sup> Desai, Deven. "3D Printing and the Digitization of Things." *Georgetown Law Journal*, 2014.

party<sup>17</sup>. Larger corporations, on the other hand, might be able to independently manufacture and distribute components not feasible or economical before. This newfound capability could potentially reduce our traditional dependency on overseas manufacturers and help to revitalize the domestic job market, as well as allowing big business to hold lower inventories, reduce shipping and environmental costs and avoid other risks associated with contracted work done overseas<sup>18</sup>.

While it is unlikely that 3D printing advancements follow a trend of true exponential growth, resembling a pattern similar to Moore's Law prediction concerning computer processing advancements, for example, it is reasonable to assume that printing capabilities will reach unforeseeable heights and produce unfathomable outcomes; starting for a cost as low as \$500 a machine<sup>19</sup>. In fact, the last technology to have such an impact on our ability to share information and spur mass production to such an extent, ironically, may be the original printing press; the framework and foundation for all subsequent printing technologies<sup>20</sup>.

Still, with every advance in this technology comes a new dilemma within the sphere of intellectual property, product liability, and the entire relationship between the consumer and the manufacturer at large. Printing technologies don't just bring the

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<sup>17</sup> Ibid.

<sup>18</sup> Katyal, Neal. "Disruptive Technologies and the Law." *Georgetown Law Journal*. August 1, 2014. Accessed September 1, 2014.

<http://www.lexisnexis.com/hottopics/lnacademic/?shr=t&sfi=AC00NBGenSrch>.

<sup>19</sup> Desai, Deven. "3D Printing and the Digitization of Things." *Georgetown Law Journal*, 2014.

<sup>20</sup> Fallows, James. "The 50 Greatest Breakthroughs Since the Wheel." *The Atlantic*. October 23, 2013. Accessed November 26, 2014.

<http://www.theatlantic.com/magazine/archive/2013/11/innovations-list/309536/2/>.

manufacturer closer to home, they make it synonymous with the home entirely. Additive manufacturing removes the technological capabilities monopoly from the manufacturer's grasp, allowing the individual to become the source of design, production and replication<sup>21</sup>. In the long run, 3D printing has the ability to completely shake intellectual property to its core, as it "decentralize[s] the means of production and challenge[s] many of the assumptions on which modern IP law[s] are based"<sup>22</sup>. In this fashion, the 3D printing revolution has also been dubbed the 'counter-industrial revolution', or the next big disruptive technology<sup>23</sup>. Leading intellectual property lawyers, for instance, predict that over \$100 billion in intellectual property losses will occur as a result of 3D printing technologies by just 2018<sup>24</sup>. It seems then that 3D printing has equal potential to both spur innovation and significantly stress our current legal frameworks.

### **Learning from Napster: Handling the Potential for Disruption**

Though the mass accessibility of additive manufacturing is an unprecedented technological marvel, it is not the first disruptive technology to enter into a hostile legal arena. In fact, the introduction and widespread use of music sharing databases such as Napster helped shape the legal environment 3D printing may soon inhabit. Moreover, Napster helped forge the foundation of file-sharing technologies and played a key element in removing the technological monopoly held so long by traditional

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<sup>21</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 5.

<sup>22</sup> Finocchiaro, Charles. "Personal Factory or Catalyst for Piracy?" *Cardozo Arts and Entertainment Law Journal* 473 (2013): 4.

<sup>23</sup> Desai, Deven. "3D Printing and the Digitization of Things." *Georgetown Law Journal*, 2014.

<sup>24</sup> "IP Lawyer: Why 3D Printing Will Lead to 'thermonuclear Wars' | ZDNet." ZDNet. Accessed November 26, 2014. <http://www.zdnet.com/why-3d-printing-wars-to-go-thermonuclear-7000028085/>.

manufacturers and larger enterprises. By examining the legal and social precedent of the Napster fiasco we can start to understand how the music industry unintentionally justified copyright infringement, and more aptly predict what fate 3D printers may likely inhabit in the coming years.

The legal fiasco between Napster and the entire music industry most accurately mirrors the legal conflict printer manufacturers and distributors may start to encounter. Just as our current legal doctrines are playing catch up to the capabilities of printers already in use, Napster tested the current understanding and use of intellectual property law to its utmost limits. Napster effectively forced the legal system to reassess its copyright protections in conjunction with the modern social climate, but in the end, fell on the wrong side of the Court's devastating opinion, eventually allowing the music industry to temporarily regain its share of the market using an inflexible and outdated business model. Still, the introduction of Napster effectively ended the golden age of the music industry's 'album era', and ushered in the beginning of the digital age of music and information.

Beginning in early 1999, Shawn Fanning and Sean Parker co-founded Napster, which became arguably the most innovative yet disruptive online resource in the history of computing technologies<sup>25</sup>. Rather than serving as a traditional database storage for online files, Napster pioneered a completely new system involving peer-to-peer file transfer in an "open model", serving as a facilitation medium to connect individual users

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<sup>25</sup> "Napster's High and Low Notes." Bloomberg Business Week. Accessed November 26, 2014. [http://www.businessweek.com/2000/00\\_33/b3694003.htm](http://www.businessweek.com/2000/00_33/b3694003.htm).

to one another to share contents of their hard drive<sup>26</sup>. In this way, Napster was temporarily separated from key liability issues, as the online resource never actually came into contact with the distribution of mp3 files. This open style model became the exemplar system for databases such as *Thingiverse* or *Piratebay*, that both serve as a similar catalyzing agent in the transfer of digital files online, as opposed to *Shapeways* more “money model”, which offers purchasable designs from the site itself<sup>27</sup>. Napster did not need long, however, to draw the attention of the music industry. Just a year later, both Metallica and Dr. Dre filed lawsuits against the music service after Napster would not comply with takedown requests<sup>28</sup>. Shortly after, the Recording Industry Association of America, or the RIAA, began to sue individual users for infringement, and eventually filed a lawsuit against the Napster service citing both contributory and vicarious copyright infringement under the Digital Millennium Copyright Act (DMCA) with the following conditions: (1) Users of the service were linked with directed infringement of copyrighted material, (2) the Napster service was liable for contributory infringement of copyrighted material, and (3) Napster was also liable for vicarious infringement of copyrighted material<sup>29,30</sup>. Napster ultimately complied with takedown requests, and was able to eliminate 99.4% of all infringing material<sup>31</sup>. However, the court argued that unless

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<sup>26</sup> Finocchiaro, Charles. "Personal Factory or Catalyst for Piracy?" *Cardozo Arts and Entertainment Law Journal* 473 (2013): 8.

<sup>27</sup> Ibid.

<sup>28</sup> "Napster's High and Low Notes." Bloomberg Business Week. Accessed November 26, 2014. [http://www.businessweek.com/2000/00\\_33/b3694003.htm](http://www.businessweek.com/2000/00_33/b3694003.htm).

<sup>29</sup> Ibid.

<sup>30</sup> "A & M Records, Inc. v. Napster Inc." - Internet Law Treatise. Accessed November 26, 2014. [https://ilt.eff.org/index.php/A\\_&\\_M\\_Records,\\_Inc.\\_v.\\_Napster\\_Inc](https://ilt.eff.org/index.php/A_&_M_Records,_Inc._v._Napster_Inc).

<sup>31</sup> Richtel, Matt. "Napster Appeals an Order To Remain Closed Down." *The New York Times*. July 12, 2001. Accessed November 26, 2014.

Napster could reduce infringement completely and utterly, its service would still be held liable for the above charges<sup>32</sup>. In response, Lawrence Lessig, who undertook the defense of Napster, stated that “this is a war on file-sharing technologies, not a war on copyright infringement”<sup>33</sup>. Mr. Lessig’s astute prediction may soon come to the forefront again during the emergence of 3D printing technologies.

### **Handling The Loss of a Technological Monopoly**

Napster may have lost the temporary battle, but the music industry lost considerably more in the long term. How? Napster succeeded not just in temporarily stymieing the authority of traditional music enterprises, but also in eliminating their technological monopoly altogether. A technological monopoly refers to the ability to serve as the only distributor of a particular good, in this case, the sharing of music. Napster’s unique technology provided a free, more powerful, and user-friendly alternative to the music industry alternative; much like 3D printing allows for a more convenient and economical alternative to direct purchase of physical goods<sup>34</sup>. Faced with the loss of a technological advantage, manufacturers are forced to adapt to a new market system, or rely on favorable legal developments and the moral normative. As we will examine with the journey of the music industry during and after the Napster fiasco, refusing to adapt to a changing market environment will spoil perceptions of the

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<http://www.nytimes.com/2001/07/13/business/technology-napster-appeals-an-order-to-remain-closed-down.html>.

<sup>32</sup> Ibid.

<sup>33</sup> "Free CultureBy Lawrence Lessig." Free Culture. Accessed November 26, 2014. <http://www.authorama.com/free-culture-8.html>.

<sup>34</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 6.

responsible brand, as well as have an immediate negative impact on sales and market share.

The music industry made two fatal mistakes when responding to the Napster phenomenon, (1) relying on negative social norms against illegal downloading, and (2) distributing large fines to infringing users in an uneven manner; mistakes that traditional manufacturers threatened by the onset of 3D manufacturers cannot afford. In tandem, these two goals cancel the other out, as the imposition of fines unevenly to the general public is bound to create public unrest, leading to a general attitude against the intentions of the responsible party. The introduction of simple economic calculus is partially responsible for this phenomenon<sup>35</sup>. When the general public became targets of the music industry through imposition fines it ensured that calculations of morality of illegal downloading were to become secondary to the overall quick benefit of free download and access, as the chances of being targeted were very small. In general, “people overweigh outcomes they consider relative to outcomes they consider probable”, and tend to simply “multiply the extremely low chance of being caught to the fine of infringement”, ultimately “crowding out” other considerations<sup>36</sup>. It’s the same reason why people speed with reckless abandon on the freeway until visual confirmation of a police car is made, or why children tend to brush their teeth only on the days leading up to a dentist appointment. Lastly, this social precedent inevitably encouraged more to follow in its wake, as the imposition of unlikely legal penalties effectively set a price on defying intellectual law; a price most individuals were more than willing to pay. For example, “if

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<sup>35</sup> Ibid., 15.

<sup>36</sup> Ibid., 10.

one multiplied [the] very small chance of being caught against the cost of settling a claim...[it] would result in a fee of seventy five cents”; a clear justification for illegal action in the eyes of the public<sup>37</sup>. When the music industry tried to scare the general public into moral and legal alignment, they unintentionally influenced the social climate to actually endorse illegal downloading.

Ultimately, the trials and tribulations of the Napster battles demonstrated that when a technological monopoly traditionally held by large corporations is eliminated, it is ill advised to salvage any remaining market share by exploiting facets of the legal system or end users in order to regain control. When technological advantage can no longer be attained, the overall business plan must transform and modify to remain competitive. In the end, businesses must recognize that the “sharing [of] files in violation of intellectual property law is not a legal or technological issue”, but rather, “an issue and an opportunity for a change in business practices”; a realization any business threatened by 3D printing must make<sup>38</sup>.

### **Issues of Intellectual Property: Patent Wars, Copyright Meltdown, and Fragile Distinctions**

Regardless of one’s perspective on the future impact of 3D printing, a new variety of legal repercussions will inevitably surface due to: (1) the crossing interaction between patent law and copyright protection as a result of 3D printing and (2) the failure of current intellectual law procedures (and contradictory precedent) to specify how printing should be received by a legal audience. The multitude of legal implications that lie in the

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<sup>37</sup> Ibid., 14.

<sup>38</sup> Ibid., 19.

shadow of 3D printing is enormous, but the current state of patent law, copyright protections, trademark associations, and the current state of the DMCA takedown procedure will serve as the main points of emphasis in this present examination.

First, one must understand the unique phenomenon that additive manufacturing presents to the legal environment before exploring the individual avenues of intellectual law separately. Because physical and tangible objects can now be copyrightable due to compression into mere sequences of code that one can download and distribute, patent law and copyright start to blend together in the context of 3D printing legal concerns<sup>39</sup>. In the past, patent law and copyright protections served to protect different avenues of intellectual property; with “[p]atents protect[ing] application of ideas” while “copyrights protect [the] expression of ideas”<sup>40</sup>. For example, authors of a new children's story may contain both copyright and patent law protection for their work, though they serve to protect entirely different domains of the work. Copyright protections, which are generated automatically by the inherent creation of the work itself, will secure the authors' exposition, plot, character dialogue (or expressive elements), whereas as patent law, which involves a time-intensive application/license procedure, would place protections on the physical medium of the expression itself; for example, any innovative binding process previously unused before, or an advanced cardboard popup illustration feature native to just the new product. Considering that “a single product may have components protected by various patents, expiring at different times” while also

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<sup>39</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 5.

<sup>40</sup> Richard Watt. *A Unifying Theory of Copyrights and Patents*, 12 Int. J. Econ. Bus. 389–02, 390 (Nov. 2005).

maintaining a “protection for the product as a whole”, enforcement of patent protection becomes increasingly difficult for both courts and patent holders to comprehend and practice<sup>41</sup>.

Unlike the illegal downloading of digital music or media content that can be distinguished solely by copyright infringement, however, the compression of physical objects into digital ‘blueprints’ of CAD files and the open model sources that host them may effectively trespass both of these avenues of law. This is the primary legal conundrum that larger manufacturers will try to explore in order to maintain a larger share of the market than emerging printing industries, who must navigate these murky legal waters in fear of constant backlash.

### **Copyright**

With respect to copyright enforcement, our body of law already has several protective mechanisms in place, though they are ill-suited for the complexities and untapped potential of 3D printing. Additionally, uneven and inconsistent interpretation from our higher courts has left the legitimacy and true understanding of copyright protections hanging by an ever-withering thread. To be able to holistically apply our current copyright protections to the advent of printing technologies, we must explore the following domains: (1) our current copyright protections for objects in respect to the “intrinsic” nature of a particular work (whether more utilitarian features of an object can be separated from artistic features), and (2) how the future use of 3D printers will be affected by the ambiguity of the fair use principle, and other wavering legal protections.

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<sup>41</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 58.

The Copyright Act of 1976 clearly defines that any “pictorial, graphic and sculptural works”, as well as “three-dimensional works of...graphic...applied art...[and] models”, fall under the jurisdiction of copyright protection<sup>42</sup>. However, considering the individual nature of each work requires the application of several sub-doctrines problematic in practice, including: originality, utility, separability, fair use, and other transformative uses.

### **Originality**

The status of originality serves as the primary and “indispensable” starting point towards possible copyright protection<sup>43</sup>. To be considered original, a work must stem from a completely independent formation while maintaining a “modicum of creativity”, or an innovative/unique inflection feature<sup>44</sup>. However, not all creative objects automatically surpass this legal requirement. Take, for example, the case of the Warhammer model, a case familiar amongst the 3D printing hobbyists and manufacturers. In 2011, Games Workshop, responsible for the creation of the Warhammer franchise, reported a copyright infringement to *Thingiverse* in regards to CAD designs uploaded by Thomas Valenty<sup>45</sup>. Valenty argued against Games Workshop’s suit, claiming that his individual creation was meant to be “in the style of” a particular

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<sup>42</sup> "17 U.S. Code § 102 - Subject Matter of Copyright: In General." LII / Legal Information Institute. Accessed November 26, 2014. <http://www.law.cornell.edu/uscode/text/17/102>.

<sup>43</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 3.

<sup>44</sup> *Ibid.*, 22.

<sup>45</sup> Finocchiaro, Charles. "Personal Factory or Catalyst for Piracy?" *Cardozo Arts and Entertainment Law Journal* 473 (2013): 4.

Warhammer model, as opposed to a blatant and unoriginal copy<sup>46</sup>. Workshop claimed that Valenty's work added no significant creative aspect to the work, and thus fails the originality requirement. Due to Valenty's lack of resources, he was forced to withdraw from the legal suit and ultimately took down his CAD rendering in favor of Games Workshop's<sup>47</sup>. As demonstrated by the Warhammer case, protections become increasingly limited in respect to mainly "derivate" works, or works that are based on the creativity of others<sup>48</sup>. This legal precedent marks the beginning of the conflicting divergence of the traditional use of originality towards two-dimensional expressions, to that of three-dimensional designs. This becomes problematic because consumers often crossbreed existing designs to create new objects, in lieu of the complicated process of designing CAD file renderings completely from scratch. For example, Sean Ragan, a frequent user of the *Thingiverse* depository for downloadable CAD files, demonstrates the culture of "remixes, improvements, and changes" that make up most CAD designs within a simple illustration of a family tree based on 3D printed designs<sup>49</sup>. Ragan traces back several objects, including a prop from a popular video game and a series of interlocking gears, to one primary ancestor<sup>50</sup>.

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<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

<sup>48</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 3.

<sup>49</sup> Ragan, Sean. "The Thingiverse "Heart Gears" Phenomenon – A Physible Family Tree." Smragancom Sean Michael Ragan. June 1, 2012. Accessed November 26, 2014. <http://www.smragan.com/2012/06/11/the-heart-gears-phenomenon-a-physible-family-tree/>.

<sup>50</sup>Weinberg, Michael J. "What's the Deal with Copyright?" *Public Knowledge*, 2013, 21.

To further complicate this legal condition, satisfaction of the originality requirement may also depend on the mode of conception before the actual 3D print; whether by 3D scanning technologies or manual creation using CAD software. Due to the advent of 3D scanners, seamless replication of duplicate objects of an original author may become a frequently occurring phenomenon. Due to the ease and sophistication of the technology, it appears that high quality scans of an object may not meet the originality requirement, as no intensive and individual “creative spark” may be present in the scan to print process<sup>51</sup>. However, designs created manually using computer assisted design software may produce a different outcome, as CAD file creation is both time consuming and difficult. As technologies behind scanning and CAD creation software continue to advance, the mode of creation behind 3D printed objects is likely to play a lesser role in the future. Originality, then, will merely be a function of how high the legal parameter has been set by past actions of the court. However, even if high quality scans or CAD creations of a physical object pass as original contributions of work, the sharing of these files to another party may trigger another copyright infringement entirely.

### **Utility and Separability**

Another presently ambiguous facet of intellectual law lies within the dynamic presence of the utility and separability restrictions. The utility principle restricts access to copyright protection if a pictorial, graphic or sculptural work has any inherently useful function “that is not merely to portray the appearance of the article or to convey

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<sup>51</sup> "Originality Requirements under U.S. and E.U. Copyright Law - Software Freedom Law Center." Originality Requirements under U.S. and E.U. Copyright Law - Software Freedom Law Center. Accessed November 29, 2014.  
<https://www.softwarefreedom.org/resources/2007/originality-requirements.html>.

information”<sup>52</sup>. For example, simple chairs, table plates, or coffee mugs are not suitable for copyright protections, as their existence has a purely “intrinsic utilitarian function”<sup>53</sup>. Useful items may be able to receive copyright protection if the item contains certain “sculptural features” that “[exist] independently of, the utilitarian aspects of the article”<sup>54</sup>. Stated more plainly, a particular useful object may be copyrightable only if the more artistic aspects of the work can be identified separately and serve no immediate and direct connection with a utilitarian feature. The determination of those separate useful features, though, requires further clarification of the separability distinction.

The separability provision states that potential useful items may still acquire copyright protection if said items contain certain separate artistic features that can either be physically separable, or conceptually separable<sup>55</sup>. Certain designs meet physical separability, and subsequent copyright protection, if the particular designs of a useful object are physically removable from the rest of the object. Physical separability poses less of a threat to the advent of 3D printing and scanning capabilities, as it is much easier to apply and enforce. Conceptual separability, however, constitutes the most concern and difficulty surrounding the emergence of 3D printing technologies, as courts have argued whether or not a conceptual separation from a useful object is a reasonable proposition. Certainly, some design features become meaningless once conceptually removed from a useful article. A decorative vase to hold flowers for example, tests this conundrum. The

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<sup>52</sup> "Copyright Law of the United States of America." U.S. Copyright Office. Accessed November 26, 2014. <http://www.copyright.gov/title17/92chap1.html#101>.

<sup>53</sup> Ibid.

<sup>54</sup> Ibid.

<sup>55</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 39

separability test “seeks to deal with the fact that sometimes an uncopyrightable object, the vase, and a copyrightable object, the design on the vase, can exist in the same object”<sup>56</sup>.

Omitting, or “severing”, then, certain artistic and decorative features of an original design would seem to counteract a strong indicator of copyright infringement. But can decorations that exist primarily as a function of the object itself be conceptually separable? These distinctions are difficult to make even when considering rudimentary designs and basic objects.

Take, for example, a case of designer belt buckles. The original creator of a particular designer belt buckle demanded that copyright protection be granted in favor of his creation, but the court was hesitant to allow such a creator to hold a monopoly on the useful object<sup>57</sup>. Belt buckles inherently possess a utilitarian feature, necessary for the restraint of one’s pants from constantly falling down. However, the design elements of the belt buckle itself were unnecessary towards the utilitarian feature. Still, those design features could be understood as severable creative elements protectable under copyright law. In the end, the court held that the buckles had “conceptually separable sculptural elements” and granted those features copyright protection<sup>58</sup>. Why? Because the utilitarian aspects of the object were found to play an ancillary role to the primary sculptural and artistic elements of the belt buckles<sup>59</sup>.

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<sup>56</sup> Weinberg, Michael. "IT WILL BE AWESOME IF THEY DONT SCREW IT UP." Public Knowledge. November 1, 2010. Accessed November 26, 2014. <https://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf>.

<sup>57</sup> Weinberg, Michael J. "What's the Deal with Copyright?" *Public Knowledge*, 2013, 10.

<sup>58</sup> *Ibid.*

<sup>59</sup> *Ibid.*

### **Character Doctrine, Fair Use, and Commercial Purpose**

Unfortunately, considerations of originality, utility and separability still do not encompass all potential protective powers of the copyright law. Just recently, DMCA takedown requests were filed by HBO television network regarding a user submitted cellphone charger dock modeled after the popular TV drama ‘Game of Thrones’<sup>60</sup>. The iPhone ‘throne’ dock was said to have violated copyright protections after instructions documenting the creation of the dock were released online to the general public<sup>61</sup>. As the courts were later to explore, there are several strategies to argue for or against this possible copyright infringement.

The first strategy to utilize would be to claim that the work served an inherent useful purpose, as a useable dock for the creators iPhone, meaning that copyright protections only fell in place for certain separable elements. In response, HBO could draw from earlier precedent, claiming that the “character” doctrine may actually overpower any usefulness of the object<sup>62</sup>. This character doctrine, for example, found that the ‘Batmobile’ vehicle, of the Batman comic book franchise, is actually portrayed as a character due to its distinguishable features<sup>63</sup>. Which precedent overrules the other is a subjective matter left only to the courts.

Additionally, issues of fair use find themselves in the legal mix. The fair use provision allows for special exceptions, such as this modification, to copyright infringement in the case that transformations to a previous design are made for parodic or

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<sup>60</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 9.

<sup>61</sup> Ibid.

<sup>62</sup> Ibid.

<sup>63</sup> Ibid.

educational purposes<sup>64</sup>. A fair use is defined under a four-factor test that excludes copyright infringement in special cases depending on the (1) the purpose or character of the particular use, (2) the nature of the copyrighted item, (3) the actual amount or “substantiality of the portion” of copyrighting incurred, and (4) the potential market intentions of the creator<sup>65</sup>. Additionally, the Copyright Act specifies that transformations of a particular copied item towards some parodic or educational means allow bypass of infringement<sup>66</sup>. These factors, though, are incredibly difficult to weigh in practice and often involve subjective assessments based on individual perspectives. Thus any notion of fair use is likely to serve more as an obstruction rather than legal clarification. As Judge Posner once stated, “a fair use defense...[is] not exhaustive and do[es] not constitute an[y] algorithm that enables decisions to be ground[ed] out mechanically” or efficiently, for that matter<sup>67</sup>. In the HBO case, the creator of the phone dock could claim that the throne was actually intended to be a parodic transformation of the ‘Iron Throne’, rather than a direct replica<sup>68</sup>. For example, in *Louis Vuitton Malletier S.A. v. Haute Diggity Dog*, the court found that a pet merchandise company that copied Louis Vuitton designs for a line of dog accessories modified the existing design in a satirical manner, meaning that Louis Vuitton could not sue for direct infringement<sup>69</sup>. While on the other

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<sup>64</sup> "Copyright Law of the United States of America." U.S. Copyright Office. Accessed November 26, 2014. <http://www.copyright.gov/title17/92chap1.html#107>.

<sup>65</sup> Ibid

<sup>66</sup> Ibid.

<sup>67</sup> "OpenJurist." 354 F3d 624 Chicago Board of Education v. Substance Inc N. Accessed November 26, 2014. <http://openjurist.org/354/f3d/624>.

<sup>68</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 9.

<sup>69</sup> *Louis Vuitton Malletier S.A. v. Haute Diggity Dog, LLC*. United States Court of Appeals for the Fourth Circuit 507 F.3d 252 (4th Cir. 2007)

hand, the fair use provision could be countered by emphasizing an actual lack of transformative values, as the dock was only reduced in scale for use. Considerations of the degree of modification required for exemption, as well as the degree of modification or transformation actually inherent within a copying itself are difficult to determine and often fall to the discretion of judges, rather than within the law itself.

Lastly, commercial purposes of the possible copying infringement must be taken into account. In regards to the HBO case, sharing the dock design on an online depository for 3D designs raised a flag in the fourth prong of the fair use doctrine. If the creator of the dock had merely demonstrated his product online, rather than distributing it for interested consumers, this commercial clause would not be applicable. Determining to what extent an individual can be labeled as a personal manufacturer of goods, however, is another complicated legal dilemma entirely. In the end, HBO won the copyright tug of war, forcing the original creator of the dock to remove his design from *Thingiverse* and refund any individual that purchased a copy of his work<sup>70</sup>.

Ultimately, similar conflicts will continue to surface when considering the shaky foundation behind current copyright law in its application to additive manufacturing and file sharing technologies. Unfortunately, considerations of these legal precedents are extremely uneven, and the practice of determining potential infringement seems more “metaphysics” than it is law<sup>71</sup>. The ambiguous nature of copyright law makes it difficult not only for copyright to be enforced, but for online domains, consumers, and manufacturers to adhere to or respect these legal boundaries.

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<sup>70</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 9.

<sup>71</sup> *Ibid.*, 6.

### **The Digital Millennium Copyright Act**

The Digital Millennium Copyright Act (DMCA) was established in 1998 by the Clinton Administration in order to provide a more active vehicle for copyright enforcement, as well as serve as a more accessible medium between copyright owners and Internet service providers, or ISPs (Internet service providers)<sup>72</sup>. Basically, the DMCA provides a takedown notification standard that allows copyright holders to hold a third party liable for infringement, giving them an opportunity to withdraw a design or digital file to escape further prosecution. The DMCA has seen extensive use in the prime of the Napster fiasco, but can also be used against any digital piracy (i.e. movies, audiobooks, programs, etc.). In all likelihood, the DMCA will continue to be the main weapon against unchecked copyright infringement in the emerging 3D printing industry, although not without several complications. The ambiguous standing of previous copyright elements including fair use, originality, utility, and other key distinctions will make the application of this legal tool towards 3D related applications a complex and inconsistent process.

Interestingly, the DMCA takedown requests procedure also produces an expansive protective shield for 3D printing ISPs and users of these services, serving as a safe harbor for activities that meet certain prerequisites. These predetermined conditions stipulate the following: that ISPs must not have any knowledge of potentially infringing activity, ISPs may not receive any sort of financial compensation for acts of infringement, and that “upon receiving proper notification of claimed infringement, the

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<sup>72</sup> "The Digital Millennium Copyright Act of 1998." U.S Copyright Office Summary. December 1, 1998. Accessed November 26, 2014. <http://www.copyright.gov/legislation/dmca.pdf>.

[ISP] must expeditiously take down or block access to the material”<sup>73</sup>. If a certain ISP provider, like *Thingiverse*, has met these requirements, then the online domain may serve as a safe harbor for all other CAD file designs. This also places the responsibility of copyright enforcement detection onto the copyright holders themselves, making online depositories like *Thingiverse* an even more attractive option for CAD designers and 3D printer users. Further, the DMCA provides counter takedown procedures for users found liable for certain copyright infringement behavior. Section 512 of the Digital Millennium Copyright Act of 1998 specifies that once a copyright owner has received proper counter removal submission from a subscriber mistakenly branded with infringement, then that copyright owner has 10-14 days to submit a follow up lawsuit<sup>74</sup>. Failure to file this lawsuit within the given time range eliminates the original takedown notice, excusing any infringement concerns of the ISP and subscriber and qualifying the material in contention to be reposted without legal concern<sup>75</sup>.

It didn't take long for DMCA takedown requests in the 3D printing domain to stir this legal pot. Recently in 2011, a 3D file rendering of the famous “Penrose Triangle” optical illusion was uploaded to *Shapeways.com* by Ulrich Schwanitz, as well as a video detailing step-by-step instructions for its post-printing construction<sup>76</sup>. A CAD file designer by the name of Arthur Tchoukanov then reverse engineered this Penrose triangle, based on the video tutorial, and later released a CAD file free for public

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<sup>73</sup> Ibid.

<sup>74</sup> Ibid.

<sup>75</sup> Ibid.

<sup>76</sup> Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 9.

download<sup>77</sup>. Schwanitz, infuriated with this apparent copying then filed a DMCA takedown request to the ISP listing this reverse engineered triangle, that quickly complied and removed the design from its database<sup>78</sup>. However, later Schwanitz recalled his original DMCA takedown notice, after an onslaught of disagreement from angry 3D printing enthusiasts.

Schwanitz's takedown notice was received with harsh public criticisms because he ultimately failed to consider basic principles constituting copyright infringements, highlighting an obvious abuse of otherwise useful DMCA procedures. Ironically, Schwanitz's version of the Penrose Triangle was borrowed from the work of others<sup>79</sup>. Additionally, since Schwanitz never added some unique ornamental feature that would allow for his creation to fall under copyright protection, his DMCA request should have subsequently been denied legitimacy in the first place<sup>80</sup>.

Unfortunately, it seems that DMCA takedown requests can be filed with relatively little comprehension of existing copyright law. This creates numerous opportunities for infringement false positives, as they "are an inevitable side effect of automatic search and enforcement technologies" so accessible to the general public<sup>81</sup>. As we examined in the earlier Napster fiasco, mass infringement lawsuits come with a significant moral cost to

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<sup>77</sup> Ibid., 10.

<sup>78</sup> Ibid., 9.

<sup>79</sup> Ibid.

<sup>80</sup> Ibid.

<sup>81</sup> Evgeny Morozov, *To Save Everything, Click Here* 140–80 (2013).

society, eventually deterring the public's perception of copyright law legitimacy and authority<sup>82</sup>.

### **Patent Law**

The legal implications surrounding patent law are markedly different from copyright concerns. Patents are not automatically generated by the onset of a work; instead, one must apply for the protections through the United States Patent and Trademark Office. Patents, unlike copyright protections, also only last for a short duration of time. Patents also practice a much stricter set of guidelines in regards to possible infringement, as the fair use defense does not extend to patent copy cases. Additionally, an "invention must be new, useful, and non obvious", and upon application for a patent, "the inventor must disclose information that would allow others to practice the invention"<sup>83</sup>. Unlike copyright holders, patent owners have no streamlined procedure, like DMCA take down requests, to utilize in the case of an infringement.

### **Staple Article of Commerce Doctrine**

Instead, patent owners that wish to take legal action do so through two main options: (1) direct infringement, and (2) contributory infringement. Patent infringement is an extremely tedious and demanding legal procedure. Larger and more resourceful enterprises are often able to drown out smaller parties after direct infringement claims through war of attrition; though, at the cost of social disdain, who may become apprehensive about using services altogether for fear of infringement. Manufacturers of

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<sup>82</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 5.

<sup>83</sup> Weinberg, Michael J. "What's the Deal with Copyright?" *Public Knowledge*, 2013, 21.

3D printers, in contrast, seem to be suspended in a legal limbo, as any infringement performed on a device manufactured by the same company could technically be held accountable for contributory infringement. For the time being, the staple article of commerce doctrine shields these manufacturers. The staple article of commerce doctrine was established by the U.S. Supreme Court in *Sony Corp. of Am. v. Universal City Studios, Inc.*, holding that as long as certain commodities, like personal VCRs, “can be used in a way that does not infringe intellectual property”, then a manufacturer’s connection to illegal activity on the part of the consumer can not be established<sup>84</sup>. Likewise, a manufacturer of 3D printers or materials cannot be held legally at risk for a consumer’s improper use. In other words, because 3D printers can also be used to produce creations that don’t infringe on a patent holder’s property, the companies that sell them cannot be held accountable. However, interpretations of commerce and market intentions will become a primary area of future concern for the future use of 3D printing technologies, as patent/copyright holders will likely seek a less expansive interpretation.

### **The Repair-Reconstruction Doctrine**

The most potent patent related legal complication barring 3D printing is the adoption and understanding of the repair reconstruction doctrine. Generally speaking, performing minor repairs to a legally obtained item trespasses no legal boundaries. For example, an individual who breaks a game console remote controller may glue together the remaining pieces of a battery back plate cover for a temporary fix. If, on the same controller, the cord is damaged by a teething puppy in the family, the user is also obliged

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<sup>84</sup> "Sony Doctrine Law & Legal Definition." Sony Doctrine Law & Legal Definition. Accessed November 26, 2014. <http://definitions.uslegal.com/s/sony-doctrine/>.

to use electrical tape to form a temporary electrical current for further use. But what if the user uses a 3D printer to print an entirely new spare plastic functional exterior to replace a broken one? After a certain point, patent holders may be able to ascertain that a ‘reconstruction’ rather than just a ‘repair’ has incurred, warranting possible patent infringement. This repair versus reconstruction conundrum highlights a very practical and realistic use of 3D printing, and a very tangible fear for traditional manufacturers of products. Unfortunately, the distinction between a legal repair and an illegal reconstruction is faint, if at all present. Traditional manufacturers have strong incentive to pursue a more refined understanding of this distinction, as 3D printing repairs will sever the dependence of a consumer on seeking assistance of the manufacturer of an item, as he is able to replace or repair a certain component on his own for a much lower cost. Consumers will likely pursue self-manufactured replacement parts rather than going through traditional manufacturers to replace the part at a much higher price. Just as an average consumer might weigh the costs and benefits of illegally downloading music (obvious benefit of free music, infinitesimally small chance/cost of legal repercussion), consumers of the future will likely seek to repair products on their own accord, changing the “cost calculus” of repairs forever<sup>85</sup>.

The present condition of the repair-reconstruction doctrine, however, provides little direction as to what would be considered a clear infringement of repair standards, and is in urgent need of clarification from higher legal courts. Under traditional patent law, the owner of a particular purchased good also subsequently owns the right and

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<sup>85</sup> Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*: 2.

privilege to repair the product as needed. However, the owner of a particular good cannot “reconstruct a patented item entirely, or to use unapproved parts to repair or reconstruct the item” in any way<sup>86</sup>. According to Article 1, Section 8 of the US Constitution, anyone “without authority [who then] makes [or] uses...any patented invention...during the term of the patent...infringes on the patent” as consequence<sup>87</sup>. As a result, when an object incurs damages that are beyond home remedy, patent law mandates that an individual purchases a new product entirely to resume further use<sup>88</sup>. Actions contrary to this are considered an unwarranted reconstruction of a product, or repairs so extensive as to constitute “a new article” entirely<sup>89</sup>. This stipulation is active even if a consumer is unaware of particular patents or potential patent infringement. But what if a consumer uses a home 3D printer to replace many minor components of a product over a long period of time? Existing legal precedent clarifies the extreme ends of the repair-reconstruction debate, but leaves tremendous gray area that 3D printing technology is likely to prod. To fully comprehend how this deficit in precedent will affect 3D printing, however, we need to take a closer at the history of the court’s treatment of this legal doctrine through its many inconsistent interpretations.

The first known legal encounter dealing with the repair versus reconstruction quandary occurred more than a century ago, emerging within the case of *Wilson v Simpson*. Wilson, the defendant, had repaired blade cutting components of his legally

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<sup>86</sup> Ibid., 3.

<sup>87</sup> "35 U.S. Code § 271 - Infringement of Patent." LII / Legal Information Institute. Accessed November 26, 2014. <http://www.law.cornell.edu/uscode/text/35/271>.

<sup>88</sup> Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*

<sup>89</sup> Ibid., 31

purchased and patented wood-cutting machine, against the intentions of the actual patent owner of the machine<sup>90</sup>. In response, the Court found that because the knives themselves were a temporary and exhaustive component of the machine as a whole, the defendant's replacement of the knives (without permission of the patent owner) was justified because this addition did not significantly modify the use and intention of the machine as a whole<sup>91</sup>. The Court went on to stress the exhaustive lifespan of the knives, stressing that a replacement in this domain would not stray from the object's original use<sup>92</sup>. More importantly, the Court decided against creating a substantial "bright-line rule", meaning that cases in the future regarding similar legal situations would have to apply a more circumstantial analysis<sup>93</sup>.

The closest the courts have come to creating a true guideline for the repair-reconstruction doctrine emerges during *Aro Manufacturing Co. v. Convertible Top Replacement Co*, eventually building a guideline around earlier court's reluctance to build a bright-line standard. In *Aro*, a defendant was faced with an accusation of unlawful reconstruction and replacement of a fabric cover for a convertible car, where the fabric was part of a larger combination patent<sup>94</sup>. Combination patents often cover multiple functioning components of an overall object; in this case, the supporting structures,

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<sup>90</sup> Ibid., 13

<sup>91</sup> Ibid.

<sup>92</sup> "Wilson v. Simpson 50 U.S. 109 (1850)." Justia Law. Accessed November 26, 2014. <https://supreme.justia.com/cases/federal/us/50/109/>.

<sup>93</sup> Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*. 15

<sup>94</sup> "Aro Mfg. Co., Inc. v. Convertible Top Co. 377 U.S. 476 (1964)." Justia Law. Accessed November 26, 2014.

<https://supreme.justia.com/cases/federal/us/377/476/case.html>.

sealing mechanisms, and fabric cover itself<sup>95</sup>. The Court handed down a significant ruling, claiming that the replacement of the fabric component was a lawful repair, stating that “no element...that constitutes one of the elements of a combination patent is entitled to patent monopoly”<sup>96</sup>. Further, the Court made an important distinction in that the “mere replacement of individual...parts, one at a time, whether of the same part repeatedly or different parts successively, is no more than the lawful right of the owner to repair his property”<sup>97</sup>. In the opinion of the Court, an unlawful reconstruction of an object only occurred when it was used to “make a new article” altogether, after the expected life of the original product had come to pass<sup>98</sup>.

This decision was met with severe criticism and concern. In a concurring opinion delivered by Justice Brennan, it was argued that multiple variables must be considered in a case dealing with repair-reconstruction conflicts rather than the application of a single test. These variables included the intent of the patent user, the intent of the actual patent owner, and the “life, importance, and cost of the part replaced” when compared holistically to the function of the product as a whole<sup>99</sup>. In stark contrast, Justice Black argued in his own concurring opinion that considering these values would resemble judges applying a “psychoanalysis” of the patent owner and user’s underlying intentions, bound to only obscure the legal analysis further<sup>100</sup>. Instead, Black offered that cases in such domains should only rely on the common sense of the courts at hand, rather than

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<sup>95</sup> Ibid.

<sup>96</sup> Ibid.

<sup>97</sup> Ibid.

<sup>98</sup> Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*. 25

<sup>99</sup> Ibid., 14.

<sup>100</sup> Ibid.

applying preordained standards that would drift away from the sensible reluctance of the *Wilson* court to create bright-line standards.

The lack of a coherent standing inherent within the *Aro* decision becomes evident in the incongruous use of precedent in future lower court decisions. In *Monroe Auto Equipment Co. v. Precision Rebuilders, Inc.*, for example, the lower courts found the defendant liable for unwarranted reconstruction of automotive accessory scrap into new and usable shock absorbers for future use<sup>101</sup>. The court drew from earlier Supreme Court precedent, claiming that since the defendant transformed otherwise unsalvageable garbage “into a second creation” altogether, that the actions went beyond the scope of jurisdiction for the owner of the good<sup>102</sup>. Interestingly, the lower court also established that the shock absorber component in question served a substantial function in relation to the automotive machine and could not be limited to distinction as “merely a temporary part”<sup>103</sup>. While the court made clear effort to reference guidelines established earlier in *Aro*, the standards used in conjunction (originally proposed by opposing Justices’ Black and Brennan) in *Monroe* were actually meant to be competitive with one another. As evident by the *Monroe* decision, courts have made little progress towards defining a clear threshold between repair and reconstruction. A clear consensus must arrive soon, as 3D printing will exaggerate the extent to which repairs will push the threshold of illegal reconstruction.

In fact, current CAD designs and prints already challenge the standing of this important legal doctrine. Strangely, the most well-known and relevant case of 3D

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<sup>101</sup> *Ibid.*, 15.

<sup>102</sup> *Ibid.*

<sup>103</sup> *Ibid.*

printing-meets-patent law case surrounds a simple repair of a popular consumer baby stroller. Just recently, a hobbyist who goes by the name dscott4, posted an online step-by-step tutorial detailing how to replace small steel hinges for the ‘Bugaboo Chameleon Push-chair’, and provided a link to the appropriate CAD file design onto the Shapeways online depository<sup>104</sup>. The owner additionally notes that repairs performed by Bugaboo themselves were estimated at \$250, compared to the \$25 dscott4 estimates the DIY repair to cost<sup>105</sup>. Could Bugaboo patent owners sue dscott4 for an extensive and unlawful reconstruction? Given the precedent of past courts, one cannot accurately make a prediction. For example, if the court decided to use a more common sense approach emphasized in the *Wilson* case, dscott4 may be entitled to form small permissible repairs, such as the replacement of small steel hinges, without tampering with the original purpose of the product and its patent owner; whatever that might be. However, courts could refer to more concrete standards in the *Aro* case, weighing considerations of the product owner’s intent, the patent owner’s intent, the lifespan of the product replaced, its connection with the purpose of the larger product in a holistic sense, etc. Applying the standards of these two cases may lead the court to vastly different judicial decisions; depending on which legal lens they employ. For the time being, it seems dscott4 will escape legal repercussion because of the court’s passed insistence on eliminating sweeping blanket-patents from controlling a monopoly on several unpatented parts within

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<sup>104</sup> "How to Repair a Bugaboo Pram with 3D Printing." Instructables.com. Accessed November 26, 2014. <http://www.instructables.com/id/How-to-repair-a-Bugaboo-Pram-with-3D-Printing/>.

<sup>105</sup> Ibid.

a single design<sup>106</sup>. Still, upon a closer examination of the instructables website, it appears several owners have provided strategies/suggestions for similar repairs dealing with other Bugaboo stroller parts, for example a DIY front wheel design repair provided by Matt Bryne<sup>107</sup>. If a single user had submitted both the steel hinge and front wheel designs, Bugaboo might then have the right to claim a patent infringement as protections regarding singular elements in isolation, offered in *Aro*, would likely lose their merit.

With the availability of 3D printers and materials on the rise, more potentially illegal designs will flood the market and inevitably force the hand of manufacturers that continue to grow weary from their loss of a technological advantage to produce replacement parts. As stated by Michael Weinberg, “as incumbent companies begin to see small-scale 3D printing as a threat, they will inevitably attempt to restrict it by expanding intellectual property protections...in doing so” they attempt to maintain “existing business models” and try to prevent “lost sales, lower profits, and reduced employment”<sup>108</sup>. Manufacturers that have enjoyed, thus far, a technological advantage over consumers will likely want to maintain their stranglehold over the potential repair-market. To accomplish this, manufacturers may attempt to regain their advantage using several different strategies.

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<sup>106</sup> "Aro Mfg. Co., Inc. v. Convertible Top Co. 377 U.S. 476 (1964)." Justia Law. Accessed November 26, 2014.

<https://supreme.justia.com/cases/federal/us/377/476/case.html>

<sup>107</sup> "Bugaboo Pram - Front Wheel Repair." Instructables.com. Accessed November 26, 2014. <http://www.instructables.com/id/Bugaboo-Front-wheel-repair/>.

<sup>108</sup> "Is the 3D Printing Industry about to Start Turning out Lawsuits?" Digital Trends. Accessed November 26, 2014. <http://www.digitaltrends.com/cool-tech/3d-printing-and-copyright-lawsuits/>.

Once an infringement occurs, manufacturers now have the advantage of being able to track infringers directly from the source of online depositories where the CAD files were originally distributed; a luxury not as widely enjoyed with patent infringements of the past. Once end users have been established, manufacturers can choose to attack a large pool of users with the goal of eventually capitalizing on settlement claims from deterred users. Although this would not compensate for losses sustained, this would create a negative social atmosphere about the ethics of illegal downloading; mimicking the music industry's strategy to regain control of music distribution when Napster entered the market. Just as the music industry and the RIAA tried to rely on the maintenance of a moral monopoly on the sharing of digital files, manufacturers may pursue this seemingly tangible outcome as well. Another potential strategy of threatened parties would be to strengthen current patent protection, while also expanding protection to cover unpatented parts that function within existing designs; though the courts in past practice have generally dismissed this possibility.

### **Product Liability**

One last avenue of legal concerns surrounding the emergence of 3D printing technologies is the dissolution of product liability guidelines. Under traditional understanding, any business "engaged in...selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect"<sup>109</sup>. For example, if a fork utensil purchased by a consumer breaks immediately after its first use, causing severe lacerations, the kitchenware

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<sup>109</sup> "Restatement of the Law, Third, Torts: Product Liability." *The American Law Institute*, 1998.

company responsible for its distribution can be held strictly liable. 3D printing may split this conventional consumer-to-enterprise relationship, however, as the transference of coded sequences to actual product 3D construction obscures notions of accountability. Using this example, if the consumer had endured the same product malfunction and resulting lacerations from a 3D printed utensil, the question arises as to who assumes responsibility; the consumer of the 3D printer, the designer of the utensil CAD file, or the 3D printer manufacturer? Current strict liability guidelines provide no definite legal answer. By exploring some of these potential culprits, we will discover that product liability will fail to return a verdict.

One obvious distinction from the former example of traditional strict liability is the introduction of the digital architect of a CAD file and the problematic tangible/intangible distinction resultantly brought forth<sup>110</sup>. These CAD file designers are responsible for the intangible foundation of printable physical objects, embodied in sequences of code and algorithms, but not absolutely answerable to the tangible physical object itself. The few legal precedents available for examination regarding this threshold do little to elucidate this problem.

In one particular avenue, video game developers have escaped liability concerns after being found on the legal side of the tangible/intangible distinction. In *Sanders v. Acclaim Entertainment, Inc.*, the defendants were charged with influencing the violent actions of the students behind the Columbine High School shooting, mediated through its

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<sup>110</sup> Engstrom, Nora Freeman. "3-D Printing and Product Liability: Identifying the Obstacles." *Stanford Law Journal*, 2013, 4.

explicit and violent game play<sup>111</sup>. In response, the court exonerated the game developers because "intangible thoughts, ideas, and expressive content" in violent video games "are not 'products' as contemplated by the strict liability doctrine" and that ruling in the other favor would "run afoul of the First Amendment"<sup>112</sup>. But, this did not serve to provide any conclusion for tangible property debate. In reality, the actual question as to whether mere sequences of code and other computer technologies can be associated as a tangible product has thus far received no definite answer from related legal investigation. This will likely become an area of focus for future 3D printing legal debate, and ultimately must be resolved in the future event of widespread 3D printing use.

Even in the event that computer code and software technology is found to be a tangible product, CAD developers and hobbyists involved in similar applications of CAD development may still find safe haven in the commercial-casual divide, or the threshold between mass distributors of goods and more casual ones, as strict liability concerns itself only with more commercial sellers<sup>113</sup>. According to current product liability standards, strict product liability does not apply to casual producers of goods, for example, a neighbor who prepares a jar of jam for a small insignificant price<sup>114</sup>. Therefore, the fault of liability may just depend on the "frequency and volume of...sales, and the existence and nature of any mass marketing"<sup>115</sup>. This standard would appeal to digital designers who casually distribute CAD files through online hobbyist depositories, becoming further

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<sup>111</sup> Sanders v. Acclaim Entertainment, Inc., 188 F. Supp. 2d 1264 - Dist. Court, D. Colorado 2002

<sup>112</sup> Ibid., 1275

<sup>113</sup> Engstrom, Nora Freeman. "3-D Printing and Product Liability: Identifying the Obstacles." *Stanford Law Journal*, 2013, 4.

<sup>114</sup> Ibid., 3.

<sup>115</sup> Ibid.

removed from the notion of commercial selling. Additionally, mere distribution on said online depositories would likely not serve as a significant advertising effort, escaping this facet of product liability concern. Because the majority of 3D printing and CAD designs stems from these free online marketplaces, digital designers, for now, can take refuge from the commercial aspect of product liability.

In her work in *3-D Printing and Product Liability*, Nora Engstrom also draws an interesting parallel between architects of physical structures and those of intangible CAD files that may illuminate an additional barrier of protection in favor of 3D file designers. Engstrom explains that courts of the past have refused to recognize architectural blueprints of physical buildings “through the lens of [product liability]”, because even if those designs could be considered a product, only after a severe transformation through construction could the designs actually be analogous with a structure that can be vulnerable to potential product liability<sup>116</sup>. In order to substantiate claims of product liability, one must demonstrate that a particular product was delivered and used without any considerable changes on the part of the user<sup>117</sup>. However, because online designs can only see fruition after extensive transformation of immaterial sequences of code through the printing process into the actual material object, prosecutors in search of liable causes will likely lose footing.

A second potential target for product liability cases involving 3D printing products lies within the actual manufacturer of the printers themselves. This would likely be the second target of prosecution, pursued only after digital designers and hobbyists are

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<sup>116</sup> Ibid., 6.

<sup>117</sup> Ibid.

unavailable. Verifying that these manufacturers are liable for defective printers, though, becomes an extremely difficult feat. In order to prove manufacturers liable, the prosecution must not only prove that a printer is substantially defective, but that it was defective effectively before it left shop, long before the first usage<sup>118</sup>. Even with some evidence of the latter example, cases of product liability will rarely ever be “slam dunks” as searching for the location of this fixed proximate cause behind a particular accident becomes an essentially impossible task<sup>119</sup>.

### **Creating an Open Environment for 3D Printing**

It remains an almost impossible task to accurately predict what strategies traditional manufacturers, as well as 3D printing related businesses, might take in the early stages of this growing enterprise. Much will ultimately depend on the court’s future interpretation of various copyright and patent laws, such as: originality, separability, the commerce clause, the distinction of tangible computer software products, etc.

Nevertheless, there are several strategies beneficial to both traditional manufacturers and sponsors of the 3D printing revolution that should be seriously considered, including: (1) introducing the bifurcated model to larger manufacturers of physical goods, (2) using an economic analysis to tackle the ambiguity of the repair- reconstruction threshold, (3) applying similar DMCA protections to patent law application, and (4) modifying our application of the fair use doctrines to allow for a clearer understanding and application of intellectual property law.

### **Applying the Bifurcated Sales Model**

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<sup>118</sup> Ibid., 5.

<sup>119</sup> Ibid.

Following the trials and tribulations of the Napster battles, one way for traditional manufacturers of physical goods to adapt to 3D printing is to implement an adaptation of the flexible “bifurcated sales model”<sup>120</sup>. This multifunctional sales model allows for one price to reflect traditional product distribution in conventional distribution channels such as retail, and another much lower price for access to a printable CAD file of the same product for consumers interested in using home printing technologies. The higher price point of the physical object sale can account for factors of “overhead, transportation, and sales costs of maintaining the product in a retail environment”, whereas the lower priced CAD file variant provides a beneficial alternative for consumers with capable home 3D printers<sup>121</sup>. Additionally, the lower priced online option would likely give consumers an incentive to obtain product designs legally, rather than risk legal prosecution, faulty design or computer malware, assuming that these manufacturers offer a sensibly reduced price.

Take, for example, the makers of Bugaboo baby strollers and other stroller accessories<sup>122</sup>. Using a bifurcated pricing model, Bugaboo can continue to sell physical replacement components of the stroller in a retail environment at a cost comparable to prices already established. In addition, however, Bugaboo can also offer online computer software variants of the same replacement components at a much cheaper price, potentially swaying interested consumers towards going through the business directly rather than possibly breaching legal protocol using open source 3D design domains.

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<sup>120</sup> Ibid., 24.

<sup>121</sup> Ibid.

<sup>122</sup> "Baby Strollers, Accessories, Parts – Bugaboo (United States) English." Baby Strollers, Accessories, Parts – Bugaboo (United States) English. Accessed November 26, 2014. [https://www.bugaboo.com/US/en\\_US/strollers](https://www.bugaboo.com/US/en_US/strollers).

Businesses can choose to offer separate product prices, similar to the popular iTunes system, or choose to offer a larger price for unlimited access to different designs and products, comparable to the strategy of the Spotify music service. The success of both of these music distribution hubs in the past decade encourages the idea that consumers are willing to pay certain premiums for legal and high quality products.

Several companies are already adapting bifurcated sales models, and reaping the benefits of expanded market potential. Just this year, Hasbro, a popular toy manufacturer, and *Shapeways*, a centralized 3D printed product provider, launched a partnership under the name “SuperFanArt”, which aims to provide consumers the opportunity to design, print and sell individual creations based on preexisting Hasbro products<sup>123</sup>. Hasbro kicked off this partnership by encouraging consumers to customize preexisting templates for My Little Pony toys, giving these individuals free reign to design the toys to their liking, as well as set customized price points in the case that they decide to sell their designs<sup>124</sup>. With a small percentage likely going to both *Shapeways* and Hasbro in the event of a SuperFanArt sale, both companies can profit from the inclusion of one another. After the success of the initial SuperFanArt project, Hasbro has expanded this service to include the customization of Marvel superhero figurines, as well as Monopoly gameplay boards<sup>125</sup>. Hasbro has made immediate revenue growth since the inception of

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<sup>123</sup> Duann. "Shapeways Blog - Hasbro & Shapeways Enable 3D Printing Fan Art with SuperFanArt." Shapeways.com. Accessed November 26, 2014. <http://www.shapeways.com/blog/archives/16759-hasbro-shapeways-enable-3d-printing-fan-art-with-superfanart.html>.

<sup>124</sup> Ibid.

<sup>125</sup> "Hasbro Starts to Play Nice with 3D printing." Fortune Hasbro Starts to Play Nice with 3Dprinting Comments. Accessed November 26, 2014. <http://fortune.com/2014/07/21/hasbro-3d-playing-nice/>.

SuperFanArt, recording “an 8% jump in second-quarter sales” due primarily to this intellectual property experiment<sup>126</sup>.

Another giant among plastic toy industries, Lego, may also soon choose a bifurcated model system to reflect the growing popularity of 3D printers; a particularly keen business strategy considering that the current specialty of home 3D printers to construct simple plastic designs may threaten toy companies such as Lego the most severely. Lego was recently awarded a patent “for the 3D printing of plastic on Lego block bases”, which would effectively allow the company to permit consumers to customize Lego bricks in a similar fashion to the Hasbro model, allowing individuals the opportunity to “customize the Lego experience” as well as “driv[e] more excitement to [Legos] products” and future vitality of the brand<sup>127</sup>.

Shifting business models to a bifurcated pricing system allows traditional manufacturers a chance to gain a competitive edge over other competitors, rather than suffer at the hands of a new and innovative market. Businesses that can successfully price and distribute products in these multiple distribution channels will also help consumers “feel a moral reason for continuing to purchase from the traditional manufacturer”, rather than seeking cheaper and potentially free alternative services<sup>128</sup>.

### **Rethinking the Repair-Reconstruction Doctrine**

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<sup>126</sup> Ibid.

<sup>127</sup> Gardner, Alan. "Lego Awarded 3D Printing Patent, May Allow Users to Print Own Bricks." 3DPrint.com. Accessed November 26, 2014. <http://3dprint.com/1383/lego-awarded-3d-printing-patents-may-allow-users-to-print-own-bricks/>.

<sup>128</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 26.

In order to clarify the repair-reconstruction doctrine for both consumers and patent owners we need be to abandon traditional approaches for the doctrine altogether, for the reparative abilities of 3D printing is a very real and tangible use of the technology in the coming years. As proposed by Kelsey Wilbanks, one potential solution to the repair-reconstruction conflict would be to adopt an “all or nothing” standard<sup>129</sup>. Using this standard, consumers would only be held liable for direct copying of the entire product as whole, rather than printing isolated parts separately. This would agree with court interpretation of the past, claiming that “simultaneous replacement of multiple parts” was considered a legal “repair as long as the parts gave a patented device a different purpose” in the end<sup>130</sup>. Additionally, Wilbanks offers that John Locke’s theory of labor-mixing would recognize this approach. Following Locke’s premise, the blending of individual labor into another resource serves as a the foundation for property ownership itself as it would sever the item form an original “state of nature”; subsequently justifying any modification or repair of a product but not the transference of patent ownership itself<sup>131</sup>. Using this theory, dscott4’s Bugaboo design would claim an ownership interest by investing labor into an existent product, escaping liability without claiming ownership of the patented product as a whole.

Another strategy would be to expand on standards explored in *Aro* by introducing a potential two-tier ‘cost of repair’ calculus to tackle substantial costs and the valued importance of replaced items. This calculus would be an objective means to apply the

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<sup>129</sup> Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*: 1175.

<sup>130</sup> *Ibid.*

<sup>131</sup> *Ibid.*

ideas set forth in the cost and importance sub standards introduced by Justice Brennan in the concurrence for *Aro*. In my proposal for this cost of repair calculus, I would include two different formulas, one to weigh the costs of self-repair versus the cost of having to purchase another product at full price, and another formula to handle the unlikely circumstance that a particular manufacturer actually can offer some reparative service towards an unpatented part. In the first cost of repair calculus, costs of self-repair 'A' would have to be less than some percentage 'X' multiplied by the cost of purchasing another whole product 'B' (or  $A < (X) B$ ). The value 'X' would vary depending on the price of the product, but would constitute some percentage that repairs must cost less than. For example, objects valued under \$50 might have an 'X' value of 25%, and objects under \$100 might have an 'X' value of 20%, and so on. This would allow ample breathing room for consumers to pursue self-repairs of products, while still giving patent owners a larger share of authority over this process. Additionally, having changing boundary percentage values for 'X' would give patent owners more jurisdiction over higher valued commodities that may possess more intricate working parts and repair potential.

The second cost of repair calculus would mimic the first formula, but would offer a different value percentage in respect to the cost of buying a repair service from the manufacturer or patent owner (rather than the cost of purchasing the whole item). In this formula, costs of self-repair 'A' would have to be less than the cost of purchasing a repair service from the manufacturer/patent owner 'C' multiplied by an additional 40%, although this percentage is not locked and could change depending on how substantial the burden for the consumer should be weighed (or  $A < (.40) C$ ). In this version, more

leeway is given to consumers than in the first calculus, who may be able to pursue alternative repair services for a cheaper price. However, manufacturers/patent owners still have a larger power share of the calculus. By offering this two-tier calculus, we can introduce a clear methodology for distinguishing unlawful reconstruction from permissible legal repairs. Both of these formulas allow for an appropriate range of permissible repair, and allow for both consumers and patent holders to have a clear understanding of the repair-reconstruction doctrine.

Using this repair of cost calculus, we would see that dscott4's Bugaboo repair design escapes any potential of unlawful reconstruction. First consider the variables measured in this instance: the cost of self-repair is \$25, the cost-quote of the repair through manufacturer is \$250, and the cost of the product as a whole (the baby stroller) is valued around \$1000 (Shop, BUGABOO). Using the formula,  $A < (.40) C$ , would mean that the cost of self-repair falls well within the permissible range of \$100 (calculated as \$250 multiplied by .40). The courts could then potentially agree that repairs were unsubstantial enough towards the overall importance and cost of object as to avoid an unwarranted construction; and this would be a logical conclusion, since the printing and application of small replacement steel hinges does not likely reconstruct an object past its original purpose. Using this model, we would associate importance with cost pricing point of the original product. Although potentially problematic, this may be a more objective standard substitution than the alternative of judges debating the merits of a particular repair versus the construction of the whole and allows for a solution that custom tailors it's specifications to the price and overall value of a product. We can abandon an ambiguous set of subjective analyses used in past precedent that fail to encapsulate the interests of

patent users and owners. Additionally, this would encourage manufacturers to offer more accessible repair opportunities in order to compete with a now viable market of self-repair.

### **Revitalizing DMCA Protections**

The basic structure of the DMCA has the potential to provide a beneficial template for both manufacturers and consumers of 3D printers in the future. First and foremost, DMCA safe harbor protections and takedown requests must be expanded to cover patent law. This transition is not an unrealistic endeavor, as the DMCA is already a working defense in many online depositories. Copyright and patent owners face similar threats in the coming of 3D printing technologies, so it would make logical sense to have similar protection systems in place for patent infringements. The DMCA serves as a useful buffer zone to avoid engaging users in direct infringement violation and has proven to be a valuable tool when used correctly by prosecuting parties, as well. Because many open model online depositories do not inherently claim a financial/commercial interest in the distribution of the CAD files, Internet 3D printing service providers such as *thingiverse* are able to more actively avoid contributory infringement as well, as long as these services meet a small number of basic safe harbor requirements set forth by the DMCA. Expansion of the DMCA into patent law protection would allow for a fair interaction for both copyright/patent protection holders, users of 3D printers, as well as various ISPs that host these files. Some modifications need to occur, however, in order to make sure that the DMCA serves as a sensible medium for lawful intervention, beneficial for both copyright/patent owners and users.

As it presently stands, copyright infringements impose substantial and unreasonable costs for otherwise insignificant acts of breach. For example, an online resource *PRDaily* was recently sued for \$8,000 in damages following the unapproved use of a low quality photograph of a Nebraskan city located through Google image services<sup>132</sup>. *PRDaily* attempted to remove the photo, as well as link the original producer of the image in order to give proper credit to the origin of the image, but ultimately failed to escape the legal suit<sup>133</sup>. *PRDaily* made extensive efforts to negotiate settlement costs but ultimately paid \$3,000 in fees; a rather unreasonable consequence for a particular blog submission that received less than 100 viewers<sup>134</sup>. Copyright protections, as demonstrated in the previous scenario, pay little attention to the severity or value of infringing activity. In order to avoid abuses of DMCA, we must make penalties for infringing activity a certain, and much smaller, percentage of the value (either intrinsic or monetary) of the originally copied item. The extreme penalties of infringing arguably serve no benefit other than to reward the legal actors who enforce them, and certainly do not “fit the crime” of sometimes trivial copyright trespass<sup>135</sup>.

Another flaw of the DMCA procedure that concerns primarily copyright and patent owners is the threat of automatic repost. As many who have attempted to navigate

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<sup>132</sup> DePhillips, Kari. "How Using Google Images Can Cost You \$8,000." PR Daily News: Public Relations News and Marketing in the Age of Social Media. Accessed November 27, 2014.

[http://www.prdaily.com/Main/Articles/How\\_using\\_Google\\_Images\\_can\\_cost\\_you\\_8000\\_14912.aspx](http://www.prdaily.com/Main/Articles/How_using_Google_Images_can_cost_you_8000_14912.aspx).

<sup>133</sup> Ibid.

<sup>134</sup> Ibid.

<sup>135</sup> Lee, Timothy B. "Five Ways Congress Should Improve the Copyright System." Ars Technica. Accessed November 27, 2014. <http://arstechnica.com/tech-policy/2013/04/five-ways-congress-should-improve-the-copyright-system/>.

the legal process have encountered, users who have been verified to have committed copyright infringement can often repost infringing material immediately after it has been taken down, bypassing the entire notion of DMCA protections entirely. For instance, let's imagine a copyright owner who may have successfully encouraged a certain individual to remove material from the Internet. After the initial takedown request has been satisfied, a user may be able to immediately repost the material unknowingly to the copyright owner who must subsequently repeat the DMCA procedure<sup>136</sup>. Weighty and much more substantial fines, or even complete blockage of recognition from internet search engines, should be imposed on individuals who attempt to ignore the legitimacy of copyright patent concerns by simply reposting identical infringing material to host sites<sup>137</sup>. Ignoring the issue of reposting puts copyright/patent owners at an extreme disadvantage, who will otherwise fall prey to the lengthy and arduous process of filing additional DMCA takedown requests.

Lastly, the DMCA process must also be made more accessible and user friendly for copyright/patent owners to use. If a particular copyright/patent owner wants to utilize DMCA protections, they must go through the U.S Copyright Office beforehand. Unfortunately, the Copyright Office's available DMCA agent list "is not searchable, not indexable and completely useless for anything other than one-time checks"<sup>138</sup>. A copyright owner must spend inordinate amounts of time searching for particular host sites

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<sup>136</sup> Bailey, Jonathan. "The Need to Modernize the DMCA Agent List." *Plagiarism Today*. Accessed November 27, 2014. <https://www.plagiarismtoday.com/2007/08/21/the-need-to-modernize-the-dmca-agent-list/>.

<sup>137</sup> *Ibid.*

<sup>138</sup> *Ibid.*

that may display infringing content, whom often register for DMCA safe haven protections under various names<sup>139</sup>. This problem amounts to more than just an inconvenience. The amount of time and resources to successfully file DMCA takedown requests often becomes too staggering for smaller name copyright and patent owners to actually utilize. As it currently stands, the DMCA only realistically protects larger corporations and enterprises that can afford to navigate the Copyright Office's lackluster and inefficient system. With the potential of 3D printing to effect both large corporations as well as smaller independent users, massive reformation of the DMCA must occur for equal opportunity of all intellectual property owners.

#### **Retooling our Fair Use Doctrine**

Additionally, the fair use clause must continue to be substantiated and respected. Considering the multitude of 3D printing copyright deficiencies, the continued protection of the fair use provision serves as the most monumental. As described before, fair use provides protections for works that have parodic, transformative, or educational intents in their underlying function. Yet, the actual practice of the fair use provision is often met with little success. For example, teachers and professors are often barred from using film/television samples for educative reasons in their classrooms, a very reasonable and otherwise permissible use of copyrighted material. However, due to a tricky combination of DRM (Digital Rights Management) and DMCA protections, these instructors often are

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<sup>139</sup> Ibid.

barred access regardless. Instructors who manage to bypass DRM restrictions are often liable for huge financial repercussions, and even criminal charges<sup>140</sup>.

Some authorities in intellectual law argue for a complete restructuring of our conception of fair use; from a more defensive-minded procedure to an active right. As presently constructed, “a copyright consumer does not currently have a natural or positive right to fair use; instead fair use is [used as] an affirmative defense”<sup>141</sup>. Currently, fair use is limited to a more after the act application, which collides markedly with the purpose behind its original inception. The original drafting of the Copyright Act in 1778, intended to “promote the progress of science and useful arts”<sup>142</sup>. Instead, our current legal drafting of the fair use standard distributes substantial advantage elsewhere. With additive manufacturing technologies more commonly finding their way into universities and other educational settings, it is imperative that our fair use standard return to its original understanding.

### **Closing Remarks: Changing our Perspective**

Unfortunately, more conservative future interpretations of these intellectual property protections may risk spoiling the usefulness and potential of 3D printers, freezing further technological advancements that are practically limitless. Courts may

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<sup>140</sup> "TABLE OF CONTENTS." The Digital Learning Challenge: Obstacles to Educational Uses of Content in the Digital Age A Foundational White Paper. Accessed November 26, 2014.

[http://cyber.law.harvard.edu/media/files/copyrightandeducation.html#2\\_2](http://cyber.law.harvard.edu/media/files/copyrightandeducation.html#2_2).

<sup>141</sup> Loos, Thomas. "Fair Use and the Digital Millennium Copyright Act." University of Michigan Law School. Accessed November 26, 2014.

<http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1099&context=mttlr>.

<sup>142</sup> Berry, John. "The Real Purpose of Copyright." Library Journal. Accessed November 26, 2014. [http://lj.libraryjournal.com/2000/07/copyright/the-real-purpose-of-copyright/#\\_](http://lj.libraryjournal.com/2000/07/copyright/the-real-purpose-of-copyright/#_).

choose to reframe these legal provisions to allow for more expansive printer use, spurring future innovation and subsequently allowing for 3D printing technologies and capabilities to grow to their fullest potential. However, waging a legal war over the use of printers fails to capture the actual lingering issue. Admittedly, our legal framework may not hold for even a fraction of a 3D printer's possible uses. But, only by changing our traditional means of business can we hope to harness the potential of additive manufacturing, rather than contain it. Additionally, traditional manufacturers threatened by the onset of 3D printing must learn from the mistakes of the Napster fiasco to avoid making the same mistakes that both plagued the music industry in the long term, as well as changed the public perceptions of the legitimacy of intellectual property and piracy.

We can look to improve intellectual property law to help guide the printing revolution, but we must rely on traditional manufacturers to see 3D printers as an opportunity for growth. "The biggest, and arguably most permanent, error that the tangible goods industries can make when addressing those who share patented designs with others who can print them on 3-D printers, would be to treat this as a legal problem rather than a market or business problem, and to use the civil litigation and legislative process to seek redress"<sup>143</sup>. Intellectual property must return to its original intention of encouraging technological innovation, not impeding it. According to Article 1 Section 8 of the Copyright Act, intellectual property rights were meant "not merely to reward creators" of new technology, but also to "encourage creativity and innovation for the

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<sup>143</sup> Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 5.

benefit of society” as a whole<sup>144</sup>. In its preliminary stages, 3D printing may disrupt several dimensions of our conventional systems of trade, manufacturing, and distribution. "It's true", as Cory Doctorow imagined in his fictional work, but to focus on 3D printing's negative potential is to be "so tunnel visioned, as to be practically blind."<sup>145</sup>

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<sup>144</sup> Finocchiaro, Charles. "Personal Factory or Catalyst for Piracy?" *Cardozo Arts and Entertainment Law Journal* 473 (2013): 4.

<sup>145</sup> Doctorow, Cory. "'Printcrime'" In *Over Clocked: Stories of the Future Present*, 1. Philadelphia: Running Press, 2005.

## Bibliography

- "17 U.S. Code § 102 - Subject Matter of Copyright: In General." LII / Legal Information Institute. Accessed November 26, 2014.  
<http://www.law.cornell.edu/uscode/text/17/102>.
- "3D Printed Carbomorph Circuit Boards." ENGINEERING.com. Accessed November 26, 2014.  
<http://www.engineering.com/3DPrinting/3DPrintingArticles/ArticleID/7539/3D-Printed-Carbomorph-Circuit-Boards.aspx>.
- "3D Printing Materials." Shapeways. Accessed September 1, 2014.  
<http://www.shapeways.com/materials>.
- "3D Printing Scales up." The Economist. September 7, 2013. Accessed November 26, 2014. <http://www.economist.com/news/technology-quarterly/21584447-digital-manufacturing-there-lot-hype-around-3d-printing-it-fast>.
- "35 U.S. Code § 271 - Infringement of Patent." LII / Legal Information Institute. Accessed November 26, 2014. <http://www.law.cornell.edu/uscode/text/35/271>.
- "Aro Mfg. Co., Inc. v. Convertible Top Co. 377 U.S. 476 (1964)." Justia Law. Accessed November 26, 2014.  
<https://supreme.justia.com/cases/federal/us/377/476/case.html>.
- "A & M Records, Inc. v. Napster Inc." - Internet Law Treatise. Accessed November 26, 2014. [https://ilt.eff.org/index.php/A\\_&\\_M\\_Records,\\_Inc.\\_v.\\_Napster\\_Inc](https://ilt.eff.org/index.php/A_&_M_Records,_Inc._v._Napster_Inc).
- "Baby Strollers, Accessories, Parts – Bugaboo (United States) English." Baby Strollers, Accessories, Parts – Bugaboo (United States) English. Accessed November 26, 2014. [https://www.bugaboo.com/US/en\\_US/strollers](https://www.bugaboo.com/US/en_US/strollers).

- Bailey, Jonathan. "The Need to Modernize the DMCA Agent List." *Plagiarism Today*. Accessed November 27, 2014. <https://www.plagiarismtoday.com/2007/08/21/the-need-to-modernize-the-dmca-agent-list/>.
- Berry, John. "The Real Purpose of Copyright." *Library Journal*. Accessed November 26, 2014. [http://lj.libraryjournal.com/2000/07/copyright/the-real-purpose-of-copyright/#\\_](http://lj.libraryjournal.com/2000/07/copyright/the-real-purpose-of-copyright/#_).
- "Bugaboo Pram - Front Wheel Repair." *Instructables.com*. Accessed November 26, 2014. <http://www.instructables.com/id/Bugaboo-Front-wheel-repair/>.
- "Copyright Law of the United States of America." U.S. Copyright Office. Accessed November 26, 2014. <http://www.copyright.gov/title17/92chap1.html#101>.
- "Copyright Law of the United States of America." U.S. Copyright Office. Accessed November 26, 2014. <http://www.copyright.gov/title17/92chap1.html#107>.
- Desai, Deven. "3D Printing and the Digitization of Things." *Georgetown Law Journal*, 2014.
- DePhillips, Kari. "How Using Google Images Can Cost You \$8,000." *PR Daily News: Public Relations News and Marketing in the Age of Social Media*. Accessed November 27, 2014. [http://www.prdaily.com/Main/Articles/How\\_using\\_Google\\_Images\\_can\\_cost\\_you\\_u\\_8000\\_14912.aspx](http://www.prdaily.com/Main/Articles/How_using_Google_Images_can_cost_you_u_8000_14912.aspx).
- Doctorow, Cory. "'Printcrime'" In *Over Clocked: Stories of the Future Present*, 1-4. Philadelphia: Running Press, 2005.
- Duann. "Shapeways Blog - Hasbro & Shapeways Enable 3D Printing Fan Art with

SuperFanArt." Shapeways.com. Accessed November 26, 2014.

<http://www.shapeways.com/blog/archives/16759-hasbro-shapeways-enable-3d-printing-fan-art-with-superfanart.html>.

Engstrom, Nora Freeman. "3-D Printing and Product Liability: Identifying the Obstacles." *Stanford Law Journal*, 2013, 4.

Evgeny Morozov, To Save Everything, Click Here 140–80 (2013).

Finocchiaro, Charles. "Personal Factory or Catalyst for Piracy?" *Cardozo Arts and Entertainment Law Journal* 473 (2013): 4.

"Free CultureBy Lawrence Lessig." Free Culture. Accessed November 26, 2014.

<http://www.authorama.com/free-culture-8.html>.

Gardner, Alan. "Lego Awarded 3D Printing Patent, May Allow Users to Print Own Bricks." 3DPrintcom. Accessed November 26, 2014.

<http://3dprint.com/1383/lego-awarded-3d-printing-patents-may-allow-users-to-print-own-bricks/>.

Gross, Doug. "Obama's Speech Highlights Rise of 3-D Printing." CNN. February 13, 2013. Accessed November 26, 2014.

<http://www.cnn.com/2013/02/13/tech/innovation/obama-3d-printing/>.

Gupta, Deepak, Marc Tarlock, and Farella Braun. "3D Printing, Copyright Challenges, and the DMCA." *Farella, Bruan and Martell* 38, no. 3 (2013): 3.

"Hasbro Starts to Play Nice with 3D printing." Fortune Hasbro Starts to Play Nice with 3Dprinting Comments. Accessed November 26, 2014.

<http://fortune.com/2014/07/21/hasbro-3d-playing-nice/>.

"How to Repair a Bugaboo Pram with 3D Printing." Instructables.com. Accessed

November 26, 2014. <http://www.instructables.com/id/How-to-repair-a-Bugaboo-Pram-with-3D-Printing/>.

"IP Lawyer: Why 3D Printing Will Lead to 'thermonuclear Wars' | ZDNet." ZDNet.

Accessed November 26, 2014. <http://www.zdnet.com/why-3d-printing-wars-to-go-thermonuclear-7000028085/>.

"Is the 3D Printing Industry about to Start Turning out Lawsuits?" Digital Trends.

Accessed November 26, 2014. <http://www.digitaltrends.com/cool-tech/3d-printing-and-copyright-lawsuits/>.

Katyal, Neal. "Disruptive Technologies and the Law." *Georgetown Law Journal*. August 1, 2014. Accessed September 1, 2014.

<http://www.lexisnexis.com/hottopics/lnacademic/?shr=t&sfi=AC00NBGenSrch>.

Loos, Thomas. "Fair Use and the Digital Millennium Copyright Act." University of Michigan Law School. Accessed November 26, 2014.

<http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1099&context=mttlr>.

*Louis Vuitton Malletier S.A. v. Haute Diggity Dog, LLC*. United States Court of Appeals for the Fourth Circuit 507 F.3d 252 (4th Cir. 2007)

Moskowitz,, Michael J. "Beyond 2014: Evolving Opportunities in Technology." *Wells Fargo*, February 1, 2014, 6.

"Napster's High and Low Notes." Bloomberg Business Week. Accessed November 26, 2014. [http://www.businessweek.com/2000/00\\_33/b3694003.htm](http://www.businessweek.com/2000/00_33/b3694003.htm).

"OpenJurist." 354 F3d 624 Chicago Board of Education v. Substance Inc N. Accessed November 26, 2014. <http://openjurist.org/354/f3d/624>.

"Originality Requirements under U.S. and E.U. Copyright Law - Software Freedom Law

Center." Originality Requirements under U.S. and E.U. Copyright Law - Software Freedom Law Center. Accessed November 29, 2014.

<https://www.softwarefreedom.org/resources/2007/originality-requirements.html>.

Petronzio, Matt. "How 3D Printing Actually Works." Mashable. March 28, 2013.

Accessed September 1, 2014. <http://mashable.com/2013/03/28/3d-printing-explained/>.

Ragan, Sean. "The Thingiverse "Heart Gears" Phenomenon – A Physible Family Tree."

Smragancom Sean Michael Ragan. June 1, 2012. Accessed November 26, 2014.

<http://www.smragan.com/2012/06/11/the-heart-gears-phenomenon-a-physible-family-tree/>.

"Restatement of the Law, Third, Torts: Product Liability." *The American Law Institute*, 1998.

*RepRap Open Source Printer*. Youtube, 2014. Film.

Richtel, Matt. "Napster Appeals an Order To Remain Closed Down." The New York Times. July 12, 2001. Accessed November 26, 2014.

<http://www.nytimes.com/2001/07/13/business/technology-napster-appeals-an-order-to-remain-closed-down.html>.

Sanders v. Acclaim Entertainment, Inc., 188 F. Supp. 2d 1264 - Dist. Court, D. Colorado 2002

"Sony Doctrine Law & Legal Definition." Sony Doctrine Law & Legal Definition.

Accessed November 26, 2014. <http://definitions.uslegal.com/s/sony-doctrine/>.

"Stereolithography." Materialize. Accessed September 1, 2014.

<http://manufacturing.materialise.com/stereolithography>.

Storch, Joseph C. "3-D Printing Your Way Down the Garden Path." *JOURNAL of INTELLECTUAL PROPERTY and ENTERTAINMENT LAW*, 2014, 5.

"TABLE OF CONTENTS." The Digital Learning Challenge: Obstacles to Educational Uses of Content in the Digital Age A Foundational White Paper. Accessed November 26, 2014.

[http://cyber.law.harvard.edu/media/files/copyrightandeducation.html#2\\_2](http://cyber.law.harvard.edu/media/files/copyrightandeducation.html#2_2).

"The Digital Millennium Copyright Act of 1998." U.S Copyright Office Summary. December 1, 1998. Accessed November 26, 2014.

<http://www.copyright.gov/legislation/dmca.pdf>.

Lee, Timothy B. "Five Ways Congress Should Improve the Copyright System." *Ars Technica*. Accessed November 27, 2014. <http://arstechnica.com/tech-policy/2013/04/five-ways-congress-should-improve-the-copyright-system/>.

Weinberg, Michael. "IT WILL BE AWESOME IF THEY DONT SCREW IT UP." *Public Knowledge*. November 1, 2010. Accessed November 26, 2014.

<https://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf>.

Weinberg, Michael J. "What's the Deal with Copyright?" *Public Knowledge*, 2013, 21.

Wilbanks, Kelsey. "The Challenges of 3D Printing To The Repair-Reconstruction Doctrine In Patent Law." *George Mason Law Journal*: 2.

"Wilson v. Simpson 50 U.S. 109 (1850)." *Justia Law*. Accessed November 26, 2014.

<https://supreme.justia.com/cases/federal/us/50/109/>.