

NOTE

CLOSING THE FLOODGATES ON 3D PRINTING  
COPYRIGHT INFRINGEMENT

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## I. INTRODUCTION

3D printing, also known as additive manufacturing, is a technology that has been hailed multiple times in the past decade as being a revolutionary technology.<sup>1</sup> With the COVID-19 pandemic, 3D printing showed its power when designers and printers worked to supplement parts and equipment shortages in the healthcare industry.<sup>2</sup> However, with the rise in the use of 3D printing comes the ability for 3D printing to be used to violate copyright on a grand scale comparable to what the music industry experienced with Napster.<sup>3</sup> An individual that has access to a 3D printer and the CAD files required to tell the printer how to print has the ability to print out as many copies as they desire. As the quality of 3D prints increases with further improvements to the technology, it becomes easier for any person to 3D print a copyrighted object to a quality nearly indistinguishable from properly licensed products. Copyright holders have generally thus far stuck to issuing takedown requests of infringing materials that online distribution platforms are hosting, but there is an endless arms race between the copyright holder issuing takedowns and individual file sharers that will upload copyrighted designs online for free, or even sell.<sup>4</sup> Holders of 3D printed designs once again face the same issue that the music industry confronted in the early 2000s with the use of Napster, the potential for their copyrights to be violated in a decentralized manner that makes it difficult to track and enforce.<sup>5</sup>

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<sup>1</sup> See Expert Panel, Forbes Tech. Council, *12 Revolutionary Ways 3D Printing is Changing the World*, FORBES (Sept. 18, 2019, 08:15 AM), <https://www.forbes.com/sites/forbestechcouncil/2019/09/18/12-revolutionary-ways-3d-printing-is-changing-the-world/?sh=66f6c5935cfc> [https://perma.cc/35KY-7TL3].

<sup>2</sup> See Yu Ying Clarrisa Choong et al., *The Global Rise of 3D Printing During the COVID-19 Pandemic*, NATURE (Aug. 12, 2020), <https://www.nature.com/articles/s41578-020-00234-3> [https://perma.cc/33GY-QJH8].

<sup>3</sup> Ben Depoorter, *Intellectual Property Infringements & 3D Printing Decentralized Piracy*, 65 HASTINGS L.J. 1483, 1495 (2014).

<sup>4</sup> See, e.g., Nick Statt, *Print Chop: How Copyright Killed a 3D-Printed Final Fantasy Fad*, CNET (Aug. 16, 2013, 11:29 AM), <https://www.cnet.com/tech/services-and-software/print-chop-how-copyright-killed-a-3d-printed-final-fantasy-fad/> [https://perma.cc/TE68-PT7R]; Nathan Hurst, *HBO Blocks 3-D Printed Game of Thrones Phone Dock*, WIRED (Feb. 13, 2013, 1:57 PM), <https://www.wired.com/2013/02/got-hbo-cease-and-desist/> [https://perma.cc/TWM2-PHSK].

<sup>5</sup> Depoorter, *supra* note 3, at 1494–95.

Because 3D printing is done for the purpose of obtaining real objects, it may not be possible for rights holders to copy the solutions that the music industry used to stop Napster in the past. This Note seeks to provide a solution to this problem. First, Part II examines the background of 3D printing and its development from a specialized process that could only produce plastic toys to a growing sector of technology accessible to ordinary consumers with the potential to be used to produce lifesaving technology.<sup>6</sup> Then, Parts III and IV cover an overview of the most important aspects of copyright law to 3D printing, as well as how different parties might be directly or indirectly liable.<sup>7</sup> Finally, Part V proposes solutions based on both government regulation of the practice itself as well as industry specific reforms analogous to those that the music industry implemented.<sup>8</sup>

## II. BACKGROUND

The process of 3D printing is one that has become more prominent in recent news, especially after it was deployed extensively during the COVID-19 pandemic,<sup>9</sup> where it was utilized extensively to supplement global shortages on parts and materials.<sup>10</sup> 3D printing is a type of additive manufacturing, which is a manufacturing process that begins with nothing and constructs an object through adding layers upon some sort of base, while most other forms of manufacturing are subtractive and instead involve removing material from a larger source until you have the part needed.<sup>11</sup> Modern day 3D printing involves the use of Computer-Aided Design (“CAD”) files, which are files that act as a schematic for a 2D or 3D object.<sup>12</sup> These files can be read by a 3D printer, which will then print

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<sup>6</sup> See discussion *infra* Part II.

<sup>7</sup> See discussion *infra* Parts III, IV.

<sup>8</sup> See discussion *infra* Part V.

<sup>9</sup> See Choong et al., *supra* note 2.

<sup>10</sup> See *id.*

<sup>11</sup> See *Additive Manufacturing/3D Printing*, NAT’L INST. FOR OCCUPATIONAL HEALTH & SAFETY, (Aug. 7, 2019), <https://www.cdc.gov/niosh/topics/advancedmnf/additivemnf.html> [<https://perma.cc/5QW4-ZUFL>].

<sup>12</sup> See Nathan Reitingner, *CAD’s Parallel to Technical Drawings: Copyright in the Fabricated World*, 97 J. PAT. & TRADEMARK OFF. SOC’Y 111, 118 (2015).

out the object using melted plastic filaments at a certain resolution, with the best models today being able to print objects at the micron level.<sup>13</sup>

The technological precursor to 3D printing was created by the Teletype Corporation in the 1960s, who created inkjet technology which had the idea of dispensing material (wax initially) from a nozzle onto paper.<sup>14</sup> This was then followed by Johannes F. Gottwald, who was working for Teletype, patenting a machine called the liquid metal recorder, which would use a modified version of inkjet technology to dispense drops of liquid metal that once dried, would form an object.<sup>15</sup> Hideo Kodama later took the idea of the liquid metal recorder and instead of using liquid metal, would use plastics.<sup>16</sup> Chuck Hall would ultimately build what is generally considered as the first 3D printer in 1987, though at this time the technology was expensive and generally limited to manufacturing plants.<sup>17</sup>

Accessibility to 3D printing grew with the RepRap project, which was an open-source project based around the idea of having a 3D printer that could have all of its non-metal parts 3D printed, with all the needed files to print out the components being shared online for users to modify and improve upon to create an evolving design.<sup>18</sup> With the launch of Kickstarter, companies began to launch their own 3D printers, with the designs of the printers moving away from open source and assembly from 3D printed parts and commonly used metal components, to more proprietary systems.<sup>19</sup>

With the barrier to entry to 3D printing being lowered from prohibitively expensive and limited to manufacturing facilities to a desktop device that can be shipped to a customer and ready to use immediately, rights holders are now facing an issue that the music industry had to confront in the past: decentralized piracy. With 3D printing, any person with access to a 3D printer and a 3D scanner can

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<sup>13</sup> See Pat Nathaniel, *8 Best High Resolution 3D Printers in 2023*, PRINTING ATOMS (Nov. 24, 2023), <https://printingatoms.com/3d-printers/high-resolution-3d-printer>.

<sup>14</sup> Drew Turney, *History of 3D Printing: It's Older Than You Think*, AUTODESK, (Aug. 31, 2021), <https://redshift.autodesk.com/articles/history-of-3d-printing> [<https://perma.cc/4KL9-VEDP>].

<sup>15</sup> See *id.*

<sup>16</sup> See *id.*

<sup>17</sup> See *id.*

<sup>18</sup> JOAN HORVATH, *MASTERING 3D PRINTING 7* (Michelle Lowman et al. eds., 2014).

<sup>19</sup> See *id.* at 9.

take an object that is protected by IP laws and produce a highly accurate, if not identical copy in plastic, or simply design their own file and print it out. The first notable takedown in 3D printing history was issued by artist Ulrich Schwanitz for a 3D printed Penrose Triangle that another 3D modeler had managed to replicate and uploaded onto Thingiverse.<sup>20</sup> Notable recent takedowns have included Games Workshop, a miniatures manufacturer, issuing takedown notices against 3D artists for violations of their copyright,<sup>21</sup> or Honda issuing takedown requests against 3D CAD file repositories for all files that used the name Honda as well as parts compatible with Honda vehicles generally for violations of trademarks and patents.<sup>22</sup>

### III. COPYRIGHT OVERVIEW

This Note seeks to specifically address the impact that 3D printing has on U.S. copyright law, and thus an overview of the requirements to obtain copyright, the rights that copyright holders possess, as well as different methods of infringement are required.

#### A. BACKGROUND AND REQUIREMENTS FOR COPYRIGHTABILITY

The source of copyright law stems from the Constitution, under Article I, Section 8, Clause 8, in which it is stated that Congress shall have the power “To promote the Progress of Science and useful Arts, by securing for limited Times to Authors ... the exclusive Right to their respective Writings.”<sup>23</sup> To this end,

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<sup>20</sup> See Peter Hanna, *The Next Napster? Copyright Questions as 3D Printing Comes of Age*, ARS TECHNICA (Apr. 6, 2011, 12:35 AM), <https://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/> [https://perma.cc/9GQX-WBL5].

<sup>21</sup> See Rob Baer, *Games Workshop Opens the War Against 3D Artists*, SPIKEYBITS (May 5, 2022), <https://spikeybits.com/2021/05/games-workshop-opens-the-war-against-3d-artists.html> [https://perma.cc/JT3T-92GW].

<sup>22</sup> See Rob Stumpf, *Honda Orders Big Takedown of Honda-Related 3D Printing Models From Maker Communities*, THE DRIVE, (Apr. 13, 2022, 1:49 PM), <https://www.thedrive.com/news/honda-orders-big-takedown-of-honda-related-3d-printing-models-from-maker-communities> [https://perma.cc/4GZD-ZTD3].

<sup>23</sup> U.S. CONST. art. I, § 8, cl. 8.

Congress initially enacted the Copyright Act of 1790,<sup>24</sup> which underwent several revisions in the following centuries, the most recent of which being in 1976, and includes more than just written works.<sup>25</sup> Section 102 of the Copyright Act simply states that copyright protection will apply to “original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.”<sup>26</sup> The most important parts of the statute is the requirement that the work be original, that it be a “work of authorship” and that it be fixed in a tangible medium of expression.<sup>27</sup>

Originality is not defined in the statute, and instead courts have created their own definition of originality for copyright purposes.<sup>28</sup> To fulfill the requirement of originality, the work must “Possess . . . at least some minimal degree of creativity.”<sup>29</sup> This requirement is perhaps the easiest to fulfill, with the Supreme Court stating that “the requisite level of creativity is extremely low; even a slight amount will suffice. The vast majority of works make the grade quite easily, as they possess some creative spark, no matter how crude, humble, or obvious it might be.”<sup>30</sup> Even taking one work and turning it into a different medium can qualify for copyright protection, as was seen in *Alfred Bell & Co. v. Catalda Fine Arts, Inc.*<sup>31</sup> In *Alfred Bell*, the court found that making mezzotint engravings of public domain paintings was enough to qualify for copyright of the engravings.<sup>32</sup> So long as the author has added something that is “recognizably his own,” that is enough to fulfill originality.<sup>33</sup> However, the precedent set by *Meshwerks Inc. v. Toyota Motor Sales USA, Inc* would have to be considered as well, since even if one were to put in significant effort into replicating something as

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<sup>24</sup> See *Timeline: The 18th Century*, U.S. COPYRIGHT OFF., [https://www.copyright.gov/timeline/timeline\\_18th\\_century.html](https://www.copyright.gov/timeline/timeline_18th_century.html) [<https://perma.cc/R8UX-5ELU>].

<sup>25</sup> 17 U.S.C. § 102.

<sup>26</sup> See *id.*

<sup>27</sup> See *id.*

<sup>28</sup> See Howard B. Abrams, *Originality and Creativity in Copyright Law*, 55 L. & CONTEMP. PROBS. 3, 7–9 (1992).

<sup>29</sup> *Feist Publ'ns, Inc. v. Rural Tel. Serv.*, 499 U.S. 340, 345 (1991).

<sup>30</sup> See *id.*

<sup>31</sup> See *Alfred Bell & Co. v. Catalda Fine Arts*, 191 F.2d 99 (2d Cir. 1951).

<sup>32</sup> See *id.* at 104–05.

<sup>33</sup> See *id.* at 103.

accurately as possible in another medium, it may still be ineligible for copyright protection.<sup>34</sup> In *Meshwerks*, the defendant Meshwerks had been subcontracted by advertisers working for Toyota to provide 3D digital models of Toyota's vehicles.<sup>35</sup> Meshwerks then obtained copyright registration of their digital models, and claimed that their copyright had been infringed.<sup>36</sup> The Tenth Circuit found that Meshwerk's 3D model of Toyota's car did not qualify for copyright protection despite the time and skill that went into making it as accurate as possible, as creating a perfect digital copy of something lacked the sufficient creativity to qualify for copyright protection.<sup>37</sup>

The requirement that the work be a "work of authorship" means that the work must fall within the eight categories of authorship that are listed in § 102 of the Copyright Act.<sup>38</sup> To be "fixed in a tangible medium of expression," the work only needs to be capable of existing in a "sufficiently permanent medium such that the work can be perceived, reproduced, or communicated for more than a short time."<sup>39</sup> This "fixation" requirement allows one to not only copyright items that are fixed in the physical realm like books or statues, but also digital media like works that are fixed as computer files.<sup>40</sup>

Once a piece of work fulfills all these requirements, it can be registered with the U.S. Copyright Office. Registration is a prerequisite for any copyright holder that wishes to bring action and obtain remedies such as statutory damages or attorney's fees.<sup>41</sup> A copyright holder possesses "exclusive rights" in the copyrighted work.<sup>42</sup> These rights include the right to "reproduce" and "distribute

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<sup>34</sup> See *Meshwerks, Inc. v. Toyota Motor Sales U.S.A., Inc.*, 528 F.3d 1258 (10th Cir. 2008).

<sup>35</sup> See *id.* at 1260.

<sup>36</sup> See *id.* at 1261.

<sup>37</sup> See *id.* at 1268.

<sup>38</sup> 17 U.S.C. § 102.

<sup>39</sup> See U.S. COPYRIGHT OFF., COPYRIGHT BASICS: CIRCULAR 1 (2021), <https://www.copyright.gov/circs/circ01.pdf> [<https://perma.cc/24WQ-6KY5>].

<sup>40</sup> *Copyright and Digital Files*, U.S. COPYRIGHT OFF., <https://www.copyright.gov/help/faq/faq-digital.html> [<https://perma.cc/2YB3-CSJG>].

<sup>41</sup> 17 U.S.C. § 412.

<sup>42</sup> *Id.* § 106.



copies . . . of the copyrighted work.”<sup>43</sup> The copyright holder also has the power to authorize others to use the copyright holder’s rights.<sup>44</sup>

## B. INFRINGEMENT

Those that do not have authorization from the copyright holder and utilize one of the rights granted to the holder are liable for infringement.<sup>45</sup> Notably, infringement does not require that the infringement be literal in that the infringer created an identical copy of what was copyrighted. Instead, courts will often look at how similar the two works are to find infringement. While circuits have slightly different tests for what constitutes copyright infringement, most generally follow the approach set by *Arnstein v. Porter*.<sup>46</sup> *Arnstein* involved a copyright infringement claim by songwriter Ira Arnstein against another songwriter for allegedly copying one of his songs.<sup>47</sup> To determine to what extent there needs to be similarities between two works such that it constitutes infringement, the court set out a two-step test that required (1) finding evidence of access and similarities to the copyrighted work, as well as (2) showing that the copying was illegal and constituted misappropriation.<sup>48</sup> The question as to what exactly amounts to appropriation is determined as a matter of fact, with most courts taking the approach that the comparison should be made to the works as a whole.<sup>49</sup>

Indeed, even changing the format of the work into a completely different medium can be found to still be a copyright violation, as shown in *Rogers v. Koons*.<sup>50</sup> *Rogers* involved the artist Jeff Koons creating a sculpture depicting a couple holding eight puppies, based off of a black and white photo taken by Art Rogers that also depicted a couple holding eight puppies.<sup>51</sup> Despite Koons’ sculpture

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<sup>43</sup> *See id.* §§ 106(1), (3).

<sup>44</sup> *See id.* § 106.

<sup>45</sup> *Id.* § 501.

<sup>46</sup> Shyamkrishna Balganesh et al., *Judging Similarity*, 100 IOWA L. REV. 267, 272 (2014).

<sup>47</sup> *Arnstein v. Porter*, 154 F.2d 464, 467 (2d Cir. 1946).

<sup>48</sup> Balganesh et al., *supra* note 46, at 272–73.

<sup>49</sup> *See id.* at 274 (noting that the question of similarity is one for the jury and that most courts conduct a holistic comparison).

<sup>50</sup> *See Rogers v. Koons*, 960 F.2d 301, 312 (2d Cir. 1992) (finding that a change of medium does not preclude a work from having an effect on the original’s market value and therefore infringing on the original).

<sup>51</sup> *Id.* at 304–05.

utilizing color as well as translating the work into a 3D medium from a 2D one, making it an entirely different medium as well as adding the Koons' own original work, the court found that the similarities of the design of the sculpture was enough to render it similar enough to the photo to constitute copying and affirmed the lower court's finding of copyright infringement.<sup>52</sup>

### C. LIABILITY?

A copyright holder has the option of finding liability from several different parties involved in the infringement of their copyrighted works. The most obvious party to find liable is the one that is actually infringing upon the rights of the copyright holder, usually by reproducing or distributing a copyrighted work, making them liable under a theory of direct liability. However, other parties that are not actually carrying out infringement may also be found liable, such as those that facilitate the directly liable party, under a theory for indirect liability.

#### 1. *Direct Liability*

The basis for direct liability for copyright infringement originates from the Copyright Act, in which it is stated that "Anyone who violates any of the exclusive rights of the copyright owner . . . is an infringer of the copyright or right of the author."<sup>53</sup> In most cases, a direct infringer is the one that is taking action to violate the copyright holder's rights, be it making copies of their work, authorizing redistribution, or any other exclusive right listed in the Copyright Act.<sup>54</sup>

The Copyright Act is a strict liability statute,<sup>55</sup> though courts have stated that the direct infringers in certain cases must have some element of volition in order to be directly liable, as seen in *Religious Tech. Ctr. v. Netcom On-Line Commc'n Servs., Inc.*<sup>56</sup> In *Religious Tech*, the plaintiff, who held the copyright to the works of L. Ron Hubbard, attempted to sue Netcom, an internet service provider, after an individual uploaded those copyrighted works onto Netcom's computers, allowing

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<sup>52</sup> *Id.* at 308.

<sup>53</sup> 17 U.S.C. § 501(a).

<sup>54</sup> *Id.* § 106 (establishing the exclusive rights of copyright holders which might therefore be infringed).

<sup>55</sup> *Religious Tech. Ctr. v. Netcom On-Line Commc'n Servs., Inc.*, 907 F. Supp. 1361, 1370 (N.D. Cal. 1995).

<sup>56</sup> *See id.*

Netcom customers to download them.<sup>57</sup> The plaintiff claimed that this created direct liability as Netcom would be making copies of these copyrighted works if any user was to attempt to access them.<sup>58</sup> The court held that to find a party directly liable there are “volitional or causal elements necessary,” and since those were missing from this case, despite Netcom having engaged in copying, it could not be found directly liable.<sup>59</sup> However, this does not necessarily protect every direct infringer who makes copies without volition, as courts have generally only applied this to service providers.<sup>60</sup>

## 2. *Indirect Liability*

Besides direct infringement, one might be held indirectly liable for copyright infringement. Unlike the Patent Act which specified indirect liability for infringement in its text, indirect liability for copyright infringement is not directly mentioned in the Copyright Act.<sup>61</sup> Instead, the basis for holding individuals that are not directly infringing still liable originates from the legislative history of the Copyright Act itself.<sup>62</sup> In writing the Copyright Act, legislative history stated that the words “to authorize” in Section 106 “is intended to avoid any questions as to the liability of contributory infringers” though the exact standards as to what would create liability are not discussed.<sup>63</sup> Instead, courts have since applied common law theories in order to impose indirect liability.<sup>64</sup> There are three theories for indirect liability: contributory liability, vicarious liability, and inducement of infringement.<sup>65</sup> Contributory liability refers to liability for those

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<sup>57</sup> See *id.* at 1365–66.

<sup>58</sup> See *id.* at 1367.

<sup>59</sup> See *id.* at 1381–82.

<sup>60</sup> See *BWP Media USA Inc. v. Polyvore, Inc.*, 922 F.3d 42, 47 (2d Cir. 2019).

<sup>61</sup> See William M. Landes & Douglas Gary Lichtman, *Indirect Liability for Copyright Infringement: An Economic Perspective 2* (University of Chicago Law School, Working Paper No. 179, 2003) [hereinafter Landes & Lichtman Working Paper].

<sup>62</sup> See H.R. REP. NO. 94-1476, at 61 (1976), as reprinted in 1976 U.S.C.C.A.N. 5659.

<sup>63</sup> See *id.*

<sup>64</sup> See Landes & Lichtman Working Paper, *supra* note 61, at 2–3.

<sup>65</sup> See Connie Davis Powell, *The Saga Continues: Secondary Liability for Copyright Infringement Theory, Practice and Predictions*, 3 AKRON INTELL. PROP. J.189, 190 (2009).

that assist or encourage the infringement.<sup>66</sup> Vicarious liability refers to liability for those that get a benefit out of the infringement and possess the authority or right to stop it, but do not.<sup>67</sup> Finally, inducement of infringement creates liability for “one who distributes a device with the object of promoting its use to infringe copyright.”<sup>68</sup>

#### D. ONLINE DISTRIBUTION PLATFORMS AND LIABILITY

Online distribution platforms (“ODPs”) are in a difficult position with regards to liability, as they must deal with the potential that users might upload copyrighted content onto their services, making the ODP liable for either direct or indirect infringement.

Direct liability for infringement by an ODP can be founded under a violation of the copyright holder’s exclusive right to distribute under § 106(3).<sup>69</sup> Precedence for holding ODPs liable for infringement of distribution rights come from the case *Perfect 10, Inc. v. Amazon.com Inc.*, in which the court discusses the “server test.” The “server test” holds ODPs that stored electronic information and serves it to users liable for infringement if the ODP is actually hosting said information on servers rather than just providing a link to the information.<sup>70</sup> *Perfect 10* involved an adult entertainment website that hosted member exclusive content that was intended to only be viewed by members of the website.<sup>71</sup> The website attempted to hold Amazon and Google liable for copyright infringement, as Google was framing (displaying content from one website within another) content from third party websites that had infringing images depicting the members’ exclusive content.<sup>72</sup> The Ninth Circuit found that Google would only be found to be liable for infringement if it had actually hosted infringing material on its servers, and that the process of framing material did not qualify as copyright infringement because it was simply linking to the website itself.<sup>73</sup>

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<sup>66</sup> See Landes & Lichtman Working Paper, *supra* note 61, at 3.

<sup>67</sup> See *id.* at 5.

<sup>68</sup> See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913, 936–37 (2005).

<sup>69</sup> See 17 U.S.C. §§ 106, 501.

<sup>70</sup> See *Perfect 10, Inc. v. Amazon.com, Inc.*, 508 F.3d 1146, 1159 (9th Cir. 2007).

<sup>71</sup> See *id.* at 1157.

<sup>72</sup> See *id.* at 1154, 1157.

<sup>73</sup> See *id.* at 1162.

ODPs may also be found to be secondarily liable via either inducement theory, vicarious liability, or contributory liability. The most significant case on inducement theory by an ODP comes from *Metro Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*<sup>74</sup> In this case, the Supreme Court found that Grokster, an ODP which had distributed software that could be used to share files via a peer to peer network, possessed enough intent to be held indirectly liable via inducement theory.<sup>75</sup> The Court focused on evidence that showed that the intention of Grokster was to have its users utilize its software for infringing purposes, and also noted that Grokster took no steps to remove or filter out infringing content.<sup>76</sup> However, *Grokster* creates a very high standard for liability for ODPs, in that it suggests that not only must the copyright holder show that the ODP learn of infringing conduct and do nothing to remove it, it must also show that the ODP intended for its users to use its service to infringe copyright.<sup>77</sup> As such, it would likely be difficult for a copyright holder to successfully sue an ODP without the ODP taking such flagrant measures to not only ignore copyright but also encourage infringement.

An alternative method of holding ODPs liable is through vicarious liability. The elements for vicarious liability require (1) that the defendant has “the right and ability to supervise the infringing conduct,” and (2) “that defendant must have an ‘obvious and direct’ financial interest in the exploitation of copyrighted materials.”<sup>78</sup> The most relevant case for vicarious liability for ODPs is from *A&M Records, Inc. v. Napster, Inc.*, in which the Ninth Circuit found that the defendant Napster stood to gain financial benefit from infringement occurring on its platform as “financial benefit exists where the availability of infringing material ‘acts as a “draw” for customers.’”<sup>79</sup> The Ninth Circuit also stated that in order to for the ODP to escape vicarious liability, “the reserved right to police must be exercised to its fullest extent” and that Napster failed to do so.<sup>80</sup> As such, the Ninth Circuit affirmed the district court’s finding that Napster was vicariously liable for

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<sup>74</sup> See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913, 936–37 (2005).

<sup>75</sup> See *id.* at 916.

<sup>76</sup> See *id.*

<sup>77</sup> See *id.* at 913–14.

<sup>78</sup> See *Gordon v. Nextel Commc'ns & Mullen Advert., Inc.*, 345 F.3d 922, 925 (6th Cir. 2003).

<sup>79</sup> See *A&M Recs., Inc. v. Napster, Inc.*, 239 F.3d 1004, 1023 (9th Cir. 2001).

<sup>80</sup> See *id.*

infringement.<sup>81</sup> The Ninth Circuit has since further clarified when exactly ODPs would be found vicariously liable for infringement. In *Perfect 10*, the court added on the requirement that a legal right and practical ability to control infringement must exist for an ODP to be found vicariously liable.<sup>82</sup> Applying this to the defendant, Google, the court found that it lacked the legal right because the infringing activity was occurring on third party websites as opposed to Google's own website, and that it also lacked the practical ability to do so as Google's software was not capable of checking every single image it was displaying against every currently copyrighted image.<sup>83</sup>

The final method of holding ODPs indirectly liable is through contributory liability. "[O]ne who, with knowledge of the infringing activity, induces, causes, or materially contributes to the infringing conduct of another, may be held liable as a 'contributory' infringer."<sup>84</sup> This can be split into elements of requiring material contribution to the infringement, as well as having knowledge of the infringing activity.<sup>85</sup> Contributory infringement appeared in *Napster*, as well, in which the Ninth Circuit found that because Napster was providing a service that made it easy for individuals to search music that they wanted, they were materially contributing to infringement.<sup>86</sup> However, the court refused to find that Napster satisfied the knowledge requirement simply because it was a file sharing platform.<sup>87</sup> Instead, the court utilized the knowledge requirement from *Netcom*.<sup>88</sup> From *Netcom*, the Ninth Circuit stated that "evidence of actual knowledge of specific acts of infringement is required" for there to be

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<sup>81</sup> See *id.* at 1024.

<sup>82</sup> See *Perfect 10, Inc. v. Amazon.com, Inc.*, 508 F.3d 1146, 1173 (9th Cir. 2007).

<sup>83</sup> See *id.* at 1174.

<sup>84</sup> See *Gershwin Publ'g Corp. v. Columbia Artists Mgmt., Inc.*, 443 F.2d 1159, 1162 (2d Cir. 1971).

<sup>85</sup> *Intentional Inducement of Copyright Infringements Act of 2004: Hearing on S. 2560 Before the S. Comm. on the Judiciary*, 108th Cong. 2 (2004) (statement of Marybeth Peters, Register of Copyrights), <https://www.copyright.gov/docs/regstat072204.html> [<https://perma.cc/2JZ7-DHP2>].

<sup>86</sup> See *Napster*, 239 F.3d at 1023.

<sup>87</sup> See *id.* at 1021.

<sup>88</sup> See *Religious Tech. Ctr. v. Netcom On-Line Commc'n Servs., Inc.*, 907 F. Supp. 1361, 1373 (N.D. Cal. 1995).

contributory infringement.<sup>89</sup> Applying this standard, the court in *Napster* found that knowledge was fulfilled as evidence showed that Napster had actual knowledge that infringing material existed on its platform and it had not been taken down.<sup>90</sup>

#### E. DIGITAL MILLENNIUM COPYRIGHT ACT AND ODPs

In response to the growing adoption of the internet by the public in the early 1990s, Congress introduced the Digital Millennium Copyright Act (“DMCA”) in 1998 to “move the nation’s copyright law into the digital age.”<sup>91</sup> The most relevant parts of the DMCA with regards to copyright infringement is that it created several “safe harbors” from indirect liability for ODPs.

To qualify for protection under the DMCA, the party must first qualify as a service provider under the statute, which is defined as “an entity offering the transmission, routing, or providing of connections for digital online communications, between or among points specified by a user, of material of the user’s choosing, without modification to the content of the material as sent or received.”<sup>92</sup> Furthermore, the party must comply with the threshold requirements set by statute: (1) they must adopt or reasonably implement and “[inform] subscribers and account holders of the service provider’s system or network of, a policy that provides for the termination in appropriate circumstances of subscribers and account holders of the service provider’s system or network who are repeat infringers”;<sup>93</sup> (2) accept and adopt standard technical measures “used by copyright owners to identify or protect copyrighted works”;<sup>94</sup> and (3) a specific requirement unique to each safe harbor.<sup>95</sup>

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<sup>89</sup> See *Napster*, 239 F.3d at 1022.

<sup>90</sup> See *id.* at 1022.

<sup>91</sup> See *Executive Summary Digital Millennium Copyright Act: Section 104 Report*, U.S. COPYRIGHT OFF., [https://www.copyright.gov/reports/studies/dmca/dmca\\_executive.html](https://www.copyright.gov/reports/studies/dmca/dmca_executive.html) [<https://perma.cc/DF9Q-J2D5>].

<sup>92</sup> 17 U.S.C. § 512(k)(1)(A) (2018).

<sup>93</sup> See *id.* § 512 (i)(1)(A).

<sup>94</sup> See *id.* § 512 (i)(1)(B).

<sup>95</sup> See *id.* §§ 512(a)(1-5), (b)(2), (c)(2), (d)(3).

The first two safe harbors are detailed in § 512(a) and § 512(b), and are safe harbors for the transmission of infringing material, as well as exemption from liability for caching copies of infringing material.<sup>96</sup> The more prominent safe harbors are in § 512(c) and § 512(d). § 512(c) protects providers from being liable for hosting infringing material on their servers,<sup>97</sup> while § 512(d) protects providers from liability if they were to direct or link others to infringing material.<sup>98</sup> Both of these safe harbors are subject to a process called “notice and takedown” that the service provider must comply with if they wish to utilize the safe harbor.<sup>99</sup>

§ 512(c) states that if the service provider “does not have actual knowledge that the material or an activity using the material on the network is infringing;” or “in the absence of such knowledge, is not aware of facts or circumstances from which infringing activity is apparent;” or “upon obtaining such knowledge or awareness, acts expeditiously to remove, or disable access to, the material,” then they are generally not liable for copyright infringement.<sup>100</sup>

#### F. DMCA NOTICE AND TAKEDOWN

As discussed previously, the safe harbors of § 512(c) and (d) are subject to a notice and takedown process.<sup>101</sup> Under this process, the copyright holder will first send a notice of infringement to an agent that the service provider is required to appoint as one of the threshold requirements to gain the protection of the safe harbor of § 512(c).<sup>102</sup> To protect against abuse from individuals sending frivolous notice, the copyright holder’s notice is subject to penalty of perjury.<sup>103</sup> Upon receiving the notice, the service provider, if they have received a proper notice, must act “expeditiously to remove, or disable access to, the material that is claimed to be infringing.”<sup>104</sup> There is also protection from liability for any claim that might arise out of “any claim based on” the service provider’s good faith takedown, so

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<sup>96</sup> See *id.* § 512(a)–(b).

<sup>97</sup> See *id.* § 512(c).

<sup>98</sup> See 17 U.S.C. § 512(d).

<sup>99</sup> See *id.* § 512(c).

<sup>100</sup> See *id.* § 512(c)(1).

<sup>101</sup> See *id.* § 512(c)–(d).

<sup>102</sup> See *id.* § 512(c)(2).

<sup>103</sup> See *id.* § 512(c)(3)(A)(vi).

<sup>104</sup> 17 U.S.C. § 512(c)(1)(C).



long as the user that uploaded the material is notified.<sup>105</sup> Those that have their material taken down have the option of filing a “counter notification,” which is a statement that says that the material was taken down improperly, again under penalty of perjury.<sup>106</sup> With both of these provisions in place, a service provider has essentially no reason to not take down content that they have received a takedown notice for, as the DMCA will protect them both from the notice issuer as well as the user that uploaded the content.

#### IV. ANALYSIS

Having set out the legal landscape with regards to copyright law as well as the various theories available to copyright holders, the next step is to assess how these theories apply to 3D printing specifically.

##### A. COPYRIGHT LAW AND 3D PRINTING

The first step is to determine what copyright aspects exist in 3D printing, followed by which parties are in consideration when an infringement lawsuit takes place, as well as relevant provisions of the DMCA and how that affects the parties.

##### 1. *What Aspects of 3D Printing Can be Copyrighted?*

As a baseline, the CAD files used in 3D printing, as well as the 3D prints themselves, are both copyrightable. From the Copyright Act, the two main requirements for something to be copyrightable is that it must fulfill originality, and be fixed in a tangible medium of expression.<sup>107</sup> So long as the CAD file possessed some degree of originality that the author added, one could create a CAD file of any object and copyright it, though it would be subject to the precedent set by *Meshwerks* in that the author must have not sought to perfectly replicate something as accurately as possible.<sup>108</sup> In addition to originality and fixation requirements, a work must also fall under one of the eight categories of authorship that are listed in § 102 of the Copyright Act.<sup>109</sup> Applying this to 3D printing, the 3D

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<sup>105</sup> See *id.* § 512(g)(1).

<sup>106</sup> See *id.* § 512(g)(3).

<sup>107</sup> 17 U.S.C. § 102(a).

<sup>108</sup> See *Meshwerks, Inc. v. Toyota Motor Sales U.S.A., Inc.*, 528 F.3d 1258, 1263; 1267; 1270 (10th Cir. 2008).

<sup>109</sup> 17 U.S.C. § 102(a).

printed objects as well as the CAD file would fall under § 102(a)(5) as the 3D printed object would be a sculptural work, and the file itself is essentially a technical drawing, which can be copyrighted.<sup>110</sup>

## 2. *Liability for Direct Infringement in 3D Printing*

A copyright holder to either a CAD file or a 3D print has the option to pursue several parties, under different theories for liability. The most obvious party is the direct infringer, the one that is directly infringing upon the rights of the copyright holder by using one of the exclusive rights of the copyright holder without authorization.<sup>111</sup> This might be an individual that printed out or 3D-scanned a copyrighted work, or a website that is hosting infringing material. One might also choose to pursue indirect infringers, those that are facilitating the infringement in some way.<sup>112</sup> In the 3D printing space, this might be an ODP that distributes CAD files, or a 3D printer/3D scanner manufacturer.

In the process of 3D printing, there are several steps that would create direct liability for infringement if a copyrighted work were involved. The process of scanning a work to convert into a CAD file format, sharing that CAD file, and printing out that CAD file can all be considered to be forms of infringement if done without the authorization of the copyright holder. An individual that carries out the actual process of scanning, sharing, or printing out a protected work is directly liable for infringement of the copyright owner's right to create copies<sup>113</sup>.

Courts have already addressed how conversions of objects into 3D models can constitute copying, regardless of how much skill or time might have been required. As seen in *Meshwerks*, the act of 3D scanning a car chassis and going through the work needed to make it as accurate as possible to the real object does not constitute a separate work that qualifies for its own copyright but makes it a mere copy of the original.<sup>114</sup> The court considered the intentions of Meshwerks,

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<sup>110</sup> See U.S. COPYRIGHT OFF., COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 903.1 (3d ed. 2021), 5–6, 40.  
<https://www.copyright.gov/comp3/chap900/ch900-visual-art.pdf>  
[<https://perma.cc/G26U-ENYS>].

<sup>111</sup> See Elliot M. Zimmerman, *P2P File Sharing: Direct and Indirect Copyright Infringement*, 78 FLORIDA BAR. 40 (2004).

<sup>112</sup> See *Indirect Liability for Copyright Infringement: An Economic Perspective*, *supra* note 61, at 396.

<sup>113</sup> See 17 U.S.C. § 106.

<sup>114</sup> *Meshwerks, Inc. v. Toyota Motor Sales U.S.A., Inc.*, 528 F.3d 1258, 1268 (10th Cir. 2008).

noting that the intent was “to copy Toyota’s vehicles, rather than create, or even add, any original expression,” and that Meshwerks’ models did not depict anything more than a copy of the vehicle itself.<sup>115</sup> In a 3D printing context, *Meshwerks* suggests that CAD files of copyrighted material are copies of the material, making those CAD files infringing by default as only the copyright holder can create copies, since that is one of the exclusive rights of the copyright holder.<sup>116</sup>

### 3. *Liability for Indirect Infringement*

Other than direct infringers, the copyright holder can also attempt to find indirect liability from other parties, which for 3D printing would be manufacturers of 3D printing equipment as well as ODPs. A 3D printing equipment manufacturer could be analogized to being like Sony in *Sony Corp. of America v. Universal City Studios, Inc.*, in that they are producing equipment that can be used in an infringing manner,<sup>117</sup> whereas an ODP could be compared to Napster in *Napster*, in which they are hosting and helping users find infringing material, facilitating the users infringement.<sup>118</sup> The most likely way of holding manufacturers indirectly liable would be through contributory liability, under the argument that that manufacturer, in selling this 3D scanner or printer to the infringer, has provided a tool that has materially contributed to the infringement, since without this tool that infringer would have never been able to create the infringing CAD files or prints. However, manufacturers would likely be treated the same as Sony in *Sony Corp. of America v. Universal City Studios, Inc.*, rendering them not liable generally.<sup>119</sup> In *Sony Corp.*, the copyright holder attempted to hold Sony liable as a secondary infringer under the doctrine of contributory liability, suggesting that by manufacturing videocassette recorders (“VCRs”) Sony was providing a means of infringing copyright and thus was contributorily liable.<sup>120</sup> However, the Court found that Sony was not liable for contributory infringement.<sup>121</sup> The Court in particular noted that “the sale of copying equipment, like the sale of other articles

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<sup>115</sup> *See id.* at 1268–69.

<sup>116</sup> *See* 17 U.S.C. § 106.

<sup>117</sup> *See* *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 417 (1984).

<sup>118</sup> *See* *A&M Recs., Inc. v. Napster, Inc.*, 239 F.3d 1004, 1004 (9th Cir. 2001).

<sup>119</sup> *Sony*, 464 U.S. at 417.

<sup>120</sup> *See id.* at 417.

<sup>121</sup> *See id.* at 442.

of commerce, does not constitute contributory infringement if the product is widely used for legitimate, unobjectionable purposes, or, indeed, is merely capable of substantial non-infringing uses<sup>122</sup> Under this standard, it would be difficult to find a 3D printer or scanner manufacturer liable under a theory of contributory infringement, as a 3D printer or scanner can be used for many non-infringing purposes, whether it be used to produce parts, create art, or in research.

#### 4. *Liability for ODPs*

There is also the option to pursue an ODP for either direct or indirect infringement. Direct liability for infringement by an ODP can be found to exist under violation of the copyright holder's exclusive right to distribute under § 106(3).<sup>123</sup> Precedence for holding ODPs liable for infringement of distribution rights come from *Perfect 10*.<sup>124</sup> The Ninth Circuit found that Google would only be found to be liable for infringement if it had actually hosted infringing material on its servers, and that the process of framing material did not qualify as copyright infringement because it was simply linking to the website itself.<sup>125</sup> Under *Perfect 10*, an ODP would likely fulfill the "server test," making them directly liable.<sup>126</sup> Most ODPs in the 3D printing space host the CAD files on their own servers, as one can verify by attempting to access a user-uploaded design on Thingiverse where a link to download the files for the design will directly provide you with said file rather than linking you elsewhere.<sup>127</sup> As any user of the website would be able to download said files from the website directly, rather than being redirected elsewhere, that would make the ODP a distributor of infringing material, making them a direct infringer. The court's holding in *Perfect 10* would however, protect 3D printing search engines like Yeggi from liability, as they are services essentially analogous to Google in that they frame content rather than actually hosting it.<sup>128</sup> One could argue that an ODP might try to skirt around the server test by instead requiring the users to host their own private servers rather than on the ODPs

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<sup>122</sup> *See id.* at 418.

<sup>123</sup> 17 U.S.C. § 106(3).

<sup>124</sup> *See Perfect 10, Inc. v. Amazon.com, Inc.*, 508 F.3d 1146, 1162–63 (9th Cir. 2007).

<sup>125</sup> *See id.*

<sup>126</sup> *See id.* at 1159.

<sup>127</sup> *See V29, THINGIVERSE* (Dec. 6, 2015), <https://www.thingiverse.com/thing:1179160> [<https://perma.cc/U2Y3-T7PT>].

<sup>128</sup> *See Perfect 10*, 508 F.3d at 1159.

servers, protecting them like how *Perfect 10* prevented Google from being liable. However, this protection creates issues for the user, as now the cost of hosting the files has now been offloaded to the user, which would be likely to instead drive those users to an ODP that does host the material on their own servers. Reducing traffic to their own services in an effort to avoid lawsuits makes this an unattractive solution, especially given the protections that an ODP gains from the DMCA.

A copyright holder may also choose to impose indirect liability on a 3D printing ODP, through inducement of infringement, contributory liability, or vicarious liability. From *Grokster*, to find that the ODP induced infringement and is indirectly liable, the ODP must have taken some affirmative action to encourage its users to infringe, as well as not taking any actions to remove infringing content.<sup>129</sup> However, ODPs in the 3D printing space offer tools for copyright holders to take down infringing content, putting them in direct opposition to what *Grokster* did. For example, looking at the Thingiverse's website and terms of service,<sup>130</sup> one can find that it explicitly prohibits the uploading of illegal content, and also gives rights holders an opportunity to file a request to have their content taken down.<sup>131</sup> Rather than encouraging users to infringe and refusing to take actions to remove the infringing material, ODPs are actually explicitly prohibiting users from uploading infringing material and taking steps to remove the infringing material. With ODPs taking such measures to discourage users from using their services for infringing purposes, it is highly unlikely that any commonly used ODP would be held liable under inducement of infringement. The problem with this approach is that it prevents a copyright holder from obtaining lasting relief from infringement or some form of compensation, as once the infringing material gets removed, another user can simply reupload that file, causing the copyright holder to have to play a never-ending game of cat and mouse trying to hunt down infringing materials and issuing takedown requests. While such a costly task might be feasible on a corporate level, an individual copyright holder would likely find this to be too burdensome.

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<sup>129</sup> See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913, 919 (2005).

<sup>130</sup> See *MakerBot Terms of Use*, MAKERBOT, (Jan. 3, 2023), <https://www.makerbot.com/legal/terms-of-use/> [<https://perma.cc/758C-QZ9J>] [hereinafter *MakerBot Terms of Use*].

<sup>131</sup> See *Thingiverse Content Removal Wizard*, THINGIVERSE, <https://www.thingiverse.com/legal/dmca> [<https://perma.cc/497B-BT76>] [hereinafter *Thingiverse Content Removal Wizard*].

Contributory liability for 3D printing ODPs may exist if the ODP became aware of infringing material on its platform and did not take steps to remove it, per the contributory infringement standard from *Napster*.<sup>132</sup> However, for the same reason that is discussed above regarding inducement of infringement,<sup>133</sup> 3D printing ODPs generally take steps to remove any infringing material from their services.<sup>134</sup> Even though the ODP might be materially contributing to infringement by hosting the infringing content, finding actual knowledge that the ODP knew it was hosting infringing content and chose to not remove it would be difficult, as the ODPs take so many measures to help copyright holders take down content.<sup>135</sup> As such, contributory liability is unlikely to be a successful way to hold 3D printing ODPs liable.

Vicarious liability is another way to find a 3D printing ODP indirectly liable for infringement. If we are to apply the standard for vicarious liability to ODPs in the 3D printing space, we can likely find adequate financial interest as well as the right and ability to supervise content. ODPs like MyMiniFactory act as essentially storefronts for users to sell their designs which means that it has a financial interest in users buying designs off of the website,<sup>136</sup> while Thingiverse is maintained by MakerBot Industries, a 3D printer manufacturer that would have a financial interest in having more content be uploaded for users to print.<sup>137</sup> Additionally, 3D printing ODPs possess the ability and right to supervise the content that appears on their services, as they are closed systems that require users to upload information rather than being internet-wide services like Google that simply redirect users to third parties.<sup>138</sup> As such, vicarious liability would likely be a successful way to hold a 3D printing ODP liable.

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<sup>132</sup> See *Napster*, 239 F.3d at 1020.

<sup>133</sup> See *supra* Section III.2.

<sup>134</sup> See *Thingiverse Content Removal Wizard*, *supra* note 131.

<sup>135</sup> See *id.*

<sup>136</sup> See MYMINIFACTORY, <https://www.myminifactory.com/> [<https://perma.cc/E49T-QT9M>].

<sup>137</sup> See Adi Robertson, *MakerBot's Thingiverse 3D Printing Library is Getting a Print-On-Demand Button*, THE VERGE (Apr. 21, 2015, 10:24 AM), <https://www.theverge.com/2015/4/21/8461055/makerbot-thingiverse-3d-hubs-printing-partnership> [<https://perma.cc/MA8Z-AV6G>].

<sup>138</sup> See THINGIVERSE, <https://www.thingiverse.com/> [<https://perma.cc/W264-XT83>] (noting that the create tab has a drop down menu that allows users to upload files); *MakerBot Terms of Use*, *supra* note 130 (noting that the terms of

5. *The DMCA and 3D Printing ODPs*

The DMCA created many safe harbors for online service providers, with the most relevant ones to 3D printing ODPs being the safe harbors set out in § 512(c) and (d).<sup>139</sup> So long as the ODP proceeds with notice and takedown as well as complying with the other threshold requirements to gain the protection of the safe harbor, they are immune to liability for copyright infringement for content that users upload, which would defeat any attempts to hold them vicariously liable. § 512(c) states that if the service provider “does not have actual knowledge that the material or an activity using the material on the network is infringing”; or “in the absence of such knowledge is not aware of facts or circumstances from which infringing activity is apparent”; or “upon obtaining such knowledge or awareness, acts expeditiously to remove or disable access to the material”; then they are generally not liable for copyright infringement.<sup>140</sup>

The knowledge standard to defeat the safe harbor was clarified in *Viacom International, Inc. v. YouTube, Inc.*<sup>141</sup> In *Viacom*, Viacom attempted to sue YouTube for nearly 80,000 videos that had been uploaded on YouTube that were infringing Viacom’s copyright.<sup>142</sup> The Second Circuit stated that there is both a subjective standard of “actual knowledge or awareness of specific instances of infringement” as well as a “red flag knowledge” standard which “turns on whether the provider was subjectively aware of facts that would have made the specific infringement objectively obvious to a reasonable person.”<sup>143</sup> Both standards require the defendant to have some knowledge or awareness of the fact that copyright infringing material was being hosted on their service.<sup>144</sup> Furthermore, if an ODP had the knowledge that it was hosting infringing material, it would be not liable for infringement if the material was expeditiously taken down.<sup>145</sup> Additionally, § 512(m) expressly specifies that ODPs have no affirmative duty to monitor their platforms for infringing content, and that it is up to the copyright holders to

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use permits MakerBot to investigate and remove any user-uploaded content).

<sup>139</sup> 17 U.S.C. § 512(c)–(d).

<sup>140</sup> *See id.* § 512(c).

<sup>141</sup> *Viacom Int’l, Inc. v. YouTube, Inc.*, 676 F.3d 19, 26 (2d Cir. 2012).

<sup>142</sup> *See id.* at 28–29.

<sup>143</sup> *See id.* at 30.

<sup>144</sup> *See id.*

<sup>145</sup> 17 U.S.C. § 512(c)(1)(C).

request takedowns.<sup>146</sup> Applying these facts to the 3D printing space and ODPs, it appears that the shield of the DMCA would be very difficult to pierce. The express lack of duty to monitor would mean that to fulfill the knowledge requirement, the copyright holder would have to notify the ODP in some way, and then the ODP would have to not take down the material. With the DMCA granting protection from any claims arising from the user whose content has been taken down,<sup>147</sup> as well as protection from claims for infringement from the copyright holder,<sup>148</sup> there is very little reason for an ODP to not comply with a takedown request. As such, it would be difficult to find a situation in which an ODP could be found indirectly liable under the DMCA.

## B. PROBLEM

The problem that 3D printing poses for rights holders is that CAD files and 3D scanners can easily be used to infringe copyright in a decentralized manner. A CAD file can be shared anonymously on the internet, easily turning a single case of infringement into one spread out among thousands over the world. Additionally, a 3D scanner can be used to create a CAD file of any object, which could then be shared online or used by the scanner to produce illegal copies of said object. Though currently 3D scanning technology might only be able to scan objects at the resolution of 0.1 mm,<sup>149</sup> it is not hard to imagine that technological improvements in the future would allow that resolution to continuously increase.

The first barrier to enforcement lies in the parties involved in infringement. As discussed above, we have the individual direct infringers, the manufacturers of printers/scanners, and the ODPs that are hosting CAD files.<sup>150</sup> An individual infringer is an unrealistic defendant for several reasons. An individual that is printing out illegal 3D prints at home would be difficult to detect.<sup>151</sup> Even if it were possible to detect that individual, there may be so many infringers that the rights holder would not be able to detect them all and sue them together.<sup>152</sup> The infringer may not even be within the jurisdiction of the United States, and even if they were, the remedies offered by U.S. copyright law consists

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<sup>146</sup> *Id.* § 512(m).

<sup>147</sup> *Id.* § 512(c)(1).

<sup>148</sup> *See id.* § 512(g).

<sup>149</sup> *See Nathaniel, supra* note 13.

<sup>150</sup> *See generally supra* Part IV.

<sup>151</sup> Depoorter, *supra* note 3, at 1496.

<sup>152</sup> *See id.* at 1497.



of either injunctive relief<sup>153</sup> or statutory damages of up to \$150,000 per work infringed upon.<sup>154</sup> Injunctive relief, if one had to consider litigation costs, would be largely pointless against any defendant other than those involved in large scale infringing operations, given that the value of whatever the individual might have printed out is almost certainly far less than the cost of litigation, though this is an issue that is not unique to 3D printing.<sup>155</sup> The damages would also be largely pointless, as the defendant may be judgment proof, given how a significant portion of the American population has difficulties paying off an unexpected \$400 expense, much less those in the tens of thousands.<sup>156</sup> Additionally, given the great number of infringements that might be occurring at any time with 3D printing becoming more widespread, infringers could realize that they are very unlikely to get caught and will continue to take the risk of infringing.<sup>157</sup> The rights holder would also have to consider what sort of backlash they might receive from society if they were to try to sue an individual.<sup>158</sup> Suing individuals may even lead to situations in which society might believe that the law itself is unjust and push for change, harming copyright owners' ability to recover.<sup>159</sup>

One might also consider suing 3D printer or scanner manufacturers, but as discussed above, under the standard set by *Sony*, manufacturers would be free of liability unless they were to directly suggest to customers that their products should be used for infringement, as 3D printers and scanners are capable of substantial non-infringing uses.<sup>160</sup>

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<sup>153</sup> 17 U.S.C. § 502.

<sup>154</sup> *See id.* § 504.

<sup>155</sup> *See Terrica Carrington, A Small Claims Court is on the Horizon for Creators, COPYRIGHT ALL. (Oct. 4, 2017), <https://copyrightalliance.org/small-claims-court-on-the-horizon/> [<https://perma.cc/9LSY-QFQA>] (discussing how a small claims court for copyright infringement could solve the issue of litigation costs outweighing potential damages in the vast majority of copyright infringement cases).*

<sup>156</sup> *BD. OF GOVERNORS OF THE FED. RSRV. SYS., ECONOMIC WELL-BEING OF U.S. HOUSEHOLDS IN 2020 34 (2021)* (stating that 35% of American adults would have difficulty paying off an unexpected \$400 expense).

<sup>157</sup> *See Depoorter, supra* note 3, at 1496.

<sup>158</sup> *See id.* at 1497–99.

<sup>159</sup> *See id.* at 1498–99.

<sup>160</sup> *See Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 418 (1984) (holding that video tape recorders have substantial non-infringing uses beyond violating copyrights by recording television programs and therefore

Finally, we have ODPs to consider. While suing the ODP that hosts the files might be the most fruitful in terms of potentially being able to get damages, as they are much easier to contact and have much deeper pockets than an individual, there are still several barriers to getting relief. The ODP may be hosted in other countries outside of U.S. jurisdiction.<sup>161</sup> Even if an ODP is liable, the DMCA's safe harbor provision would still be applied<sup>162</sup>, meaning that barring the unlikely situation in which the ODP receives a takedown request and chooses to do nothing about it, the rights holder has no lasting relief as others can simply reupload the infringing material again. Thus, it appears that the use of courts is not particularly effective, and the best method of fighting infringement is through ordering takedown requests.

However, issuing takedown requests essentially creates an endless arms race between uploaders and the copyright holder. An individual will upload an infringing file, the copyright holder will have to find that file, and then submit a takedown request to the ODP, who will then take down the file and perhaps ban the user from the service. However, creating new accounts on these ODPs is usually free, and it will always take some time for the copyright holder to find this material and take it down, so the material will always be able to be spread to some extent, making it an imperfect solution.

Furthermore, there are significant financial incentives associated with 3D printing that did not exist when the music industry faced Napster. Unlike Napster, in which an infringer that uploaded a song saw no financial benefit, 3D printing gives the individual that infringes a significant financial incentive in selling the fruits of his infringement to others, as they now have a real object that can be sold to others. 3D printing as it currently exists is not as simple as just putting in a command to the 3D printer and then you will have a perfect replica.<sup>163</sup> Instead, there are many post-processing steps required for a highly refined final product if one is doing the printing,<sup>164</sup> or, if one is doing the scanning process, significant

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Sony, the manufacturer of the video tape recorders, could not be held liable for contributory infringement).

<sup>161</sup> *Cults*, LINKEDIN, <https://www.linkedin.com/company/cults> [<https://perma.cc/4JTL-3MAK>] (noting that the company is headquartered in France).

<sup>162</sup> 17 U.S.C. § 512(c).

<sup>163</sup> See HORVATH, *supra* note 18, at 6 (stating that there are many steps involved in preparing a 3D print; it is not so simple as "clicking Print").

<sup>164</sup> MAKERBOT, POST-PROCESSING GUIDE FOR PROFESSIONALS 4.

preparation and troubleshooting needed to get the most accurate scan.<sup>165</sup> To this end, 3D printing and scanning require significant effort from the individual that is doing the printing or scanning. This creates a potential market for individuals that might not want to pay the full price for a product directly from the copyright holder but are willing to pay a reduced price for something that has been 3D printed and assembled that is functionally identical.

### C. POTENTIAL SOLUTION FROM THE MUSIC INDUSTRY

One might imagine that because ODPs in 3D printing are comparable to services like Napster, the 3D printing industry can simply implement similar solutions to the music industry. In the early 2000s, the CD was the popular format to listen to music, and at around 16 dollars per album in the U.S., this paved the way for services like Napster to rise and offer users the possibility of getting the music for free.<sup>166</sup> By simply downloading the Napster software, one could then search for the music they wanted and download it from other users.<sup>167</sup> Initially, the music industry tried to use lawsuits to enforce their copyright, though this was ineffective, with some even suggesting that this actually exacerbated the problem.<sup>168</sup> To counteract music piracy, the music industry began to make it both cheaper and more convenient for the consumer to get access to their songs, with iTunes being the harbinger of change.<sup>169</sup> With iTunes, users simply could pay as little as a dollar for the song that they wanted, making them competitive with illegal free downloads.<sup>170</sup> Instead of downloading files from a website, users could pay a few dollars for the songs that they wanted and conveniently access their whole collection on any device that supported the iTunes store.<sup>171</sup> At first glance,

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<sup>165</sup> *3D Scanning: All Issues That May Be Encountered and the Solutions to Solve Them*, GO3DPRO, <https://www.go3dpro.com/blog/post/3d-scanning-all-issues-that-may-be-encountered-and-the-solution-to-solve-them> [<https://perma.cc/9MYH-S88E>].

<sup>166</sup> See Stephen Dowling, *Napster Turns 20: How It Changed the Music Industry*, BBC (Feb. 24, 2022, 7:56 AM), [<https://perma.cc/47C3-SBTG>].

<sup>167</sup> See *id.*

<sup>168</sup> See *id.*

<sup>169</sup> See Nathan Jolly, *Forget Napster, It Was iTunes That Held the Record Industry to Ransom*, THE MUSIC NETWORK (June 5, 2019), <https://themusicnetwork.com/forget-napster-it-was-itunes-that-held-the-record-industry-to-ransom/> [<https://perma.cc/9XLQ-LL9D>].

<sup>170</sup> See *id.*

<sup>171</sup> See *id.*

one might imagine that rights holders could do the same thing with regards to 3D printing and simply sell cheap CAD files to consumers, mirroring the solution used by the music industry. However, the fundamental difference in what the music industry offers and what copyright holders of actual objects offer render this solution unlikely to succeed.

The music industry, in licensing out music to platforms like Apple Music or Spotify, is offering an experience for the consumer. In this situation, making the experience easier to access allows for copyright holders to compete with illegal file sharers, as they are both offering the same thing and thus the convenience of having all their music available on multiple devices for a low cost can compete with downloading a free file. However, the copyright holder to something that can be 3D printed is, in almost all cases, offering something that cannot compete with a CAD file due to it being an actual object and the amount of money involved. We can consider tabletop miniatures as an example, as this is a field in which copyright holders have begun issuing takedowns against 3D artists that produce CAD files. Artist Duncan Shadow has created his own model of a figure that Games Workshop claimed was similar to a figure referred to as an “Eldar Revenant Titan.”<sup>172</sup> One could buy a model of the Eldar Revenant Titan from Games Workshop, the copyright holder, for 265 pounds,<sup>173</sup> or one could download a CAD file for free and print out as many models as they wish for no more than the cost of the filament and time spent processing the print. Even outside of the tabletop figure industry, where some might find the prices to be very expensive, 3D printing offers a drastically cheaper alternative even in fields like toys. Analysis has been done in the toy industry suggesting that on average, if one was to use the cheapest filament, one could 3D print toys at 3% of the cost of purchasing an equivalent toy.<sup>174</sup> Even when using a more typical filament than the cheapest recycled ones, it was found that on average the cost was still only 22% of the cost of buying the actual item.<sup>175</sup> Furthermore, having access to the CAD file is something that does not compete with having the item itself, as the CAD file grants the holder the ability to replicate as many copies of the item as the user wants. While currently a consumer might be interested in the convenience of being able

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<sup>172</sup> See Baer, *supra* note 21.

<sup>173</sup> See *Revenant Titan with Pulsars*, WARHAMMER, <https://www.forgeworld.co.uk/en-US/Eldar-Revenant-Titan-with-Pulsars> [<https://perma.cc/SEF5-LC7A>].

<sup>174</sup> See Emily E. Petersen et. al, *Impact of DIY Home Manufacturing with 3D Printing On the Toy and Game Market*, TECHNOLOGIES, July 20, 2017, at 6.

<sup>175</sup> See *id.*

to just buy the item, as 3D printing becomes more commonly adopted, it is possible that it might be preferable to have the CAD file for the item instead as that would give you the ability to make as many of the item as you need. Furthermore, it may not be economically feasible for a copyright holder to sell their CAD files, as they would have to price them knowing that with every CAD file sold, that individual can then go on to print as many figures as they need and will no longer have to purchase them from the copyright holder again.

## V. PROPOSED SOLUTION

The best way for copyright holders to protect their rights from the problems created by 3D printing is a combined approach that addresses the problem from multiple directions upstream of the infringement, namely from the side of the manufacturers of 3D printing equipment as well as on the side of ODPs distributing 3D printing files. As explained in Section V.A, 3D printer manufacturers can implement measures designed to prevent their printers from even being used to print infringing files, as well as ways to track down where an infringing print might have originated from.<sup>176</sup> And as explained in Section V.B, from the side of ODPs, DMCA § 512 can be altered to implement additional standard technical measures upon 3D printing ODPs, focusing on additional pre-screening measures, and a database of copyrighted 3D printed items can be gradually developed.<sup>177</sup> By addressing both the 3D printer manufacturers and the ODPs, this solution seeks to reduce the amount of infringement by targeting the much larger parties that many infringers would have to interact with rather than the individual infringer, which will alleviate the difficulties of policing the actions of individuals.

### A. 3D PRINTER MANUFACTURER PRINTER REQUIREMENTS

The first vector to address is the manufacturers of the 3D printers themselves, as they are the source of tools that direct infringers may use.

One potential modification to 3D printers could parallel a solution that was initially created in the 1980s by Sony and Phillips for audio digital tapes.<sup>178</sup> This is the serial copyright management system (“SCMS”), which involved the addition of a marker within a digital audio tape that would determine whether or not the copy that was currently being made was a first generation copy that was

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<sup>176</sup> See *infra* Section V.A.

<sup>177</sup> See *infra* Section V.B.

<sup>178</sup> Fabien A.P. Petitcolas et al, *Attacks on Copyright Marking Systems*, in 1525 LECTURE NOTES IN COMPUTER SCIENCE 218, 219 (1998).

based off of an authorized version, or a second generation one that was being created based off of another copy.<sup>179</sup> In doing so, a user could buy a copy of music and then create a single copy for their own personal use, but would not be able to allow others to create copies from that copy.<sup>180</sup> To enforce this technology, Congress passed the Audio Home Recording Act, which prohibited manufacturers from distributing any devices which did not contain SCMS or a similar analog.<sup>181</sup> In the 3D printing space, 3D printer manufacturers could take similar measures in how the printer processes a CAD file. The CAD file itself might have some sort of digital marker that only allows it to be used a limited number of times or is missing when downloaded from any source other than the copyright holder. The 3D printer would recognize that the marker is either present or missing and refuse to print if it is lacking the marker. This solution also creates the potential for copyright holders to sell CAD files for their copyrighted works, as use of the CAD file would be limited to however many times the copyright holder desires. However, this solution may fail for the same reason that SCMS ultimately failed, which is that some manufacturers may not apply this technology to their printers.<sup>182</sup> However, mandating that domestic manufacturers and foreign importers implement this measure via the passing of legislation would help curb infringement to a large degree, as those would likely make up a significant portion of the devices used domestically.

Another measure that 3D printer manufacturers could be required to implement would involve the addition of small markers left on the 3D print itself that would not be visible, much like how printers will leave invisible machine identification codes on documents that they print.<sup>183</sup> Machine identification codes are yellow dots that are repeated on pages that a printer prints, and can reveal information about the print like the date and time something was printed, as well as identification about the printer like a serial number.<sup>184</sup> 3D printer manufacturers may be able to implement a similar technique in how their printers will print items, like leaving small indentations or other markers in a pattern throughout the print that would not affect how the end product looks, but could be used by copyright

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<sup>179</sup> *See id.*

<sup>180</sup> *See id.*

<sup>181</sup> 17 U.S.C. § 1002.

<sup>182</sup> *See Petitcolas, supra* note 178, at 219.

<sup>183</sup> *See* Chris Baraniuk, *Why Printers Add Secret Tracking Dots*, BBC (Feb. 22, 2022, 12:35 PM), <https://www.bbc.com/future/article/20170607-why-printers-add-secret-tracking-dots> [<https://perma.cc/94DJ-6WLJ>].

<sup>184</sup> *See id.*

holders to trace infringers. If a copyright holder is able to get ahold of the printed item and decipher the hidden markers, they can identify the manufacturer and serial number and potentially learn from the manufacturer who purchased the printer, and by extension who printed the infringing item. In the same vein, printer filament manufacturers could insert specific markers like dyes into the plastic filament itself and create a database of which batches contain what mixture that can then be traced back to whoever uses the filament to 3D print. This would also allow the copyright holder to more easily trace down large scale operations that might be selling counterfeit 3D printed objects.

The final part of the solution for manufacturers involves the addition of digital rights management (“DRM”) features into CAD files in conjunction with 3D printer manufacturers putting DRM requirements into what the printer will be able to print. DRM technologies have already been deployed in many other fields concerned with piracy such as Denuvo in videogames,<sup>185</sup> or a variety of techniques in eBooks.<sup>186</sup> DRM generally functions by preventing anyone outside of the authorized viewer, who will have an electronic license that will allow them to view the content, from making copies or viewing the content.<sup>187</sup> This DRM could either be in the form of requiring logging into an account, or their device possessing the correct key to unlock the content, with more sophisticated versions being able to block the user from screenshotting material or even allowing the copyright holder to revoke the license after a certain period of time.<sup>188</sup> In the video games industry, DRM has been used by developers to some success, with major developer Ubisoft stating that their DRM requiring an online connection at all times resulted in “a clear reduction in piracy of our titles which required a persistent online connection, and from that point of view the requirement is a success.”<sup>189</sup> Applying this to the 3D printing space, ODPs could require that all files that are uploaded onto their platforms will have some level of DRM placed upon them that could

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<sup>185</sup> See Nick Lewis & Chris Hoffman, *What is Denuvo, and Why Do Gamers Hate It?*, HOW-TO GEEK (Mar. 8, 2023), <https://www.howtogeek.com/400126/what-is-denuvo-and-why-do-gamers-hate-it/> [<https://perma.cc/Z7WB-F5C4>].

<sup>186</sup> See *Ebook DRM Protection: Which DRM is Best for Ebooks (EPUB & PDF)?*, LOCKLIZARD, <https://www.locklizard.com/ebook-drm/> [<https://perma.cc/S9HC-SQE6>].

<sup>187</sup> See *id.*

<sup>188</sup> See *id.*

<sup>189</sup> See Owen Hill, *Ubisoft: Our DRM “Is a Success,”* PC GAMER (July 28, 2011), <https://www.pcgamer.com/ubisoft-our-drm-is-a-success/> [<https://perma.cc/WVJ9-2VXH>].

either be applied by the uploader or automatically applied by the ODP. In conjunction with this, 3D printer manufacturers could place restrictions upon the 3D printers that they sell that would prevent them from printing any CAD files that the user does not hold the license to. Users on Thingiverse or any other ODP would get the license to unlock the DRM when they download or purchase the file. Implementation of this solution would also once again allow the copyright holders themselves to sell CAD files, as they would be able to control the usage of the file and prevent it from being disseminated online for free.

In sum, legislation should be passed that would require manufacturers to implement an SCMS-like measure into their printers and prohibit the sale of devices that do not implement that measure. These printers would also require some form of MIC-like function that would allow individuals to identify which printer was responsible for creating each print. Additionally, manufacturers would also be required to ensure that the printers that were sold would only be capable of printing CAD files that have the required DRM. 17 U.S.C. §512 would also be amended to create a new provision for 3D printing specifically in which it would largely mirror the existing four safe harbor provisions, but have the requirement that an ODP can only distribute files that have a form of DRM on them.

#### B. A NEW STANDARD TECHNICAL MEASURE

Modifications to the DMCA's safe harbor provision are a potential solution to copyright infringement facilitated through ODPs hosting infringing material. As discussed above, the safe harbor currently requires that the service provider receive notice and perform takedowns, which while effective at removing the material, does little to stop users from uploading said material again.<sup>190</sup> However, part of the DMCA as it currently exists requires the service provider to "[accommodate] and [do] not interfere with standard technical measures," with "standard technical measures" being defined as "technical measures that are used by copyright owners to identify or protect copyrighted works."<sup>191</sup> These standard technical measures include the addition of audio or visual watermarks into materials that the copyright holder uploads onto platforms like YouTube that can allow them to identify when their work has been copied.<sup>192</sup> Since the industry is already required to comply with these measures, it is possible

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<sup>190</sup> See *supra* Section III.F; 17 U.S.C. § 512(c).

<sup>191</sup> 17 U.S.C. § 512(i).

<sup>192</sup> See Lauren G. Gallo, *The (Im)possibility of "Standard Technical Measures" for UGC Websites*, 34 COLUM. J.L. & ARTS 283, 285 (2011).



that a requirement to pre-screen all uploaded files against a database of copyrighted designs could be implemented in the DMCA. While it would be difficult for ODPs to have a human manually check every single submitted file and compare it against every entry in a database, it is possible to have software that can do comparisons between two 3D objects and determine how similar they are. Algorithms already exist in biochemistry that can overlay protein structures on top of each other and return a value of the root mean square deviation (“RMSD”) between the two structures.<sup>193</sup> In doing so, the algorithm will determine how similar the two objects are, with the lower the RMSD meaning that the two structures are more similar, with an RMSD of 0 making them identical.<sup>194</sup> Assuming that such algorithm could be created and would work effectively, an ODP could create an algorithm that can do something similar with uploaded 3D files, returning some numerical value that the ODP could then use to either accept or reject the uploaded files. Combining this with some way to appeal rejected files, this would allow users to continue to upload new content or derivations of existing works, while screening out illegal identical copies. A database of copyrighted designs could initially be created from CAD files that have already been copyrighted, and then as copyright holders request more takedowns, more copyrighted designs can be added to the database. Pre-screening all uploads to ODPs would also help to stop the issue of individuals simply reuploading removed content, as the process would automatically screen out identical copies, reducing the work that needs to be done on the side of the copyright holder.

## VI. CONCLUSION

3D printing is a rising technology that is rapidly being embraced by the public and faces similar issues as what the music industry faced from early file sharing websites. Given the difficulties that rights holders face in attempting to pursue individual infringers and the shield that the DMCA provides to service providers who might be part of the distribution of infringing material, a solution that targets infringement at two upstream sources is instead needed. By requiring changes in the designs of the 3D printers themselves from manufacturers and requiring new standard technical measures in the form of additional screening requirements from service providers, this increases the difficulty of infringement,

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<sup>193</sup> See David W. Ritchie et al., *Fast Protein Structure Alignment Using Gaussian Overlap Scoring of Backbone Peptide Fragment Similarity*, 28 *BIOINFORMATICS* 3274, 3274 (2012).

<sup>194</sup> Vladimir N. Maiorov & Gordon M. Crippen, *Significance of Root-Mean-Square Deviation in Comparing Three-Dimensional Structures of Globular Proteins*, 235 *J. MOL. BIOL.* 625, 625 (1994).

reducing the number of infringers. As such, this would reduce the harm done to copyright owners while still allowing creators to share their works.