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CAD's Cradle: Untangling Copyrightability, Derivative Works, and Fair Use in 3D Printing

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I. Introduction

Copyright law continually struggles to keep up with technological advances.[1] A combination of the often unpredictable pace of technological innovation, the reliably slow pace of lawmaking, and other factors leads to a delay in the legal response to copyright issues posed by new technology.[2] These issues—including those surrounding home video recording,[3] MP3 files,[4]

1. *See* Ben Depoorter, *Technology and Uncertainty: The Shaping Effect on Copyright*, 157 U. PA. L. REV. 1831, 1835–36 (2009) ("Because innovation is rapid and unpredictable, the adaptation of copyright law lags far behind the introduction of new technological advancements.").

2. *See id.* at 1840–41 (listing as contributing factors "the creation of new legal rules takes time . . . [,] the dynamic and unpredictable nature of technological innovation[,] . . . the unpredictability of innovation [that] necessitates . . . open-ended standards in copyright law[, and] . . . ambiguity as to the potential social and economic implications of a novel technology").

3. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 456 (1984) (concluding that the private home use of Betamax recorders is a noninfringing fair use).

4. *See* UMG Recordings v. MP3.com, Inc., 92 F. Supp. 2d 349, 353 (S.D.N.Y. 2000) (determining that defendant's website, which allowed CD owners to obtain MP3 copies of their CDs, infringed on plaintiff record companies' copyrights).

and peer-to-peer file sharing software[5]—are many times not resolved either by Congress or the courts until years after these technologies are first introduced.[6]

Furthermore, unlike copyright cases in general, cases involving new technology call into question "not just the legality of certain uses of copyrighted works, but also, quite often, the legality of new technologies that can have a profound impact on innovation and the growth of the U.S. economy, as well as on people's daily lives."[7] For example, the Supreme Court's 1984 decision *Sony Corp. of America v. Universal City Studios, Inc.*[8] saved the fledgling VCR industry—thereby enabling the home video industry to make billions for the very studios that had challenged the legality of VCRs[9]—but required a significant shift in copyright fair use doctrine to do so.[10] With the advent of new technologies, copyright law not only must attempt to keep pace but must do so in a way that accounts for its impact on the technology at issue, industry, and daily life.[11]

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5. *See* Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd., 545 U.S. 913, 936–37 (2005) (holding "that one who distributes a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement, is liable for the resulting acts of infringement by third parties").

6. *See* Depoorter, *supra* note 1, at 1843 (providing a table that lists technologies, the year they were introduced, the congressional or court action that resolved corresponding copyright issues, and the difference in years between the introduction of the technology and the year of the legal action).

7. Edward Lee, *Technological Fair Use*, 83 S. CAL. L. REV. 797, 797 (2010).

8. 464 U.S. 417 (1984).

9. *See* Lee, *supra* note 7, at 797 (describing how instead of dooming Hollywood studios, the VCR "facilitated the growth of a vast new and unforeseen market for the movie studios in the rental and sale of videos for home viewing, which, perhaps ironically, became 'the largest source of revenue for the [U.S.] movie industry'" (alteration in original) (quoting Edward Lee, *The Ethics of Innovation: P2P Software Developers and Designing Substantial Noninfringing Uses Under the Sony Doctrine*, 62 J. BUS. ETHICS 147, 148 (2005))).

10. *See Sony*, 464 U.S. at 442 (determining that the issue was whether "Betamax is capable of commercially significant noninfringing uses").

11. *See* Depoorter, *supra* note 1, at 1842 (describing how until the effects of the new technology on the market are known, "both copyright owners and users of new technologies operate in a vacuum of considerable legal uncertainty").

Three-dimensional (3D) printing has been called the next disruptive technology to conflict with copyright law.[12] This technology, which allows people in their own homes to reproduce any 3D object, "eventually promises to democratize *creation*."[13] Although 3D printing is now generally the province of industry[14] and hobbyists,[15] it is only a matter of time before it becomes ubiquitous, given that 3D printer prices continue to fall.[16] And while no one has filed a lawsuit yet,[17] parties have fired opening salvos. Copyright holders have issued takedown notices per the

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12. *See* Peter Hanna, *The Next Napster? Copyright Questions as 3D Printing Comes of Age*, ARS TECHNICA (Apr. 6, 2011, 12:35 AM), http://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/ (last visited Jan. 31, 2014) ("Though still in its infancy, personal 3D printing technology already shows the same disruptive potential as the original printing press. . . . And it's precisely because of its potential as a game changer that 3D printing presents challenging legal questions best addressed before the technology becomes ubiquitous.") (on file with the Washington and Lee Law Review).

13. *Id.*

14. *See* Chris Morrison, *What Works: 3-D Printing for the Rest of Us*, CNNMONEY (Aug. 22, 2007, 9:29 AM), http://money.cnn.com/2007/08/21/technology/3d_printing.biz2/index.htm (last visited Jan. 31, 2014) (explaining how companies such as Logitech and Boeing use 3D printers to quickly create testable prototypes and how manufacturers use 3D printers to create spare parts) (on file with the Washington and Lee Law Review).

15. *See* Hanna, *supra* note 12 ("3D printing today remains a hobbyist-driven enterprise with a high barrier to entry.").

16. *See* HOD LIPSON & MELBA KURMAN, FABRICATED: THE NEW WORLD OF 3D PRINTING 39 (2013) (explaining that when someone develops a "killer app"—Facebook, Angry Birds, etc.—consumers will be compelled to purchase 3D printers). *Compare* Morrison, *supra* note 14 (noting that 3D printers in 1997 were used almost exclusively by major manufacturing companies for prototypes and cost $120,000, while by 2007, similar machines cost $50,000), *with* Andy Greenberg, *Inside Thingiverse, the Radically Open Website Powering the 3D Printing Movement*, FORBES (Nov. 21, 2012, 6:00 AM), http://www.forbes.com/sites/andygreenberg/2012/11/21/inside-thingiverse-the-radically-open-website-powering-the-3d-printing-movement/ (last visited Jan. 31, 2014) ("In September the Brooklyn, N.Y. firm Makerbot started selling the $2,200 Replicator 2, its latest and most polished 3-D printer . . . .") (on file with the Washington and Lee Law Review).

17. *See* Greenberg, *supra* note 16 ("The site has already had to remove several designs after receiving takedown notices under the Digital Millennium Copyright Act. . . . Thingiverse has yet to face an intellectual property lawsuit over the infringing content its users upload, like the $1 billion tort that Viacom threw at Google's YouTube service in 2007.").

Digital Millennium Copyright Act[18] (DMCA) to websites that allow users to download 3D computer-aided design (CAD) files.[19] Moreover, the U.S. Patent and Trademark Office recently issued a patent for a 3D printing digital rights management method, similar to those used by Apple and by Barnes & Noble's Nook, which would prevent 3D printers from using pirated CAD files.[20] As 3D printing becomes more widespread, however, copyright owners who until now have looked the other way will be more likely to take action.[21] 3D printing will either exploit a sufficient portion of the market,[22] or it will affect the works of specific copyright owners who will take exception to the 3D printing of their works.[23]

3D printing will pose a number of novel challenges for courts in copyright cases. First, as individual authors and companies try to claim copyright over CAD files, "[t]he line between a physical object and a digital description of a physical object may . . . begin to blur. With a 3D printer, having the bits [will be] almost as good as having the atoms."[24] In addition, there are numerous

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18. Digital Millennium Copyright Act, 17 U.S.C. §§ 1201–05, 1301–32 (2012).

19. *See infra* notes 36–47 and accompanying text (explaining what CAD files are and how they work).

20. *See* Antonio Regalado, *Nathan Myhrvold's Cunning Plan to Prevent 3-D Printer Piracy*, MIT TECH. REV. (Oct. 11, 2012), http://www.technologyreview.com/view/429566/nathan-myhrvolds-cunning-plan-to-prevent-3-d-printer-piracy/ (last visited Jan. 31, 2014) ("The patent basically covers the idea of digital rights management, or DRM, for 3-D printers. Like with e-books that won't open unless you pay Barnes & Noble and use its Nook reader, with Myhrvold's technology your printer wouldn't print unless you've paid up.") (on file with the Washington and Lee Law Review).

21. *See* Hanna, *supra* note 12 ("If the current 3D printing free-for-all sounds too good to last, it is. The community today is small and has avoided, either by chance or design, stepping on any really big toes . . . .").

22. *See id.* (comparing 3D printing to home video recording before Sony introduced Betamax, which studios feared would cut into their home video and box office profits).

23. *See id.* (comparing 3D printing to Napster before Metallica complained about one of its demos surfacing on the p2p site).

24. Michael Weinberg, *It Will Be Awesome if They Don't Screw It Up: 3D Printing, Intellectual Property, and the Fight over the Next Great Disruptive Technology*, PUB. KNOWLEDGE (Nov. 2010), http://publicknowledge.org/it-will-be-awesome-if-they-dont-screw-it-up (last visited Jan. 31, 2014) [hereinafter Weinberg, *It Will Be Awesome*] (on file with the Washington and Lee Law

relationships to consider between copyrighted works, CAD files, and 3D-printed objects.[25] For example, an individual can create a CAD file of an entirely original design or a design that is potentially protected by a copyright on an existing work.[26] Although sometimes independent designers create CAD files of existing works,[27] in other cases, the copyright owner or a licensee creates the CAD file.[28] The result is a complex web of relationships between works. The copyrightability of a CAD file might depend on whether the object depicted was copyrightable.[29]

Review); *see also* LIPSON & KURMAN, *supra* note 16, at 23 ("Scanning technology and 3D printing will together introduce high resolution shapeshifting between the physical and digital worlds."). Lipson and Kurman also highlight that sales revenue for mid- and small-sized non-industrial 3D printers increased 40% between 2010 and 2011. *Id.* at 40. *But see id.* at 39–40 (quoting analyst Terry Wohlers as speculating that consumers will rely on services such as Shapeways or Amazon instead of purchasing their own printers).

25. *See* Michael Weinberg, *What's the Deal with Copyright and 3D Printing?*, PUB. KNOWLEDGE 8 (Jan. 29, 2013), http://www.publicknowledge.org/files/What's%20the%20Deal%20with%20Copyright_%20Final%20version2.pdf [hereinafter Weinberg, *What's the Deal?*] ("However, as the Penrose triangle story suggests, the intersection of 3D printing and copyright is often not a clean one, and the situation tends to get complicated quickly."). The "Penrose triangle story" refers to the story of Dr. Ulrich Schwanitz, who posted a CAD file of a well-known optical illusion online. *Id.* at 6–7. Thingiverse users subsequently posted similar files, which were presumably downloaded and printed. *Id.*

26. *Compare The Wired 3D Print-off*, WIRED, http://www.wired.com/design/2013/01/3-d-print-off/ (last visited Jan. 31, 2014) (publishing examples of "original, printable" designs for a contest such as "a heart [pendant] created by 365 smaller hearts," "a three legged robot with a mini cannon," and "a Christmas ornament of a snowflake trapped within an intricate hollow star cage") (on file with the Washington and Lee Law Review), *with* Greenberg, *supra* note 16 ("[T]he site turns up plenty of potentially trademarked or copyrighted designs, like an Iron Man helmet or figurines from Star Wars and the videogame Doom.").

27. *See* Greenberg, *supra* note 16 (implying that the designers of CAD files depicting Iron Man or Star Wars characters did not have the copyright owners' permission to create the files).

28. *See* Mike Senese, *Nokia Releases Files for 3-D Printing Your Own Phone Case*, WIRED (Jan. 18, 2013, 5:14 PM), http://www.wired.com/design/2013/01/nokia-3d-print-case/ (last visited Jan. 31, 2014) ("Nokia has opened its arms to 3-D printing with the release of printable design files and instructions for making your own Nokia phone case.") (on file with the Washington and Lee Law Review).

29. *See* Weinberg, *What's the Deal?*, *supra* note 25, at 7 ("Although the story ends well, there is a gaping hole at the center of it: the entire narrative

The outcomes of derivative works and fair use issues might depend on whether the potentially infringing work is a CAD file or a 3D-printed object, or whether the protected work is a CAD file or a preexisting copyrighted object. Courts will have to sort through these ancillary matters in order to determine the outcomes of infringement actions.

This Note seeks to untangle the component issues of the network of relationships unique to 3D printing. First, it addresses whether CAD files, insofar as they contain both design drawing and computer code elements and exist for the distinct purpose of 3D printing, are copyrightable. Second, in light of the issue of copyrightability, it examines whether CAD files and 3D-printed objects are independently copyrightable as derivative works, and whether they infringe on authors' derivative works rights. Finally, it questions whether current fair use doctrine, as an affirmative defense for otherwise infringing works, can adequately account for 3D printing as an emerging technology.

After explaining how 3D printing and CAD files work in Part II, this Note provides the legal background for copyrightability, derivative works, and fair use in Parts III, IV, and V, respectively. In Part VI.A, this Note explains why CAD files fail to fit within any current category of copyrightable works. As a solution, it poses a new test that considers a CAD file's drawing and code components separately before determining whether otherwise copyrightable expression has merged with the CAD file's functional purpose. With this test in mind, Part VI.B examines the derivative works issues. Finally, in Part VI.C, this Note argues that the established fair use doctrine will fail to provide predictable outcomes in 3D printing cases that are consistent with the goals of fair use and copyright generally. Rather, 3D printing poses unique challenges that demonstrate the need to adopt Professor Edward Lee's technological fair use standard as a separate test that can account for the potential benefits of and harm to emerging technologies.

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assumes that Schwanitz has a copyright in his design that was copied in the first place.").

II. An Explanation of 3D Printing and CAD Files

To examine the copyright issues pertaining to 3D printing, one must first understand 3D printers, CAD files, and the relationship between the two. 3D printers operate in a similar manner to inkjet printers except that, instead of printing on a two-dimensional piece of paper, 3D printers build up a 3D object by printing tiny layers of plastic, metal, ceramics, or other materials on top of each other.[30] These printers are capable of producing—among other things—machine parts,[31] architectural models,[32] board games,[33] and even (when cellular material is used in the printer) human tissue.[34] Assuming that the 3D printer is large enough, it can print objects of any size.[35]

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30. *See* LIPSON & KURMAN, *supra* note 16, at 68, 73 (describing two types of 3D printers: those that "squirt, squeeze, or spray" materials (most consumer models); and those that use lasers to "fuse, bind, or glue" powdered materials together); *id.* at 82 ("[M]ost companies and printing hobbyists must content themselves with plastic, metals, ceramics, edible semi-solid foodstuffs, and to a lesser extent concrete or glass."); Weinberg, *It Will Be Awesome, supra* note 24 ("Instead of taking a block of material and cutting away until it produces a solid object, a 3D printer actually builds the object up from tiny bits of material, layer by layer.").

31. *See* Morrison, *supra* note 14 ("[H]e pulls out a perfectly turned machine part—a plastic housing that slides neatly into place . . . .").

32. *See id.* (discussing how one family business "toyed with several ideas—jewelry making, medical printing—before settling on architectural modeling").

33. *See* Joseph Flaherty, *Watch Your Back, Hasbro, 3-D Printed Games Have Arrived*, WIRED (Aug. 30, 2012, 6:30 AM), http://www.wired.com/design/2012/08/watch-your-back-hasbro-3d-printed-games-have-arrived/ (last visited Jan. 31, 2014) ("3D printers are sometimes called Santa Claus machines because, like Santa, they can create anything imaginable. . . . The team at Ill Gotten Games is doing just that by creating Pocket Tactics, the first open source miniatures game designed to be manufactured on a 3D printer.") (on file with the Washington and Lee Law Review).

34. *See Biological Tissues from a Printer*, GEN NEWS HIGHLIGHTS (Sept. 14, 2012), http://www.genengnews.com/gen-news-highlights/biological-tissues-from-a-printer/81247319/ (last visited Jan. 31, 2014) ("[T]he new technique . . . effectively allows complex nanostructures such as blood vessels or potentially new heart tissue, for example, to be printed out of biocompatible materials in just seconds.") (on file with the Washington and Lee Law Review).

35. *See* Hanna, *supra* note 12 ("The size of these shapes is only limited by the size of the printer making them.").

3D printers operate from virtual 3D models called CAD files.[36] CAD files are saved in .amf format[37] or the older and more widely used .stl format—"the object equivalent of a .pdf file—they are more or less universally printable by 3D printers and allow objects to be transferred digitally around the world."[38] The files are either rendered by a designer on a computer software program or created using a 3D scanner.[39] "Much as a word processor is superior to a typewriter because it allows a writer to add, delete, and edit text freely, a CAD program [as opposed to a physical prototype] allows a designer to manipulate a design as she sees fit."[40] There are two types of design software. First, "solid modeling" software offers users a library of ready-made shapes "that can be cut stretched, and combined with a few clicks of a mouse."[41] Second, "surface modeling" software allows users to construct 3D objects freehand by "digitally 'wrapping' shapes in a virtual fishing net" to map the objects in space.[42] On the other hand, 3D scanners "capture physical dimensions of things . . . as

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36. *See* Weinberg, *It Will Be Awesome*, *supra* note 24 (explaining how CAD files work).

37. *See* LIPSON & KURMAN, *supra* note 16, at 101–02 (describing .amf files as a "new XML-based standard").

38. Weinberg, *What's the Deal?*, *supra* note 25, at 14. Lipson and Kurman argue that the .stl format cannot handle the volume of information in modern CAD files, but that until 3D-printing vendors adopt the .amf format, "we're stuck . . . [with] the old but tired warhorse STL." LIPSON & KURMAN, *supra* note 16, at 102.

39. *See* Weinberg, *It Will Be Awesome*, *supra* note 24 ("3D printing starts with a blueprint, usually one created with a computer aided design (CAD) program running on a desktop computer. This is a virtual 3D model of an object. . . . A designer uses the CAD program to create the model, which is then saved as a file."); *As 3-D Printing Becomes More Accessible, Copyright Questions Arise*, KUNC 91.5 (Feb. 19, 2013, 2:13 PM), http://www.kunc.org/post/3-d-printing-becomes-more-accessible-copyright-questions-arise (last visited Jan. 31, 2014) (describing how companies have created software that turns the Kinect for Microsoft's Xbox 360 into a 3D scanner capable of "collect[ing] 3-D data and images, and . . . stitch[ing] everything together into a detailed 3-D model") (on file with the Washington and Lee Law Review).

40. Weinberg, *It Will Be Awesome*, *supra* note 24.

41. LIPSON & KURMAN, *supra* note 16, at 92. "Solid modeling was born from industrial design and manufacturing." *Id.* at 93.

42. *Id.* at 94. "If solid modeling grew up among engineers, surface modeling design software grew up in the midst of animators and illustrators." *Id.*

a surface coating of digital confetti [in which e]ach piece of digital confetti represents a data point . . . documented as a set of x, y, and z coordinates."[43]

To print a 3D object, the CAD software "deconstructs the image into a series of 2D cross-sectional slices"[44] and sends them through computer code to the 3D printer.[45] The printer then deposits the material layer by layer.[46] Software that is available on the Internet enables individuals with any level of CAD modeling experience to create their own designs, with some programs including a variety of drawing tools and others supplying a library of premade shapes.[47]

Websites make CAD files available to the public for download.[48] Some such sites charge users to download files.[49] Others, however, allow "users to freely upload, improve upon, and distribute virtually any designs at all."[50] The website Thingiverse, for example, makes 25,000 CAD files available for free.[51] These files often depict copyrighted works, whether they are "distinctive designer items" or Darth Vader heads.[52] As a step

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43. *Id.* at 96.

44. Hanna, *supra* note 12.

45. *See* Thomas Olson, *Technology Takes Printing to Whole Different Dimension*, PITT. TRIB. (Jan. 14, 2013, 9:23 PM), http://triblive.com/news/adminpage/3265615-74/printing-greene-pittsburgh#axzz2JhO6mvSH (last visited Jan. 31, 2014) ("The 3-D printing process starts with a computer file of code that describes an object's dimensions and properties.") (on file with the Washington and Lee Law Review). For examples of .stl file code, see *The STL Format: Standard Data Format for Fabbers*, FABBER.COM, http://www.ennex.com/~fabbers/StL.asp (last visited Jan. 31, 2014) (on file with the Washington and Lee Law Review).

46. *See* Hanna, *supra* note 12 ("The printer deposits layers of material, typically plastic or metal, one atop the other in the shape of each 2D slice.").

47. *See The Wired 3D Print-Off*, *supra* note 26 (providing links to CAD modeling software and sites including Tinkercad, Shapeways Creator, Autodesk 123D Design, and Sketchup).

48. *See* Hanna, *supra* note 12 ("Two models have emerged for websites that distribute and/or fabricate 3D designs.").

49. *See id.* (describing the "money model" typified by Shapeways).

50. *Id.* (describing the "open model" typified by Thingiverse).

51. *See* Greenberg, *supra* note 16 ("Anyone who buys a Makerbot can immediately download and print any of Thingiverse's 25,000 designs.").

52. *See* Hanna, *supra* note 12 (discussing the types of items for which CAD files are available on Shapeways and Thingiverse, respectively).

to prevent future lawsuits after receiving its first DMCA takedown notice,[53] Thingiverse posted online its Intellectual Property Policy, which "provides for the removal of any infringing or unauthorized materials and for the termination, in appropriate circumstances, of users of our online Site and Services who are repeat infringers of intellectual property rights or who repeatedly submit unauthorized content."[54] But while websites such as Thingiverse may attempt to limit their liability,[55] copyright suits almost inevitably loom in the near future for these sites, individual CAD designers, and users of 3D printers.[56]

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53. *See* Brian Rideout, Note, *Printing the Impossible Triangle: The Copyright Implications of Three-Dimensional Printing*, 5 J. BUS., ENTREPRENEURSHIP & L. 161, 165–66 (2011) (recounting the first DMCA takedown notice for 3D printing in February 2011, which Ulrich Schwanitz issued when another designer posted a CAD file of his Penrose Triangle model on the open website, Thingiverse).

54. *Intellectual Property Policy*, THINGIVERSE, http://www.thingiverse.com/legal/ip-policy (last visited Jan. 31, 2014) (on file with the Washington and Lee Law Review); *see also* Thingiverse Blog, *Copyright Policy*, THINGIVERSE (Feb. 18, 2011), http://blog.thingiverse.com/2011/02/18/copyright-and-intellectual-property-policy/ (last visited Jan. 31, 2014) (explaining that on the day after Schwanitz issued his takedown notice, Thingiverse "updated [its] legal page with a new DMCA specific policy") (on file with the Washington and Lee Law Review). Thingiverse's Terms of Use also require a user to select either a "Creative Commons License" or an "All Rights Reserved" license for any content that she uploads onto the site. *Terms of Use*, THINGIVERSE, http://www.thingiverse.com/legal (last visited Jan. 31, 2014) (on file with the Washington and Lee Law Review). In addition, the user agrees "not to use the Site or Services to collect, upload, transmit, display, or distribute any User Content . . . that violates any third-party right, including any copyright, trademark, patent, trade secret, moral right, privacy right, right of publicity, or any other intellectual property or proprietary right." *Id.*

55. *See* 17 U.S.C. § 512(c)(1)(A) (2012) (providing safe harbor from contributory infringement for websites that do not "have actual knowledge that the material or an activity using the material on the system or network is infringing" and "upon obtaining such knowledge or awareness, acts expeditiously to remove or disable access to, the material").

56. *See supra* notes 21–23 and accompanying text (explaining how it is only a matter of time before a copyright holder commences an action related to 3D printing).

III. Legal Requirements of and Limitations on Copyrightability

The Supreme Court has asserted that "[t]o establish [copyright] infringement, two elements must be proven: (1) ownership of a valid copyright, and (2) copying of constituent elements of the work that are original."[57] Thus, in any infringement case concerning 3D printing or otherwise, courts will first have to determine whether the plaintiff owns a valid copyright. This Part explains the legal requirements of and limitations on copyrightability.

A. Original Works Fixed in a Tangible Medium of Expression

Section 102(a) of the Copyright Act of 1976[58] defines copyrightable subject matter. Under this section, copyright protection extends 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."[59] Copyrightability can therefore be broken into two components: a work must be "original" and "fixed in any tangible medium."[60]

1. Originality

Originality consists of "independent creation" and a "modicum of creativity."[61] Independent creation does not require novelty, and "a work may be original even though it closely resembles other works so long as the similarity is fortuitous, not the result of copying."[62] In other words, if two authors independently—and ignorant of each other—created the exact

57. Feist Publ'ns v. Rural Tel. Serv., 499 U.S. 340, 361 (1991).
58. 17 U.S.C. § 102(a) (2012).
59. *Id.*
60. *Id.*
61. *Feist*, 499 U.S. at 346.
62. *Id.* at 345.

same work, both would satisfy the originality requirement.[63] When compared to a previously existing work, the work in question is original if "the 'author' contributed something more than a 'merely trivial' variation, something recognizably 'his own.'"[64] The creativity requirement is a similarly low threshold.[65] Almost any work possesses "some creative spark 'no matter how crude, humble or obvious' it might be."[66] Some works, such as those containing mere facts, however, fail the creativity prong.[67]

2. Fixed in a Tangible Medium of Expression

Works must not only be original to be copyrightable; they must also be fixed in a tangible medium of expression.[68] Although the Constitution authorizes Congress to "secur[e] for limited Times to Authors . . . the exclusive Right to their respective Writings,"[69] courts have historically interpreted "writings" broadly.[70] As noted above, Congress has since codified the courts' approach, extending protection to works "fixed in *any* tangible medium of expression."[71] As a nonexaustive list of

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63. *See id.* at 345–46 ("To illustrate, assume that two poets, each ignorant of the other, compose identical poems. Neither work is novel, yet both are original and, hence, copyrightable." (citing Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936))).

64. Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 103 (2d Cir. 1951).

65. *See id.* ("To be sure, the requisite level of creativity is extremely low; even a slight amount will suffice.").

66. Feist Publ'ns v. Rural Tel. Serv., 499 U.S. 340, 345 (1991) (quoting 1 M. NIMMER & D. NIMMER, NIMMER ON COPYRIGHT § 201(A), (B) (1990)).

67. *See id.* at 347 (explaining that facts "do not owe their origin to an act of authorship" and are therefore unoriginal discoveries rather than creations).

68. *See supra* notes 58–59 and accompanying text (stating the § 102(a) requirement).

69. U.S. CONST. art. I, § 8, cl. 8.

70. *See* Goldstein v. California, 412 U.S. 546, 561 (1973) (explaining how courts have interpreted the term "writings . . . to include any physical rendering of the fruits of creative intellectual or aesthetic labor" (citing Trade-Mark Cases, 100 U.S. 82, 94 (1879))), *superseded by statute on other grounds*, Copyright Act of 1976, Pub. L. No. 94-553, 90 Stat. 2572 (codified as amended at 17 U.S.C. § 101–805 (2012)).

71. 17 U.S.C. § 102(a) (2012) (emphasis added).

examples,[72] the statute specifically declares copyright-eligible "(1) literary works; (2) musical works, including any accompanying words; (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works; (5) pictorial, graphic, and sculptural works; (6) motion pictures and other audiovisual works; (7) sound recordings; and (8) architectural works."[73]

B. Limits on Copyrightability

Although § 102(a) sets a relatively low originality threshold for copyrightability,[74] the Copyright Act does provide limits on what is protected. Under § 102(b), copyright protection does not extend to "any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."[75] Just as courts have had to separate noncopyrightable facts from the potentially copyrightable compilation of those facts,[76] so too have courts struggled with the idea–expression dichotomy—the difference between noncopyrightable ideas and the expression of those ideas.[77] Furthermore, copyrightability, insofar as it protects expression, does not extend to useful articles—or the functional aspects—of a work.[78]

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72. *See id.* ("Works of authorship *include* the following categories . . . ." (emphasis added)).

73. *Id.*

74. *See supra* Part III.A.1 (explaining that the "independent creation" and "modicum of creativity" requirements for originality are easily met).

75. 17 U.S.C. § 102(b).

76. *See* Feist Publ'ns v. Rural Tel. Serv., 499 U.S. 340, 344–51 (1991) (discussing how compilations of facts, rather than the facts themselves, can be copyrightable when "choices as to selection and arrangement, so long as they are made independently by the compiler[,] . . . entail a minimal degree of creativity").

77. *See id.* at 349–50 ("To this end, copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work. This principle, known as the idea/expression . . . dichotomy, applies to all works of authorship.").

78. *See* Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1143

1. The Idea–Expression Dichotomy and Merger

The basis for the idea–expression dichotomy comes from § 102(b) of the Copyright Act of 1976, which states that "[i]n no case does copyright protection for an original work of authorship extend to any idea . . . regardless of the form in which it is described, explained, illustrated, or embodied in such work."[79] Thus, "[u]nlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea—not the idea itself."[80] The Supreme Court first articulated the concept of the idea–expression dichotomy in *Baker v. Selden*,[81] stating that

> [T]here is a clear distinction between the book, as such, and the art which it is intended to illustrate. The mere statement of the proposition is so evident, that it requires hardly any argument to support it. The same distinction may be predicated of every other art as well as that of book-keeping. A treatise on the composition and use of medicines, be they old or new; on the construction and use of ploughs, or watches, or churns; or on the mixture and application of colors for painting or dyeing; or on the mode of drawing lines to produce the effect of perspective,—would be the subject of copyright; but no one would contend that the copyright of the treatise would give the exclusive right to the art or manufacture described therein.[82]

(2d Cir. 1987) (explaining how Congress attempted to draw a clear line between copyrightable pictorial and sculptural works, on the one hand, and noncopyrightable elements of design, on the other).

79. 17 U.S.C. § 102(b) (2012).

80. Mazer v. Stein, 347 U.S. 201, 217 (1954), *superseded on other grounds by federal regulation*, 37 C.F.R. § 202.10 (1959).

81. 101 U.S. 99 (1880). In *Baker*, the plaintiff published a book describing an accounting system that he had invented. *Id.* at 99–100. When the defendant used the plaintiff's system without his permission, the plaintiff sued for copyright infringement. *Id.* at 100. As the Court noted, "[i]f the complainant's testator had the exclusive right to the use of the system explained in his book, it would be difficult to contend that the defendant does not infringe it." *Id.* But, the Court explained, the plaintiff's copyright lay in the book only as an explanatory work; he could not claim copyright over the system itself. *See id.* ("[I]t seems to be equally difficult to contend that the books made and sold by the defendant are a violation of the copyright of the complainant's book considered merely as a book explanatory of the system.").

82. *Id.* at 102.

For the Court, the distinction between idea and expression marked the line between patent and copyright.[83] The question of ownership of an idea hinged on novelty—a patent concept—whereas an author's book was copyrightable even if it described an idea thousands of years old.[84] Thus, "expression" in this context can be better understood as the *means* of expression.[85]

The idea–expression dichotomy presents a number of problems, including the doctrine of merger. The doctrine of merger states that "[w]hen there is essentially only one way to express an idea, the idea and its expression are inseparable and copyright is no bar to copying that expression."[86] When the expression becomes essential to the idea itself, the two effectively "merge," rendering the expression noncopyrightable.[87] Thus, as the Supreme Court noted in *Baker*, copyright protection extends only to those expressions that are not "necessary incidents" to the idea.[88]

For example, in the context of computer software, a number of concerns can limit an author's choices of expression until only a single means of expression is possible.[89] Software copyrights,

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83. *See id.* ("To give to the author of the book an exclusive property in the art described therein, when no examination of its novelty has ever been officially made, would be a surprise and a fraud upon the public. That is the province of letters-patent, not of copyright.").

84. *See id.* ("The copyright of the book, if not pirated from other works, would be valid without regard to the novelty, or want of novelty, of its subject-matter. The novelty of the art or thing described or explained has nothing to do with the validity of the copyright.").

85. *See* Mark A. Lemley, *Convergence in the Law of Software Copyright?*, 10 HIGH TECH. L.J. 1, 5 (1995) ("In particular, a copyright owner may not lay claim to the *ideas* within her work, but only to her particular means of expressing those ideas.").

86. Concrete Mach. Co. v. Classic Lawn Ornaments, Inc., 843 F.2d 600, 606 (1st Cir. 1988).

87. *See* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 708 (2d Cir. 1992) ("Under these circumstances, the expression is said to have 'merged' with the idea itself. In order not to confer a monopoly of the idea upon the copyright owner, such expression should not be protected.").

88. Baker v. Selden, 101 U.S. 99, 103 (1880).

89. *See Altai*, 982 F.2d at 709–10 ("[A] programmer's freedom of design choice is often circumscribed by extrinsic considerations such as . . . (1) mechanical specifications of the computer . . . ; (2) compatibility requirements of other programs . . . ; (3) computer manufacturers' design

which serve a largely utilitarian function, face specific problems because almost all "expression" in the code or structure of the program is incidental to the purpose of the program.[90] In an attempt to formulate a bright-line rule to account for the idea–expression dichotomy, the Third Circuit determined in *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*[91] that "the purpose or function of a utilitarian work would be the work's idea, and everything that is not necessary to that purpose or function would be part of the expression of the idea."[92] Under *Whelan*, then, anything that survives a merger inquiry is copyrightable expression.[93] Later decisions, however, determined that lack of merger alone is not sufficient to constitute copyrightability. Rather, courts must also account for whether elements were dictated by external factors,[94] and they must determine whether certain aspects were noncopyrightable under § 102(b).[95]

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standards; (4) demands of the industry being serviced; and (5) . . . programming practices within the computer industry.").

90. *See* Lemley, *supra* note 85, at 7 ("[C]omputer programs are written for a utilitarian purpose. Expression in the code or structure and organization of a program is normally only incidental to that purpose.").

91. 797 F.2d 1222 (3d Cir. 1986).

92. *Id.* at 1236 (emphasis omitted).

93. *See id.* ("Where there are various means of achieving the desired purpose, then the particular means chosen is not necessary to the purpose; hence, there is expression, not idea.").

94. *See* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 707–10 (2d Cir. 1992) (employing an "abstraction–filtration–comparison" test in which the court, during the filtration step, determines whether any of the potentially infringed expression is necessitated by efficiency (essentially a merger inquiry), necessitated by external elements such as constraints on hardware, or taken from the public domain).

95. *See* Lotus Dev. Corp. v. Borland Int'l, 49 F.3d 807, 814 (1st Cir. 1995) (determining that the court need not apply the *Altai* test if the menu tree at issue was a noncopyrightable method of operation from the start).

2. The Useful Article Doctrine

Another limitation on copyrightability that has posed problems for the courts is the useful article doctrine. The doctrine essentially states that

> the design of a useful article . . . shall be considered a pictorial, graphic, or sculptural work [which is copyright-eligible under § 102(a)] only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.[96]

While pictorial, graphic, and sculptural works as defined by § 101[97] are eligible for copyright protection under § 102(a),[98] any mechanical or utilitarian aspects of the work are not.[99] Section 101 defines "useful article" as an "article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information."[100] The useful article doctrine seeks to draw a line between copyrightable works of art and noncopyrightable works of industrial design.[101] Although the useful article doctrine is like the idea–expression dichotomy in its attempt to create a boundary between copyrightable and noncopyrightable subject matter, the idea–expression dichotomy applies to all works of authorship,[102] while the useful article

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96. 17 U.S.C. § 101 (2012).

97. *See id.* ("'Pictorial, graphic, and sculptural works' include two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproductions, maps, globes, charts, diagrams, models, and technical drawings, including architectural plans.").

98. *See id.* § 102(a) ("Works of authorship include . . . pictorial, graphic, and sculptural works . . . .").

99. *See id.* § 101 ("Such works shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned.").

100. *Id.*

101. *See* H.R. REP. NO. 94-1476, at 55 (1976) ("In adopting this amendatory language, the Committee is seeking to draw as clear a line as possible between copyrightable works of applied art and uncopyrighted works of industrial design.").

102. *See* 17 U.S.C. § 102(b) (2012) (providing that an idea is not copyrightable "regardless of the form in which it is described, explained, illustrated, or embodied").

doctrine applies only to pictorial, graphic, and sculptural works.[103] Furthermore, because expression survives the doctrine of merger if it is not incidental to the idea that it expresses,[104] certain copyrightable elements of an article can survive the useful article doctrine.[105]

The challenge for the courts has been to devise a standard by which copyrightable elements can be separated from useful articles.[106] Courts have drawn on language in the legislative history of the Copyright Act of 1976 to develop two theories of separability: physical separability and conceptual separability.[107] For an element to be physically separable it must be "capable of existing as a work of art independent of the utilitarian article into which [it was] incorporated."[108] It must be "a 'feature' segregable from the overall shape" of the useful article.[109] On the other hand, conceptual separability requires that elements, regardless of whether they possess aesthetic features, can be "conceptualized as existing independently of their utilitarian function."[110] Courts, however, have struggled to determine what constitutes a conception of independent existence.[111]

Three distinct tests have emerged for determining whether features of a work are conceptually separable from the useful

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103. *See id.* § 101 (defining "useful article" in terms of pictorial, graphic, and sculptural works).

104. *See supra* note 88 and accompanying text (describing how expression not incidental to the idea is copyrightable).

105. *See* H.R. REP. NO. 94-1476, at 55 (1976) ("[O]nly elements, if any, which can be identified separately from the useful article as such are copyrightable.").

106. *See* Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1142 (2d Cir. 1987) ("The courts, however, have had difficulty framing tests by which the fine line establishing what is and what is not copyrightable can be drawn.").

107. *See id.* at 1143 ("One aspect of the distinction that has drawn considerable attention is the reference in the House Report to 'physically *or conceptually*' . . . separable elements." (quoting H.R. REP. NO. 94-1476, at 55 (1976))).

108. Esquire, Inc. v. Ringer, 591 F.2d 796, 804 (D.C. Cir. 1978).

109. *Id.* at 805.

110. Carol Barnhart, Inc. v. Econ. Cover Corp., 773 F.2d 411, 418 (2d Cir. 1985).

111. *See Brandir*, 834 F.2d at 1144 ("The problem, however, is determining exactly what it is and how it is to be applied.").

article.[112] First, Judge Newman's dissent in *Carol Barnhart, Inc. v. Economy Cover Corp.*[113] proposed a "temporal displacement test" for conceptual separability.[114] Under the temporal displacement test, which William Patry supports in his treatise,[115] an artistic element is separable from the useful article if "the design creates in the mind of the ordinary observer two different concepts that are not inevitably entertained simultaneously."[116] Rather than merely evoking in the observer a concept separate from utilitarian function,[117] the "design [must]

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112. *See id.* at 1144–45 (considering Judge Newman's "temporal displacement test" from *Barnhart* and Professor Denicola's test); 1 PAUL GOLDSTEIN, GOLDSTEIN ON COPYRIGHT § 2.5.3.1 (2d ed. 1996) [hereinafter GOLDSTEIN ON COPYRIGHT] (providing a third test dependent on traditional conceptions of art). Professor Goldstein actually identifies five tests for conceptual separability besides his own, but considers the tests "overlapping." *Id.* By narrowing the list to three, this Note touches on those tests that consider distinct criteria.

113. 773 F.2d 411 (2d Cir. 1985). *Barnhart* concerned the copyrightability of torso mannequins. *Id.* at 412. The court affirmed the district court's ruling that the mannequins were useful articles, and that artistic elements could not be physically or conceptually separated. *Id.* at 419. While the majority relied almost entirely on legislative history, however, to settle the question of conceptual separability, Judge Newman's dissent advocated for a new temporal displacement test. *See id.* at 418 ("The legislative history thus confirms that, while copyright protection has increasingly been extended to cover articles having a utilitarian dimension, Congress has explicitly refused copyright protection for works of applied art or industrial design which have aesthetic or artistic features that cannot be identified separately from the useful article."); *id.* at 422 (Newman, J., dissenting) ("I think the requisite 'separateness' exists whenever the design creates in the mind of the ordinary observer two different concepts that are not inevitably entertained simultaneously.").

114. *See id.* at 422–24 (explaining the test); Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1144 (2d Cir. 1987) (referring to the test as the "temporal displacement" test).

115. *See* 1 WILLIAM F. PATRY, PATRY ON COPYRIGHT § 3:141 (2006) (preferring the temporal displacement test to the Denicola test from *Brandir*).

116. *Barnhart*, 773 F.2d at 422.

117. *See id.* at 423 ("Some might think that the requisite separability of concepts exists whenever the design of a form engenders in the mind of the ordinary observer any concept that is distinct from the concept of the form's utilitarian function."). Such an understanding of conceptual separability would allow for copyrightability of merely aesthetically pleasing articles—protection that Congress specifically intended not to extend. *See id.* ("That approach, I fear, would subvert the Congressional effort to deny copyright protection to designs of useful articles that are aesthetically pleasing."); H.R. REP. NO. 94-1476, at 55

engender[] a non-utilitarian concept *without at the same time* engendering the concept of a utilitarian function."[118]

The majority in *Brandir International, Inc. v. Cascade Pacific Lumber Co.*[119] rejected the temporal displacement test in favor of a standard that Professor Denicola articulated in *Applied Art and Industrial Design: A Suggested Approach to Copyright in Useful Articles*.[120] Professor Denicola suggested that there is not a bright line between creative works and useful articles, but rather "a spectrum of forms and shapes responsive in varying degrees to utilitarian concerns."[121] The *Brandir* court interpreted Professor Denicola's test to mean that "if design elements reflect a merger of aesthetic and functional considerations, the artistic aspects of a work cannot be said to be conceptually separable from the utilitarian elements. Conversely, where design elements can be identified as reflecting the designer's artistic judgment exercised independently of functional influences, conceptual separability exists."[122]

Finally, in *Goldstein on Copyright*, Professor Paul Goldstein presents a test that incorporates traditional notions of art and a concept similar to the physical separability test from *Esquire, Inc. v. Ringer*.[123] Professor Goldstein's test posits that a useful article

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(1976) ("On the other hand, although the shape of an industrial product may be aesthetically satisfying and valuable, the Committee's intention is not to offer it copyright protection under the bill.").

118. Carol Barnhart, Inc. v. Econ. Cover Corp., 773 F.2d 411, 423 (2d Cir. 1985) (Newman, J., dissenting) (emphasis added).

119. 834 F.2d 1142 (2d Cir. 1987). *Brandir* concerned the copyrightability of the now common "RIBBON Rack" bicycle rack, which David Levine based on his wire sculptures "formed from one continuous undulating piece of wire." *Id.* at 1146. The court adopted Professor Denicola's test and determined that the rack was sufficiently influenced by utilitarian concerns to be not conceptually separable, and therefore not copyrightable. *Id.* at 1146–47.

120. *See* Robert C. Denicola, *Applied Art and Industrial Design: A Suggested Approach to Copyright in Useful Articles*, 67 MINN. L. REV. 707, 741–47 (1983) (expressing dissatisfaction with *Mazer* and *Esquire* and establishing a more flexible test).

121. *Id.* at 741.

122. *Brandir*, 834 F.2d at 1145.

123. *Compare* Esquire, Inc. v. Ringer, 591 F.2d 796, 804 (D.C. Cir. 1978) (explaining that for an element to be physically separable it must be "capable of existing as a work of art independent of the utilitarian article into which they were incorporated"), *with* GOLDSTEIN ON COPYRIGHT, *supra* note 112, § 2.5.3.1

is conceptually separable "if it can stand on its own as a work of art traditionally conceived, and if the useful article in which it is embodied would be equally useful without it."[124] Essentially, the Goldstein test is a reformulation of the physical separability test, except that the act of separation becomes a mental exercise instead of an inquiry into whether the artistic and functional elements can literally be pulled apart.[125]

While the statutory requirements of originality and fixation are not particularly stringent,[126] the limitations posed by the idea–expression dichotomy and the useful article doctrine help to draw a clearer line between copyrightable and noncopyrightable subject matter. Copyrightability issues pertaining to 3D printing must therefore focus on both the originality and fixation requirements and these limitations.[127]

IV. Derivative Works

Once the issue of copyrightability is settled, the issue of derivative works arises. Section 106(2) of the Copyright Act of 1976 gives the author of a copyrighted work "exclusive rights . . . to prepare derivative works."[128] In terms of 3D printing, it will be necessary to determine whether 3D-printed objects are derivative

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(requiring a feature to be able to "stand on its own as work of art traditionally conceived, and if the useful article in which it is embodied would be equally useful without it").

124. GOLDSTEIN ON COPYRIGHT, *supra* note 112, § 2.5.3.1.

125. *Compare id.* (arguing that a useful article is conceptually separable if it "can *stand on its own* as a work of art traditionally conceived, and if the useful article in which it is *embodied* would be equally useful without it" (emphasis added)), *with id.* ("[A] useful article is physically separable from the article and is thus protectable if it can be *physically* separated from the article *without impairing the article's utility* and if, once separated, it can stand alone as a work of art traditionally conceived." (emphasis added)).

126. *See supra* notes 61–73 (explaining the low thresholds for independent creation and modicum of creativity for the originality requirement and how a work can be fixed in any tangible medium).

127. *See infra* Part VI.A.2 (discussing the copyrightability of CAD files both in terms of the originality and fixation requirements and the limitations of the idea–expression dichotomy and the useful article doctrine).

128. 17 U.S.C. § 106(2) (2012).

works of the CAD files from which they were printed if the CAD files themselves are copyrightable. Even if they are not copyrightable, CAD files that depict already-existing copyrightable objects could be derivative works of the preexisting objects. To conduct this analysis, however, one must know what constitutes a derivative work and what exactly it means to have the exclusive rights to prepare derivative works.

A. What Works Are "Derivative"?

Section 101 of the Copyright Act of 1976 defines a derivative work as a "work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted."[129] A derivative work must therefore be (1) a transformation, recasting, or adaptation of (2) a preexisting work.

To qualify as a derivative work, a work must transform, adapt, or recast a preexisting work.[130] Transformativeness, in the context of derivative works, is a change in content, rather than a change in the purpose of the work.[131] The listed examples of derivative works in § 101 of the Copyright Act suggest as much, focusing on content-based changes such as "translation,"[132] "motion picture version,"[133] and "abridgment,"[134] rather than a change in purpose, such as parody.[135] Examples in case law of

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129. *Id.* § 101.

130. *See id.* (defining "derivative work" under the Copyright Act).

131. *See* R. Anthony Reese, *Transformativeness and the Derivative Work Right*, 31 COLUM. J.L. & ARTS 467, 494 (2008) (comparing the transformativeness requirement for derivative works, which focuses on change in content, with the transformativeness requirement for fair use, which focuses on the purposes of the copyrighted work and the potentially infringing work).

132. 17 U.S.C. § 101.

133. *Id.*

134. *Id.*

135. *See* Campbell v. Acuff-Rose Music, 510 U.S. 569, 579 (1994) (determining that parody is transformative for purposes of fair use); Reese, *supra* note 131, at 486–94 (determining that a transformation in *purpose* is

transformative content constituting derivative works include the transformation of a magazine cover photograph into a computer animation[136] and user-created video game levels.[137]

For a derivative work to be transformative, however, there must be a preexisting work off of which it is based.[138] The preexisting work must be copyrightable itself.[139] Although this is not mentioned expressly in the Copyright Act, the requirement that the preexisting work be copyrightable prevents the protection of derivative works from extending to subject matter outside the realm of copyright law.[140] Furthermore, a new work will be "based on"[141] a preexisting work, and therefore will be a derivative work, only if the two are substantially related so that

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necessary for fair use, and that a mere transformation of content is not sufficient). For further discussion of the transformativeness requirement of fair use, see *infra* notes 176–82 and accompanying text.

136. *See* Greenberg v. Nat'l Geographic Soc'y, 244 F.3d 1267, 1274 (11th Cir. 2001) (concluding that the defendant's computer animation of plaintiff's photograph of a diver violated the plaintiff's right to prepare derivative works).

137. *See* Micro Star v. FormGen Inc., 154 F.3d 1107, 1112 (9th Cir. 1998) (concluding that user-created levels for the Duke Nukem 3D video game were effectively sequels, and therefore derivative works). Professor Reese notes that *Micro Star* expressly mentions transformativeness only once, in a footnote, in which the court stated that the levels were *not* transformative. *See* Reese, *supra* note 131, at 474 ("In reviewing Micro Star's fair use claim, however, the court discussed transformativeness only in a single footnote, in which it concluded, with no further analysis, that the additional game levels 'can hardly be described as transformative; anything but.'" (quoting *Micro Star*, 154 F.3d at 1113 n.6)). But the court was using "transformative" in the fair use, transformative-purpose sense (*Micro Star* also considers the issue of fair use). *See id.* ("[I]n discussing the transformativeness of Micro Star's use, it never even adverted to the transformation of the underlying work involved in preparing the derivatives.").

138. *See* 17 U.S.C. § 101 (2012) (providing that a derivative work is "based upon one or more *preexisting works*" (emphasis added)).

139. *See* Ets-Hoken v. Skyy Spirits, 225 F.3d 1068, 1078 (9th Cir. 2000) ("Under the Copyright Act, a work is not a 'derivative work' unless it is 'based upon one or more preexisting works' and, in order to qualify as a 'preexisting work,' the underlying work must be copyrightable.").

140. *See id.* at 1079 ("[T]he fact that the term 'derivative work' appears only in the Copyright Act, and not, for example, in the patent or trademark statutes, indicate[s] that for a work to qualify as a derivative work, the work from which it derives must itself be within the ambit of copyright.").

141. 17 U.S.C. § 101.

the new work would otherwise be infringing on the copyright of the preexisting work.[142]

B. Rights Associated with Derivative Works

Derivative works can qualify for copyright protection in two ways. First, a derivative work that otherwise meets the § 102 copyrightability criteria can qualify for independent copyright protection.[143] The originality requirement for derivative works is the same as that for copyrightability generally.[144] Thus, to be independently copyrightable as a derivative work, the new work must have been created independently and must possess a modicum of creativity.[145] Second, the possibility of independent copyrightability notwithstanding, § 106(2) of the Copyright Act of 1976 grants authors of copyrighted works "exclusive rights to . . . prepare derivative works."[146] In this way, the author of an original work has the opportunity to capitalize on her copyright for use of the work beyond its immediate scope.[147] When someone

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142. 1 M. NIMMER & D. NIMMER, NIMMER ON COPYRIGHT § 3.01 (2012) (explaining that a derivative work is "based on" the underlying work "only if [the new work] would be considered an infringing work if the material which it has derived from a preexisting work had been taken without the consent of a copyright proprietor of such preexisting work"). The new work must be "substantially similar in both ideas and expression." Micro Star v. FormGen Inc., 154 F.3d 1107, 1112 (9th Cir. 1998). Idea is embodied in the "objective details of the works," while expression focuses on the "total concept and feel of the works." *Id.*

143. *See* 17 U.S.C. § 103(a) (2012) ("The subject matter of copyright as specified by section 102 includes compilations and derivative works . . . ."); *see also* Lewis Galoob Toys, Inc. v. Nintendo of Am., Inc., 964 F.2d 965, 968 (9th Cir. 1992) (implying that derivative works are themselves copyrightable if they meet the criteria of 17 U.S.C. § 102(a)).

144. *See* Meshwerks, Inc. v. Toyota Motor Sales U.S.A., 528 F.3d 1258, 1266 n.7 (10th Cir. 2008) ("In . . . examining the elements that are original to the author, the originality analysis ought to be the same.").

145. *See supra* notes 61–67 and accompanying text (identifying independent creation and a modicum of creativity as necessary components of originality and further explaining each component).

146. 17 U.S.C. § 106(2) (2012).

147. *See* ROBERT P. MERGES, PETER S. MENELL & MARK A. LEMLEY, INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 573 (6th ed. 2012) (explaining how authors such as John Grisham, Michael Crichton, and J.K.

without the original author's permission creates a work that is derivative per § 101 of the original author's copyrighted work, that person is liable for infringement of the original author's copyright in the preexisting work.[148] While derivative works must satisfy the § 102 requirements to achieve independent protection, "the Act does not require that the derivative work be protectable for its preparation to infringe."[149]

In sum, a derivative work is based on a preexisting work and transforms that work's content.[150] The author of preexisting copyrighted work is protected from infringing derivative works in two ways: he can seek independent protection for his own derivative works,[151] and the derivative works of others infringe on his exclusive right to prepare such works.[152] An understanding of derivative works and the rights associated with them will be especially important in copyright cases involving 3D printing because infringement actions are likely to arise in cases of transformations of content and shifting media.[153]

Rowling have earned more money from film adaptations and commercial tie-ins based on their books than they have for the books themselves).

148. *See* Micro Star v. FormGen Inc., 154 F.3d 1107, 1110 (9th Cir. 1998) ("[The] copyright holder enjoys the exclusive right to prepare derivative works based on [Duke Nukem 3D]. . . . [T]he audiovisual displays generated when [Duke Nukem 3D] is run in conjunction with the N/I CD MAP files are derivative works that infringe this exclusivity.").

149. Paul Goldstein, *Derivative Rights and Derivative Works in Copyright*, 30 J. COPYRIGHT SOC'Y U.S.A. 209, 231 n.75 (1983) [hereinafter Goldstein, *Derivative Rights*]; *accord* Lone Ranger Television v. Program Radio Corp., 740 F.2d 718, 722 (9th Cir. 1984)) ("[I]t makes no difference that the derivation may not satisfy certain requirements for statutory copyright registration itself.").

150. *See supra* notes 130–42 and accompanying text (explaining the requirements for derivative works).

151. *See supra* notes 143–45 and accompanying text (discussing how a derivative work can be independently copyrightable).

152. *See supra* notes 146–49 and accompanying text (explaining how a work can infringe on an author's right to prepare derivative works).

153. *See, e.g.*, Nathan Hurst, *HBO Blocks 3-D Printed Game of Thrones iPhone Dock*, WIRED (Feb. 13, 2013, 1:57 PM), http://www.wired.com/design/2013/02/got-hbo-cease-and-desist/all (last visited Jan. 31, 2014) (describing how HBO sent a cease and desist letter to an individual who designed a CAD file for an iPhone dock resembling the Iron Throne from the *Game of Thrones* television series) (on file with the Washington and Lee Law Review).

V. Fair Use

In cases in which the court will find a work otherwise infringing, fair use is the defendant's primary shield, "the most important—and amorphous—limitation on the otherwise extraordinarily broad rights granted to copyright owners under § 106 of the Act."[154] Section 107 of the Copyright Act, intending to codify common law doctrine,[155] specifically provides for the defense of fair use.[156] Under the statute the court shall consider four factors:

> (1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; (2) the nature of the copyrighted work; (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and (4) the effect of the use upon the potential market for or value of the copyrighted work.[157]

Insofar as "these factors are all weighed in the 'equitable rule of reason' balance," no one factor should be dispositive.[158] An inquiry need not end there, however. The factors are not exhaustive; rather, courts may take into account other considerations.[159]

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154. Barton Beebe, *An Empirical Study of U.S. Copyright Fair Use Opinions, 1978–2005*, 156 U. PA. L. REV. 549, 551 (2008).

155. *See* H.R. REP. NO. 94-1476, at 66 (1976) ("The bill endorses the purpose and general scope of the judicial doctrine of fair use, but there is no disposition to freeze the doctrine in the statute . . . .").

156. *See* 17 U.S.C. § 107 (2012) ("Notwithstanding the provisions of Sections 106 and 106A, the fair use of a copyrighted work . . . is not an infringement of copyright.").

157. *Id.*

158. Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 454 (1984).

159. *See* UMG Recordings, Inc. v. MP3.com, Inc., 92 F. Supp. 2d 349, 351 (S.D.N.Y. 2000) ("Other relevant factors may also be considered, since fair use is an 'equitable rule of reason' to be applied in light of the overall purposes of the Copyright Act." (citing *Sony*, 464 U.S. at 448, 454)).

A. The Purpose and Character of the Use

Courts have divided the first fair use factor—the purpose and the character of the use—into two separate inquiries: whether the use is commercial or noncommercial, and whether the use is transformative.[160] An analysis of the first factor thus requires an examination of both subfactors.

1. Commercial or Noncommercial Use

The first inquiry concerning the fair use factor of purpose and character of the use is whether the use in question is commercial or noncommercial. As the Supreme Court noted in *Sony Corp. of America v. Universal City Studios, Inc.*,[161] "every commercial use of copyrighted material is presumptively an unfair exploitation of the monopoly privilege that belongs to the owner of the copyright."[162] On the other hand, noncommercial use will constitute fair use unless there is "proof either that the particular use is harmful, or that if it should become widespread, it would adversely affect the potential market for the copyrighted

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160. *See* Kelly v. Arriba Soft Corp., 336 F.3d 811, 818 (9th Cir. 2003) (discussing first whether the search engine's use of thumbnail photos was commercial, and then noting that "the second part of the inquiry . . . involves the transformative nature of the use"). After *Sony*, courts tended to consider only whether the use was commercial or noncommercial until *Campbell v. Acuff-Rose Music*. *See* Campbell v. Acuff-Rose Music, 510 U.S. 569, 594 (1994) (reestablishing that commercial use alone is not sufficient to find against fair use, but that courts must also consider whether the use has a transformative purpose).

161. 464 U.S. 417 (1984). In *Sony*, the court considered whether the sale of Betamax video tape recorders (VTRs) to the public violated any of plaintiff's copyrights. *Id.* at 420. In examining whether VTR users engaged in unauthorized "time-shifting" (recording publicly broadcast programs for later viewings) constituted copyright infringement, the Court focused on the fair use doctrine. *Id.* at 447. The Court conducted the four-factor analysis provided in 17 U.S.C. § 107, focusing on the fact that those who recorded television programs did so for private, noncommercial use, and that VTR recordings would likely benefit the market for plaintiff's home videos rather than harm it. *Id.* at 449–53. The Court concluded that use of the Betamax VTRs constituted fair use and that "Sony's sale of [Betamax] equipment to the general public does not constitute contributory infringement of respondents' copyrights." *Id.* at 456.

162. *Id.* at 451.

work."[163] In *Sony*, the Court agreed with the district court's findings that owners' use of Betamax video tape recorders to record television programs for personal, non-profit-making purposes was noncommercial.[164] Since *Sony*, however, courts and scholars have clarified what constitutes noncommercial use[165] and have rejected the notion that commercial use creates a presumption against fair use.[166]

Although *Sony* drew the commercial–noncommercial line at whether the user sought to make a profit,[167] courts have since gone further in defining what constitutes a commercial use. In *A&M Records v. Napster, Inc.*,[168] the Ninth Circuit stated that "[d]irect economic benefit is not required to demonstrate a commercial use. Rather, repeated and exploitative copying of copyrighted works, even if the copies are not offered for sale, may constitute a commercial use."[169] In determining whether peer-to-peer file sharing constituted fair use, the court found that the use was "commercial . . . demonstrated by a showing that repeated and exploitative unauthorized copies of copyrighted works were made to save the expense of purchasing authorized copies."[170] A

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163. *Id.*

164. *See id.* at 450 ("If the Betamax were used to make copies for a commercial or profit-making purpose, such use would presumptively be unfair. The contrary presumption is appropriate here, however, because the District Court's findings plainly establish that time-shifting for private home use must be characterized as a noncommercial, nonprofit activity.").

165. *See* A&M Records v. Napster, Inc., 239 F.3d 1004, 1015 (9th Cir. 2001) (positing that "[d]irect economic benefit is not required to demonstrate a commercial use").

166. Beebe, *supra* note 154, at 571–72 (discussing circuit courts' criticism of the so-called "Sony presumption" and how the Supreme Court eventually "explicitly demoted the commerciality of the defendant's use to merely one issue among others that a court may consider as part of its analysis of the 'purpose and character' of the defendant's use").

167. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 450 (1984) ("If the Betamax were used to make copies for a commercial or profit-making purpose, such use would presumptively be unfair. The contrary presumption is appropriate here, however, because the District Court's findings plainly establish that time-shifting for private home use must be characterized as a noncommercial, nonprofit activity.").

168. 239 F.3d 1004 (9th Cir. 2001).

169. *Id.* at 1015.

170. *Id.*

use is commercial, therefore, either if it is for purposes of making a profit or if it provides an alternative, free means of obtaining copyrighted material.

But while courts have broadened the definition of a commercial use, they have reduced the impact of a finding that such use is commercial. Although the Supreme Court determined in *Sony* that a finding of commercial use creates a presumption against fair use,[171] the Court explicitly rejected the "Sony presumption" in *Campbell v. Acuff-Rose Music*.[172] The Court explained that "[t]he language of the statute makes clear that the commercial or nonprofit educational purpose of a work is only one element of the first factor enquiry into its purpose and character."[173] If commerciality of the use were the sole determining consideration in the first factor, "the presumption would swallow nearly all of the illustrative uses listed in the preamble paragraph of § 107, including news reporting, comment, criticism, teaching, scholarship, and research, since these activities 'are generally conducted for profit in this country.'"[174] Since *Campbell*, courts have considered commercial use an important but not dispositive consideration weighing against fair use.[175]

2. Transformative Purpose

Because whether a use was commercial could no longer by itself determine the first factor, courts needed to focus on other considerations. The Supreme Court provided such a consideration

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171. *See Sony*, 464 U.S. at 450 (establishing the "Sony presumption").

172. *See* Campbell v. Acuff-Rose Music, 510 U.S. 569, 584 (1994) ("In giving virtually dispositive weight to the commercial nature of the parody, the Court of Appeals erred.").

173. *Id.*

174. *Id.* (quoting Harper & Row, Publ'rs, Inc. v. Nation Enters., 471 U.S. 539, 592 (1985) (Brennan, J., dissenting)).

175. *See* A&M Records v. Napster, Inc., 239 F.3d 1004, 1015 (9th Cir. 2001) ("A commercial use weighs against a finding of fair use but is not conclusive on the issue."); UMG Recordings v. MP3.com, Inc., 92 F. Supp. 2d 349, 351 (S.D.N.Y. 2000) (explaining that the first factor inquiry was not over simply because the defendant did not dispute that its purpose was commercial).

in *Campbell*, determining that a "transformative purpose" weighed in favor of fair use.[176] The Court defined transformativeness as "add[ing] something new, with a further purpose or different character, altering the first with new expression, meaning, or message."[177] Furthermore, in *Transformativeness and the Derivative Work Right*, Professor R. Anthony Reese differentiates between transformativeness in fair use and derivative works analyses.[178] Professor Reese explains that transformativeness in the latter context requires a transformation of content, but for fair use, courts instead "focus on whether the *purpose* of the defendant's use is transformative."[179] For example, while courts have determined that parody[180] and thumbnail reproductions of copyrighted photographs for Internet search engines[181] are sufficiently transformative purposes, a "space-shift" of digital music file storage from CD format to an online MP3 database is not.[182]

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176. *See Campbell*, 510 U.S. at 579 ("Although such transformative use is not absolutely necessary for a finding of fair use . . . the more transformative the new work, the less will be the significance of other factors, like commercialism, that may weigh against a finding of fair use.").

177. *Id.*

178. *See* Reese, *supra* note 131, at 494 (comparing transformativeness in terms of the derivative work right with transformativeness in terms of fair use).

179. *Id.* (emphasis added).

180. *See id.* ("Suffice it to say now that parody has an obvious claim to transformative value . . . .").

181. *See* Kelly v. Arriba Soft Corp., 336 F.3d 811, 818 (9th Cir. 2003) (determining that the defendant search engine's use of a thumbnail reproduction of the plaintiff photographer's copyrighted work served a functional, rather than aesthetic purpose, and therefore was sufficiently transformative); Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1165 (9th Cir. 2007) ("Although an image may have been created originally to serve an entertainment, aesthetic, or informative function, a search engine transforms the image into a pointer directing a user to a source of information.").

182. *See* UMG Recordings v. MP3.com, Inc., 92 F. Supp. 2d 349, 351 (S.D.N.Y. 2000) (concluding that "a transformative 'space shift' by which subscribers can enjoy the sound recordings contained on their CDs without lugging around the physical discs themselves" was a simply a transformation to another medium, and not a transformative purpose as required under the first fair use factor).

B. The Nature of the Copyrighted Work

The second fair use factor per § 107 of the Copyright Act, after the purpose and character of the use, is "the nature of the copyrighted work."[183] Courts have examined the nature of the copyrighted work through two inquiries. First, they have focused on whether a work is creative or noncreative, positing that the former is "closer to the core of intended copyright protection than are mere fact-based works" and thus more likely to be covered by fair use.[184] Second, "[p]ublished works are more likely [than unpublished works] to qualify as fair use because the first appearance of the artist's expression has already occurred."[185] Courts often do not even mention this factor, and when they do, it seldom plays a role in the outcome of the case.[186]

C. The Amount of the Portion Used in Relation to the Copyrighted Work as a Whole

Section 107 directs courts to consider as the third fair use factor "the amount and substantiality of the portion used in relation to the copyrighted work as a whole."[187] The Ninth Circuit has explained that "the extent of permissible copying varies with the purpose and character of the use."[188] But generally, "the more the defendant takes of the plaintiff's work, the less likely it is that the taking will qualify as a fair use."[189] This does not mean, however, that copying a work in its entirety will preclude a finding of fair use.[190] Rather, the question is whether the new

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183. 17 U.S.C. § 107 (2012).

184. A&M Records v. Napster, Inc., 239 F.3d 1004, 1118 (9th Cir. 2001).

185. *Kelly*, 336 F.3d at 820.

186. *See* Beebe, *supra* note 154, at 610 ("Despite § 107[] . . . 17.7% of the 306 opinions failed even to refer to the factor, while an additional 6.5% did so only to call it irrelevant. . . . [T]he outcome of factor two typically has no significant effect on the overall outcome of the fair use test.").

187. 17 U.S.C. § 107.

188. Kelly v. Arriba Soft Corp., 336 F.3d 811, 820 (9th Cir. 2003).

189. Beebe, *supra* note 154, at 615.

190. *See* Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1165 (9th Cir. 2007) ("The fact that Google incorporates the entire Perfect 10 image in to the

work uses a sufficient amount of the copyrighted work to supersede that work.[191]

D. The Effect on the Market of the Copyrighted Use

Finally, for the fourth fair use factor, § 107 directs courts to consider "the effect of the use upon the potential market for or value of the copyrighted work."[192] The factor applies to "[n]ot only the extent of market harm caused by the particular actions of the alleged infringer, but also 'whether unrestricted and wide-spread conduct of the sort engaged in by the defendant . . . would result in a substantially adverse impact on the potential market for the original.'"[193] For example, the Court in *Sony* decided that the sale of Betamax recorders would not negatively affect either television revenue through a decline in ratings or the infant home video industry.[194] Conversely, the Ninth Circuit concluded in *Napster* that peer-to-peer file sharing sites harm the music industry both by reducing CD sales and by preventing record companies from entering the digital download market.[195] Furthermore, Justice O'Connor noted that this factor is "undoubtedly the single most

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search engine results does not diminish the transformative nature of Google's use.").

191. *See id.* at 1165–66 (determining that Google's use did not supersede Perfect 10's copyrighted photographs because there was no evidence that users were downloading the thumbnail images on Google instead of paying for access to the copyrighted images).

192. 17 U.S.C. § 107 (2012).

193. Campbell v. Acuff-Rose Music, 510 U.S. 569, 586–87 (1994) (quoting 3 M. NIMMER & D. NIMMER, NIMMER ON COPYRIGHT § 13.05[A][4] (1993)).

194. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 452–53 (1984) (rejecting the argument "that live television or movie audiences will decrease as more people watch Betamax tapes as an alternative").

195. *See* A&M Records v. Napster, Inc., 239 F.3d 1004, 1016 (9th Cir. 2001) ("Napster harms the market in 'at least' two ways: it reduces audio CD sales among college students and it 'raises barriers to plaintiffs' entry into the market for digital downloading of music.'" (quoting A&M Records, Inc. v. Napster, Inc., 114 F. Supp. 2d 896, 913 (N.D. Cal. 2000))).

important element of fair use."[196] Some scholars, however, have questioned whether this is really the case.[197]

E. Other Considerations

Although § 107 provides only four factors, courts have interpreted the statute as permitting other considerations.[198] The legislative history of the Copyright Act supports this interpretation, explaining that "since the doctrine is an equitable rule of reason, no generally applicable definition is possible."[199] Furthermore, "there [was] no disposition to freeze the doctrine in the statute, especially during a period of rapid technological change."[200] In considering unenumerated factors, courts have focused on the extent to which the use in question benefits the public.[201] Although the courts have considered the public benefit of a use while analyzing other § 107 factors,[202] the Supreme Court

196. Harper & Row, Publ'rs, Inc. v. Nation Enters., 471 U.S. 539, 566 (1985).

197. *See, e.g.*, Beebe, *supra* note 154, at 617 (arguing that the fourth factor is the "most important" only because it "essentially constitutes a metafactor under which courts integrate their analyses of the other three factors and, in doing so, arrive at the outcome not simply of the fourth factor, but of the overall test"). This explains why a court's determination of the fourth factor almost always coincides with its conclusion of whether the fair use defense applied. *See id.* ("[O]f the 141 opinions that found that factor four disfavored fair use, 140 found no fair use."). For more on Beebe's criticisms of current fair use doctrine, see *infra* notes 451–65 and accompanying text.

198. *See* UMG Recordings, Inc. v. MP3.com, Inc., 92 F. Supp. 2d 349, 351 (S.D.N.Y. 2000) ("Other relevant factors may also be considered, since fair use is an 'equitable rule of reason' to be applied in light of the overall purposes of the Copyright Act." (citing Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 448, 454 (1984))).

199. H.R. REP. NO. 94-1476, at 66 (1976).

200. *Id.*

201. *See, e.g.*, Twentieth Century Music Corp. v. Aiken, 422 U.S. 151, 156 (1975) ("The immediate effect of our copyright law is to secure a fair return to an 'author's' creative labor. But the ultimate aim is, by this incentive, to stimulate artistic creativity for the public good.").

202. *See* Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1166 (9th Cir. 2007) (integrating the public benefit inquiry into the court's first factor analysis by examining "the significantly transformative nature of Google's search engine, particularly in light of its public benefit"); Bill Graham Archives v. Dorling Kindersley Ltd., 448 F.3d 605, 613 (2d Cir. 2006) ("[Analysis of the fourth fair

has also considered public benefit as an independent factor in the balancing test.[203]

Under the current doctrine, therefore, a fair use inquiry consists of the four statutory factors,[204] and if the court elects to consider them, other extrinsic factors.[205] The issue of whether courts can effectively apply the current doctrine to 3D printing cases will ultimately hinge on the extent to which courts can—and should—consider factors besides those mentioned explicitly in the statute.[206]

VI. Analysis of the Legal Issues Pertaining to 3D Printing

Among the copyright issues pertaining to 3D printing are the following: whether CAD files are copyrightable; whether CAD files and 3D-printed objects are derivative works protected by copyrights on already-existing works; and whether courts can adequately apply the fair use defense as currently constructed to cases in which defendants have 3D printed or created CAD files of copyrighted works.[207] It is necessary to examine these issues in

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use factor] requires a balancing of 'the benefit the public will derive if the use is permitted and the personal gain the copyright owner will receive if the use is denied.'" (quoting MCA, Inc. v. Wilson, 677 F.2d 180, 183 (2d Cir. 1981))).

203. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 454 (1984) ("The District Court's conclusions are buttressed by the fact that to the extent time-shifting expands public access to freely broadcast television programs, it yields societal benefits.").

204. *See supra* note 157 and accompanying text (providing the four factors from § 107).

205. *See supra* notes 198–203 and accompanying text (explaining the justification for courts' consideration of other factors, including the public benefit of the use).

206. *See infra* Part VI.C.2–3 (criticizing the current doctrine and advocating for the application in the context of 3D printing of Professor Edward Lee's technological fair use, which considers the public benefit of the technology and the potential harm to the market of that technology if the court finds no fair use).

207. *See supra* Part I (setting out the issues of this Note). Another copyright issue that will likely arise in the context of 3D printing is whether websites such as Thingiverse will be secondarily liable for a third party's infringement. *See* Rideout, *supra* note 53, at 170–73 (discussing whether Thingiverse would fall under one of the Digital Millennium Copyright Act's safe harbor provisions).

this order. Whether CAD files are copyrightable will determine how they fit into the derivative works inquiry,[208] and to assess whether the fair use doctrine applies in a particular case, one must know whether works are protected in the first place.[209]

A. Copyrightability of CAD Files

Copyrightability issues in the context of 3D printing center on the copyrightability of CAD files. 3D-printed objects fall clearly within the category of "pictorial, graphical, and sculptural works" protected by copyright,[210] and courts will likely be able to discern the copyrightability of such objects within the current jurisprudence.[211] CAD files, on the other hand, do not fit neatly into one of the categories explicitly listed in the Copyright Act. A CAD file is a computer file used to send a design to a 3D printer,[212] but it is also the 3D-printable design itself.[213] To concentrate only on the copyrightability of the design is to ignore the copyrightability of the computer code, and vice versa.

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208. *See supra* notes 138–39, 141–49, and accompanying text (discussing how a work must be based on a preexisting copyrighted work to be protected as a derivative work, and whether a derivative work must independently meet the copyrightability requirements to be protected).

209. *See* 17 U.S.C. § 107 (2012) (providing the four factors for fair use, all of which refer to the "copyrighted work"); *see also, e.g.*, Micro Star v. FormGen Inc., 154 F.3d 1107, 1112 (9th Cir. 1998) (concluding first that the defendant's compilation of user-created video game levels infringed on the plaintiff's right to create derivative works, and then considering whether the defendant's compilation was a fair use).

210. *See* 17 U.S.C. § 102(a) (listing as copyrightable works "(1) literary works; (2) musical works, including any accompanying words; (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works; (5) pictorial, graphic, and sculptural works; (6) motion pictures and other audiovisual works; (7) sound recordings; and (8) architectural works").

211. *See* Weinberg, *What's the Deal?*, *supra* note 25, at 8–13 (concentrating on the useful article doctrine and separability as exemplified in cases such as *Brandir* and *Barnhart* to determine whether 3D-printed objects would be copyrightable). For discussion on whether 3D-printed objects are independently copyrightable derivative works, see *infra* Part VI.B.2.

212. *See supra* notes 44–45 and accompanying text (discussing how a CAD file sends code to a 3D printer to produce the 3D-printed object).

213. *See The Wired 3D Print-Off*, *supra* note 26 (including the two-dimensional computer renderings of the CAD drawing contest entries).

Furthermore, because the § 102(a) criteria of originality and fixation in a tangible medium are relatively lenient,[214] the question of copyrightability will depend on limitations such as the useful article doctrine[215] and the idea–expression dichotomy.[216] To evaluate how these limitations apply to CAD files, it will be helpful first to search for an analog among other types of works that the courts have had the opportunity to examine.[217] Through a survey of the copyrightability of works potentially analogous to CAD files—architectural plans and other technical drawings, recipes, computer software, and computer program outputs—and comparing these works to CAD files, this subpart formulates a test for copyrightability of CAD files.

1. Searching for a Work Analogous to CAD Files

When Congress and the courts have confronted copyright issues surrounding new technologies, they have often resorted to analogy. In its final report to Congress, the National Commission on New Technological Uses of Copyrighted Works (CONTU) concluded that "the computer affects the copyright status of a resultant work no more than the employment of a still or motion-picture camera, a tape recorder, or a typewriter."[218] Similarly, courts have compared circuit boards that speed up the rate of play in video games to playing phonograph records at faster-than-recorded speeds,[219] and they have equated a detailed description

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214. *See supra* notes 61–74 and accompanying text (discussing how the Copyright Act sets a relatively low threshold with the originality and fixation requirements but that other statutory limits exist).

215. *See supra* Part III.B.2 (defining and discussing the useful article doctrine).

216. *See supra* Part III.B.1 (defining and discussing the idea–expression dichotomy).

217. *See* Weinberg, *What's the Deal?*, *supra* note 25, at 22 ("[I]t is possible to draw guidance and principles by analogy from cases not involving 3D printing . . . .").

218. NAT'L COMM'N ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS 45 (1978) [hereinafter CONTU REPORT].

219. *See* Midway Mfg. Co. v. Artic Int'l, Inc., 704 F.2d 1009, 1013 (7th Cir. 1983) ("There is this critical difference between playing records at a faster than

of an audiovisual display to sheet music.[220] Searching for proper analogies to CAD files, therefore, seems an appropriate place to begin a copyrightability inquiry.

a. Architectural Plans

Given that CAD files are often described as blueprints,[221] it makes sense to begin by examining whether this is an appropriate comparison. The Architectural Works Copyright Protection Act of 1990 (AWCPA)[222] amended § 102 of the Copyright Act of 1976 to include architectural works among the list of explicitly copyright-eligible works of authorship.[223] The amendment also included in its definition of architectural work "the design of a building as embodied in any tangible medium of expression, including a building, architectural plans, or drawings."[224] Because the architectural work itself is embodied in the plans, a copyright in the blueprint extends protection not just to the plans but also to the physical structure itself, even if it has not yet been constructed.[225]

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recorded speed and playing video games at a faster than manufactured rate: there is an enormous demand for speeded-up video games but there is little if any demand for speeded-up records.").

220. *See* Micro Star v. FormGen Inc., 154 F.3d 1107, 1111–12 (9th Cir. 1998) ("This raises the interesting question whether an exact, down to the last detail, description of an audiovisual display counts as a permanent or concrete form for purposes of *Galoob*. . . . What, after all, does sheet music do but describe in precise detail the way a copyrighted melody sounds?").

221. *See* Weinberg, *It Will Be Awesome*, *supra* note 24 ("3D printing starts with a blueprint, usually one created with a computer aided design (CAD) program running on a desktop computer."); Hanna, *supra* note 12 ("Downloading or sharing [CAD] files could constitute copyright infringement, although the strength of the protection for such files will turn on whether courts treat them more like blueprints than art."); Greenberg, *supra* note 16 (discussing the number of "blueprints" uploaded onto Thingiverse in the past year).

222. Architectural Works Copyright Protection Act of 1990, 17 U.S.C. §§ 101, 102(a)(8), 120 (2012).

223. *See id.* § 102(a) ("Works of authorship include . . . architectural works.").

224. *Id.* § 101.

225. *See* Hunt v. Pasternack, 192 F.3d 877, 878–79 (9th Cir. 1999) ("Because the statute provides that the copyright is in the design as embodied not only in a

Although architectural plans seem like a logical analog to CAD files, important differences make the comparison inappropriate. CAD files and blueprints are both pictorial depictions of 3D structures that may eventually be built—hence the comparisons between the two in news articles explaining how 3D printing works.[226] If CAD files were afforded the same protection as architectural blueprints, then the CAD designer would receive copyright protection not only for the CAD file itself but for any 3D-printed versions that might eventually exist. Such protection would be appealing for designers, given the volume of CAD downloads on sites such as Thingiverse.[227] Congress, however, granted broad protection specifically to architectural works, as embodied in plans.[228] Moreover, Congress granted this extra protection to architectural works through plans to address a particular problem: "a potential gap in protection may exist where an architectural work has been depicted in plans or drawings, but has not yet been constructed."[229] Congress was concerned that in the months or years between the completion of architectural plans and the end of construction on the architectural work itself, someone "could construct an identical building but escape liability so long as the plans or drawings were not copyrighted."[230] The same problem, however, does not exist with 3D printing. If a CAD designer desires a copyright in the 3D-printed object itself, he need only wait a few hours at most for

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building, but alternatively in the architectural plans, we hold that construction of the actual building was not required."); Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010) ("Now the holder of a copyright in architectural plans is entitled to two forms of protection under the Act[:] . . . one in the architectural work (§ 102(a)(8)), the other in the plans or drawings (§ 102(a)(5))." (citing T-Peg, Inc. v. Vt. Timber Works, Inc., 459 F.3d 97, 109 (1st Cir. 2006))).

226. *See supra* note 221 and accompanying text (providing such comparisons).

227. *See* Greenberg, *supra* note 16 (explaining how Thingiverse's downloads doubled in 2012 to 8.5 million with half a million between August and November).

228. *See supra* notes 222–24 and accompanying text (explaining how the AWCPA added protection for architectural works).

229. H.R. REP. NO. 101-735, at 19 (1990).

230. *Id.*

a 3D printer to complete the finished product.[231] CAD files are not explicitly mentioned in the Copyright Act, and they do not present the same problems as architectural plans. Therefore, basing a determination of the copyrightability of CAD files on the copyrightability of architectural plans would be inappropriate.

b. Other Technical Drawings and Pre-1990 Architectural Plans

Perhaps a more accurate comparison to CAD files would be technical drawings in general. Whereas Congress has provided for the protection of architectural works as a special category, it included technical drawings in its definition of pictorial, graphical, and sculptural works.[232] Copyright protection for technical drawings, however, extends only to the drawings themselves, rather than also extending to finished products such as recreational vehicles[233] or medicine cabinets.[234] Similarly, before Congress passed the AWCPA in 1990, architectural plans were limited to protection as pictorial or graphical works.[235]

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231. *See* Olson, *supra* note 45 ("With 3-D printing, it takes just hours [to create a prototype].").

232. *See* 17 U.S.C. § 101 (2012) ("'Pictorial, graphic, and sculptural works' include . . . technical drawings . . . ."). Courts have recognized on numerous occasions that technical drawings fall within the category of pictorial or graphical works included in § 102(a). *See, e.g.*, Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010) ("Graphic works, including technical drawings, are among the works that are eligible for copyright protection." (citing 17 U.S.C. § 102(a)(5) (2012))); Niemi v. Am. Axle Mfg. & Holding, Inc., No. 05-74210, 2006 U.S. Dist. LEXIS 50153, at *7 (E.D. Mich. July 24, 2006) ("Plaintiffs' technical drawings are original pictorial or graphic works protected by 17 U.S.C. § 102(a)(5).").

233. *See Forest River*, 753 F. Supp. 2d at 760 ("However, because the Plaintiff's copyright protects the design drawing from being copied, and the Amended Complaint alleges that the Defendant created derivative Floor Plan drawings, it states a claim for copyright infringement as to the copies (as distinct from the actual trailer).").

234. *See* Nat'l Med. Care, Inc. v. Espiritu, 284 F. Supp. 2d 424, 435–36 (S.D. W. Va. 2003) (determining that copyrights in technical drawings of medicine cabinets did not extend to the cabinets themselves).

235. *See* Eales v. Envtl. Lifestyles, Inc., 958 F.2d 876, 880 (9th Cir. 1992) ("It is settled law that architectural drawings and plans are thus eligible for protection under the copyright code as 'pictorial, graphic, [or] sculptural works.'"). In *Eales*, the court concluded that the AWCPA would not have applied

Courts limit the copyrights to the drawings themselves because of the useful article doctrine.[236] While the "AWCPA now extends copyright protection to as-built architectural works, [it] does not extend that protection to other useful articles."[237] Except in the case of architectural works, for which Congress made a specific exception, the Copyright Act "does not afford, to the owner of copyright in a work that portrays a useful article as such, any greater or lesser rights with respect to the making, distribution, or display of the useful article so portrayed than those afforded to such works under the law."[238] In other words, while the drawing of an object may be copyrighted, the object portrayed in the drawing must overcome the useful article doctrine to receive protection.

More importantly, however, the useful article doctrine does not bar the copyrightability of technical drawings themselves.[239] One could argue that by serving as a blueprint for the construction of an object, a technical drawing is not copyrightable because it has a utilitarian function.[240] Section 107 of the Copyright Act, however, defines a useful article as one that has "an intrinsic utilitarian function that [does] not merely . . . portray the appearance of the article or . . . *convey information*."[241] The Ninth Circuit noted in *Eales v.*

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to the plaintiff's architectural plans even if the copyright had not arose before the AWCPA was passed because "this case involves a claim of infringement of copyrighted plans, not a structure." *Id.* at 880 n.2. The Ninth Circuit later acknowledged that this conclusion was incorrect and that the AWCPA should apply in cases in which the building has not yet been constructed. *See* Hunt v. Pasternack, 192 F.3d 877, 880 (9th Cir. 1999) ("It is now clear that this dicta in *Eales* is inaccurate.").

236. See *supra* Part III.B.2 for an explanation of the useful article doctrine.

237. *Forest River*, 753 F. Supp. 2d at 760; *see also Espiritu*, 284 F. Supp. 2d at 434–36 (refusing to extend protection in a technical drawing of a medicine cabinet to the physical cabinets because of the useful article doctrine, despite the AWCPA's extension of similar protection to architectural works).

238. 17 U.S.C. § 113(b) (2012).

239. *See infra* notes 241–45 and accompanying text (explaining why technical drawings themselves do not fail a useful article inquiry).

240. *See Eales*, 958 F.2d at 879 (outlining the defendants' argument that the plaintiff's plans were not copyrightable because they did not survive the useful article exception to copyrightability).

241. 17 U.S.C. § 101 (emphasis added).

Environmental Lifestyles, Inc.[242] that, unlike with noncopyrightable useful articles, "the intrinsic function of an architectural plan is to convey the information necessary to enable the reader to construct a building."[243] Because the court decided *Eales* by treating the architectural plans at issue as pictorial or graphical works instead of applying the AWCPA,[244] it is logical to conclude that the intrinsic function of any technical drawing is to convey information necessary to enable the reader to build the depicted object.[245] Finally, technical drawings survive the idea–expression dichotomy because the act of composing the drawing serves as expression of the design itself.[246]

At first glance, technical drawings seem to be the perfect analog for CAD files. Like technical drawings, CAD files are designs that convey to the builder necessary information to construct a 3D object. But while architectural plans and other technical drawings convey information to human beings, who then build the object themselves or with the help of machines, CAD files send coded information directly to a 3D printer, which then constructs the 3D object without human intervention.[247] It is unclear whether the statutory exception to useful articles, permitting copyrightability of those works whose "intrinsic utilitarian function . . . convey[s] information,"[248] applies only to

242. 958 F.2d 876 (9th Cir. 1992).

243. *Id.* at 879–80.

244. *See supra* note 235 (explaining how architectural plans were protectable only as pictorial or graphical works until Congress passed the AWCPA).

245. *See* Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 760 (N.D. Ind. 2010) (applying the doctrine from NIMMER ON COPYRIGHT that "a copyright for a work of utility protects only against copying of such works for purposes of explanation" to a nonarchitectural technical drawing (quoting 1 M. NIMMER & D. NIMMER, NIMMER ON COPYRIGHT § 2.08[D][2] (1990))).

246. *See Eales*, 958 F.2d at 880 ("Eales' plans laid out the location and sizes of numerous features of model home #3, and thus her ideas were 'fixed' in tangible form. That is all the copyright code requires. Eales won damages because defendants copied the plans she drew, not the idea she created." (citations omitted)).

247. *See supra* notes 44–46 and accompanying text (explaining the process through which a CAD file goes from a drawing on a screen to a 3D-printed object).

248. 17 U.S.C. § 101 (2012).

information conveyed to a human being, or whether digitally conveyed computer code would be covered.[249] If the function of sending code to a 3D printer did fall under the statutory definition of useful article, then one would have to determine if the design were conceptually or physically separable from the functional code.[250] Furthermore, while one who reads a blueprint must interpret the design and included dimensions to determine the process by which the object should be constructed, "CAD files . . . carry directions for manufacturing objects."[251] Although the design-drawing element of a CAD file would on its own survive the idea–expression dichotomy,[252] nothing in the case law concerning technical drawings addresses whether the code component of a CAD file constitutes copyrightable expression.[253] Therefore, one must look elsewhere to determine the copyrightability of CAD files given their inclusion of coded instructions.

c. Recipes

Recipes are one type of work consisting of a set of instructions for which courts have examined the question of copyrightability. In *Publications International, Ltd. v. Meredith*

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249. *See infra* Part VI.B.3 (analyzing how both the useful article doctrine and the idea–expression dichotomy apply to CAD files in the merger inquiry of this Note's proposed test).

250. *See supra* notes 106–25 and accompanying text (outlining the various tests for physical and conceptual separability); *infra* notes 351–56 and accompanying text (applying those tests to CAD files).

251. Regalado, *supra* note 20.

252. *See supra* note 246 and accompanying text (explaining why the blueprints in *Eales* survived the idea–expression dichotomy).

253. *See e.g.*, Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010) (concerning hand-drawn technical drawings and therefore not addressing issues of whether a code component of a drawing is copyrightable). Even in cases concerning non-CAD virtual models, courts have not considered whether the computer code corresponding to the model is copyrightable. *See, e.g.*, Meshwerks, Inc. v. Toyota Motor Sales U.S.A., 528 F.3d 1258, 1268 (10th Cir. 2008) (determining that Meshwerks's derivative virtual models of Toyota's cars were not sufficiently original because they did not depict any expressive elements that were not Toyota's).

Corp.,[254] the Seventh Circuit concluded that the "functional listing of ingredients" in a Dannon Yogurt cookbook did not constitute copyrightable subject matter.[255] The court noted that the plaintiff "was not giving literary expression to his individual creative labors. Instead he was writing down an idea, namely the ingredients necessary to the preparation of a particular dish."[256] Furthermore, a recipe that includes preparation instructions does not survive the idea–expression dichotomy.[257] In certain cases, however, recipes can be "sufficiently expressive to exceed the boundaries of mere fact."[258] When a recipe includes "'suggestions for presentation, advice on wines to go with the meal, or hints on place settings with appropriate music,' . . . 'tales of their historical or ethnic origin[,' or] light-hearted or helpful commentary," those aspects of the recipe may be copyrightable.[259] To fall on the expression side of the idea–expression dichotomy, a recipe must contain "literary expression."[260]

Like recipes, then, CAD files' computer codes might be copyrightable if they contain some form of literary expression. The obvious problem with recipes as an analog to CAD files, however, is that while recipes' instructions are written for human interpretation, CAD files' instructions are written in computer code for a 3D printer to read. Thus, it is impossible to measure what constitutes literary expression in computer code by analyzing literary expression in a cookbook.[261] To answer questions about the idea–expression dichotomy in terms of CAD

254. 88 F.3d 473 (7th Cir. 1996).

255. *Id.* at 480.

256. *Id.*

257. *See* Harrell v. St. John, 792 F. Supp. 2d 933, 943 (S.D. Miss. 2011) ("The recipes are nothing more than a list of ingredients with very basic assembly or preparation instructions.").

258. Barbour v. Head, 178 F. Supp. 2d 758, 764 (S.D. Tex. 2002).

259. *Id.* (quoting *Publ'ns Int'l*, 88 F.3d at 481).

260. *Harrell*, 792 F. Supp. 2d at 943.

261. *Compare* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 707–10 (2d Cir. 1992) (considering whether code contains nonessential elements or elements dictated by external factors such as mechanical specifications of computers on which a program will run), *with* Nichols v. Universal Pictures Corp., 45 F.2d 119, 121–23 (2d Cir. 1930) (examining whether characters and plot in a play are copyrightable despite the idea–expression dichotomy).

files, it will be necessary to examine the copyrightability of computer code.

d. Computer Software

Courts have addressed the copyrightability of computer code primarily in the context of software.[262] Computer programs are copyrightable in two respects: their codes are protected as "literary works," and their outputs—what appears on the screen—are protected as "audiovisual works."[263] Courts have struggled with the idea–expression dichotomy in computer software cases because "computer programs are written for a utilitarian purpose. Expression in the code or structure and organization of a program is normally only incidental to that purpose. Courts must therefore identify and protect that incidental material, while leaving the functional aspects of the program free for all to duplicate."[264] Because a computer program can be broken down into a number of different levels of code—individual mathematical instructions, subroutines, routines, software modules, higher-level modules, and overall function—the Second Circuit developed the abstraction–filtration–comparison test to discern copyrightability at each level of the software.[265] The abstraction–filtration–comparison test is a sort of "all-in-one" test that determines both copyrightability and infringement. First the court "dissects" the program into its constituent parts, concentrating on the part of the program upon

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262. *See, e.g.*, Lotus Dev. Corp. v. Borland Int'l, Inc., 49 F.3d 807, 814 (1st Cir. 1995) (concerning the copyrightability of a spreadsheet program); *Altai*, 982 F.2d at 698 (concerning the copyrightability of a job-scheduling program for IBM mainframe computers); Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1224 (3d Cir. 1986) (concerning the copyrightability of a computer program for dental laboratory record keeping).

263. *See* Lemley, *supra* note 85, at 6 n.25 (noting that the 1980 amendments to the Copyright Act added a definition of "computer program" to § 101, but did not include them in the list of protectable works because CONTU considered them to be both literary and audiovisual works).

264. *Id.* at 7.

265. *See id.* at 13 (explaining why the Second Circuit developed the abstraction–filtration–comparison test in *Computer Associates Int'l, Inc. v. Altai, Inc.*).

which the defendant is allegedly infringing.[266] Second, the court "'filter[s]' the unprotectable elements out of the program structure at every level of abstraction."[267] Finally, the court compares the remaining copyrightable elements of the plaintiff's program to those of the allegedly infringing program.[268] Given that the inquiry at hand concerns copyrightability and not whether a specific work is infringing, one should focus on the abstraction and filtration portions of the test.

While the concept of abstraction is fairly straightforward—break the program into its constituent parts[269]—the Second Circuit elaborated on the filtration portion in *Computer Associates International, Inc. v. Altai, Inc.*[270] The filtration process weeds out structural components of a program that constitute any of the following: "elements dictated by efficiency," "elements dictated by external factors," and "elements taken from the public domain."[271] "Elements dictated by efficiency" refer to those portions of code that a programmer can express in only so many ways to avoid superfluity.[272] Such code is not copyrightable because the expression of the code has merged with the idea—the task that it performs.[273] Those elements of the program that are not necessarily incidental to the idea pass this first level of filtration.[274] An element of a program is "dictated by external factors" if

> the programmer's freedom of design choice is . . . circumscribed by extrinsic considerations such as (1) the

266. *Id.*

267. *Id.*

268. *Id.* at 13–14.

269. *See id* at 13. ("The first step in this process is to break the 'structure' of a computer program into different levels of abstraction . . . .").

270. 982 F.2d 693 (2d Cir. 1992).

271. *Id.* at 707–10.

272. *See id.* at 708 ("In the context of computer program design, the concept of efficiency is akin to deriving the most concise logical proof or formulating the most succinct mathematical computation.").

273. *See id.* at 709 (concluding "that application of the merger doctrine in this setting is an effective way to eliminate non-protectable expression contained in computer programs").

274. *See id.* at 708 (determining that those components that are "necessarily incidental" to the idea are not protectable).

> mechanical specifications of the computer on which a particular program is intended to run; (2) compatibility requirements of other programs with which a program is designed to operate in conjunction; (3) computer manufacturers' design standards; (4) demands of the industry being serviced; and (5) widely accepted programming practices within the computer industry.[275]

Finally, an element of a program that has "entered the public domain by virtue of freely accessible program exchanges and the like" is not protected.[276] Although the abstraction–filtration–comparison test is now widely accepted by the courts (albeit generating inconsistent results),[277] the First Circuit added in *Lotus Development Corp. v. Borland International, Inc.*[278] that courts could circumvent the abstraction–filtration–comparison test if the program element in question was itself a noncopyrightable "idea, procedure, process, system, method of operation, concept, principle, or discovery"[279] under § 102(b) of the Copyright Act.[280]

While the abstraction–filtration–comparison test appears capable of answering the question of whether the code in a CAD file is copyrightable expression, this potential analog also presents problems. On the one hand, it would be easy enough to "filter" the code of a CAD file through the three steps of the *Altai* test's filtration portion. The test would work perfectly if the issue were the copyrightability of the CAD *program* in which one designed a CAD *file*. The problem is that the designer of a CAD file does not write the file's code—at least, not in the sense that the programmer of the CAD software does.[281] For example, in

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275. *Id.* at 709–10.

276. *Id.* at 710.

277. *See* Lemley, *supra* note 85, at 17–19 (discussing the various inconsistent results among the circuit courts in applying the test from *Altai*).

278. 49 F.3d 807 (1st Cir. 1995).

279. 17 U.S.C. § 102(b) (2012).

280. *See Lotus*, 49 F.3d at 815 (holding "that the Lotus menu command hierarchy is an uncopyrightable 'method of operation'" without applying the *Altai* test).

281. *See The STL Format: Standard Data Format for Fabbers*, *supra* note 45 ("Most fabber users do not need to be concerned with [the details of StL code]. It is provided here for those who are interested in developing hardware or software

Tinkercad, a web-based solid modeling CAD program,[282] the designer creates a CAD file by applying pre-rendered shapes onto a virtual "workplane" and altering their dimensions to create a 3D model.[283] The specific design that the user creates will determine the exact code that is sent to the 3D printer, but the programmer of the software itself must predetermine the individual pieces of the code with which the user composes the CAD file.[284] By comparison, the author of a Microsoft Word document is not the author of the code that her computer sends to a traditional 2D printer when she wishes to obtain a hard copy. Thus, while using computer software as an analog to 3D printing presents a useful test for the copyrightability of the code itself, it is limited to cases in which the work in question is the software itself, rather than a work produced using that software.

e. Computer-Generated Works and Program Outputs

The final potential analogs to CAD files are computer-generated works and program outputs. The author of a computer-generated work is the person who created the work itself, rather than the person who created the underlying program.[285] That said, "[t]he ultimate use of a program or data base might limit or negate the author's claim of copyright in the ultimate work."[286] On the one hand, the author of a literary work created on Microsoft Word would clearly hold the copyright on that work

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that will read or write StL files.").

282. *See supra* note 41 and accompanying text (describing solid modeling software—as opposed to surface modeling software—as providing users with pre-rendered shapes that the CAD designer can then manipulate).

283. *Tinkercad*, TINKERCAD, https://tinkercad.com/ (last visited Jan. 31, 2014) (providing a free tutorial on how to use Tinkercad and presenting the option to download the software for free) (on file with the Washington and Lee Law Review).

284. *See The STL Format: Standard Data Format for Fabbers*, *supra* note 45 (providing templates for the code syntax in .stl files).

285. *See* CONTU REPORT, *supra* note 218, at 45 ("It appears to the Commission that authorship of the program or of the input data is entirely separate from authorship of the final work . . . .").

286. *Id.* at 45–46.

over Bill Gates.[287] But on the other hand, courts have granted video game creators copyrights in program outputs (the images displayed on the screen) despite the fact that players ultimately control what image appears onscreen at a given time.[288] In *Stern Electronics, Inc. v. Kaufman*,[289] the Second Circuit determined that although "the entire sequence of all the sights and sounds of the game are different each time the game is played, depending upon the route and speed the player selects for his spaceship and the timing and accuracy of his release of his craft's bombs and lasers," the creator of the game could hold a valid copyright because "many aspects of the sights and the sequence of their appearance remain constant during each play of the game. . . . The repetitive sequence of a substantial portion of the sights and sounds of the game qualifies for copyright protection as an audiovisual work."[290]

When a designer uses a CAD program, there are arguably two different outputs: the design drawing and the code. The former is clearly a computer-generated work, and the author holds the copyright. As with the author of a Word document, a CAD file designer is responsible for the entire creative content of the design. Although programs with premade shape libraries might place some limits on the design, the designer's ability to resize and position these shapes ultimately distinguishes such CAD software from video game outputs, in which the player has comparatively little impact on the program output.[291]

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287. *See* MARK A. LEMLEY, PETER S. MENELL, ROBERT P. MERGES, PAMELA SAMUELSON & BRIAN W. CARVER, SOFTWARE AND INTERNET LAW 73 (4th ed. 2011) ("It would be unreasonable to suggest, for example, that the creator of a word-processing program owned the documents written using that program.").

288. *See* Stern Elecs., Inc. v. Kaufman, 669 F.2d 852, 856–57 (2d Cir. 1982) ("We agree with the District Court that the player's participation does not withdraw the audiovisual work from copyright eligibility. . . . Assessing the entire effect of the game as it appears and sounds, we conclude that its repetitive sequence of images is copyrightable as an audiovisual display.").

289. 669 F.2d 852 (2d Cir. 1982).

290. *Id.* at 856.

291. *Compare id.* (explaining that the "appearance . . . of the player's spaceship, the enemy craft, the ground missile bases and fuel depots, and the terrain over which . . . the player's ship fl[ew], as well as the sequence in which the missile bases, fuel depots, and terrain appear[ed]" remained constant regardless of the player's manipulations), *with Tinkercad*, *supra* note 283

The real question is whether the code portion of the CAD file is more like a computer-generated work or a program output. Although program outputs differ from code insofar as they are audiovisual and literary works, respectively,[292] they are similar in the context of a CAD file because the CAD designer can claim as little responsibility, if not less, for the content of the code as a video game player can claim for the output on the screen. But because a program output is an audiovisual work, a video game player can at least directly control what her character does onscreen.[293] A CAD designer, however, "creates" the code necessary to print a 3D object only by creating the design. In some programs, at least, he cannot even see the code that corresponds to his design much less write the literary work.[294] On the other hand, the video game player has complete control over a relatively small portion of the game, whereas the CAD designer ultimately determines the final compilation of code sent to a 3D printer (even if the CAD software programmer chooses the syntax of the code[295] and is responsible for determining what code represents a premade shape or a freehand-drawn line of a certain length and angle). If the building blocks of code in a CAD file are basic enough, the CAD designer, as opposed to the CAD software programmer, might be able to claim authorship over the code portion of the CAD file. Thus, using computer-generated works and program outputs as an analog can shape the analysis of whether the CAD designer or the software programmer is the author of the code (and therefore whether the abstraction–

(allowing the designer to manipulate the dimensions of premade shapes and to place them as he chooses in the virtual "workplane").

292. *See supra* note 263 and accompanying text (explaining how CONTU recognized the output of a computer program to be a copyrightable audiovisual work and the code to be a copyrightable literary work).

293. *See Stern Elecs.*, 669 F.2d at 853 ("The player controls the altitude and speed of the spaceship, decides when to release the ship's supply of bombs, and fires lasers that can destroy attacking missiles and aircraft.").

294. *See Tinkercad*, *supra* note 283 (providing no opportunity to view the code used to create the 3D-printed object).

295. *See* Lemley, *supra* note 85, at 5 (explaining that code can infringe on a copyright not only through the "words" that the programmer chooses to use "but also [through] what is called 'non-literal infringement'—the taking of the essence of the author's expression without using the author's actual words").

filtration–comparison test applies to CAD file code),[296] but it cannot provide a bright-line rule. The code portion of a CAD file differentiates it from other computer-generated works, and the fact that the code is a literary work, along with the amount of the code affected by the design, distinguishes it from audiovisual program outputs.

f. CAD Files Lack a Comprehensive Analog

Although each of the potential analogs noted above touch on one aspect of CAD files, none provides a completely translatable test for copyrightability. CAD files are different because they combine (1) a technical drawing[297] with (2) computer code,[298] and (3) they serve a distinct purpose: they send information to a 3D printer to create a 3D object.[299] Therefore, any test for the copyrightability of CAD files will have to draw on aspects from many of the potential analogs to address these three components.

2. A Composite Test for Copyrightability of CAD Files

When courts have not been able to find perfect analogs in particularly complex cases, they have developed composite tests to determine copyrightability. In 1930, Judge Hand examined the copyrightability of both the plot and characters of the plaintiff's play to determine whether the defendant's film infringed in *Nichols v. Universal Pictures Corp.*[300] More recently, courts have

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296. *See supra* Part VI.A.1.d (raising the question of whether software presents an appropriate analog given the possibility that one must attribute the code to the software programmer and not the CAD designer).

297. *See supra* note 221 and accompanying text (describing CAD files as blueprints).

298. *See supra* notes 44–45 and accompanying text (explaining how CAD files contain a computer code component).

299. *See supra* notes 36–47 and accompanying text (describing how CAD files turn a virtual design into a 3D-printed object).

300. 45 F.2d 119, 121 (2d Cir. 1930) ("But we do not doubt that two plays may correspond in plot closely enough for infringement. . . . Nor need we hold that the same may not be true as to the characters, quite independently of the 'plot' proper . . . .").

resorted to composite tests when the work in question does not fall within a category explicitly mentioned in the Copyright Act. For example, the Second Circuit addressed other circuits' struggles to formulate a test for the copyrightability of computer software[301] by developing the abstraction–filtration–comparison test, which directs courts to ascertain the copyrightability of each relevant portion of the work.[302] In a similar manner, the Ninth Circuit examined each of the different components of the Duke Nukem 3D video game in *Micro Star* to determine which components contained copyrighted artwork.[303] It is appropriate, then, to formulate a test to determine the copyrightability of CAD files that examines independently their different components. First, this test will ascertain the copyrightability of the design drawing component under the same rules as a technical drawing. Second, the test will determine whether the computer code component is copyrightable by inquiring into the authorship of the code and by applying the abstraction–filtration–comparison test. Finally, in cases in which the design drawing is copyrightable but the code is not, the test will inquire whether the expression of the former has merged with the idea embodied in the latter.

a. Determine the Copyrightability of the Design Drawing

Because it is analogous to a technical drawing,[304] the design drawing component of a CAD file will be copyrightable under the

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301. *See, e.g.*, Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1236 (3d Cir. 1986) (determining that anything not necessary to the purpose of the work is copyrightable expression); Synercom Tech. v. Univ. Computing Co., 462 F. Supp. 1003, 1013–14 (N.D. Tex. 1978) (concluding that sequencing and ordering of a program is never copyrightable expression).

302. *See supra* notes 269–76 and accompanying text (explaining the test from *Altai* in detail).

303. *See* Micro Star v. FormGen Inc., 154 F.3d 1107, 1110 (9th Cir. 1998) ("The game consists of three separate components: the game engine, the source art library and the MAP files . . . The MAP file describes the level in painstaking detail, but it does not actually contain any of the copyrighted art itself . . . .").

304. *See supra* Part VI.A.1.b (developing the analogy between technical drawings and the design drawing component of a CAD file).

same rules as any pictorial, graphical, or sculptural work.[305] Under § 102(a) of the Copyright Act, "pictorial, graphical, and sculptural works" constitute a "work of authorship," which to be copyrightable must be "original" and "fixed in any tangible medium."[306] Section 102(a) goes on to further explain the fixation requirement by stating that the tangible medium must be such that the work "can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."[307] As a digital file, a CAD file is fixed in a tangible medium of expression; it can be perceived, reproduced, and communicated using a computer.[308] Therefore, the copyrightability of a CAD file's design drawing component rests on its originality.

Original works of authorship require "independent creation" and "a modicum of creativity."[309] Because the creativity threshold is low,[310] the drawing component of any CAD file depicting a

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305. *See* Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010) ("Graphic works, including technical drawings, are among the works that are eligible for copyright protection." (citing 17 U.S.C. § 102(a)(5) (2012))).

306. 17 U.S.C. § 102(a) (2012) (providing further that the medium can be "now known or later developed").

307. *Id.*

308. *See* ProCD, Inc. v. Zeidenberg, 86 F.3d 1447, 1453 (7th Cir. 1996) (determining that the plaintiff's computer files, which were saved on CD-ROMs, were fixed in a tangible medium); Ethan Preston & John Lofton, *Computer Security Publications: Information Economics, Shifting Liability, and the First Amendment*, 24 WHITTIER L. REV. 71, 120 (2002) ("Many works, such as texts, drawings, or other files that are produced by humans and saved as files onto computer systems, qualify for copyright."); *cf.* Gregory Kent Laughlin, *Who Owns the Copyright to Faculty-Created Web Sites?: The Work-for-Hire Doctrine's Applicability to Internet Resources Created for Distance Learning and Traditional Classroom Courses*, 41 B.C. L. REV. 549, 563 (2000) ("Such [website] files are fixed in a 'tangible medium of expression,' namely an Internet server's hard drive, 'from which they can be perceived, reproduced, or otherwise communicated . . . with the aid of a machine o[r] device,' that is, by retrieval of a copy of the computer file or files."); Jeremiah A. Armstrong, Comment, *The Digital Era of Photography Requires Streamlined Licensing and Rights Management*, 47 SANTA CLARA L. REV. 785, 787 (2007) ("Therefore, a photographic image is fixed whether the media is film, negative, print, or computer-readable digital file.").

309. Feist Publ'ns v. Rural Tel. Serv., 499 U.S. 340, 346 (1991).

310. *See id.* at 345 (positing that almost any work possesses "some creative

wholly novel—and therefore necessarily independently created—design would be copyrightable.[311] Originality, then, potentially poses problems only for 3D-scanned designs[312] and user-rendered designs of preexisting works.[313] Insofar as "a work may be original even though it closely resembles other works so long as the similarity is fortuitous, not the result of copying,"[314] a 3D-scanned CAD file fails to meet the independent creation criterion for originality because the 3D scanner literally copies the work by measuring its exact dimensions and creating a virtual model.[315] For similar reasons, a user-created CAD drawing that depicts a previously existing copyrighted work will not meet the originality requirement if it "present[s] in substantial and sufficient degree"

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spark").

311. *Compare* Eales v. Envtl. Lifestyles, Inc., 958 F.2d 876, 879–80 (9th Cir. 1992) (concluding that the plaintiff's floor plans satisfied the originality requirement and were therefore copyrightable), *with How to Create Your Own Custom 3D Printed iPhone Case*, INSTRUCTABLES, http://www.instructables.com/id/How-to-create-your-own-3D-Printed-iPhone-Case-from/ (last visited Jan. 31, 2014) [hereinafter *How to Create*] (including a sample CAD drawing with two-dimensional front, back, and side views) (on file with the Washington and Lee Law Review). The two dimensional portion of the CAD drawing is the bare minimum. Unlike floor plans, CAD drawings generally are elaborate virtual 3D models. *See, e.g.*, *The Wired 3D Print-off*, *supra* note 26 (providing examples of 3D-rendered CAD files).

312. *See supra* note 39 and accompanying text (explaining how a CAD file can comprise images scanned from a 3D scanner); *infra* Part VI.B.1 (discussing whether 3D-scanned CAD files are independently copyrightable derivative works).

313. *See* Greenberg, *supra* note 16 (describing CAD files that depict Iron Man and characters from Star Wars); *infra* Part VI.B.1 (discussing whether 3D-scanned CAD files are independently copyrightable derivative works).

314. *Feist*, 499 U.S. at 345.

315. *See* Meshwerks, Inc. v. Toyota Motor Sales U.S.A., 528 F.3d 1258, 1266–68 (10th Cir. 2008) (determining that Meshwerks's virtual models of Toyota cars failed the originality requirement and were therefore not copyrightable because "the end-results were unadorned images of Toyota's vehicles, the appearances of which do not owe their origins to Meshwerks"); *cf.* NIMMER & NIMMER, *supra* note 142, § 2.08[E][2] ("[A] photograph of a photograph or other printed matter [is not original if it] amounts to nothing more than a slavish copying."). *But see* SHL Imaging, Inc. v. Artisan House, Inc., 117 F. Supp. 2d 301, 310 (S.D.N.Y. 2000) (determining that the plaintiff's photographs of the defendant's picture frames did meet the originality requirement because of the plaintiff's creative process and exercise of "significant aesthetic judgment" in composing the photos).

a copyrighted work.[316] Only if the prior work is in the public domain (absent a fair use defense) could a CAD drawing depicting that work be copyrightable.[317] Finally, an adept programmer could conceivably write code for a 3D-printable object without creating a design drawing. In such a case, there would obviously be no copyrightable drawing component of the CAD file.

Insofar as the drawing component of a CAD file depicting an original design would be copyrightable as a technical drawing, the copyright protection in the drawing component would extend only to the drawing itself.[318] Unlike copyrights in architectural plans, copyrights in other technical drawings do not afford protection to the work that the drawing depicts.[319] Copyrightable CAD drawings' protection might, however, extend to 3D-printed objects as derivative works.[320]

b. Determine the Copyrightability of the Code Component

Determining the copyrightability of a CAD file's code component consists of two inquiries. First, one must determine whether the code is attributable to the CAD designer.[321] Second,

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316. Addison-Wesley Publ'g Co. v. Brown, 223 F. Supp. 219, 224 (E.D.N.Y. 1963).

317. *See id.* ("[I]t is . . . originality which entitles plaintiff . . . in the . . . presentation of material whether new or old. As to what is old, only the common source, not the copyrighted work, except as to fair use, may be resorted to by all, for only the old lies in the public domain.").

318. Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 760 (N.D. Ind. 2010) (allowing a pleading that asserted that "the Plaintiff's copyright protects the design drawing from being copied . . . [and] claim[ed] for copyright infringement as to the copies (as distinct from the actual trailer)").

319. *See* Nat'l Med. Care, Inc. v. Espiritu, 284 F. Supp. 2d 424, 434–36 (S.D. W. Va. 2003) (refusing to extend protection in a technical drawing of a medicine cabinet to the physical cabinets because of the useful article doctrine, despite the AWCPA's extension of similar protection to architectural works).

320. *See infra* Part VI.B.2 (discussing whether 3D-printed objects are protectable as derivative works of the CAD files from which they were printed).

321. *See supra* Part VI.A.1.d (explaining how the code component of a CAD file might be attributable to the software programmer instead of the CAD designer).

one must determine whether the code itself is copyrightable under the filtration portion of the abstraction–filtration–comparison test.[322]

CAD files present a unique question of authorship because, unlike other computer-generated works in which any code only contributes to the creation of the work itself, an integral component of the CAD file itself is the code that allows it to print a 3D object.[323] The code component of a CAD file seems to fall somewhere in between computer-generated works such as Microsoft Word documents, for which the copyright holder is clearly the user of the program, and video game outputs, which the courts have found to be the work of the programmer.[324] In a 1986 article, Professor Pamela Samuelson posited that the copyrights in computer-generated works would be attributable to programs themselves rather than the users if and only if "computer-generated works incorporate recognizable blocks of expression from the underlying programs, and do so in a manner that cannot be a fair use of the underlying program."[325] Applying Samuelson's rule to 3D printing, the code component of a CAD file would be attributable to the user unless the code in the CAD file contained recognizable blocks of code from the program itself. Whether such blocks are recognizable will depend on the CAD software itself and how the programmer chose to express the code.[326] If a CAD file was created with surface modeling software and consists of minimal pieces of code—representing, for

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322. *See supra* notes 271–76 (describing the standards of the filtration component of the abstraction–filtration–comparison test).

323. *See supra* note 45 and accompanying text (explaining the crucial role of the code component in a CAD file).

324. *See supra* notes 287–90 and accompanying text (detailing the two sides of this spectrum of authorship).

325. Pamela Samuelson, *The Future of Software Protection: Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185, 1215 (1986). Despite positing that a programmer could not claim authorship over a computer-generated work created with his program only if no fair use could be asserted by the user, Professor Samuelson doubts whether fair use "would have any applicability to the computer-generated work problem." *Id.* at 1215 n.122.

326. *See id.* at 1215 ("In general, computer-generated works do not incorporate recognizable blocks of expression from the underlying program . . . .").

example, individual pixels—arranged in distinct combinations depending on the user's manipulations of the software, the code would likely be attributable to the user.[327] If, however, the programmer expressed code in large chunks corresponding with premade shapes in a solid modeling program, such code would likely not be attributable to the user.[328] Even if the code does comprise recognizable building blocks, it may still be attributable to the user if the employment of those blocks constitutes fair use.[329]

If the code component of a CAD file is attributable to the designer, the courts should apply the filtration portion of the abstraction–filtration–comparison test from *Altai*.[330] One might argue that after *Lotus*, it is inappropriate to use the abstraction–filtration–comparison test.[331] In that case, the court decided not to apply the abstraction–filtration–comparison test to a "menu tree" in the plaintiff's software because "abstracting menu command hierarchies down to their individual word and menu levels and then filtering idea from expression at that stage, as both the Altai and the district court tests require, obscures the more fundamental question of whether a menu command

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327. *See 3D for Everyone*, SKETCHUP, http://www.sketchup.com/ (last visited Jan. 31, 2014) (offering surface modeling CAD software that allows for more freehand design) (on file with the Washington and Lee Law Review).

328. *See Tinkercad*, *supra* note 283 (allowing a user to create designs with pre-rendered shapes). Because solid modeling software arose in the industrial manufacturing context, and because the useful article doctrine precludes copyrightability for utilitarian (and, often, industrial) objects, it is noteworthy, although not legally significant, that CAD files created with solid modeling software are less likely to be copyrightable. *See* LIPSON & KURMAN, *supra* note 16, at 93 (describing the industrial- and manufacturing-based origins of solid modeling CAD software). It is likewise noteworthy that CAD files created with surface modeling software, which "grew up in the midst of animators and illustrators," are more likely to be copyrightable. *Id.* at 94.

329. *See* Samuelson, *supra* note 325, at 1215 (arguing that work using recognizable blocks of a program may be attributable to the user unless he incorporates them "in a manner that cannot be fair use of the underlying program").

330. *See supra* notes 271–76 and accompanying text (describing the filtration portion of the test).

331. *See* Lotus Dev. Corp. v. Borland Int'l, Inc., 49 F.3d 807, 814 (1st Cir. 1995) (determining that the court need not apply the *Altai* test if the menu tree at issue was a noncopyrightable method of operation from the start).

hierarchy can be copyrighted at all."[332] Based on that logic, one might construe a CAD file's code to be an integral part of the noncopyrightable process by which a 3D printer operates.[333] But, as Professor Mark Lemley argues, "[t]his argument seems to misunderstand the *Altai* test."[334] Instead of rejecting the abstraction–filtration–comparison test, the First Circuit was actually engaging in the test's abstraction step.[335] Because the question at hand is whether the code—rather than the process—is copyrightable, it is appropriate to apply the filtration step of the abstraction–filtration–comparison test.

The filtration step deems "elements dictated by efficiency," "elements dictated by external factors," and "elements taken from the public domain" to be noncopyrightable.[336] Such an inquiry will depend on the code of a given CAD file created in a given CAD program, but it is possible to make some general observations. First, CAD file code is likely to contain elements that are not dictated by efficiency—those elements than can be expressed in "most succinct mathematical computation"[337]—because each CAD program will likely have its own way of organizing its particular building blocks of premade code. Second, CAD file code is likely to encounter problems with the second step of filtration—external factors—because the building blocks of premade code and the sequence in which they appear will likely be dictated in part by

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332. *Id.* at 815.

333. *See* 17 U.S.C. § 102(b) (2012) (providing no copyright protection for an "idea, procedure, process, system, method of operation, concept, principle, or discovery").

334. Lemley, *supra* note 85, at 21.

335. *See id.* at 22

> [P]roper application of the Altai approach in this context would identify the menu command hierarchy as the level of abstraction at which copying was alleged, and would then proceed to decide what if anything was copyrightable at that level.

Of course, this is in effect precisely what the *Lotus* court did, although when it reached the "filtration" step, it determined that the entire program was unprotectable at the menu command hierarchy level. *Lotus,* 49 F.3d at 815.

336. Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 707–10 (2d Cir. 1992); *see also supra* notes 272–76 (detailing each portion of the filtration step).

337. *Altai*, 982 F.2d at 708.

the CAD program itself.[338] Even if the user's actions ultimately determine the precise combination of building blocks of code based on his design, the blocks will be arranged according to directives in the program. Finally, any elements of code not discarded by any of the three steps of filtration would be copyrightable.[339] Therefore, even if certain elements of a CAD file's code might be dictated by efficiency or external factors, or taken from the public domain, any elements that pass through the filter are copyrightable. While authorship issues might preclude copyrightability of code created in certain CAD programs, and although many elements of a CAD file's code will likely be noncopyrightable elements dictated by external factors, some CAD file code may be copyrightable.

c. Consider Whether the Design Drawing's Expression Has Merged with the Idea of the Noncopyrightable Code

Given that CAD files serve a particular purpose—to send instructions to a 3D printer—it is not enough to merely determine whether each component of the CAD file is copyrightable. Instead, one must determine through the useful article doctrine[340] or the merger of idea and expression[341] whether

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338. *See id.* at 709–10 (listing as external factors mechanical specifications of computers, compatibility requirements of other programs, manufacturers' design standards, demands of the industry being serviced, and widely accepted programming practices). Although *Altai* did not expressly list CAD file code's dependence on the CAD software, it seems appropriate to infer that the limitations of the software on the file would constitute "external limitations." One reason that the list in *Altai* does not include this limitation is that *Altai* dealt specifically with the copyrightability of the program itself, instead of a file created with that program. *See id.* at 698 (describing the computer program at issue).

339. *See id.* at 707 (explaining that the filtration step is a method "for separating protectable expression from non-protectable material").

340. *See* 17 U.S.C. § 101 (2012) ("[T]he design of a useful article . . . shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates . . . features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.").

341. *See* Concrete Mach. Co. v. Classic Lawn Ornaments, Inc., 843 F.2d 600, 606 (1st Cir. 1988) ("When there is essentially only one way to express an idea,

the copyrightable elements of the CAD file are negated by its overall function. The first two steps of this test produce a number of possible results. Both the design drawing and the entirety of the code component may be copyrightable.[342] In this case, the CAD file would be protected in both respects because there would be no component embodying the idea or utility with which the expression could have merged. It is also possible that neither component is copyrightable, in which case the CAD file obviously would not be protected. Additionally, there could be copyrightable code without a copyrightable drawing.[343] If this is the case, then the third part of the test would be redundant because part of the filtration step from the *Altai* test is to conduct a merger inquiry.[344] This final step of the test therefore considers the most likely scenario: that there is a copyrightable design drawing and at least some noncopyrightable code. This subsection first explains why the appropriate inquiry concerns the idea–expression dichotomy instead of the useful article doctrine. It then discusses the situations in which a CAD file would either survive or fail the merger inquiry.

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the idea and its expression are inseparable and copyright is no bar to copying that expression."); Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1236 (3d Cir. 1986) ("[T]he purpose or function of a utilitarian work would be the work's idea, and everything that is not necessary to that purpose or function would be part of the expression of the idea." (emphasis omitted)).

342. *See supra* notes 309–17, 336–39, and accompanying text (providing the standards and analysis for the copyrightability of the design drawing and code components). Although it is possible, it is highly unlikely that the code aspect of the CAD file would be copyrightable in its entirety. *See supra* note 338 and accompanying text (explaining the problems that CAD file code is likely to encounter at the "elements dictated by external factors" step of filtration).

343. *See supra* notes 314–17 and accompanying text (describing how 3D-scanned CAD drawings and CAD designs based on preexisting copyrighted works would not be copyrightable).

344. *See* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 707–09 (2d Cir. 1992) (using a merger inquiry to determine which elements of the program in question were "dictated by efficiency").

i. The Useful Article Doctrine Versus the Idea–Expression Dichotomy

Before applying the third part of the test to CAD files, it is important to explain why a useful article doctrine inquiry would be inferior to an idea–expression dichotomy inquiry in determining whether a CAD file's function precludes copyrightability.[345] First, § 101 of the Copyright Act excludes from its definition of "useful articles" those pictorial, graphical, and sculptural works that "convey information."[346] Because "the intrinsic purpose of a design drawing is merely to convey information, the drawing itself is not a useful article under the Act."[347] Although CAD files differ from other design drawings by communicating through code to a 3D printer rather than conveying information to a human being, courts have found that computer code still conveys information.[348]

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345. *But see* Weinberg, *What's the Deal?*, *supra* note 25, at 16–17 (advocating a useful article "severability" analysis for user-rendered CAD drawings of useful articles). When Weinberg does consider the doctrine of merger, he does so only on the level of design drawings without acknowledging CAD files' code components. *Id.* at 15, n.46. Furthermore, Weinberg mentions merger in the body of the article only in the context of the useful article doctrine. *See id.* at 14 ("[D]esigns are only protected by copyright to the extent that they go beyond the utilitarian requirements of designing a useful article."); *id.* at 19 ("[A]ctual copyrightability [for a CAD file of a useful object] will turn on merger analysis.").

346. 17 U.S.C. § 101 (2012).

347. Gusler v. Fischer, 580 F. Supp. 2d 309, 317 (S.D.N.Y. 2008); *accord* Eales v. Envtl. Lifestyles, Inc., 958 F.2d 876, 879–80 (9th Cir. 1992) ("The intrinsic function of an architectural plan is to convey the information necessary to enable the reader to construct a building.").

348. *See* Universal City Studios, Inc. v. Corley, 273 F.3d 429, 448 (2d Cir. 2001) ("Instructions such as computer code, which are intended to be executable by a computer, will often convey information capable of comprehension and assessment by a human being."). The question of whether computer code conveys information has not yet made it to the courts in the copyright context. Instead, *Corley* considers the issue in the context of the First Amendment. *See id.* at 445 (considering "whether computer code is speech"). The court concluded that "[c]omputer programs are not exempted from the category of First Amendment speech simply because their instructions require use of a computer. A recipe is no less 'speech' because it calls for the use of an oven, and a musical score is no less 'speech' because it specifies performance on an electric guitar." *Id.* at 447. Similarly, one can infer that a CAD file, like a technical drawing, primarily conveys information and is therefore not a useful article under the

Furthermore, even if CAD files did not fit the "convey information" exception, their design drawings would be copyrightable notwithstanding the useful article doctrine if they were physically or conceptually separable from the code component.[349] As one can discover by conducting a simple Google Image search for "3D printing CAD file,"[350] a CAD file's drawing component is physically separable from its functional code component.[351] Although a useful article need be *either* physically or conceptually separable,[352] CAD drawings would likely be conceptually separable as well. CAD files would likely pass the temporal displacement test[353] insofar as a CAD drawing of an artistic object would "engender[] a non-utilitarian concept without at the same time engendering the concept of a utilitarian function."[354] Similarly, they would pass the Goldstein test, which is essentially a mental version of the physical separability test.[355] This leaves only Professor Denicola's test.[356]

Copyright Act.

349. *See* Carol Barnhart, Inc. v. Econ. Cover Corp., 773 F.2d 411, 414 (2d Cir. 1985) ("[T]he crucial issue in determining their copyrightability is whether they possess artistic or aesthetic features that are physically or conceptually separable from their utilitarian dimension.").

350. *See 3D Printing CAD File*, GOOGLE, http://www.google.com/search?hl=en&site=imghp&tbm=isch&source=hp&biw=1366&bih=643&q=3d+printing+cad+file&oq=3d+printing+cad+file&gs_l=img.3..0i24.1387.5471.0.5811.22.21.1.0.0.0.75.913.21.21.0.ernk_timediscounta..0.0...1.1.3.img.4U-PyPInSPo#imgrc=_ (last visited Jan. 31, 2014) (containing images of CAD drawings, which one can save in JPEG format, thereby separating the image from its code component) (on file with the Washington and Lee Law Review).

351. *See* Esquire, Inc. v. Ringer, 591 F.2d 796, 804 (D.C. Cir. 1978) (explaining that to be physically separable, the aesthetic elements must be "capable of existing as a work of art independent of the utilitarian article into which they were incorporated").

352. *See Barnhart*, 773 F.2d at 420 ("The Report states that the article must contain 'some element that physically or conceptually, can be identified as separable from the utilitarian aspects of that article.'" (quoting H.R. REP. NO. 94-1476, at 55 (1976))).

353. *See supra* notes 114–17 and accompanying text (describing the temporal displacement test).

354. *Barnhart,* 773 F.2d at 423.

355. *See supra* notes 124–25 and accompanying text (describing Professor Goldstein's test).

356. *See supra* notes 120–22 and accompanying text (describing Professor Denicola's test).

A CAD file might fail Professor Denicola's test, which precludes copyrightability "if design elements reflect a merger of aesthetic and functional considerations."[357] But because the utilitarian elements of CAD computer code are its "idea,"[358] the Denicola test in the context of CAD files is essentially the same as an idea–expression dichotomy merger inquiry.[359] Given that CAD drawings otherwise survive the useful article doctrine, an idea–expression merger inquiry, which applies not only to useful articles but to all works,[360] would better address the Denicola test's concerns.

ii. Applying the Idea–Expression Dichotomy to CAD Files

Whether or not the expression from a CAD drawing will merge with the idea of its noncopyrightable code will depend on the drawing itself. The doctrine of merger posits that "'when there is essentially only one way to express an idea, the idea and its expression are inseparable and copyright is no bar to copying that expression.' Under these circumstances, the expression is said to have 'merged' with the idea itself. . . . [S]uch expression

357. Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1145 (2d Cir. 1987).

358. Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1236 (3d Cir. 1986) ("[T]he purpose or function of a utilitarian work would be the work's idea . . . ." (emphasis omitted)).

359. *See* PATRY, *supra* note 115, § 3:141 (arguing that the Denicola test adopted in *Brandir* "confuses conceptual separability with the idea–expression doctrine of Section 102(b)"). *Compare Brandir*, 834 F.2d at 1145 ("[I]f design elements reflect a merger of aesthetic and functional considerations, the artistic aspects of a work cannot be said to be conceptually separable from the utilitarian elements. Conversely, where design elements can be identified as reflecting the designer's artistic judgment exercised independently of functional influences, conceptual separability exists."), *with* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 708 (2d Cir. 1992) ("[A] court must inquire 'whether the use of this particular set of modules is necessary efficiently to implement that part of the program's process' being implemented. If the answer is yes, then the expression represented by the programmer's choice . . . has merged with their underlying idea and is unprotected.").

360. Baker v. Selden, 101 U.S. 99, 102 (1880) (using the idea–expression dichotomy to delineate between the realms of copyright and patent law).

should not be protected."[361] Moreover, expression that is a "necessary incident" to the idea has merged.[362] Because CAD files function as a set of instructions for 3D printers, that purpose "would be the work's idea, and everything that is not necessary to that purpose or function would be part of the expression of the idea."[363] If the noncopyrightable code embodies the purpose of the CAD file,[364] then the design drawing component of a CAD file will have merged to the extent that it creates the code used to produce the 3D-printed object.[365] Because CAD software creates the coded instructions as the user designs the object,[366] and because the software sends the design to the 3D printer in 2D cross-sectional slices,[367] "necessarily incidental" CAD files would be those that portray the design in two-dimensional cross-sections or in two dimensions from multiple perspectives.[368] Although the

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361. *Altai*, 982 F.2d at 707–08 (quoting Concrete Mach. Co. v. Classic Lawn Ornaments, Inc., 843 F.2d 600, 606 (1st Cir. 1988)).

362. *Baker*, 101 U.S. at 103.

363. Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1236 (3d Cir. 1986).

364. *See supra* notes 336–39 and accompanying text (discussing how code could be dictated by efficiency and thus constitute a noncopyrightable idea).

365. *Cf.* Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1145 (2d Cir. 1987) (positing that for purposes of the useful article doctrine, the aesthetic and functional elements have merged when the former were designed with the latter in mind).

366. *See supra* notes 45–47 and accompanying text (explaining how the code portion of the CAD file serves its function in the 3D-printing process).

367. *See supra* note 44 and accompanying text (describing how CAD software deconstructs the image into two-dimensional cross-sections).

368. *See, e.g.*, *How to Create*, *supra* note 311 (providing an example of a CAD file consisting of two-dimensional drawings from multiple angles). Similarly, in *Forest River, Inc. v. Heartland Recreational Vehicles, LLC*, the defendant argued that the plaintiff's two-dimensional floor plans of a recreational vehicle failed a merger inquiry. *See* Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 761 (N.D. Ind. 2010) ("Thus, protection of a two-dimensional drawing in comparative advertising would, the Defendant argues, lead effectively to according protection to the idea itself."). The court explained that the standard for such an inquiry would be "not how many alternative methods of expression actually exist, but 'whether other options practically exist under the circumstances.'" *Id.* (quoting Lexmark Int'l, Inc. v. Static Control Components, Inc., 387 F.3d 522, 536 (6th Cir. 2004)). The court, however, concluded that the merger question was "not best undertaken in the context of a motion to dismiss for failure to state a claim." *Id.*

blueprints in *Eales* survived the idea–expression dichotomy, those plans did not include step-by-step instructions and so did not have to survive a merger inquiry.[369] In this way, CAD drawings are more like recipes, which are copyrightable only if they contain sufficiently expressive elements.[370] In the context of CAD files, such basic two-dimensional drawings like those in *Eales* would not be sufficiently expressive to escape merger. Likewise, if a user creates a design drawing mainly from pre-rendered shapes in a solid modeling program,[371] then the design is more likely to be necessarily incidental to the noncopyrightable code because each shape used will correspond with larger preprogrammed blocks of code.[372] On the other hand, CAD drawings that depict elaborate freehand 3D models created with surface modeling software[373] will likely survive the merger inquiry because they include more than the minimum amount of expression to create the code that a 3D printer will use to produce a 3D object.[374] Ultimately, however, courts will have to determine

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369. *See* Eales v. Envtl. Lifestyles, Inc., 958 F.2d 876, 880 (9th Cir. 1992) ("Eales' plans laid out the location and sizes of numerous features of model home #3, and thus her ideas were 'fixed' in tangible form. That is all the copyright code requires. Eales won damages because defendants copied the plans she drew, not the idea she created." (citations omitted)).

370. *See* Barbour v. Head, 178 F. Supp. 2d 758, 764 (S.D. Tex. 2002) (recognizing the possibility that a recipe could contain elements "sufficiently expressive to exceed the boundaries of mere fact").

371. *See, e.g.*, *Tinkercad*, *supra* note 283 (allowing users to create CAD drawings by selecting and manipulating pre-rendered shapes); *see also supra* note 41 and accompanying text (explaining solid modeling software).

372. *Cf.* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 715 (2d Cir. 1992) (approving the district court's finding that "this aspect of the [plaintiff's] program's structure was dictated by the nature of other programs with which it was designed to interact and, thus, is not protected by copyright"). *But see* Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1236 (3d Cir. 1986) ("Where there are various means of achieving the desired purpose, then the particular means chosen is not necessary to the purpose; hence, there is expression, not idea.").

373. *See The Wired 3D Print-off*, *supra* note 26 (providing examples of "original, printable" designs for a contest such as "a heart [pendant] created by 365 smaller hearts," "a three legged robot with a mini cannon," and "a Christmas ornament of a snowflake trapped within an intricate hollow star cage"); *see also supra* note 42 and accompanying text (explaining surface modeling software).

374. *See Whelan*, 797 F.2d at 1236 ("Where there are various means of

whether a CAD drawing's expression has merged with the idea of its noncopyrightable code on a case-by-case basis.[375]

In the absence of a perfect analog for CAD files, courts will be left with two options: they might try to pick the analog that represents the best fit, or they could adopt a special test for CAD files. While simply choosing an existing analog would necessarily ignore a critical component of the CAD file,[376] the test proposed in this Note accounts for both the design drawing and computer code components of a CAD file while ensuring that the design component will not be copyrightable if it merges with the noncopyrightable code embodying the CAD file's purpose as instructions for a 3D printer.

B. Derivative Works and 3D Printing in Light of the Composite Test for Copyrightability of CAD Files

Copyright protects the author's exclusive right not only to make and distribute copies of his work[377] but also to "prepare derivative works based on the copyrighted work."[378] Furthermore, derivative works are relevant in copyright infringement cases because a defendant can assert the fair use defense to otherwise infringing uses of derivative works as well as uses of the original copyrighted works.[379] Future infringement actions involving 3D

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achieving the desired purpose, then the particular means chosen is not necessary to the purpose; hence, there is expression, not idea.").

375. *See* Peter Pan Fabrics, Inc. v. Martin Weiner Corp., 274 F.2d 487, 489 (2d Cir. 1960) (positing that differentiating copyrightable expression from noncopyrightable idea will "inevitably be ad hoc").

376. *See supra* Part VI.A.1.b–d (discussing how using technical drawings as an analog ignores the function that CAD files serve as a set of instructions but how using recipes or computer programs as an analog ignores the design drawing component).

377. *See* 17 U.S.C. § 106(1), (3) (2012) (granting the author of a copyrighted work the exclusive rights to "reproduce the copyrighted work in copies . . . [and] to distribute copies . . . of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending").

378. *Id.* § 106(2).

379. *See, e.g.*, Micro Star v. FormGen, Inc., 154 F.3d 1107, 1112–14 (9th Cir. 1998) (analyzing the defendant's assertion of fair use of the plaintiff's video game in the distribution of otherwise infringing derivative works).

printing will therefore likely involve derivative works. The inquiry in terms of 3D printing is twofold. First it will be necessary to determine whether a work might infringe an author's exclusive right to prepare derivative works.[380] To do so one must determine whether the new work is transformative of a preexisting work.[381] The preexisting work must be copyrightable,[382] and the new work must only transform the preexisting work in terms of content.[383] Second, it is necessary to determine in light of the composite test for copyrightability of CAD files[384] whether the various aspects of 3D printing might be independently protectable derivative works.[385] This subpart examines whether each of the following qualifies as an independently copyrightable or infringing derivative work: CAD files as derivatives of copyrightable works; 3D-printed objects as derivatives of CAD files; and 3D-printed objects as derivatives of copyrightable works.

1. CAD Files as Derivatives of Preexisting Copyrightable Works

When discussing whether CAD files are derivative works, it is necessary to separate CAD files into two different categories:

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380. *See supra* notes 146–49 and accompanying text (discussing the criteria for a work that infringes on an author's derivative work right).

381. *See* 17 U.S.C. § 101 (defining a derivative work as a "work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted").

382. *See* Ets-Hoken v. Skyy Spirits, 225 F.3d 1068, 1078 (9th Cir. 2000) ("Under the Copyright Act, a work is not a 'derivative work' unless it is 'based upon one or more preexisting works' and, in order to qualify as a 'preexisting work,' the underlying work must be copyrightable.").

383. *See supra* notes 133–37 and accompanying text (expounding on Professor Reese's argument that the transformativeness requirement for derivative works differs from the transformativeness element of the first fair use factor).

384. *See supra* Part VI.A.2 (devising the composite test for copyrightability of CAD files).

385. *See supra* notes 143–45 and accompanying text (discussing the how the requirements for independent copyrightability of derivative works is the same as those for original works).

3D-scanned CAD files and user-rendered CAD files based on preexisting works.[386] In both cases, the CAD file must be based on a preexisting copyrightable work.[387] Thus, CAD files depicting the torso mannequins from *Barnhart* or the bicycle rack from *Brandir* would not be derivative works because the preexisting works failed useful article analysis.[388] Unlike the plaintiff's photographs in *SHL Imaging, Inc. v. Artisan House, Inc.*,[389] 3D-scanned CAD files do not "merely depict defendants' [picture] frames [without] recast[ing], adapt[ing] or transform[ing] any authorship that may exist in the frames" because they add computer code instructions to the 3D model.[390] Therefore, 3D-scanned CAD files are sufficiently transformative to infringe on a preexisting work.[391] User-rendered CAD files depicting preexisting works may be even more transformative in cases in which they add a new design element to the copyrighted work.[392] Because a work need not be independently copyrightable to

386. *See supra* notes 310–12 and accompanying text (treating separately 3D-scanned and user-rendered CAD files for purposes of copyrightability). This Note does not discuss CAD files depicting wholly original designs because, as original designs, they are by definition not based on a preexisting work.

387. *See supra* note 382 and accompanying text (rehashing the "preexisting work" requirement).

388. *See* Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1148–49 (2d Cir. 1987) (determining that the artistic elements of the bicycle rack at issue were not conceptually separable from its function); Carol Barnhart, Inc. v. Econ. Cover Corp., 773 F.2d 411, 419 (2d Cir. 1985) (concluding that any aesthetic elements of the torso mannequins at stake were "inextricably intertwined" with their utility).

389. 117 F. Supp. 2d 301 (S.D.N.Y. 2000).

390. *Id.* at 306. This Note compares 3D-scanned CAD files to *SHL Imaging* in the section on copyrightability, arguing in that section that 3D-scanned files were mere copies of the objects that they scanned. *Supra* note 315 and accompanying text. In that context, however, the question was whether the design drawing was original as part of the composite test. The code is not irrelevant to the 3D-scanned CAD file except in that context.

391. *See* Reese, *supra* note 131, at 494 (requiring only a transformation of content to satisfy the transformativeness requirement for derivative works).

392. *See, e.g.*, Hurst, *supra* note 153 (describing how HBO sent a cease and desist letter to an individual who designed a CAD file for an iPhone dock resembling the Iron Throne from the *Game of Thrones* television series); *cf.* Greenberg v. Nat'l Geographic Soc'y, 244 F.3d 1267, 1274 (11th Cir. 2001) (determining that the defendant's computer animation of a diver created with the plaintiff's photograph infringed on the plaintiff's derivative work right).

infringe on an author's right to prepare derivative works, any CAD file that satisfies these inquiries and is substantially related to the underlying work such that the new work would otherwise infringe on the preexisting work[393] would be sufficiently derivative to infringe on the preexisting work.[394]

In order to warrant independent copyright protection, however, a derivative work must meet the same originality standard as an independently created work.[395] Therefore, the question of whether and to what extent derivative CAD files are independently copyrightable will depend on whether and to what extent the CAD file passes the composite test for copyrightability articulated above.[396] Under the Copyright Act, "[t]he subject matter of copyright as specified by section 102 includes . . . derivative works, but protection for a work employing preexisting material in which copyright subsists does not extend to any part of the work in which such material has been used unlawfully."[397] Thus, a 3D-scanned CAD file that might not be sufficiently original to gain independent protection as a derivative work in terms of its design drawing element might still achieve independent protection regarding its copyrightable code.[398] Likewise, a user-rendered derivative CAD file might be independently copyrightable in terms of its original design

393. *See* NIMMER & NIMMER, *supra* note 142, § 3.01 (explaining how a work will be derivative "only if [the new work] would be considered an infringing work if the material which it has derived from a preexisting work had been taken without the consent of a copyright proprietor of such preexisting work").

394. *See* Goldstein, *Derivative Rights*, *supra* note 149, at 231 n.75 ("[T]he Act does not require that the derivative work be protectable for its preparation to infringe.").

395. *See* Meshwerks, Inc. v. Toyota Motor Sales U.S.A., 528 F.3d 1258, 1266 n.7 (10th Cir. 2008) (establishing the same originality standard for derivative works as that for any copyrightable work).

396. *See supra* Part VI.A.2 (positing that one can determine the copyrightability of a CAD file by examining separately the copyrightability of the design drawing element and the code element, and then analyzing—if applicable—whether the expression of the design drawing has merged with the idea of any noncopyrightable code).

397. 17 U.S.C. § 103(a) (2012).

398. *See supra* note 390 (discussing how 3D-scanned CAD files fail the originality requirement only in terms of the design drawing element, but are not necessarily unoriginal regarding their code).

elements and its code. Where a derivate work is copyrightable, though, the copyrightability of the derivative works does not alter the scope or duration of the preexisting copyright; the copied elements of the derivative works are not protectable.[399]

2. 3D-Printed Objects as Derivatives of CAD Files

The composite test for copyrightability of CAD files is relevant in a different way in the context of 3D-printed objects as derivatives. Insofar as a derivative work must be based on a preexisting copyrightable work,[400] a 3D-printed object will not infringe on the CAD file designer's right to prepare derivative works unless at least some element of the CAD file passes the composite test for copyrightability.[401] Furthermore, the transformation from two to three dimensions will be sufficient to constitute an infringing derivative work.[402] But courts have limited the scope of infringing derivative works. Despite plaintiffs holding valid copyrights on technical drawings, courts have refused to hold defendants' medicine cabinets,[403] recreational vehicles,[404] and car-

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399. *See* 17 U.S.C. § 103(b)

> The copyright in a . . . derivative work extends only to the material contributed by the author of such work, as distinguished from the preexisting material employed in the work, and does not imply any exclusive right in the preexisting material. The copyright in such work is independent of, and does not affect or enlarge the scope, duration, ownership, or subsistence of, any copyright protection in the preexisting material.

400. *See supra* note 382 and accompanying text (describing the requirement that the preexisting work off of which the derivative work is based be copyrightable).

401. *See supra* Part VI.A.2 (setting forth the test).

402. *See* Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905, 909 (2d Cir. 1980) (acknowledging that the plaintiff's toys of Disney's two-dimensionally drawn characters constitute derivative works).

403. *See* Nat'l Med. Care, Inc. v. Espiritu, 284 F. Supp. 2d 424, 435–36 (S.D. W. Va. 2003) (determining that copyrights in technical drawings of medicine cabinets did not extend to the cabinets themselves).

404. *See* Forest River, Inc. v. Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 760 (N.D. Ind. 2010) (noting that the defendant's construction of recreational vehicles based on the plaintiff's design did not constitute infringement of the plaintiff's technical drawings).

manufacturing machinery[405] to infringe on the plaintiffs' derivative works rights because "when a plaintiff holds a copyright in a graphic drawing of a useful article, others are not precluded from manufacturing and marketing the article itself."[406] The exception makes sense because if otherwise noncopyrightable useful articles[407] constructed from copyrightable design drawings infringed on the designer's right to prepare derivative works, then the designer could achieve backdoor copyright protection for types of works that Congress intended to relegate to patent law.[408] Whereas a useful article itself is not copyrightable,[409] a manufacturer could—without this rule—create a copyrightable CAD drawing of the useful article and then acquire protection of the 3D-printed useful article as a derivative work for a significantly longer period of time than that granted by patent.[410] Thus, in addition to the composite test for copyrightability, whether a 3D-printed object infringes on a CAD designer's

405. Niemi v. Am. Axle Mfg. & Holding, Inc., No. 05-74210, 2006 U.S. Dist. LEXIS 50153, at *9 (E.D. Mich. July 24, 2006) ("[T]he manufacture of a machine from a copyrighted technical drawing is clearly not copyright infringement.").

406. *Forest River,* 753 F. Supp. 2d at 758.

407. *See* 17 U.S.C. § 101 (2012) (providing that a useful article is not copyrightable unless its design "incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article").

408. *See* H.R. REP. NO. 94-1476, at 55 (1976) ("[T]he Committee is seeking to draw as clear a line as possible between copyrightable works of applied art and uncopyrighted works of industrial design."); Weinberg, *It Will Be Awesome*, *supra* note 24 ("This could create a type of quasi-patent system, without the requirement for novelty or the strictly limited period of protection. Useful objects could be protected for decades after creation. Mechanical and functional innovation could be frozen by fears of massive copyright infringement lawsuits.").

409. *See* 17 U.S.C. § 101 ("[T]he design of a useful article, as defined in this section, shall be [copyright-eligible] only if, and only to the extent that, such design incorporates [copyrightable] features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.").

410. *Compare id.* § 302 (a), (c) (granting copyright protection for the life of the author plus seventy years or in the case of an anonymous author or a work for hire, "95 years from the year of its first publication, or a term of 120 years from the year of its creation, whichever expires first"), *with* 35 U.S.C. § 154(a)(2) (granting patent protection for a term of twenty years from the date that the application was filed).

derivative works right will depend on whether the 3D-printed object is a useful article.

To warrant independent copyright as a derivative work, though, a 3D-printed object must still meet the originality requirement.[411] In *Durham Industries, Inc. v. Tomy Corp.*,[412] the Second Circuit concluded that the plaintiff's wind-up toys of Disney characters did not represent independently copyrightable derivative works by rejecting

> the contention that the originality requirement of copyrightability can be satisfied by the mere reproduction of a work of art in a different medium, or by the demonstration of some "physical" as opposed to "artistic" skill. . . . Thus, the mere reproduction of the Disney characters in plastic, even though the adaptation of the preexisting works to this medium undoubtedly involved some degree of manufacturing skill, does not constitute originality as this Court has defined the term.[413]

Under this formulation of originality, no derivative 3D-printed objects will be independently copyrightable because they will fail the originality requirement in some way. A 3D-printed object that is derivative of a 3D-scanned CAD file with no copyrightable code element will not be copyrightable because the 3D-printed object will not be based on a preexisting work.[414] Furthermore, all 3D-printed objects will not be independently copyrightable because insofar as they are based on a virtual drawing, they will constitute "no distinguishable variation from preexisting works, nothing recognizably the author's own."[415] The only exception would be an instance in which a user programmed copyrightable coded instructions without using a design drawing.[416] In that

411. *See supra* note 395 and accompanying text (explaining that a derivative work must meet the standard originality requirement to achieve independent copyrightability).

412. 630 F.2d 905 (2d Cir. 1980).

413. *Id.* at 910 (internal citations omitted).

414. *See supra* note 398 and accompanying text (discussing how a 3D-scanned CAD file requires a copyrightable code element to be independently copyrightable).

415. *See Durham Indus.*, 630 F.2d at 910.

416. *See supra* Part VI.A.2.a (advancing the possibility that "a particularly adept programmer could conceivably write code for a 3D-printable object without creating a design drawing").

case, the derivative 3D-printed object could be independently copyrightable because the 3D object would be sufficiently original compared to the code. But these objects would still have to satisfy the copyrightability requirements for sculptural works.[417] 3D-printed objects therefore face more rigorous standards than CAD files to achieve copyrightability as derivative works.

3. 3D-Printed Objects as Derivatives of Preexisting Copyrighted Works

The question of whether 3D-printed objects violate the derivative work right of copyrightable works or are themselves copyrightable derivative works depends on whether the 3D-printed object is an exact depiction of the copyrighted work or if it adds original expression to a portion of the preexisting work. In the former case, the 3D-printed object cannot be a mere copy to be sufficiently transformative because there is no transformation in content.[418] Furthermore, to be original and thus independently copyrightable, the work cannot make a trivial alteration—merely changing the size of a work while keeping the same dimensions, for example, is not enough.[419]

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417. *See supra* note 210–211 and accompanying text (explaining how 3D-printed objects would fall under the statutory category of "pictorial, graphical, and sculptural works").

418. *See supra* notes 130–37 and accompanying text (expounding on Professor Reese's assertion that transformativeness for derivative works requires only a transformation of content). From the perspective of infringement, the distinction between a copy and a derivative work seems academic—both infringe on the copyright holder's rights under § 106. *See* 17 U.S.C. § 106 (2012) ("[T]he owner of copyright under this title has the exclusive rights to do and to authorize any of the following: (1) to reproduce the copyrighted work in copies or phonorecords; [and] (2) to prepare derivative works based upon the copyrighted work . . . ."). But original elements of a derivative work are independently copyrightable. *See id.* § 103(a) ("The subject matter of copyright as specified by section 102 includes compilations and derivative works . . . ."). If the derivative work is copyrightable, then the term of the copyright would begin at creation of the derivative work instead of the preexisting work and would therefore be protected for a longer period of time. *See id.* § 103(b) ("The copyright in such work is independent of, and does not affect or enlarge the scope, duration, ownership, or subsistence of, any copyright protection in the preexisting material.").

419. *See* Meshwerks, Inc. v. Toyota Motor Sales U.S.A., 528 F.3d 1258, 1267

The analysis of 3D-printed objects as derivative works becomes more complicated, however, if the CAD file from which a 3D object is printed is an independently copyrightable derivative work of the preexisting copyrighted work off of which it is based. The question becomes whether the 3D-printed object infringes on the derivative rights of the original work, the CAD file, or both. Judge Posner acknowledged this conceptual nightmare in *Pickett v. Prince*,[420] tackling the issue of "[w]hether Prince's guitar is a copy of his copyrighted symbol or a copy of Pickett's guitar."[421] His conclusion: this is "not a question that the methods of litigation can readily answer with confidence."[422] The Nimmers, however, disagree in their treatise, arguing that "[t]o the extent that the nature of the underlying work dictates that any slight change made by one copier must be the same as that made by another copier, that fact in itself should immunize the second copier from liability [to the first copier]."[423] Under this standard, the 3D-printed object would infringe only on the derivative works right associated with the preexisting copyrighted work and not that of the CAD file because the 3D-printed object would necessarily be derivative of the same elements as the CAD file.

As illustrated above, the issue of derivative works in the context of 3D printing, unlike the issue of copyrightability, does not necessarily require a new legal test. Rather, the difficulty for courts will be to parse, in light of the copyrightability test for CAD files, the many different relationships between derivative

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n.9 (10th Cir. 2008) (doubting after *Feist*—which determined that "sweat of the brow" does not constitute originality—that the Second Circuit's ruling that a miniature reproduction of Rodin's "Hand of God" was sufficiently original because of the level of skill required to reproduce it (citing Alva Studios, Inc. v. Winninger, 177 F. Supp. 265 (S.D.N.Y. 1959))). 3D printing presents opportunities for other similar alterations. For example, one could theoretically reproduce Rodin's "Hand of God" in hot pink plastic instead of white marble. The "mere reproduction of a work of art in a different medium," however, is not sufficiently original. Durham Indus., Inc. v. Tomy Corp., 630 F.2d 905, 910 (2d Cir. 1980) (leaving open, admittedly, the question of whether a change of color is a mere "trivial variation").

420. 207 F.3d 402 (7th Cir. 2000).

421. *Id.* at 406.

422. *Id.*

423. NIMMER & NIMMER, *supra* note 142, § 3.03[A].

and underlying works, preexisting copyrightable works, CAD files, and 3D-printed objects.

C. Whether Current Fair Use Doctrine Applies Adequately to 3D Printing

Whereas issues of copyrightability and derivative works will be threshold questions in 3D printing infringement actions, fair use will be defendants' primary defense.[424] While Congress intended the four statutory fair use factors to be applied on a case-by-case basis,[425] courts have done so increasingly in a mechanical fashion.[426] Given the complex challenges that 3D printing poses to copyright, it is necessary to question whether an entirely ad hoc test applied strictly by the courts can accommodate 3D printing to produce consistent results that align with the greater purposes of fair use and copyright law in general.[427] Thus, this subpart first examines 3D printing under the current fair use doctrine. Next, it considers particularly pertinent criticisms of the established doctrine leveled by Professors Barton Beebe and Edward Lee. Finally, it posits that

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424. *See* Beebe, *supra* note 154, at 551 ("This affirmative defense represents the most important—and amorphous—limitation on the otherwise extraordinarily broad rights granted to copyright owners under section 106 of the Act."); Hanna, *supra* note 12 ("[T]hose accused of copyright infringement have some potent tools of their own, like invoking the DMCA safe harbor, and the defenses of fair use and innocent infringement.").

425. *See* H.R. REP. NO. 94-1476, at 65 (1976) ("The statement of the fair use doctrine in section 107 offers some guidance to users in determining when the principles of the doctrine apply. However, the endless variety of situations and combinations of circumstances that can rise in particular cases precludes the formulation of exact rules in the statute.").

426. *See* Beebe, *supra* note 154, at 563 ("[Justice Brennan's dissent in *Harper & Row*] arguably set American courts on a course toward a rhetorically more mechanical treatment of the section 107 inquiry."); Lee, *supra* note 7, at 802 (referring to current doctrine as a "straitjacket").

427. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 477 (1984) (noting that copyright protection gives authors incentive to create, but that "[t]here are situations, nevertheless, in which strict enforcement of this monopoly would inhibit the very 'Progress of Science and useful Arts' that copyright is intended to promote" (quoting U.S. CONST., art. I, § 8, cl. 8)); *id.* at 478 ("The fair use doctrine, in other words, permits works to be used for 'socially laudable purposes.'").

3D printing exemplifies the need for courts to implement Professor Lee's separate technological fair use standard.

1. 3D Printing Under the Current Doctrine

Although fair use inquiries are ad hoc,[428] an analysis of some examples of 3D printing under the current doctrine is a helpful starting point. First, it is safe to say that fair use would not apply to an infringement suit involving a CAD file depicting a copyrighted work downloaded in its entirety from a site such as Thingiverse. Using *Napster* as a guide, courts would likely find that under factor one,[429] the CAD file was not transformative because "[c]ourts have been reluctant to find fair use when an original work is merely retransmitted in a different medium."[430] Courts would likely find the transfer of the work from a two- or three-dimensional object to a virtual model to be more like a space-shift (no fair use)[431] than a time-shift (fair use).[432] While one might argue that changing an aesthetic work into a virtual model that serves the explicit function of a 3D-printing blueprint is transformative,[433] courts would likely find that a change from the aesthetic to the functional—when that function is to make 3D-printed copies of the aesthetic work—would not be a

428. *See* Lee, *supra* note 7, at 809 ("This ad hoc approach, while sensitive to the facts of each case, gives practically no guidance to the public on what constitutes permissible fair use.").

429. *See supra* notes 160–82 and accompanying text (describing the transformative and commercial–noncommercial elements of the first factor—the nature and character of the use).

430. A&M Records v. Napster, Inc., 239 F.3d 1004, 1015 (9th Cir. 2001).

431. *See* UMG Recordings v. MP3.com, Inc., 92 F. Supp. 2d 349, 352 (S.D.N.Y. 2000) (concluding that "space-shifting" from one format to another is not fair use because "this is simply another way of saying that the unauthorized copies are being retransmitted in another medium—an insufficient basis for any legitimate claim of transformation").

432. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 423 (1984) (determining that a VCR owner's recording a program to watch at a later time constitutes fair use).

433. *Cf.* Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1165 (9th Cir. 2007) ("Although an image may have been created originally to serve an entertainment, aesthetic, or informative function, a search engine transforms the image into a pointer directing a user to a source of information.").

transformative purpose.[434] Furthermore, insofar as the Ninth Circuit defined "commercial use" in *Napster* to include "repeated and exploitative unauthorized copies of copyrighted works . . . to save the expense of purchasing authorized copies,"[435] an individual who uploads a CAD file of a copyrighted work to Thingiverse, even if it is for free,[436] is making a commercial use of the copyright. Concerning the second factor,[437] unlike in *Napster*, in which the copyrighted works at issue were songs distributed on CD,[438] the works in this hypothetical need not have been published. But use of a published work is more likely than use of an unpublished work to be fair use,[439] so if anything, the CAD file in question is less likely to satisfy the second factor. In this case, the third factor[440] weighs against fair use because the potentially infringing work has copied the copyrighted work in its entirety.[441] Finally, the court in *Napster* agreed with the district court's findings that "Napster harms the market [for plaintiffs' works] in 'at least' two ways: it reduces audio CD sales among college

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434. *Cf. UMG Recordings*, 92 F. Supp. 2d at 352 (determining that a conversion of music files from CD to MP3 for online storage and download is not sufficiently transformative for fair use purposes).

435. *Napster*, 239 F.3d at 1015.

436. *See id.* ("Direct economic benefit is not required to demonstrate a commercial use. Rather, repeated and exploitative copying of copyrighted works, even if the copies are not offered for sale, may constitute a commercial use.").

437. *See supra* notes 183–86 and accompanying text (explaining that the second factor—the nature of the copyrighted work—concerns whether the work is factual or creative and whether the work was published or unpublished).

438. *See* A&M Records v. Napster, Inc., 239 F.3d 1004, 1010–11 (9th Cir. 2001) ("Plaintiffs are engaged in the commercial recording, distribution and sale of copyrighted musical compositions and sound recordings.").

439. *See* Kelly v. Arriba Soft Corp., 336 F.3d 811, 820 (9th Cir. 2003) ("Published works are more likely to qualify as fair use because the first appearance of the artist's expression has already occurred.").

440. *See supra* notes 187–91 and accompanying text (describing the third factor—the amount of the protected work used compared to the protected work as a whole).

441. *See* Worldwide Church of God v. Phila. Church of God, Inc., 227 F.3d 1110, 1118 (9th Cir. 2000) ("While 'wholesale copying does not preclude fair use per se,' copying an entire work 'militates against a finding of fair use.'" (quoting Hustler Magazine, Inc. v. Moral Majority, Inc., 796 F.2d 1148, 1155 (9th Cir. 1986))); cases cited *supra* note 315 (averring that 3D-scanned CAD files are "mere copies" of the underlying work).

students and it 'raises barriers to plaintiffs' entry into the market for the digital downloading of music.'"[442] Similarly, a CAD file exactly depicting a copyrighted work made available on Thingiverse would likely reduce sales of licensed copies of that work because people could 3D print versions for free in their own homes. Moreover, if the author of the copyrighted work wanted to make available a CAD file version to sell online, the infringing CAD file would make it more difficult to enter that market. Because CAD files that depict exact copies of copyrighted works and are made available for download on Thingiverse fail all four factors of the inquiry, courts would likely find them not to be fair use.

More difficult cases would consist of CAD files that allegedly infringe on copyrighted works' derivative works rights by altering the works or using them in remixes to create wholly new works.[443] Although such CAD files would not appropriate the entire work, a fair use analysis would likely turn on whether courts found the files' uses of the underlying works to be transformative.[444] To constitute a transformative purpose, however, the CAD files would have to do more than merely "pay homage" to the underlying works; rather, they would have to serve a transformative purpose nearer to parody.[445] Furthermore,

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442. *Napster*, 239 F.3d at 1016.

443. *See* Michael Weinberg, *3-D Printing Can Turbocharge Mashup Culture*, HUFFPOST TECH (Jan. 29, 2013), http://www.huffingtonpost.com/michael-weinberg/3d-printing-can-turbocharge_b_2578158.html?utm_hp_ref=technology (last visited Jan. 31, 2014) [hereinafter Weinberg, *Mashup Culture*] ("Easy to use tools like meshmixer allow people to remix things just as easily as they remix songs or videos.") (on file with the Washington and Lee Law Review); *see also*, *e.g.*, Hurst, *supra* note 153 (describing a CAD file for an iPhone dock designed to look like the Iron Throne from HBO's *Game of Thrones* television series). For discussion of how CAD files that alter the underlying work infringe on the author's derivative works right, see *supra* notes 386–94 and accompanying text.

444. *See infra* note 452 and accompanying text (noting through statistics the importance that the first factor plays in fair use analysis).

445. *See* Madhavi Sunder, *IP³*, 59 STAN. L. REV. 257, 309 (2006) (arguing that musical mash-ups, fan fiction, and machinima (video clip mash-ups) are not sufficiently transformative to constitute fair use if they merely "pay homage" to the original works); Kelly v. Arriba Soft Corp., 336 F.3d 811, 818 (9th Cir. 2003) (determining that the defendant's use of thumbnail versions of the plaintiff's

under the fourth factor, copyright owners could assert that the CAD files infringe on their derivative work rights no matter how little of the underlying works the CAD files in question use.[446] Therefore, even in remix cases, courts may well find under the current doctrine that CAD files do not constitute fair use.[447]

Although cases in which 3D printing appropriates a work in its entirety are clearly not fair use, the established fair use doctrine presents formidable challenges to potentially infringing works in less obvious cases. As currently construed, the definitions of "transformative" and "commercial use" in the first factor, and the ease with which a work can encroach on derivative markets in the fourth factor, will likely make findings of fair use rare in the 3D printing context.

2. Criticisms of the Established Doctrine

As courts have developed the fair use doctrine since its codification in the Copyright Act of 1976,[448] a number of criticisms have emerged. Two such criticisms seem especially relevant in the context of 3D printing. First, in 2008, Professor Barton Beebe conducted an empirical study of all fair use appellate opinions between 1978—the year the Copyright Act went into effect—and 2005, which "show[s] that much of our

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photographs were sufficiently transformative because they served as indexing tools for a search engine instead of the aesthetic purpose of the originals).

446. *See* Lee, *supra* note 7, at 852 ("The major problem is the so-called circularity problem: the copyright holder can always claim an economic harm from an unlicensed use of its work, even in unformed markets or for unforeseen uses of a work."); *As 3-D Printing Becomes More Accessible, Copyright Questions Arise*, *supra* note 39 (describing how one CAD designer has taken a popular CAD file of a Yoda bust and turned it into a vase—a use that would technically interfere with potential derivative markets).

447. *See* Weinberg, *Mashup Culture*, *supra* note 443 ("Sometimes, because of rules such as fair use, the creator [of a mash-up] does not need permission from the person who owns rights to the source material. Other times, mostly because the work falls outside of the scope of fair use, the creator does need permission.").

448. *See* Beebe, *supra* note 154, at 563 (noting that after Justice Brennan's dissent in *Harper & Row*, courts have treated the four factors in § 107 more mechanically).

conventional wisdom about our fair use case law, deduced as it has been from leading cases, is wrong."[449] Second, Professor Edward Lee argues that courts have been treating cases involving fair use and technology differently to the extent that such cases warrant "greater ex ante guidance."[450] Taken together, these two articles form the basis of this Note's analysis of fair use in the 3D printing context.

a. Professor Beebe's Empirical Study

For his study, Professor Beebe examined a total of 306 opinions to determine "[w]hether these opinions have any influence on or are representative of the true state of our fair use doctrine as it is practiced in the courts."[451] Given the data, Beebe's criticism focuses primarily on the first and fourth factors, which correlated with the outcome of the case 81.5% and 83.8% of the time, respectively.[452] Regarding factor one, Beebe argues that the statutory language, which requires courts to consider "the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes,"[453] has had little effect on courts' application of the

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449. *Id.* at 554.

450. Lee, *supra* note 7, at 802.

451. Beebe, *supra* note 154, at 553.

452. *Id.* at 584. Beebe found that the

> outcomes of factors one and four very strongly correlated with the test outcome and fairly strongly correlated with each other, while the outcome of factor two correlated weakly, if at all, with the outcome of the test and with the outcomes of the other factors. Factor three did better than factor two with respect to the overall test outcome, but the strength of its correlations with the outcomes of factors one and four was not impressive.

Id. More specifically, Beebe found that 95.3% of the opinions finding that factor one disfavored fair use ultimately found no fair use, and 90.2% of the opinions finding that factor one favored fair use eventually found fair use. *Id.* at 597. In terms of the fourth factor, 140 of the 141 opinions that determined that factor four disfavored fair use found no fair use, and of the 116 opinions that weighed factor four in favor of fair use, 110 found fair use. *Id.* at 617.

453. 17 U.S.C. § 107 (2012).

factor compared to court-created subfactors.[454] For example, even after the Supreme Court stressed the importance of transformativeness in *Campbell*,[455] 41.2% of the district court opinions since that decision have failed entirely to refer to it.[456] Instead, even though the Supreme Court rejected it in *Campbell*,[457] courts are still relying on the "Sony presumption."[458]

Meanwhile, Beebe asserts that the fourth factor, despite supposedly being "undoubtedly the single most important element of fair use,"[459] is actually "a metafactor under which courts integrate their analyses of the other three factors and, in doing so, arrive at the outcome not simply of the fourth factor, but of the overall test."[460] Instead of constituting an independent variable in the inquiry, the fourth factor serves as a forum for judges to conduct a "two-sided balancing test in which they weigh the strength of the defendant's justification for its use, as that justification has been developed in the first three factors, against the impact of that use on the incentives of the plaintiff."[461]

The data, according to Beebe, show that the leading cases in fair use jurisprudence are fundamentally flawed. First, the cases "fail[] to accurately represent the actual state of our fair use doctrine as that doctrine is applied in the courts."[462] Second, their "method is flawed as a prescriptive enterprise in that it

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454. *See* Beebe, *supra* note 154, at 597 ("To determine what motivated courts to declare that factor one favored or disfavored fair use, we need to look beneath the statutory language, which appears to have had only limited influence on the actual application of the factor, and evaluate how judges considered factor one's various subfactors.").

455. *See supra* notes 176–82 and accompanying text (describing the importance that the Court placed on transformativeness in *Campbell*).

456. *See* Beebe, *supra* note 154, at 604 ("At the district court level, 41.2% of the 119 district court opinions following *Campbell* failed even to refer to the doctrine, while 90.2% of the 92 opinions preceding *Campbell* failed to reference it . . . .").

457. *See id.* at 602 ("This is good evidence of certain courts' willful—or, at best, unknowing—use of the Sony presumption notwithstanding *Campbell*.").

458. *See supra* notes 171–75 and accompanying text (discussing the "Sony presumption").

459. Harper & Row, Publ'rs, Inc. v. Nation Enters., 471 U.S. 539, 566 (1985).

460. Beebe, *supra* note 154, at 617.

461. *Id.* at 621.

462. *Id.*

perpetuates—because it requires—the myth that nonleading cases follow the leading cases."[463] Finally, "courts tend to apply the factors mechanically and they sometimes make opportunistic uses of the conflicting precedent available to them."[464] Beebe concludes that such inconsistent applications of the doctrine "are systematic failures that require intervention."[465]

b. Professor Lee's Technological Fair Use

To address courts' failures to consistently apply the fair use factors in cases involving technology, Professor Lee advances a separate test. Lee recognizes that the general case-by-case application of the four fair use factors "has its merits when fine tailoring is needed, but it does not preclude the possibility of identifying certain specific types of fair use."[466] Citing parody and reverse engineering as examples in which courts have granted "greater ex ante guidance to the public,"[467] Lee argues that a separate standard[468] is necessary in cases in which "the legality of the unauthorized uses of the copyrighted works decided, for all intents and purposes, not just the legality of the particular uses of the copyrighted works, but also the marketability of the technology itself."[469]

Lee models the technological fair use standard off of the four statutory factors and, accounting for Beebe's findings that the

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463. *Id.* at 622.

464. *Id.*

465. *Id.*

466. Lee, *supra* note 7, at 809.

467. *Id.* at 802.

468. *See id.* at 810–11

> By "technological fair use," I mean to describe a category of fair use—like parody fair use—that recurs with certain characteristics in different cases. In the case of parody fair use, the cases are defined by the person's use of a copyrighted work to parody it. In the case of technological fair use, the use is for a new or value-adding purpose of creating, operating, or providing an output of a technology or application.

469. *Id.* at 808.

first and fourth factors dominate the inquiry,[470] differentiates the new standard from the established doctrine through these two factors.[471] Lee's first factor is a four-part inquiry in which courts should question (1) whether the use of the copyrighted work is part of a new technology; (2) whether there is a reasonably perceivable public benefit from the technology; (3) whether the use is for creating, operating, or providing output of the technology (with creation weighing heaviest in favor of fair use and output least); and (4) whether the use is commercial, with significant weight given to commerciality only if the technology is offered at a high price.[472] The second statutory factor—the nature of the copyrighted work—has less weight.[473] The third factor—as does its statutory counterpart—asks courts to determine the amount or substantiality of the portion used relative to the copyrighted work but does so in light of the creation-operation-output inquiry in the first factor.[474] Finally, the fourth factor consists of three inquiries: (1) whether the use supersedes the object of the original copyright as a "market replacement"; (2) whether the technology at issue could have a positive effect on the market for the copyrighted work; and (3) whether a finding against fair use will affect the market for the technology in question.[475] Thus, most significantly, the technological fair use

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470. *See id.* at 835 ("If factor one usually determines or coincides with the outcome in practice, then it is important to tailor this factor with enough detail for courts to ask the right questions in technological fair use cases."); *supra* Part VI.C.2.b (detailing Professor Beebe's findings).

471. *See id.* (providing a table that lays out each of the factors under technological fair use, with factor one including a multipart analysis and factor four accounting for the effect on the market of the technology as well as on derivatives of the copyrighted work).

472. *See id.* (listing the factors on the table).

473. *See id.* at 850 ("If a technology has a transformative or value-adding purpose, . . . whether the works used are factual or fictional/artistic is a poor way to determine whether the technological use or technology should be allowed.").

474. *See id.* at 851 ("[F]or technological fair use cases, the amount and substantiality of the work copied should be analyzed at the stage of use of the copyrighted work—whether during creation, operation, or output of the technology, with more leeway offered at the creation and operation stages than at the output stage.").

475. *See id.* at 854 (setting out the subfactors for the fourth factor and noting that "[a] court should not ignore how a ruling against fair use in a

standard adds an explicit instruction to consider the public benefit in the first factor and asks courts to balance the harm to derivative markets for the copyrighted work against the benefits to the market for the technology in the fourth factor.

3. 3D Printing Demonstrates the Need for Technological Fair Use

Beebe's and Lee's articles demonstrate the ineffectiveness of current fair use doctrine in the technological setting. As shown below, the advent of 3D printing only exacerbates this inadequacy and reinforces the need for a separate technological fair use standard. Not only do Beebe's data indicate that current fair use doctrine was for the most part not developed with technology in mind[476] but 3D printing is a perfect example of a technology for which the courts should consider the public benefit and expand their considerations of market effects when rendering a fair use determination. Finally, 3D printing exemplifies how Lee's technological fair use standard poses both a more nuanced and a more consistent option than the current doctrine.

Although Congress had technological advances in mind when it crafted § 107 of the Copyright Act,[477] the court-developed doctrine has evolved largely outside the technological context. As Professor Beebe points out, of the 306 opinions between 1978 and 2005 included in his study, 52.9% involved exclusively nonvirtual print works.[478] Additionally, between 1988 and 2005, only 21.6% of the opinions in the study concerned computer software works or the Internet.[479] The relatively low number of technology-centered fair use cases supports Professor Lee's assertion that,

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technology case might negatively affect, if not destroy, an emerging market for a speech technology").

476. *See infra* notes 478–81 and accompanying text (explaining how the data from Beebe's study indicate that courts did not develop the current fair use doctrine while contemplating the particular issues posed by 3D printing or other new technologies).

477. *See* Beebe, *supra* note 154, at 559–60 ("[T]he main controversy surrounding the section's perambulatory language, if not the fair use section as a whole, concerned an emergent technology of the time: photocopying.").

478. *Id.* at 573.

479. *Id.*

especially in the technological context, "the overall number of fair use cases that provide even a modicum of certainty to the public with regard to future conduct is miniscule."[480] Another statistic that is especially relevant in the context of 3D printing: only 15.6% of the opinions in Beebe's study involved a shift in medium between the plaintiff's and the defendant's works.[481] The dearth of opinions dealing with shifting media suggests that fair use doctrine has not been tailored to deal with the complicated scenarios presented by 3D printing, in which potentially infringing CAD files turn physical works into virtual models, and 3D printers turn those virtual models into potentially infringing physical objects. When one considers the small number of medium-shifting cases along with the small body of fair use case law concerning computer and Internet technology, it is not difficult to see how a doctrine that was not supposed to be "frozen in the statute, especially during a period of rapid technological change"[482] is instead applied too mechanistically[483] to adequately address 3D printing issues.

Professor Lee's technological fair use standard is necessary especially in the context of 3D printing because its first factor requires courts to consider the potential public benefit of the technology at issue. Courts have long interpreted the Copyright Clause of the Constitution—"Congress shall have Power . . . To Promote the Progress of Science and useful Arts, by securing for

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480. Lee, *supra* note 7, at 802. This is not to say that no seminal fair use cases have involved technology. *Sony*, after all, was crucial because it both saved the fledgling VCR industry and created the "Sony presumption" that a commercial use was presumptively not fair use. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 449, 456 (1984) (positing that "[i]f the Betamax were used to make copies for a commercial or profit-making purpose, such use would presumptively be unfair" but that time-shifting for personal use constituted fair use).

481. *See* Beebe, *supra* note 154, at 573 ("Finally, 84.6% of the opinions addressed facts in which both parties' works appeared in the same medium. Where a shift in medium did occur, the most common was from print to video or vice versa, which was reported in thirteen (or 4.2%) of the opinions.").

482. H.R. REP. NO. 94-1476, at 66 (1976).

483. *See* Lee, *supra* note 7, at 802 (discussing how the courts "have misunderstood this broad authority to fashion and further develop the fair use doctrine as a straitjacket that permits only very fact-specific decisions applying, almost by rote, the four statutory fair use factors").

limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries"[484]—to concern primarily the interests of the public.[485] Fair use is one of the ways that courts have been able to prevent copyright protections from actually inhibiting its constitutional goals.[486] But while courts have "frequently acknowledged that the section 107 test is illustrative rather than limitative . . . only 17% of the opinions [in Beebe's study] explicitly considered one or more additional factors, and only 8.8% stated that the additional factor was relevant to the fair use determination."[487] Thus, most courts will likely fail to consider 3D printing's numerous potential public benefits—including efficient and affordable home manufacturing[488] and the broad dissemination of original designs[489]—thereby leading to fair use determinations inconsistent with those of courts that do. Without considering public benefit, courts risk fair use determinations that ultimately harm the progress of science through overprotection; with a

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484. U.S. CONST. art. I, § 8, cl. 8.

485. *See* Campbell v. Acuff-Rose Music, 510 U.S. 569, 579 (1994) ("Like less ostensibly humorous forms of criticism, [parody] can provide social benefit . . . ."); *Sony*, 464 U.S. at 429

> The monopoly privileges that Congress may authorize are neither unlimited nor primarily designed to provide a special private benefit. Rather, the limited grant is a means by which an important public purpose may be achieved. It is intended to motivate the creative activity of authors and inventors by the provision of a special reward, and to allow the public access to the products of their genius after the limited period of exclusive control has expired.

486. *See* Lee, *supra* note 7, at 838 ("[T]he fair use doctrine has always had an overriding goal of serving the public by acting as a First Amendment safeguard within copyright law and as a doctrine to promote the progress of science.").

487. Beebe, *supra* note 154, at 564.

488. *See* Hanna, *supra* note 12 ("Broken dishwasher part? Download the relevant CAD file and print it out in plastic. While Amazon made trips to the store seem dated, 3D printing will make ordering (some) things online feel positively quaint."); Lee, *supra* note 7, at 819–20 (discussing how technological fair use can serve not only to promote the progress of science (the realm of copyright) but also to promote the progress of the useful arts (the realm of patent law)).

489. *See The Wired 3D Print-Off*, *supra* note 26 (providing a public forum through a CAD contest for designers to display and share their original designs with other users).

novel, emerging technology like 3D printing, the potential danger of ignoring possible benefits is only magnified.[490]

Similarly, the importance of Professor Lee's additions to the fourth factor is apparent in the context of 3D printing. Rather than concentrate only on "the extent of market harm caused by the particular actions of the alleged infringer,"[491] the technological fair use factor also considers "the technology's possible positive effects on the potential market for the copyrighted work"[492] and "the effect a finding against fair use would have on the market for the speech technology in question."[493] The first additional consideration recognizes that, as in *Sony*, the technology at issue might in fact benefit the very plaintiffs who attack it.[494] The second "reminds courts of the need to avoid allowing copyrights to have a patent-like effect in controlling technologies."[495] Such considerations are necessary in a fair use analysis of 3D printing because the effects on the markets of copyrighted works are still so nebulous.[496] While 3D printing's effect on the markets could resemble the Ninth Circuit's (realized) concerns in *Napster*,[497] it could also spur those

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490. *See* Mark A. Lemley & R. Anthony Reese, *Reducing Digital Copyright Infringement Without Restricting Innovation*, 56 STAN. L. REV. 1345, 1387 (2004) ("Economic evidence strongly suggests that those unanticipated future benefits, or 'spillover' effects, often exceed the immediate value of most new technologies.").

491. Campbell v. Acuff-Rose Music, 510 U.S. 569, 590 (1994) (articulating courts' interpretation of the fourth factor as considering only the negative effects of the infringing use on the market for the copyrighted work or its derivatives).

492. Lee, *supra* note 7, at 853.

493. *Id.* at 854.

494. *See id.* ("For example, the VCR opened up a new market for television shows and movies by facilitating a home rental and sale market. The technology was 'complementary,' in economic terms, to the copyrighted works.").

495. *Id.*

496. *Compare* Hanna, *supra* note 12 (discussing the potential dangers to the markets of copyrighted works posed by 3D printing), *with As 3-D Printing Becomes More Accessible, Copyright Questions Arise*, *supra* note 39 ("People printing out copies of Tintin's rocket were the company's mega-fans, he says. Instead of attacking them, Weinberg adds, the company would have been better off selling digital designs to print out Tintin himself.").

497. *See* A&M Records v. Napster, Inc., 239 F.3d 1004, 1016 (9th Cir. 2001) ("Napster harms the market in 'at least' two ways: it reduces audio CD sales among college students and it 'raises barriers to plaintiffs' entry into the market

markets by providing another channel through which copyright holders can disseminate their works.[498] Furthermore, although it is currently impossible to conclusively determine,[499] prohibiting individuals from freely downloading and printing copyrighted 3D objects might impair the market for home 3D printing. Although 3D printers might still cut production costs for commercial manufacturers,[500] and sites such as Shapeways might still print and ship individuals' designs,[501] the full potential of 3D printing to "democratize creation"[502] could go unrealized.

This does not mean that all 3D printing cases would pass the test; "[j]ust as some asserted parody fair uses may go too far and fall outside the exemption, so too some asserted technological fair uses may fail to qualify for the exemption."[503] The Thingiverse hypothetical above,[504] for example, would likely not qualify as fair use under Professor Lee's standard. The free availability of verbatim copies of copyrighted works would provide individuals with an alternative to buying the author's works and would allow them to undermine the author's efforts to market her works directly to those with 3D printers through her own CAD files.[505] This harm to the market of the copyrighted work would likely

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for digital downloading of music.'" (quoting A&M Records, Inc. v. Napster, Inc., 114 F. Supp. 2d 896, 913 (N.D. Cal. 2000))).

498. *Cf.* Steven A. Hetcher, *Using Social Norms to Regulate Fan Fiction and Remix Culture*, 157 U. PA. L. REV. 1869, 1888 n.77 (2009) (noting how copyright holders such as Joss Whedon support noncommercial fan fiction as a way to ensure that fans will "never be able to shake" their works).

499. *See* Depoorter, *supra* note 1, at 1842 (describing how until the effects of a new technology on the market are known, "both copyright owners and users of new technologies operate in a vacuum of considerable legal uncertainty").

500. *See* Morrison, *supra* note 14 (explaining how 3D printing has "ramp[ed] up" manufacturing businesses).

501. *See Made in the Future. Made for You*, SHAPEWAYS, http://www.shapeways.com/ (last visited Jan. 31, 2014) (offering to "[h]ave your designs delivered to your door") (on file with the Washington and Lee Law Review).

502. Hanna, *supra* note 12.

503. Lee, *supra* note 7, at 811.

504. *See supra* notes 428–42 and accompanying text (discussing how such a use would not qualify for fair use under the established doctrine).

505. *Cf. supra* note 497 (describing the effects that the Ninth Circuit feared that peer-to-peer file sharing would have on the music industry).

still outweigh the public benefits of the technology and the harm to the 3D printing market absent a finding of fair use. Thus, courts should adopt the technological fair use standard not because it guarantees findings of fair use in all cases, but because it allows courts to reach dispositions that are both consistent and in accord with the purpose of copyright.

Those gray areas in which findings of fair use would be unlikely under the current doctrine but more probable under technological fair use exist mainly in fan works and remixes. Most of the CAD files available on Thingiverse that reference copyrighted works are "faithful 'fan' copies of recognized works."[506] However, according to Professor Greg Lastowska, none of these works are transformative under the first fair use factor.[507] While Professor Lastowska argues that many fan works and remixes could still qualify for fair use,[508] it seems unlikely that courts would find fair use under the current doctrine when the works are not transformative and seem to, at least to some extent, encroach on the potential derivative markets of the copyrighted work.[509] But this is where a technological fair use test could impact courts' findings specifically in the context of 3D printing. While other remixes and fan works might fail to overcome nontransformativeness and commercial impact, the public benefit of 3D-printing technology (added in Professor Lee's first factor analysis)[510] and the danger to the viability of home 3D printing of a finding of no fair use (added in the Professor Lee's

506. Greg Lastowska, The Player–Authors Project 61 (Nov. 30, 2013) (unpublished manuscript) (on file with the Washington and Lee Law Review), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2361758.

507. *See id.* ("None of the referential works were deemed to be transformative.").

508. *See id.* at 34 ("There have been very few court opinions dealing with the phenomenon of non-commercial UGC fan works, and it is possible that all of the works described as "similar" could be protected as fair uses of the referenced works. However, it is hardly clear that this would be the case."). Professor Lastowska's study focuses on Internet user-generated content (UGC) in general, but 3D printing is one of the areas that it specifically examines. *See id.* at 59–62 (focusing on Thingiverse).

509. *See supra* note 452 and accompanying text (explaining how Professor Beebe's study indicated that the first and fourth fair use factors were most determinative of the court's decision).

510. *Supra* note 472 and accompanying text.

fourth factor analysis)[511] could be enough to tip the balance. Technological fair use is most likely to and should come into play in the context of 3D printing in the noncommercial fan works of the hobbyist and in the interest of fostering home 3D printing technology.

VII. Conclusion

As websites that make CAD files available for downloading continue to receive DMCA takedown notices, it is only a matter of time before a copyright holder sues a CAD designer, a website, or an individual hobbyist for infringement. In its current state, copyright law will likely struggle to handle claims involving these new types of works as it did with home video recording, MP3 files, and peer-to-peer file sharing.[512] This Note has proposed potential solutions for these looming problems. First, it has posited a composite test for the copyrightability of CAD files that accounts for the functional interaction between their design drawing and computer code components by addressing each component separately and conducting a merger inquiry. Next, this Note has applied the composite test to the complex network of potentially derivative works in 3D printing. Finally, it has asserted that courts should adopt Professor Lee's technological fair use standard given the problems that 3D printing poses for the current doctrine. Equipped with such tools, courts will hopefully establish a copyright jurisprudence for 3D printing that will both protect the rights of copyright owners and allow the technology to grow—to "democratize creation"[513] rather than stifle it.

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511. *Supra* note 475 and accompanying text.

512. *See supra* notes 2–6 and accompanying text (describing the delay between the emergence of new technologies and legislation or legal decisions resolving copyright issues surrounding that new technology).

513. Hanna, *supra* note 12.