INTELLECTUAL PROPERTY CHANNELING FOR DIGITAL WORKS

Lucas S. Osborn†

Market economies are based on free competition, which can include copying. Yet intellectual property protection in the United States prohibits copying in certain circumstances to incentivize innovation and creativity. New breeds of digital works are challenging our historical application of intellectual property law. These include certain categories of software programs as well as digital manufacturing files. These new works look deceptively like works from a previous era and thus, courts might languorously treat them as they have older works. This would be a mistake. This Article analyzes these works in terms of existing intellectual property doctrine and constructs a normative framework for channeling the works among the different intellectual property regimes and, in some cases, away from intellectual property protection altogether.

TABLE OF CONTENTS

† Visiting Associate Professor, Sturm College of Law, University of Denver; Associate Professor, Norman Adrian Wiggins School of Law, Campbell University. The author would like to thank Bernard Chao, Tim Holbrook, Viva Moffat, Pamela Samuelson, and Jasper Tran for helpful discussions on this topic, and the participants at the Denver University School of Law faculty colloquium, the 2017 Works-in-Progress IP Conference at Boston University School of Law, and the 2017 Intellectual Property Scholars Conference at Cardozo Law School for their helpful comments.

INTRODUCTION

Imagine you are a graduate student looking to make a little extra money. Your entrepreneurial side awakens one day and you conceive of a smart phone holder that will mount your phone to the air conditioning vent in your car. Within a day, you create digital drawings of the device in a computer-aided design and drafting (CAD) program, and you translate that file into a three-dimensional (3D) printable version. You 3D print the file, put it in your car, and are pleased to see it works perfectly! You offer the file for sale on a popular 3D printing website, and within days you enjoy modest sales totaling five hundred dollars. Soon, however, the sales drop off. After searching the Internet, you find your file—an exact copy—offered for free on a competing website. What role, if any, does intellectual property (IP) law play in preventing this copying? What role *should* IP play? This Article addresses these questions for a variety of digital works.

Digital technology has intensely challenged the law, and IP is no exception. The digitization of previously analog phenomena has heralded perfect and costless copying and the abandonment of physical artifacts such as CDs and DVDs. The digital era continues its remarkable growth, so much so that we take for granted the range of goods and services that are produced and delivered in digital form. Music, television, and software reach us through various digital means, including over the air, streaming, and digital delivery. We shop and socialize in digital environments, and digitization increasingly impacts fields as diverse as medicine and education.

Some digital works fit comfortably within an IP category. Digital music and movies, for example, fit comfortably in copyright's sphere. Others, after years of debate, are still unsettled. Application software, for instance, was first granted copyright protection and denied patent protection, then was granted patent and trade secret protection, and now suffers uncertainty as to the extent of its patent and copyright

protection.[1]

The continuing advance of digitization accelerates old questions and brings new challenges to the IP regime. IP is largely about incentivizing socially beneficial activity—creativity in the case of copyrights and utilitarian inventions in the case of patents.[2] Assessing digitization's challenges requires keeping one eye on incentives and the other on the fundamental assumption of a competitive economy: competition, including copying, is presumed permissible and beneficial.[3]

The changing nature of creation and innovation complicates the policy juggling. As highlighted by the introductory hypothetical, a new breed of digital creations is forcing its way into the public sphere and demanding judicial attention. These works consist of digital versions of physical objects, sometimes called CAD files or digital manufacturing files.[4] These files in part resemble traditional blueprints or technical drawings, but are imbued with vastly more potentiality in light of various digital manufacturing devices such as 3D printers and computer numeric control machines.

Other evidence of change can be seen with software programming practices in an app-centered culture. As opposed to coding software from scratch in a programming language, programmers can enjoy a commoditized coding environment where icons represent subroutines.[5] Rather than typing code as text, programmers rely on icons or default structures to do much of the coding, with the programmer simply filling in the blanks. As coding is abstracted and commoditized, and as simple programs providing purely utilitarian functions proliferate, questions resurface as to whether the resulting software meets copyright law's modicum of creativity threshold.[6]

Digitization portends increased innovation and creativity at

---

1 *See, e.g.*, Pamela Samuelson, *The Uneasy Case for Software Copyrights Revisited*, 79 GEO. WASH. L. REV. 1746 (2011) [hereinafter Samuelson, *Uneasy Case*]; Jasper L. Tran, *Two Years After* Alice v. CLS Bank, 98 J. PAT. & TRADEMARK OFF. SOC'Y 354, 356 (2016).

2 *See* U.S. CONST. art. I, § 8, cl. 8.

3 *See* TrafFix Devices, Inc. v. Mktg. Displays, Inc., 532 U.S. 23, 29 (2001) ("In general, unless an intellectual property right such as a patent or copyright protects an item, it will be subject to copying.").

4 *See, e.g.*, Lucas S. Osborn, *Regulating Three-Dimensional Printing: The Converging Worlds of Bits and Atoms*, 51 SAN DIEGO L. REV. 553 (2014) (analyzing the impact of 3D printing on various areas of law) [hereinafter Osborn, *Bits and Atoms*].

5 *See, e.g.*, *Build a Basic UI*, APPLE DEVELOPER, https://developer.apple.com/library/content/referencelibrary/GettingStarted/DevelopiOSAppsSwift/BuildABasicUI.html (last updated Dec. 8, 2016) ("Xcode provides a library of objects that you can add to a storyboard file. Some of these are elements that appear in the user interface, such as buttons and text fields. Others, such as view controllers and gesture recognizers, define the behavior of your app but don't appear onscreen.").

6 The creativity requirement is found within copyright law's requirement of originality. Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991).

relatively low costs. It is also full of opportunity for sharing and copying creations. Some will view the sharing as a good thing, but others will resist their works being copied. Still others will be willing to share but will desire some measure of control over downstream uses, such as requiring attribution or forbidding commercialization of any adaptations. IP law represents a key mechanism through which creators can potentially enjoy a measure of control over their creations.

But how (and whether) IP applies to emerging digital works has proven problematic. The literature has begun to explore this issue from a doctrinal perspective, but some of it is confused or simply incorrect. Moreover, there is a dearth of holistic analysis regarding how various IP strands—including copyright, patent, design patent, trademark, and trade secret law—apply to these new digital works doctrinally and normatively. This Article supplies that analysis and provides provocative conclusions: IP law applies less than many believe, and its incentive is less necessary than many would expect.

Part I of this Article describes digital creations that are disrupting the IP regime. Part II analyzes how IP doctrine, especially patent and copyright law, applies to these creations. After clarifying misconceptions in the literature regarding copyright protection for purely utilitarian digital works, the Part provides a key insight—many, if not all, of these files will lack the necessary creativity to qualify for copyright protection. This contentious proposition draws upon recent literature exploring the boundaries of copyright's creativity threshold.[7]

Part III removes the confines of doctrine to assess normatively whether and what types of IP protections are optimal. The analysis primarily follows the American tradition of utilitarian analysis in IP law, supplemented by insights from sociology and the psychology of innovation incentives. This Part explains why, perhaps surprisingly, many modern digital works will require relatively minor IP incentives. Digital technology decreases the costs of many creations, resulting in a proportionally smaller need for traditional IP protections. Whereas courts have stubbornly protected traditional software through copyright, in part for historical reasons and in part based on ontological fixations, this Article shows how and why to channel certain works away from copyright's sphere. These works represent a *reductio ad absurdum* of the sometimes tenuous proposition that utilitarian software code has

---

7 *See, e.g.*, Justin Hughes, *Size Matters (or Should) in Copyright Law*, 74 FORDHAM L. REV. 575 (2005); Justin Hughes, *The Photographer's Copyright—Photograph as Art, Photograph as Database*, 25 HARV. J.L. & TECH. 339, 374–75 (2012) [hereinafter Hughes, *Photograph as Database*]; Edward Lee, *Digital Originality*, 14 VAND. J. ENT. & TECH. L. 919, 928–30 (2012); Joseph Scott Miller, *Hoisting Originality*, 31 CARDOZO L. REV. 451 (2009). An early, prescient exploration of IP, creativity boundaries, digitization, and even CAD files can be found in J.H. Reichman, *Electronic Information Tools—the Outer Edge of World Intellectual Property Law*, 17 U. DAYTON L. REV. 797 (1992).

copyrightable expression. Protecting these works with copyright would be a misapplication of the law and would impede innovation. Conversely, the Article describes how patent law will often underprotect digital files of new and nonobvious inventions.

The Article demonstrates that many files will not need or receive patent or copyright protection, but rather should be channeled to other legal and nonlegal mechanisms that provide adequate appropriability mechanisms. The mechanisms vary depending on the type of file and the seller's business model, but trademarks, trade secrets, and especially contracts can play a role. Outside of the legal sphere, technological protection measures and first-mover advantages provide additional means to leverage a financial return. Part III concludes by criticizing attempts by creators to append copyrightable matter to otherwise unprotected files; a type of "lockout code." Courts should recognize these lockout codes as backdoor attempts at patents and refuse to enforce them.

The overall analysis seeks to balance competition policy, thus contributing to the ongoing discussion about the proper scope of the public domain.[8] Innovation and creation are cumulative, with each new advance building off that which came before it. Blithely applying IP protections to digital works without careful attention to each creation's nuances risks overprotection, which in turn stifles innovation. At the same time, leaving creations too vulnerable to copying likewise dampens innovation. This Article provides the approach for a proper balance.

I. DIGITAL MANUFACTURING TECHNOLOGY AND DIGITAL WORKS

3D printing (also called additive manufacturing and rapid prototyping) has exploded into the public's consciousness in the last five years, spurred by technological advances, reduced costs, media attention, and investment opportunity.[9] Numerous commentators have explained the technology[10] and explored its legal implications,[11] but much work has yet to be done.

---

8 *See, e.g.*, Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965 (1990); Kal Raustiala & Christopher Sprigman, *The Piracy Paradox: Innovation and Intellectual Property in Fashion Design*, 92 VA. L. REV. 1687 (2006); Tim Wu, *Tolerated Use*, 31 COLUM. J.L. & ARTS 617 (2008).

9 *See, e.g.*, HOD LIPSON & MELBA KURMAN, FABRICATED: THE NEW WORLD OF 3D PRINTING (2013); *A Third Industrial Revolution*, ECONOMIST (Apr. 21, 2012), http://www.economist.com/node/21552901.

10 For a description of the technology, see LIPSON & KURMAN, *supra* note 9. S*ee also* Lucas S. Osborn et al., *A Case for Weakening Patent Rights*, 89 ST. JOHN'S L. REV. 1185 (2015).

11 *See, e.g.*, Nora Freeman Engstrom, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PA. L. REV. ONLINE 35 (2013) (discussing the possible impact of 3D printing on the future of products liability law); MICHAEL WEINBERG, PUB. KNOWLEDGE, IT WILL BE

It has quickly become general knowledge that 3D printers take instructions from so-called CAD files that contain all the information needed to manufacture a physical object. Computer numerical control (CNC) machines operate on a similar principle—using CAD-type files as digital inputs—but instead of additively building up an object's layers, they cut, drill, or otherwise remove material from an existing object until obtaining the desired shape.[12]

Although the legal literature often labels the digital inputs for digital manufacturing processes as "CAD files," that is an inexact term. It can refer to files that assist in drawing or manipulating objects in a CAD environment, such as DWG files, that may never be used for 3D printing. I refer to these files as "design files." Creators can convert design files into a format suitable for digital manufacturing, such as STL, 3MF, and AMF for 3D printing,[13] and STEP files for CNC manufacturing.[14] I call these files "manufacturing-ready" files, and they are the format most often transferred, shared, and sold on sites like thingiverse.com.[15] Software translates manufacturing-ready and design files into a third group of files that can speak essentially directly to the manufacturing device (e.g., a 3D printer).[16] Examples include any of the GCODE file types. GCODE files provide instructions to the machine about where to move, how fast, and when,[17] and thus must include information about the specific digital manufacturing machine.[18] I refer to this group of files as machine-instruction files, although they should not be confused with machine-language (e.g., ones and zeros), which is what computers translate machine-instruction files into.[19]

AWESOME IF THEY DON'T SCREW IT UP: 3D PRINTING, INTELLECTUAL PROPERTY, AND THE FIGHT OVER THE NEXT GREAT DISRUPTIVE TECHNOLOGY 12 (Nov. 2010), https://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf; Osborn, *Bits and Atoms*, *supra* note 4 (analyzing the impact of 3D printing on various areas of law).

12 *See* ADRIAN MCEWEN & HAKIM CASSIMALLY, DESIGNING THE INTERNET OF THINGS 154–68 (2014).

13 *See What Is 3mf?*, 3MF CONSORTIUM, http://3mf.io/what-is-3mf (last visited Mar. 7, 2018); *see also* TJ McCue, *STL Files: What They Are and How to Use Them*, LIFEWIRE, https://www.lifewire.com/stl-files-2255 (last updated Dec. 13, 2017). An STL file approximates a three-dimensional shape's surface with a collection of nested triangles. *Id.*

14 *See* STRATASYS, INC., BEST PRACTICE: CONVERTING CAD TO STL (2015), http://www.stratasys.com/~/media/Main/Files/Best-Practices_BP/BP_DU_CADtoSTL_EN_1115.ashx (describing file conversion); *The STEP Standard*, STEP TOOLS, INC., http://www.steptools.com/library/standard/step_4.html (last visited Mar. 7, 2018).

15 *3D Printing*, THINGIVERSE, https://www.thingiverse.com/explore/newest/3d-printing (last visited Mar. 7, 2018).

16 *See* Bob Warfield, *Secrets of Going from CAD, Image, DXF, or STL to GCode for CNC and 3D Printing*, CNC COOKBOOK, http://www.cnccookbook.com/secrets-going-cad-image-dxf-stl-gcode-cnc-3d-printing (last visited Mar. 7, 2018); MCEWEN & CASSIMALLY, *supra* note 12, at 165.

17 *See* Bob Warfield, *3D Printing 101: Part 4: Software*, CNC COOKBOOK, http://www.cnccookbook.com/3d-printing-101-part-4-software (last visited Mar. 7, 2018).

18 *Id.*

19 *See, e.g.*, *How Coding Works*, CODE CONQUEST, http://www.codeconquest.com/what-is-

Throughout this Article, I apply the generic label "digital manufacturing file" to any file that can, without human intervention, provide manufacturing instructions to a relevant machine. Importantly for later analysis, any digital manufacturing file can be depicted as an image on a computer screen. It can also be depicted as "code," either higher-level computer programming language or machine-language (essentially zeros and ones). Below is an excerpt of code from a GCODE file for a simple washer[20]:

```
G1 Z15.0 F9000 ;move the platform down 15mm

G92 E0                  ;zero the extruded length
G1 F200 E3              ;extrude 3mm of feed stock
G92 E0                  ;zero the extruded length again
G1 F9000
;Put printing message on LCD screen
M117 Printing...

;Layer count: 12
;LAYER:0
M107
G0 F9000 X58.549 Y59.387 Z0.300
;TYPE:SKIRT
G1 F1800 X59.715 Y58.239 E0.03847
G1 X60.945 Y57.153 E0.07706
G1 X62.234 Y56.138 E0.11563
G1 X63.575 Y55.196 E0.15417
G1 X65.099 Y54.246 E0.19639
```

A user can also obtain digital manufacturing files from existing repositories on the Internet[21] or can use a 3D scanner to create a digital file of an existing physical object.[22] The user can modify, share, or sell them. These files cause indigestion for IP owners who feel largely powerless to stop the digital proliferation of files they perceive to infringe their IP.[23]

---

coding/how-does-coding-work (last visited Mar. 7, 2018).

20 I thank Professor Joshua Pearce of the Michigan Technological University for providing this code. In the code, the text following each semicolon on a given line constitutes a comment that has no effect on the file's functionality. A user types the comments, which can include whatever the user wants, including fanciful or creative text.

21 *See, e.g.*, *3D Printing*, *supra* note 15.

22 *See, e.g.*, Rachel Feltman & Christopher Mims, *3D Scanners Are Getting Cheap So Fast, the Age of 3D Piracy Could Soon Be upon Us*, QUARTZ (Aug. 15, 2013), http://qz.com/115824/3d-scanners-are-getting-cheap-so-fast-the-age-of-3d-piracy-could-soon-be-upon-us; Adam P. Spring, *David Laser Scanner Offers DIY, Low-Cost 3D Recording Solution*, NEW ATLAS (Aug. 12, 2012), https://newatlas.com/laser-3d-recording-david-laser/23676.

23 *See* U.S. INTELLECTUAL PROP. ENF'T COORDINATOR, EXEC. OFFICE OF THE PRESIDENT, 2013 JOINT STRATEGIC PLAN ON INTELLECTUAL PROPERTY ENFORCEMENT 6 (June 2013), https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/IPEC/2013-us-ipec-joint-strategic-plan.pdf ("[J]ust as 3D printing offers the opportunity to make meaningful contributions to our society, there also exists the opportunity for individuals who look to exploit others' hard work to abuse this technology by trading in counterfeit and pirated goods, of which we must be cognizant and diligent in our efforts to prevent."); Press Release, Gartner, Gartner Says Uses of 3D Printing Will Ignite Major Debate on Ethics and Regulation (Jan. 29,

Traditional application software represents another set of digital works that perpetually challenges IP paradigms.[24] Programmers have traditionally written code in higher-level programming languages called source code. When the source code is complete, computers translate it into object code, a machine-readable language often depicted in ones and zeros.

New methods of programming will stress the limits of IP law. These programming environments are increasingly modularized and abstracted. The "programmer" does not directly type code, but rather selects icons that represent functions[25] or selects from default structures based on commonly used features.[26] The user then fills in certain parameters to actuate the function for her particular need. The use of modules, objects, and established subroutines are not at all new to computer programming, of course.[27] But their graphical representation and use in increasingly short utilitarian programs highlights how little authorship occurs at the textual level. As will be seen, modular and abstracted approaches to programming stress certain assumptions regarding the applicability of IP to programs.

II. DOCTRINAL PROTECTIONS

In a perfect world perhaps, one would place works into either a creative basket for copyright protection or a utilitarian basket for patent protection. Many digital works fit nicely into one category, such as movies in copyright. But others are not so easy. This Part analyzes difficult-to-categorize digital creations and provides insights into how existing IP doctrines apply to these works. Courts and commentators often assume that copyright applies to virtually any digital file, so the bulk of this Part presents my controversial proposition that copyright will not protect a significant and identifiable subset of digital files. This Part also analyzes other legal protections.

A. *Copyright Law: Missing Creativity and Using Lockout Codes*

Copyright law protects creative, as opposed to utilitarian works. Eligibility for copyright protection requires the work to be original to

2014), http://www.gartner.com/newsroom/id/2658315 ("Gartner predicts that by 2018, 3D printing will result in the loss of at least $100 billion per year in IP globally.").

24 *See, e.g.*, Samuelson, *Uneasy Case*, *supra* note 1.

25 *See Build a Basic UI*, *supra* note 5 (discussing Xcode).

26 *See, e.g.*, RUBY ON RAILS, http://rubyonrails.org (last visited MAR. 7, 2018).

27 *See, e.g.*, *Modular Programming*, TECHOPEDIA, https://www.techopedia.com/definition/25972/modular-programming (last visited Mar. 7, 2018).

the author, meaning not copied and containing a modicum of creativity.[28] Most sculptures, paintings, novels, and movies all easily pass the creative threshold.

Software has had a more difficult time finding acceptance in the copyright regime, in part because programs' functional aspects limit creativity. Since the 1960s, though, software has been strong-armed into copyright law's sphere. The original rationale was that because programmers write software in programming languages, the resulting text constitutes a literary work like writing a novel.[29] This thinking, never easily accepted because of software's strongly functional nature,[30] always included a proviso that the software code must contain creativity in its expression.[31] But this proviso has often been ignored by courts and commentators who eschew an inquiry into the creativity of code,[32] perhaps hypnotized by copyright law's historical ontological fixations.[33]

---

28 *See* Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991) ("[T]he requisite level of creativity is extremely low; even a slight amount will suffice. The vast majority of works make the grade quite easily, as they possess some creative spark, 'no matter how crude, humble or obvious' it might be." (quoting 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 2.01 (rev. ed. 1990))).

29 *See* NAT'L COMM'N ON NEW TECH. USES OF COPYRIGHTED WORKS, FINAL REPORT 16 (1978).

30 The literature on software copyright is voluminous. *See, e.g.*, Peter S. Menell, *Tailoring Legal Protection for Computer Software*, 39 STAN. L. REV. 1329 (1987) (arguing for sui generis protection for programs); A. Samuel Oddi, *An Uneasier Case for Copyright Than for Patent Protection of Computer Programs*, 72 NEB. L. REV. 351 (1993) (arguing that programs should be protected by patent law, not copyright law); J.H. Reichman, *Computer Programs as Applied Scientific Know-How: Implications of Copyright Protection for Commercialized University Research*, 42 VAND. L. REV. 639 (1989); Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308 (1994) (critiquing copyright protection of software and arguing for sui generis protection for programs).

31 *See* H.R. REP. NO. 94-1476, at 54 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, 5667 (noting that copyright protects computer programs only "to the extent that they incorporate authorship in the programmer's expression of original ideas, as distinguished from the ideas themselves").

32 Much judicial analysis of software simply presumes that copyright protects the verbatim code and turns its focus to whether copyright protects non-literal elements (the structure, sequence, and organization) of the program. *See, e.g.*, Comput. Assocs. Int'l v. Altai, 982 F.2d 693, 702 (2d Cir. 1992) ("It is now well settled that the literal elements of computer programs, i.e., their source and object codes, are the subject of copyright protection." (citations omitted)); Lotus Dev. Corp. v. Borland Int'l, Inc., 788 F. Supp. 78, 91 (D. Mass. 1992) ("Rather, the central point is that because courts are bound by the congressional mandate that something in computer programs is copyrightable, I must reject Borland's premise."); Apple Comput. Inc., v. Formula Int'l, Inc., 562 F. Supp. 775, 781 (C.D. Cal. 1983) ("It is crystal-clear that CONTU recommended that *all* computer programs, fixed in any method and performing any function, be included within copyright protection. There likewise can be no doubt but that Congress accepted that recommendation and embodied it in the 1980 amendments to the Copyright Law."), *aff'd*, 725 F.2d 521 (9th Cir. 1984); *cf.* Oracle Am., Inc. v. Google Inc., 750 F.3d 1339, 1356–64 (Fed. Cir. 2014) (finding Oracle's declaring code to constitute copyrightable subject matter unaffected by merger or scenes a faire). Other commentators are more nuanced. *See* Pamela Samuelson, *Functionality and Expression in Computer Programs: Refining the Tests for Software Copyright Infringement*, 31 BERKELEY TECH. L.J. 1215, 1238 n.130 (2016) [hereinafter Samuelson, *Functionality*] ("Occasionally, a program may either have insufficient originality to

Sometimes an extended inquiry into creativity is unnecessary, as when the program or file[34] is complex and open to many creative, alternative approaches. Files that clearly contain creativity include those whose outputs constitute creative works, such as a digital manufacturing file for a creative sculpture or an app that will produce a creative audiovisual output. The copyright statute specifically lists "pictorial, graphic, and sculptural works" (PGS works) and "audiovisual works" as protectable.[35] In the nonintuitive language of the statute, a digital manufacturing file or an app is a "copy" of a "work." The statute defines copies as "material objects . . . in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly *or with the aid of a machine or device*."[36]

This definition maps perfectly onto digital manufacturing files that will print a creative sculpture: the sculpture is "fixed" in computer memory[37] and can, "with the aid of a machine" (e.g., a 3D printer) be "perceived" (i.e., printed without human intervention other than pushing the "print" button). Thus, the files constitute copies of the sculpture.[38] The same is true for an app that produces, via a computer, a

---

support a copyright or be rendered unprotectable because function and expression have merged.").

33 *See* Lloyd L. Weinreb, *Copyright for Functional Expression*, 111 HARV. L. REV. 1149, 1184–1210 (1998) (describing how certain works were protected merely because they fell within a certain category).

34 Before proceeding with the analysis, it will be useful to highlight the breadth of the copyright statute's definition of a "computer program." U.S. copyright law defines "computer program" as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." 17 U.S.C. § 101 (2012). This definition includes not only application programs like Microsoft Word, but also what people colloquially call files, such as digital manufacturing files. I will follow this definition and will use the terms "software" and "file" interchangeably with "program."

35 17 U.S.C. § 102(a)(5). PGS 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." 17 U.S.C. § 101.

36 17 U.S.C. § 101 (emphasis added).

37 *See, e.g.*, M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421, 441 (4th Cir. 1986) (holding that audiovisuals are "fixed" in a "memory device"); Apple Comput., Inc. v. Franklin Comput. Corp., 714 F.2d 1240, 1249 (3d Cir. 1983) ("Therefore we reaffirm that a computer program in object code embedded in a ROM chip is an appropriate subject of copyright.").

38 Commentators evidence some confusion on this topic. *See* Lucas S. Osborn, *The Limits of Creativity in Copyright: Digital Manufacturing Files and Lockout Codes*, 4 TEX. A&M J. PROP. L. REV. 25, 36–39 (2017) [hereinafter Osborn, *Limits of Creativity*] (describing erroneous analyses in the literature). Whether design files constitute copies of sculptural works is a little less straightforward because many design files require human alteration before a computer can use them for digital manufacturing and the design file is not tessellated. *See id.* The derivative works category would apply if the differences are material. Further, despite some confusion in the literature, there is no need to analyze whether the digital file—as a digital file—has utilitarian aspects that might render it a "useful article" under 17 U.S.C. § 101. *Id.* at 39–41. The "useful article" referred to by section 101 is only the underlying physical object, not the file. *Id.*

creative audiovisual output.[39]

It is a central thesis of this Article, however, that many digital manufacturing files and other simple software files fall within that "narrow category of works in which the creative spark is utterly lacking or so trivial as to be virtually nonexistent."[40] Even if some files contain slight creativity, the creativity "merges" with the utilitarian function or idea of the object or program.[41] As such they cannot enjoy copyright protection.

1. Files Lacking a Modicum of Creativity

At the other end of the extreme from files that 3D print creative sculptures are files whose outputs are purely utilitarian in nature.[42] These include digital manufacturing files that will make unadorned screws, shovels, or engine parts, and apps that perform purely useful functions like pinch-to-zoom on a smart phone. For reasons discussed below, these files do not qualify for copyright protection, although each will get multiple bites at the apple.[43]

Purely utilitarian digital manufacturing files will no longer fall within the definition of copies of a sculptural work. Instead of producing artistic sculptures, they produce purely utilitarian objects, which constitute "useful articles"[44] with no separable creative features.[45] Hence, the files are not copies of any protectable sculptural work. Likewise, a purely utilitarian app will no longer constitute a copy of an audiovisual work, because it does not produce a creative output.

---

39 *See* 17 U.S.C. § 101.

40 Feist Publ'ns, Inc., v. Rural Tel. Serv. Co., 499 U.S. 340, 359 (1991).

41 I will not discuss merger separately in depth in this Article. A valuable and comprehensive analysis of the doctrine can be found in Pamela Samuelson, *Reconceptualizing Copyright's Merger Doctrine*, 63 J. COPYRIGHT SOC'Y U.S.A. 417 (2016). Within Professor Samuelson's typology, digital manufacturing files would fit into cases using "[m]erger and [o]riginality" and "[m]erger and Section 102(b) [f]unctionality [e]xclusions" to deny copyright protection. *Id.* at 450–51. But the files discussed herein do not need to rely on merger and can instead be denied protection based solely on lack of creativity.

42 There is a middle category for physical objects—objects containing a mixture of utilitarian and aesthetic features. These are only copyrightable if the creative aspects are separable from the utilitarian aspects. *See, e.g.*, Star Athletica, L.L.C. v. Varsity Brands, Inc., 137 S. Ct. 1002 (2017).

43 For a more robust discussion demonstrating the lack of copyright protection for digital manufacturing files for purely utilitarian objects, see Osborn, *Limits of Creativity*, *supra* note 38, at 41–59.

44 *See* 17 U.S.C. § 101 ("A 'useful article' is an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information.").

45 *See id.* (stating that "the design of a useful article, as defined in this section, shall be considered a pictorial, graphic, or sculptural work 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").

Nevertheless, each file gets another chance at copyright protection. For instance, the digital manufacturing file may be a copy of a protectable pictorial/graphic work because it can depict the object on a computer screen. After all, the statute specifically includes "technical drawings" in the list of PGS works.[46] The two-dimensional representation of a utilitarian object might qualify as a copy of a technical drawing. Moreover, both the manufacturing file and the utilitarian app might be protected as creative literary works since the files can be depicted as programming code.[47]

That the same file can potentially represent a variety of protected categories (sculpture, drawing, and literary work) illuminates an undertheorized doctrinal phenomenon in copyright law that gives some things—here, digital files—multiple bites at the apple of copyright protection. We do not afford other things, notably machines, the same luxury.[48] Machines in operation are purely functional and receive no copyright protection. But machines in stasis (and also in motion) could be seen as sculptures. To police the boundary between patent law and copyright law, copyright protection is not available for machines despite this dual nature.[49] With computer programs, though, copyright law potentially protects them even though in operation they, like machines, are purely functional.[50] Whatever the justification for the disparate treatment of digital versus physical works, to enjoy copyright protection the pictorial/graphic work (i.e., the technical drawing) or the literary work must constitute an original work of authorship that includes some modicum of creativity.[51]

The requirement for creativity precludes copyright protections for digital manufacturing files for purely utilitarian objects as either technical drawings or literary works. First, consider the files as technical drawings. As I have explained elsewhere, not all technical drawings (whether paper or digital) contain creativity.[52] Traditional drawings

---

46 *Id.*

47 Osborn, *Limits of Creativity*, *supra* note 38, at 52–56.

48 Professor Weinreb is one who has noted and explored this phenomenon. Weinreb, *supra* note 33, at 1176–93; *see also* Reichman, *supra* note 7, at 802–06.

49 *See* 17 U.S.C. § 101 (delineating the lack of protection for useful articles).

50 Weinreb, *supra* note 33, at 1153 ("In their operational form, programs are strictly functional and contain no expression . . . .").

51 *See, e.g.*, Feist Publ'ns, Inc., v. Rural Tel. Serv. Co., 499 U.S. 340, 346 (1991) (explaining that originality requires independent creation plus a modicum of creativity); J.H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 COLUM. L. REV. 2432, 2477 (1994) [hereinafter Reichman, *Legal Hybrids*] ("Technical [d]rawings, [b]lueprints, and [e]ngineering [p]rojects . . . 'constitute some of the oldest and most instructive marginal cases in the intellectual property universe.'").

52 *See* Lucas S. Osborn, *Of PhDs, Pirates, and the Public: Three-Dimensional Printing Technology and the Arts*, 1 TEX. A&M L. REV. 811, 829 (2014) ("Of course, technical drawings can be copyrighted only to the extent they contain some minimal creativity."); Osborn, *Limits of Creativity*, *supra* note 38, at 42–52.

contain creative decisions as to which views to show, which parts to label, etc.,[53] but digital manufacturing drawings do not contain such choices.[54] Every detail in the digital manufacturing drawing exists to manufacture a precise utilitarian object—it is the equivalent of tracing. There is no coloring, shading, or perspective (the CAD program by default makes the object view rotatable). Unlike an artist who paints a landscape in as exact detail as possible, the CAD designer does not leave her "personal reaction [as] an individual"[55] in the drawing. What she draws corresponds directly and exactly to the utilitarian object to be manufactured. There is one—and only one—way to depict a shovel of given dimensions; the length and shape of the handle and spade must correspond exactly (though perhaps at scale) to the tangible shovel. Like those maps and databases devoid of creativity,[56] these files sit outside of copyright protection.

The court in *Enterprises International, Inc. v. International Knife & Saw, Inc.*[57] understood the creativity requirement when it refused copyright protection to the plaintiffs' technical drawings because the "designs *admittedly* contain[ed] only functional and utilitarian information, the sole purpose of which [was] to manufacture specific types of knives or blades to precisely fit certain machines . . . ."[58] The

53 *See* Axxiom Mfg., Inc. v. McCoy Invs., Inc., 846 F. Supp. 2d 732, 748 (S.D. Tex. 2012) (holding that a CAD drawing showing an exploded view of a valve contained enough nonmerged creativity "[b]ecause more than one way exists in which to create an exploded-parts drawing of the . . . valves"); 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 2A.14[B] (rev. ed. 2017) (noting that a drawing of an uncopyrightable object may be copyrightable because of "the original elements of perspective, angle, and the like that the artist employed in depicting the toy in two-dimensional illustrated form" and noting that noncopyrightable elements include "the structure and appearance of the toy itself").

54 *See generally* Osborn, *Limits of Creativity*, *supra* note 38, at 31–34, 47–48 (explaining in detail how digital manufacturing drawings are created and why they lack creativity).

55 Bleistein v. Donaldson Lithographing Co., 188 U.S. 239, 249–50 (1903). One commentator argues that manufacturing files for printed circuit boards should enjoy copyright protection because the designer could arrange the components and conductively connect them in numerous ways. *See* John R. Ackermann, *Toward Open Source Hardware*, 34 U. DAYTON. L. REV. 183, 199–202 (2009). This analysis ignores the fact that the designer is making choices that directly reflect the make-up of a physical circuit board, which is not copyrightable as a useful article. The author also argues that the physical circuit board is copyrightable. *Id.* at 203–04. But this is surely erroneous. Just because there are multiple ways to design a utilitarian circuit board does not make it copyrightable. Were it otherwise, all shovels would be copyrightable because there are multiple utilitarian designs for shovels.

56 *See, e.g.*, *Feist*, 499 U.S. at 347–48 (stating that collections of data are only copyrightable if creativity is used in the selection and arrangement); Darden v. Peters, 488 F.3d 277, 286–87 (4th Cir. 2007) (affirming the Copyright Office's refusal to register preexisting map with additions "color, shading, and labels using standard fonts and shapes"); Kern River Gas Transmission Co. v. Coastal Corp., 899 F.2d 1458, 1463–64 (5th Cir. 1990) ("[T]he idea of the location of the pipeline and its expression embodied in the 1:250,000 maps are inseparable and not subject to protection."); *see also* Dennis S. Karjala, *Copyright in Electronic Maps*, 35 JURIMETRICS J. 395 (1995) (noting that the *Feist* decision leaves many digital maps unprotected by copyright).

57 No. C12-5638 BHS, 2014 WL 1365398 (W.D. Wash. Apr. 7, 2014).

58 *Id.* at *6. Apparently relying on the plaintiff's own admission, the court did not provide a

court's language is arguably too broad because utilitarian information creatively arranged can be protected, but the thrust of the opinion aligns with the requirement for creativity.

With digital manufacturing drawings it may be true that minor decisions regarding the order of the manufacturing process (e.g., start manufacturing on the left or the right side of the object, or drill the left hole first) comprise "creative" decisions, but it is not at all clear that these minimal variations cross into the realm of copyrightable expression. The vast majority of potential decisions (e.g., orient the object lengthwise or widthwise) will be dictated by utilitarian concerns,[59] and what remains is so banal as to lack meaningful creativity.[60] Were it otherwise, accounting forms such as those in *Baker v. Selden* would have received copyright protection as pictorial or graphic works.[61]

A recent controversial case from the Court of Appeals for the Tenth Circuit also demonstrates that digital drawings lacking creativity will not receive copyright protection. In *Meshwerks, Inc. v. Toyota Motor Sales U.S.A., Inc.*,[62] the court held that Meshwerks' digital model of a Toyota car could not enjoy copyright protection.[63] Meshwerks created initial drafts of the drawings using actual measurements from existing cars, and then its "personnel fine-tuned or, as the company prefers it, 'sculpted,' the lines on screen to resemble each vehicle as closely as possible."[64] The court confusingly focused on Meshwerks' *copying* of the physical car, deeming the final model not to be independently created.[65] Although that reasoning is suspect if the court

---

detailed analysis, nor did it provide a copy of the drawing at issue (probably because it was also claimed as a trade secret). *Id.*

59 And for that reason cannot constitute copyrightable expression. *See, e.g.*, Richard H. Stern, *Legal Protection of Screen Displays and Other User Interfaces for Computers: A Problem in Balancing Incentives for Creation Against Need for Free Access to the Utilitarian*, 14 COLUM.-VLA J.L. & ARTS 283, 333–34 (1990) ("That there is more than one way to do something does not mean that some ways will not be better than other ways. Interpreting copyright law to protect better methods against unauthorized use turns copyrights into patents without the safeguards and limitations of the patent system."). Further, manufacturing-ready and machine-instruction files are overwhelmingly created from design files exclusively by computer programs using utilitarian rules, rendering any slight variations in the resulting file uninfluenced by the design drawing creator. *See* Osborn, *Limits of Creativity*, *supra* note 38, at 27–28.

60 *See* Weinreb, *supra* note 33, at 1159 n.32 ("But the expression, even in a flow chart, is banal and unoriginal, and of no value.").

61 Baker v. Selden, 101 U.S. 99, 104–07 (1879) (holding that forms used to implement an accounting system were not protected by copyright).

62 528 F.3d 1258 (10th Cir. 2008).

63 *Id.* at 1269–70.

64 *Id.* at 1260.

65 *Id.* at 1263–69. Professor Ed Lee criticizes the court's failure to recognize the difference between copying a copyrighted "work" versus an uncopyrighted object from the world. Lee, *supra* note 7, at 928–30. But the court is best understood as equating the employee's work to slavish copying (e.g., mere tracing), which does not involve creativity, as opposed to an artist

meant that realistic depictions of objects cannot be copyrighted, the result is likely correct because the model lacked any protectable creativity.[66] For example, the court highlighted that "Meshwerks did not make any decisions regarding lighting, shading, the background in front of which a vehicle would be posed, the angle at which to pose it, or the like . . . ."[67]

One may attempt to distinguish *Meshwerks* because that case involved the copying of an existing object, whereas a digital manufacturing drawing may be created before the tangible object exists; but this distinction is without significance when focusing on creativity. All would agree that creating a purely utilitarian object from a *traditional* drawing (e.g., a sketch that is protected by copyright by virtue of perspectives or the like) results in no protectable creativity for the tangible object.[68] As Professor Nimmer explains in the context of a noncopyrightable toy:

> [T]he only copyrightable elements contained in the copyrighted illustration are the original elements of perspective, angle, and the like that the artist employed in depicting the toy in two-dimensional illustrated form. One who reproduces the toy in three-dimensional form, by hypothesis, does so by copying from the illustration only the noncopyrightable elements—the structure and appearance of the toy itself—without copying the copyrightable elements, such as the lighting and particular perspective that go into depicting the toy in two-dimensional form.[69]

Notice the only protectable aspect of the traditional drawing to which Professor Nimmer points are things like lighting, perspective, and angle. None of these things exist in most digital manufacturing drawings because the drawing is generic regarding angle—the view is by default rotatable and thus has no fixed angle or perspective. He correctly indicates that the structure and appearance of the object are noncopyrightable elements. Digital manufacturing files, particularly STL and GCODE files, generally contain nothing but functional information as to the structure and appearance of the physical object.

These manufacturing drawings can be analogized to Platonic "forms," which Plato argued were the most accurate reality even though

---

painting a nature landscape, which does.

66 *See Meshwerks*, 528 F.3d at 1265–67.

67 *Id.* at 1265. The court continued, stating, "in short, its models reflect none of the decisions that can make depictions of things or facts in the world, whether Oscar Wilde or a Toyota Camry, new expressions subject to copyright protection." *Id.*

68 *See, e.g.*, 17 U.S.C. § 113(b) (2012); Lamb v. Grand Rapids Sch. Furniture Co., 39 F. 474, 475 (W.D. Mich. 1889) (allowing the defendant to make copies of the plaintiff's noncopyrightable furniture and then to create drawings of those copies without infringing plaintiff's copyrights in drawings of the same furniture).

69 NIMMER & NIMMER, *supra* note 53, § 2A.14[B].

they were nonphysical.[70] Like Plato's forms, digital manufacturing files are akin to mathematical formulae that define abstract versions of tangible objects.[71] And we can think of digital files as "real" versions of tangible objects as Plato saw forms as the real versions of tangible objects.[72] The analogy is not perfect, and few today operate under a belief in Plato's forms, but it helps to see how in a world of 3D printing it makes little sense to treat digital manufacturing files of utilitarian objects differently from the tangible object. To do so would be to protect functionality.

Aside from potential protection as technical drawings, digital manufacturing files might qualify for copyright protection as a literary work because they can be represented in textual (code) form. This avenue is complicated by the fact that digital manufacturing file creators typically do not write in a programming language. Rather, they draw the picture in a CAD environment, often using stock shapes and objects that they manipulate into the specific size needed.[73] The CAD environment thus abstracts the coding one or more levels above the literal code, rendering the literal code something that is not authored directly by the programmer.[74] Further, the CAD program writes the text algorithmically, presumably based purely on utilitarian considerations, thus leaving no creativity in the particular textual choices.[75] In effect, the CAD environment renders every copyright analysis of digital manufacturing files a question as to whether the structure, sequence, and organization of the files contain protectable expression. If so, the only potential creativity in the text will flow, if at all, from the order in which the creator drew the object.[76] Once again, these miniscule choices are too small to cross the admittedly low threshold of creativity.

The lack of protection for other types of digital files likewise demonstrates the noncopyrightability of digital manufacturing files for utilitarian objects. Take for example a noncopyrightable photograph. Courts and commentators agree that some photographs, such as slavish copies of public domain works, lack any creativity.[77] If a physical copy of

---

70 *See, e.g.*, JOHN M. FRAME, A HISTORY OF WESTERN PHILOSOPHY AND THEOLOGY 64–65 (2015).

71 *See id.* at 64.

72 *See id.*

73 *See, e.g.*, *CAD Blocks*, AUTODESK, http://www.autodesk.com/solutions/cad-blocks (last visited Mar. 8, 2018).

74 *Cf.* Comput. Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 703–12 (2d Cir. 1992) (assuming that the literal code, which the programmer drafted, was protectable, and implementing an abstraction-filtration-comparison test to test what else, if anything, was protectable).

75 *See* Osborn, *Limits of Creativity*, *supra* note 38, at 53–55.

76 The order will presumably be reflected in the design drawing file. But upon conversion to a manufacturing-ready file, such ordering may be replaced by an algorithmically determined order. *Id.* at 54–56.

77 *See* Schrock v. Learning Curve Int'l, Inc., 586 F.3d 513, 519 (7th Cir. 2009) (recognizing

a photograph is not protected by copyright it must follow that a digital copy of that photograph would not be protected either. Even though a JPEG file is a "computer program" (per the copyright statute's definition)[78] and can be represented in code format, this cannot transform it into a protectable work. The file's code is written by a digital camera. And even if a person set out to recreate the photograph on a computer pixel-by-pixel, the person exhibits no creativity by merely copying the pixels. Analogously, a digital manufacturing file of a utilitarian object exhibits no protectable creativity.

Consider also digital files for typeface fonts (a stylized set of characters such as Times New Roman), a phenomenon that came to the fore with the personal computer era.[79] Courts and lawmakers regard most printed typeface fonts as too functional to merit copyright protection.[80] Once font designers digitized the fonts, however, a new debate kindled as to whether the digital files that would display the fonts might be copyrightable as literary works or compilations.[81]

The Copyright Office initially rejected claims to copyright protection for the files, finding they lacked creativity as mere transformations of analog characters into digital versions.[82] It reasoned that, "[b]ecause the typefont data is determined by the ultimate shape of the typeface character, and requires *de minimis*, if any, selection and arrangement, it does not qualify as a compilation or any other original

---

that there exists a "narrow category of photographs that can be classified as 'slavish copies,' lacking any independently created expression"); Bridgeman Art Library, Ltd. v. Corel Corp., 36 F. Supp. 2d 191 (S.D.N.Y. 1999); Daniel J. Gervais, Feist *Goes Global: A Comparative Analysis of the Notion of Originality in Copyright Law*, 49 J. COPYRIGHT SOC'Y U.S.A. 949, 956–57 (2002) ("[A] photographer trying to take a technically perfect picture is not making *creative* choices[.]" (emphasis in original)); Hughes, *Photograph as Database*, *supra* note 7, at 374–81.

78 17 U.S.C. § 101 (2012).

79 *See generally* Phillip W. Snyder, *Typeface Design After the Desktop Revolution: A New Case for Legal Protection*, 16 COLUM.-VLA J.L. & ARTS 97 (1991). I credit Aaron Perzanowski for pointing out the analogy to typeface.

80 *See* H.R. REP. NO. 94-1476, at 55–56 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659 ("The Committee has considered, but chosen to defer, the possibility of protecting the design of typefaces. . . .The Committee does not regard the design of typeface, as thus defined, to be a copyrightable 'pictorial, graphic, or sculptural work' within the meaning of this bill and the application of the dividing line in section 101."); Monotype Corp. PLC v. Int'l Typeface Corp., 43 F.3d 443, 446 (9th Cir. 1994) (noting that "typefaces are not afforded copyright protection"). Though this position is not without detractors. *See* Terrence J. Carroll, *Protection for Typeface Designs: A Copyright Proposal*, 10 SANTA CLARA COMPUTER & HIGH TECH. L.J. 139, 168–82 (1994) (arguing in favor of copyright protection for typeface designs); Jacqueline D. Lipton, *To © or Not to ©? Copyright and Innovation in the Digital Typeface Industry*, 43 U.C. DAVIS L. REV. 143, 151–55 (2009) (discussing dissenting views).

81 *See, e.g.*, Lipton, *supra* note 80, at 172–73; Snyder, *supra* note 79, at 110–15.

82 *See* Policy Decision on Copyrightability of Digitized Typefaces, 53 Fed. Reg. 38,110, 38,112 (Sept. 29, 1988) ("The Copyright Office concludes that typefaces created by a computerized-digital process are also uncopyrightable. Like analog typefaces, digitally created typefaces exhibit no creative authorship apart from the utilitarian shapes that are formed to compose letters or other font characters.").

work of authorship."[83] The analogy to digital manufacturing files is clear. The physical utilitarian object is not copyrightable just like the utilitarian written letters of a font. Likewise, the digital manufacturing file is dictated entirely by the need to create the specific utilitarian object, just as the basic image of the font is dictated by the need to create a specific character. Thus, the digital file lacks creativity.

But the typeface debate took an abrupt turn soon after the 1988 Policy Decision. Under intense lobbying from typeface protectionists, the Copyright Office eventually issued a regulation that, although not recanting its 1988 Decision, clarified that certain font files, such as *scalable* font files, could receive copyright protection.[84] The arguments in favor of copyrightability distinguished the primitive bitmapped font files[85] and stressed the arguably creative decisions designers made when creating fonts, such as selecting points along curves to approximate the shape of characters, which can be grown or shrunk by increasing or decreasing the distance between the points.[86] Although the Copyright Office agreed that such creative choices can render some font files copyrightable (and some courts have agreed),[87] it continued to stress that that "digitized typeface as typeface is unregistrable . . . ."[88]

Even so, the rationale that supports protections for some font files (however dubious in terms of meaningful creativity) does not support protection for digital manufacturing files. Unlike the font designers who define shapes by hand-selecting points along characters' curves, digital manufacturing file creators generally rely on computer programs to draw the shapes and lines.[89] It is true that the creator may need to produce a custom shape, but that shape will correspond directly to the shape of the physical object. Thus, digital manufacturing files are more akin to nonprotectable bitmap font files than scalable font files. Of course, modern manufacturing files are easily scalable, but not based on any action of the digital file creator—the CAD or other program has

---

83 *Id.* at 38,112.

84 Registrability of Computer Programs That Generate Typefaces, 57 Fed. Reg. 6201, 6202 (Feb. 21, 1992) (codified at 37 C.F.R. pt. 202) ("[T]he Copyright Office is persuaded that creating scalable typefonts using already-digitized typeface represents a significant change in the industry since our previous Policy Decision.").

85 In a bitmap file, a particular character is defined by selecting all the dots on a screen that are needed to produce the character; it is essentially redrawing the character exactly. *See* Blake Fry, *Why Typefaces Proliferate Without Copyright Protection*, 8 J. TELECOMM. & HIGH TECH. L. 425, 438 (2010).

86 *See id.* at 437–39; *cf.* Adobe Sys., Inc. v. S. Software, Inc., No. C 95-20710 RMW (PVT), 1998 WL 104303, at *4 (N.D. Cal. Feb. 2, 1998) ("Adobe contends that while the shape of the glyph necessarily dictates some of the points to be chosen to create the glyph, it does not determine all the points to be chosen. Thus, each rendering of a specific glyph requires choices by the editor as to what points to select and where to place those points.").

87 *See* Adobe Sys., Inc., 1998 WL 104303, at *5.

88 Registrability of Computer Programs That Generate Typefaces, 57 Fed. Reg. at 6202.

89 *See* Osborn, *Limits of Creativity*, *supra* note 38, at 50–52.

scalability "built in."

Turning from manufacturing files to utilitarian programs like a pinch-to-zoom app, these files can also be represented in textual form and thus might be protected as literary works. Unlike with most manufacturing files, though, programmers traditionally have typed (or pasted) most of the lines of code for application programs. In part because of the loose parallel between writing a book and coding a program, courts have indulged Congress's prescription that literal code is typically copyrightable, albeit with "thin" protection.[90] But even as to literal code, works must contain a modicum of creativity.[91] If every line of code is dictated by efficiency or dictated by external factors, there is no protectable expression.[92]

Beyond the limits of hand-typed code, new practices are challenging copyright's détente with code. Indeed, programmers now can code using stock subroutines represented graphically in a manner loosely resembling a CAD environment.[93] Thus, the programmer does not write much of the code's text—the layer of software that courts generally see as the most deserving of protection.[94] Instead, the programmer simply chooses an icon representing a function she desires to include. A program translates that icon into code, presumably according to utilitarian rules. Just as with digital manufacturing files, as computer application programming becomes automated and modularized, serious questions arise as to whether purely utilitarian programs are copyrightable.[95]

These programs begin to look more and more like simple recipes, which are not copyrightable.[96] Perhaps the programmer could exchange the order of certain subroutines, but are such simple choices enough to overcome the modicum of creativity requirement? If simple ordering

---

90 *See* Comput. Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 702, 711–12 (2d Cir. 1992) ("It is now well settled that the literal elements of computer programs, i.e., their source and object codes, are the subject of copyright protection.") (responding to arguments that the resulting protection is too thin).

91 *See* H.R. REP. NO. 94-1476, at 54 (1976), *as reprinted in* 1976 U.S.C.C.A.N. 5659, 5667 (noting that copyright protects computer programs only "to the extent that they incorporate authorship in programmer's expression of original ideas, as distinguished from the ideas themselves").

92 *See Comput. Assocs. Int'l*, 982 F.2d at 707.

93 *See, e.g.*, *Build a Basic UI*, *supra* note 5 (describing Xcode).

94 *See Comput. Assocs. Int'l*, 982 F.2d at 702.

95 I exclude from this analysis programs containing creative output as they will be protectable as audiovisual works.

96 *See* 37 C.F.R. § 202.1(a) (stating that "mere listing of ingredients or contents" are not copyrightable). Further, even inclusion of simple instructions for mixing the ingredients does not make the recipe copyrightable because it is merely a functional system or process. *See* Tomaydo-Tomahhdo, L.L.C. v. Vozary, 629 F. App'x 658, 661 (6th Cir. 2015); Lambing v. Godiva Chocolatier, No. 97-5687, 1998 WL 58050 (6th Cir. Feb. 6, 1998); Publ'ns Int'l, Ltd. v. Meredith Corp., 88 F.3d 473, 480–81 (7th Cir. 1996); Lapine v. Seinfeld, No. 08 Civ. 128(LTS)(RLE), 2009 WL 2902584 (S.D.N.Y. Sept. 10, 2009).

choices could constitute sufficient creativity, then even simple listings of ingredients would qualify for copyright protection. After all, one could list flour first and eggs second or vice versa. One could alphabetize the ingredients or organize them by weight. And yet, we are told that mere listings of ingredients are not copyrightable.

Again, one could frame this issue in terms of merger rather than a complete lack of creativity.[97] In some cases merger may be the appropriate doctrine, but it has its drawbacks. Most notably, some jurisdictions apply it only as an affirmative defense, which leads to unnecessary uncertainty and litigation costs.[98]

Increasingly then, certain digital files present fundamental copyright eligibility issues. If we take the requirement of creativity seriously, basic digital manufacturing files of purely utilitarian objects and relatively short applications, especially those programmed in graphical environments, are not copyrightable. These digital works present in starker form the longstanding discomfort with copyright protection for computer programs.[99] Importantly, however, the copyrightability issues discussed herein are not simply matters of congressional intent. On the contrary, the *Feist* Court presented its modicum of creativity test as a constitutional requirement flowing from the Intellectual Property Clause.[100]

2. Appending Creativity as Lockout Codes to Circumvent *Feist*

Creators will often want copyright protection for their files and if those files do not inherently contain sufficient creativity, their creators may seek to add ancillary copyrightable aspects to the files. They would do so solely to attempt to protect the otherwise uncopyrightable file. How will users accomplish this, and how might courts approach such behavior?

Essentially any file's code can include nonexecutable statements called comments. A user can take advantage of this feature by inserting arbitrary creative comments into the file to append copyrightable expression.[101] For example, a user might insert a creative and original

---

97 *See, e.g.*, Pamela Samuelson, *Reconceptualizing Copyright's Merger Doctrine*, 63 J. COPYRIGHT SOC'Y U.S.A. 417 (2016).

98 *Id.* at 437–38.

99 *See, e.g.*, Weinreb, *supra* note 33, at 1160 (stating that computer programs present the issue of "whether a functional work may be copyrightable subject matter. As far as programs are concerned, Congress had said yes. Perhaps long-accepted copyright principles said no").

100 Feist Publ'ns, Inc., v. Rural Tel. Serv. Co., 499 U.S. 340, 346 (1991) ("Originality is a constitutional requirement.").

101 A user could, of course, also insert comments for practical purposes, such as explaining to others the author's thought process in organizing the file. Whereas comments can be important for lengthy application programs, they will likely be rare in digital manufacturing

poem in the comments.[102] Alternatively, users of digital manufacturing files can overlay an otherwise uncopyrightable digital object with a copyrightable image.[103] Either scenario will render the file, as a whole, potentially protected by copyright. Although only the expressive aspects are protected from copying, a user wanting to obtain the file cannot selectively copy only portions of the file.

In these scenarios, the expressive content acts as a lockout code,[104] attempting to limit the public's access to utilitarian, noncopyrightable aspects of the files. The user does not want or care about the expressive content but will be forced technologically to copy it to obtain access to the utilitarian content. Indeed, the user will likely discard (in the case of images) or be unaware of (in the case of comments) the creative content.

Lockout codes are not new.[105] In other instantiations, creators typically used them to prevent interoperability between a creator's system or hardware and a competitor's follow-on products.[106] In those cases, the competitor was not seeking to unlock a file simply for the sake of copying the file (copyright law precluded verbatim copying), but instead wanted access to a system so that the competitor could independently create competing products like video games or printer cartridges. In contrast, a user seeking to circumvent the lockout codes described herein wants to copy the file directly and may not independently develop anything.[107]

---

files, which are primarily drafted not in text form but in CAD drawing environments. Minimal comments might not be copyrightable. *See, e.g.*, Morrissey v. Procter & Gamble Co., 379 F.2d 675 (1st Cir. 1967) (holding that any possible expression in a text describing the rules of a contest had "merged" with the idea because there were only a small, finite, and limited number of ways to express the idea of such a contest).

102 A company performed a similar trick by embedding an original haiku into the header of outgoing emails as part of a spam prevention system. *See* Tarah S. Grant, *Habeas Haiku Splatters Spam*, INTA BULL. (Int'l Trademark Ass'n, New York, N.Y.), (July 1, 2003), http://www.inta.org/INTABulletin/Pages/HabeasHaikuSplattersSpam.aspx; John Leyden, *Habeas Sues Haiku Abusers*, REGISTER (Apr. 4, 2003, 3:51 PM), http://www.theregister.co.uk/2003/04/04/habeas_sues_haiku_abusers.

103 The user could also put the creative image off to the side of the utilitarian object but still within the file. *See* MICHAEL WEINBERG, PUB. KNOWLEDGE, WHAT'S THE DEAL WITH COPYRIGHT AND 3D PRINTING? 16 (Jan. 2013), https://www.publicknowledge.org/files/What's%20the%20Deal%20with%20Copyright_%20Final%20version2.pdf.

104 *Cf.* Julie E. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs*, 68 S. CAL. L. REV. 1091, 1094–97 (1995) [hereinafter Cohen, *Reverse Engineering*] (discussing lockout programs that limit access to video games without a key, wherein the key consists of copyrighted material); Andrea Pacelli, *Who Owns the Key to the Vault? Hold-Up, Lock-Out, and Other Copyright Strategies*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1229, 1242–46 (2008) (discussing the use of copyrighted material as a password for access to a computer program or other proprietary source).

105 *See* Cohen, *Reverse Engineering*, *supra* note 104; Pacelli, *supra* note 104.

106 *See* Samuelson, *Functionality*, *supra* note 32, at 1221.

107 In this sense, courts may be more likely to look down on the circumventer as a "free-rider." Whether this is an appropriate approach is considered in Part III.

Doctrinally, courts can respond in a variety of ways to these uses of nonexecutable comments and creative image overlays. First, courts can treat the copyrightable expression as protected and find anyone who copies it a prima facie infringer. A court might feel comfortable with this approach by noting that nothing in copyright law prevents an imitator from independently creating his own utilitarian digital manufacturing file or app.[108]

Second, courts may find that the lockout code's expression merges with its function.[109] Merger typically applies where expression is minimal, but lockout codes may be highly creative. Nonetheless, courts have been categorically unsympathetic to lockout codes, and a court may find that any expression—no matter its length—merges with the overarching function as a lockout code.[110] Such an approach would provide a bright-line rule for follow-on users of digital files, allowing them to create copies of the files without worry.

If a categorical merger approach is too blunt an instrument, more finely tuned tools exist. With computer programs, fair use can preserve "public access to the ideas and functional elements embedded in copyrighted computer software programs."[111] Fair use can serve as a defense to infringement when users copy lockout codes solely for access to the utilitarian aspects of the file.[112]

The copyright statute lists several factors courts must balance to

---

108 A third party can always independently create a drawing or file of an uncopyrighted physical object. *See* Bleistein v. Donaldson Lithographing Co., 188 U.S. 239, 249 (1903) ("Others are free to copy the original [if it is not protected by copyright]. They are not free to copy the copy."); Lamb v. Grand Rapids Sch. Furniture Co., 39 F. 474, 475 (W.D. Mich. 1889) (allowing defendant to make copies of plaintiff's noncopyrightable furniture and then to create drawings of those copies without infringing plaintiff's copyrights in drawings of the same furniture). In addition, the copyright in a technical drawing does not extend to the right to manufacture the utilitarian object depicted therein. 17 U.S.C. § 113(b) (2012) ("This title 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, whether title 17 or the common law or statutes of a State, in effect on December 31, 1977, as held applicable and construed by a court in an action brought under this title.").

109 *Cf.* Lexmark Int'l, Inc. v. Static Control Components, Inc., 387 F.3d 522, 541 (6th Cir. 2004) ("[T]he fact that [the expression] also functions as a lock-out code undermines the conclusion that Lexmark had a probability of success on its infringement claim.").

110 *Id.* at 544 ("[A] poem in the abstract could be copyrightable. But that does not mean that the poem receives copyright protection when it is used in the context of a lock-out code.").

111 Sony Comput. Entm't, Inc. v. Connectix Corp., 203 F.3d 596, 603 (9th Cir. 2000).

112 *See Lexmark*, 387 F.3d at 544–45 (discussing how the use of a program as a lockout code can affect the fair use analysis in favor of fair use); *cf.* Chamberlain Grp., Inc. v. Skylink Techs., Inc., 381 F.3d 1178 (Fed. Cir. 2004) (refusing to allow a DMCA claim to eviscerate a fair use defense); *Connectix*, 203 F.3d at 602–08 (finding that intermediate copying of BIOS that was necessary to access unprotected functional elements of video game console constituted fair use); Sega Enters. Ltd. v. Accolade, Inc., 977 F.2d 1510, 1520–28 (9th Cir. 1992) (finding intermediate copying to understand video game compatibility with game console to be per se fair use); Cohen, *Reverse Engineering*, *supra* note 104, at 1104–51.

determine whether an otherwise infringing use is excused.[113] As to the first factor, even though some users may copy the file to manufacture objects and sell them for profit (or sell the files directly), this will not necessarily weigh against fair use. The user will be profiting from the utilitarian aspects of the file, not its creative aspects, and the copying of the creative aspects will often be entirely incidental.[114] Regarding the second factor, the nature of the copyrighted work, the copyrighted work is undoubtedly expressive in one sense, but its use as a lockout code can militate in favor of fair use.[115]

The third fair use factor looks at how much protected expression the copier takes, and here by necessity the defendant takes the whole of the expressive lockout code. Although copying a whole work normally weighs against fair use, in this context it may be of little or no weight because the amount taken is analyzed in light of the lockout nature of the work.[116] Finally, the fourth fair use factor looks at the effect of the use upon the potential market for, or value of, the copyrighted work. Courts analyzing lockout codes tend carefully to distinguish between an effect on the market for the utilitarian work versus an effect on the market for the copyrighted expression—only the latter is relevant to the fair use analysis.[117] Almost by definition, the copyrighted expression has limited or no market significance because almost any user would be happy to avoid copying it altogether. Thus, courts have found that the

---

113 17 U.S.C. § 107 (2012) (listing as nonexclusive 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").

114 *See Lexmark*, 387 F.3d at 544 ("In copying the Toner Loading Program into each of its SMARTEK chips, SCC was not seeking to exploit or unjustly benefit from any creative energy that Lexmark devoted to writing the program code. As in *Kelly,* SCC's chip uses the Toner Loading Program for a different purpose, one unrelated to copyright protection."); Kelly v. Arriba Soft Corp., 336 F.3d 811, 818–19 (9th Cir. 2003) (determining that commercial use did not weigh against fair use where it was "more incidental and less exploitative in nature" because the copies were used for a different purpose from the originals).

115 *See Sega*, 977 F.2d at 1526 ("Because Sega's video game programs contain unprotected aspects that cannot be examined without copying, we afford them a lower degree of protection than more traditional literary works.").

116 *See id.* at 1526–27 (finding that the wholesale copying weighed against fair use, but because the copying was incidental to accessing utilitarian aspects of the program, "the factor is of very little weight"); Cohen, *Reverse Engineering*, *supra* note 104, at 1124–25 (arguing that copying a whole work to gain interoperability should not weigh against fair use); *cf.* Pierre N. Leval, *Toward a Fair Use Standard*, 103 HARV. L. REV. 1105, 1122–24 (1990); Lloyd L. Weinreb, Commentary, *Fair's Fair: A Comment on the Fair Use Doctrine*, 103 HARV. L. REV. 1137, 1146 (1990).

117 *See Lexmark*, 387 F.3d at 544–45 (focusing only on the market effect for the expressive portion of the work and not on the market for the utilitarian aspects); *Connectix*, 203 F.3d at 607 ("Sony understandably seeks control over the market for devices that play games Sony produces or licenses. The copyright law, however, does not confer such a monopoly.").

fourth factor weighs in favor of fair use.[118]

Besides merger and fair use, a court unfavorably disposed toward lockout codes can apply the doctrine of copyright misuse. Whereas fair use protects against infringement on a case-by-case basis, the doctrine of copyright misuse can render a copyright unenforceable against all, at least until the misuse is purged.[119] Copyright misuse is an equitable doctrine and typically involves instances of anticompetitive behavior that violate antitrust laws, but "[t]he question is not whether the copyright is being used in a manner violative of antitrust law . . . but whether the copyright is being used in a manner violative of the public policy embodied in the grant of a copyright."[120] Commentators have argued that courts should apply misuse more broadly, including in the context of lockout codes.[121]

I reserve a normative discussion of how courts should respond to these lockout codes for Section III.C. For now, the Article turns to a doctrinal assessment of patent protection for digital works.

B. *Patent Law*

Patent law protects new and nonobvious utilitarian inventions. Unlike free and automatic copyright protections, patent applications undergo extensive examination and cost several thousand dollars. And, unlike copyright's permissive scope, patents protect only a modest subset of purely utilitarian design files because patent law requires novelty and nonobviousness.[122] Known or obvious variations on known objects, like a basic hammer or toothbrush holder, will not be patentable.

Patents are very technical documents, and the language of the patent claims governs the scope of the right to exclude.[123] Patent law's

---

118 *See Lexmark*, 387 F.3d at 545.

119 *See, e.g.*, Alcatel U.S.A., Inc. v. DGI Techs., Inc., 166 F.3d 772 (5th Cir. 1999) (extending copyright misuse to a license that required licensees to agree not to create competing software); Practice Mgmt. Info. Corp. v. Am. Med. Ass'n, 121 F.3d 516 (9th Cir. 1997) (same); Lasercomb Am., Inc. v. Reynolds, 911 F.2d 970, 979 (4th Cir. 1990).

120 *Lasercomb*, 911 F.2d at 978.

121 *See, e.g.*, Brett Frischmann & Dan Moylan, *The Evolving Common Law Doctrine of Copyright Misuse: A Unified Theory and Its Application to Software*, 15 BERKELEY TECH. L.J. 865, 912 (2000) (arguing that "copyright misuse is an appropriate judicial mechanism for restricting the social costs of granting copyrights on functional innovations"); Karen E. Georgenson, *Reverse Engineering of Copyrighted Software: Fair Use or Misuse?*, 5 ALB. L.J. SCI. & TECH. 291, 312–13 (1996) (supporting copyright misuse defense for necessary intermediate copying and any derivative uses); Kathryn Judge, Note, *Rethinking Copyright Misuse*, 57 STAN. L. REV. 901 (2004).

122 35 U.S.C. §§ 102–03 (2012).

123 *See* SRI Int'l v. Matsushita Elec. Corp. of Am., 75 F.2d 1107, 1121 (Fed. Cir. 1985) ("It is the claims that measure the invention.").

insistence on tying protection to what is claimed poses problems for inventions of devices that can be digitally manufactured. If a patent contains claims directed *only* to the physical embodiment of the invention, such a claim likely will not provide any direct protection to a digital manufacturing file of the device.[124] For example, a claim to a "motor" does not cover a "file that will manufacture a motor."

Using a 3D printer to print a patented device constitutes direct infringement of the patent claim covering the physical object.[125] Direct infringement is patent law's strongest form of protection. Making, using, selling, and offering to sell the claimed invention will constitute direct infringement.[126] Direct infringement exists regardless of whether the infringer knows of the patent or intends to infringe.

Practically, however, direct infringement claims based on physical "makings" will be difficult to pursue in a world of mature digital manufacturing technology.[127] Would-be infringers can obtain digital manufacturing files on the Internet largely anonymously, and even if they are discovered, the patent holder would face the additional hurdle of proving that they actually printed the files.[128] Even where the infringement is discovered, patent holders will find it inefficient to sue individual infringers rather than the traditional high-volume, centralized manufacturer.[129] Likewise, many would-be infringers will not sell and offer to sell physical embodiments of the invention, but only digital versions.

Patent owners would thus prefer to control the digital manufacturing files directly. As Tim Holbrook and I explored in other work, courts could extend current doctrines to cover "digital patent infringement," particularly when the infringer sells or offers to sell a digital file. We singled out the actions of selling and offering to sell because those acts appropriate the economic value of the invention.[130] We were more circumspect regarding whether acts of making and using digital versions of the claimed invention should be actionable because of

---

124 *See* Timothy R. Holbrook & Lucas S. Osborn, *Digital Patent Infringement in an Era of 3D Printing*, 48 U.C. DAVIS L. REV. 1319, 1353–56 (2015).

125 *Id.* at 1332.

126 35 U.S.C. § 271(a).

127 *See* Holbrook & Osborn, *supra* note 124, at 1332–69.

128 *Id.* Copyright decisions debate the right of distribution in roughly related contexts. *See, e.g.*, Elektra Entm't Grp., Inc. v. Barker, 551 F. Supp. 2d 234 (S.D.N.Y. 2008) (holding that an *offer* to distribute a file, as opposed to actual distribution, on a P2P network can infringe the distribution right); London-Sire Records, Inc. v. Doe 1, 542 F. Supp. 2d 153 (D. Mass. 2008) (holding that when a file is made available on a P2P network, distribution (download) by third parties is presumed, and the accused must rebut the presumption). *Contra* PAUL GOLDSTEIN, GOLDSTEIN ON COPYRIGHT § 7.5.1 (3d ed. 2005) ("The crux of the distribution right lies in the transfer . . . of a copy or phonorecord. . . . [A]n actual transfer must take place; a mere offer of sale will not infringe the right.").

129 *See* Holbrook & Osborn, *supra* note 124, at 1332–69.

130 *Id.* at 1353–64.

practical consequences and the effects on follow-on innovation.[131] Until courts adopt our proposal or something similar, patent claims covering physical objects offer only modest direct protection with respect to digital files.

Of course, even if a patent claim to the physical embodiment cannot give rise to successful direct infringement claims, a patent owner can still assert indirect infringement claims. These claims, however, suffer from serious limitations. Foremost is the requirement that the infringer have knowledge of the patent and an intent to infringe it.[132] Moreover, the patent owner must identify acts of direct infringement, which can be difficult as mentioned previously. Thus, indirect infringement doctrines offer only modest protection.

Given the difficulties with claims directed to physical objects, inventors could seek patent claims directed to the file itself. This strategy appeals not only to inventors of digitally manufacturable items, but also to inventors of software-based inventions. Any patent claims drawn to digital files, however, run into difficulties because one cannot patent an abstract idea.[133]

Although the abstract idea exclusion was a stumbling block to early software patent applications, software patents were relatively easy to obtain in the 1990s and 2000s. But the Supreme Court initiated a monumental shift toward software patents with its decision in *Alice Corp. v. CLS Bank International*.[134] Jasper Tran reports that as of the decision's two-year anniversary on June 19, 2016, "courts have examined 568 challenged patents brought under [section] 101 motions citing *Alice*, resulting in 190 valid patents and 378 patents invalidated with an average invalidation rate of 66.5%. The Federal Circuit has upheld [three] patents and invalidated [thirty-four] patents—an average invalidation rate of 91.9%."[135] The vast majority of the patents affected by *Alice* are software-related inventions, and as of June 19, 2016 (the two-year anniversary of *Alice*), the Federal Circuit had only upheld two software-related inventions.[136] One of these cases, *Enfish, L.L.C. v. Microsoft Corp.*,[137] involved patent claims that specifically improved a computer's functionality,[138] a type of claim that has long been patentable even in Europe and that will not assist patent claims discussed in this Article. Intriguingly, between June 19, 2016 and March 13, 2017, the

131 *Id.* at 1364–67, 1377–84.

132 *See* Global-Tech Appliances, Inc. v. SEB S.A., 563 U.S. 754, 766 (2011).

133 Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2354 (2014).

134 *Id.* at 2352 (holding that a method of intermediated settlement was not patent eligible even if computer implemented).

135 Tran, *supra* note 1, at 356.

136 *See id.* at 364.

137 822 F.3d 1327 (Fed. Cir. 2016).

138 *Id.*

Federal Circuit has issued several decisions upholding patent validity in the face of an abstract idea challenge, four of which were software-related.[139]

After *Alice*, the landscape for software-related patents is at best uncertain and at worst bleak. Obviously, if patents are largely unavailable for software-type claims, inventors of the type discussed in this Article do not have many options. Perhaps, though, the recent potential trend toward finding software claims eligible may signal hope for these inventors.

Even if these patent claims face a more receptive future, it is not clear how much protection inventors will enjoy from claims directed to digital manufacturing files. One cannot patent a file in the abstract.[140] The traditional way to claim a computer file in a non-abstract way has been to use the *Beauregard* claim format,[141] which recites a "computer readable medium" (e.g., a CD or other computer memory) containing the computer program. Even assuming such claims could survive after *Alice*,[142] they offer inventors only limited protection because they are tied to a tangible storage medium.[143]

Specifically, a claim to a tangible storage medium containing a

---

139 *See* Thales Visionix Inc. v. United States, 850 F.3d 1343 (Fed. Cir. 2017) (finding claims non-abstract that were directed to an inertial tracking system (e.g., accelerometers and gyroscopes connected to a computer) for tracking the motion of an object relative to a moving reference frame); Amdocs (Isr.) Ltd. v. Openet Telecom, Inc., 841 F.3d 1288 (Fed. Cir. 2016) (finding not abstract a Beauregard-style claim); McRO, Inc. v. Bandai Namco Games Am. Inc., 837 F.3d 1299 (Fed. Cir. 2016) (finding not abstract a claim directed to automated 3D animation speech method that used unconventional rules that relate sub-sequences of phonemes, timings, and morph weight sets); Rapid Litig. Mgmt. v. CellzDirect, Inc., 827 F.3d 1042 (Fed. Cir. 2016) (upholding hepatocyte preparation method); BASCOM Glob. Internet Servs., Inc. v. AT&T Mobility L.L.C., 827 F.3d 1341 (Fed. Cir. 2016) (finding, for the purposes of 12(b)(6), the patent claims provided a solution for filtering content by installing a filter on an Internet service provider's servers in a non-abstract way). Between March 2017 and the time this Article was headed to print, the Federal Circuit issued several additional decisions favorable to software patents. *See, e.g.*, Core Wireless Licensing S.A.R.L. v. LG Elecs., Inc., 880 F.3d 1356 (Fed. Cir. 2018); Finjan, Inc. v. Blue Coat Sys., Inc., 879 F.3d 1299 (Fed. Cir. 2018). Moreover, two of the cases held that genuine factual issues subsumed within the patent eligibility analysis may preclude dismissal at the pleadings stage or the grant of summary judgment. Aatrix Software, Inc. v. Green Shades Software, Inc., 882 F.3d 1121, 1126–30 (Fed. Cir. 2018) (holding that factual allegations precluded Rule 12(b)(6) dismissal); Berkheimer v. HP Inc., 881 F.3d 1360, 1369–70 (Fed. Cir. 2018) (holding that summary judgment was improper due to genuine issues of material fact).

140 *See* Digitech Image Techs., L.L.C. v. Elecs. for Imaging, Inc., 758 F.3d 1344, 1350 (Fed. Cir. 2014) ("Data in its ethereal, nonphysical form is simply information that does not fall under any of the categories of eligible subject matter under section 101.").

141 This name derives from the eponymous case that signaled an endorsement of the format, *In re Beauregard*, 53 F.3d 1583 (Fed. Cir. 1995).

142 As the author was writing this Article, the Federal Circuit upheld a "Beauregard" claim in *Amdocs*, 841 F.3d 1288. But they still face an uncertain future. *See* Daniel Harris Brean, *Patenting Physibles: A Fresh Perspective for Claiming 3D-Printable Products*, 55 SANTA CLARA L. REV. 837, 845 (2015) (noting the claims are "are increasingly scrutinized for abstractness").

143 *See* Brean, *supra* note 142, at 845–46.

specific file is only infringed by one who makes, uses, sells, or offers to sell, etc., a tangible storage medium so programed.[144] While it is true that one who makes a copy of the file and stores it on her computer infringes the claim by "making" the invention, this only constitutes a single act of infringement.[145] Single acts of infringement give rise to relatively small damages, and though they give the patent holder a chance to obtain an injunction, injunctions are expensive to obtain and are not automatically granted.[146]

The patent holder would prefer to capture sales and offers to sell the invention, but when an accused party puts a file on the Internet for sale, she is not selling the *tangible storage medium*, and thus is not infringing the claim directly.[147] Moreover, in a digital world of costless copying, many people will not even bother to charge money for the file they have made available on the Internet, thus avoiding infringement for "selling" and "offering to sell" the invention.[148]

Additionally, *Beauregard* claims may offer insufficient protection if they only protect machine-instruction files. Recall that digital manufacturing files come in at least three types. The design file (e.g., DWG file) constitutes a drawing for the object that must be converted to a manufacturing-ready file (e.g., STL file), which in turn must be converted into a machine-instruction file (e.g., GCODE). Clearly the machine-instruction file would qualify as instructions for making the object, but the manufacturing-ready file is less clear, and the design file even less so.[149] If design files and manufacturing-ready files are not covered by *Beauregard* claims, competitors will be able to trade in them with relative impunity from direct infringement.[150]

In conclusion, patent law currently offers uncertain prospects for the protection of digital files. Even if the files are protectable, current patent claim formats offer less than equal protection when compared to claims to physical objects.

C. *Other Modes of Protection*

Utility patents and copyrights are not the only forms of protection. The IP doctrines of design patents, trademarks, and trade secrets can offer some control to creators of digital works. In addition, creators can reach outside of IP law and use contract law and technological

144 *Id.*
145 *Id.* at 846.
146 *Id.*
147 *Id.*
148 Holbrook & Osborn, *supra* note 124, at 1363–64.
149 *See* Brean, *supra* note 142, at 847–48.
150 Though they could still be guilty of indirect infringement.

protection measures to increase control. Each of these options is briefly outlined below.

Design patents, which sit at the crossroads between patent and copyright, offer protection to utilitarian objects embodying ornamental design features.[151] Objects that do not contain sufficient creativity for copyright may nevertheless enjoy design patent protection.[152] This category of works pushes against this Article's focus on *purely* utilitarian files, but given design patent law's low bar for ornamentality,[153] design patents serve as a potential avenue for protection.

Even this brief introduction to design patents requires a caveat: like utility patents, digital files present challenges to the design patent regime. Design patents are granted only to "article[s] of manufacture"[154] and it is unclear whether digital files displayed on a computer screen fall into this category.[155] Although the U.S. Patent and Trademark Office has issued many design patents for digital icons as depicted on a computer screen, no reported court decision has upheld the validity of design patent claims to digital representations.[156] In a somewhat related context, the Court of Appeals for the Federal Circuit opined that the word "articles" in the Tariff Act of 1930 includes only material things and does not include transmission of digital data.[157] In the design patent context, the "article" could be the computer screen on which the design appears, rather than the file itself. But even under this interpretation there is tension because the image on the phone is transitory.[158]

---

151 *See* 35 U.S.C. § 171(a) (2012).

152 Under current doctrine, a work can simultaneously enjoy design patent and copyright protection. *See* Mazer v. Stein, 347 U.S. 201, 217 (1954) ("Neither the Copyright Statute nor any other says that because a thing is patentable it may not be copyrighted."); *In re* Yardley, 493 F.2d 1389 (C.C.P.A. 1974); *see, e.g.*, Sarah Burstein, *The Patented Design*, 83 TENN. L. REV. 161, 168–69 (2015).

153 Since almost any design leaves "alternative designs" available, the test for ornamentality is easily met. *See* Best Lock Corp. v. Ilco Unican Corp., 94 F.3d 1563, 1567–68 (Fed. Cir. 1996) (Newman, J., dissenting) ("A design is 'not dictated by function alone' when there are alternative designs or configurations available for the article of manufacture . . . .") (holding that ornamentality fails if the design is primarily functional); William J. Seymour & Andrew W. Torrance, *(R)evolution in Design Patentable Subject Matter: The Shifting Meaning of "Article of Manufacture,"* 17 STAN. TECH. L. REV. 183, 189–90 (2013) (noting the lack of a requirement that the design be aesthetically pleasing).

154 35 U.S.C. § 171(a).

155 *See* Burstein, *supra* note 152, at 204–07 (discussing design patent protection for digital icons); Seymour & Torrance, *supra* note 153, at 206–15.

156 *See* Seymour & Torrance, *supra* note 153, at 205.

157 ClearCorrect Operating, L.L.C. v. Int'l Trade Comm'n, 810 F.3d 1283, 1286 (Fed. Cir. 2015) (holding that the word "articles" in the Tariff Act of 1930, which provides the International Trade Commission with authority to remedy only those unfair acts that involve the importation of articles, includes only material things and does not include transmission of digital data).

158 *See* John R. Boulé III, Comment, *Redefining Reality: Why Design Patent Protection Should Expand to the Virtual World*, 66 AM. U. L. REV. 1113, 1147–49 (2017); Seymour & Torrance, *supra* note 153, at 208–14.

Further, design patent claims to smart phone icons differ in substance from claims to digital manufacturing files. A smart phone or similar icon often performs a dual role. It is, of course, the functional way to access the program. But it also plays a role somewhat similar to printed designs worked into (e.g., painted or etched) an object, which are squarely within design patent law's domain. Many icons can offer ornamentation even when the app of the program is not in use.[159] Design files, on the other hand, do not exist to decorate one's computer screen. Rather, the image is used primarily, if not exclusively, as a means of creating, manipulating, and understanding what the file will manufacture. Thus, digital manufacturing files seem in many ways a poor fit for design patent law, unless perhaps protection is limited to files for physical objects that would otherwise qualify for design patent protection.

Even if design patent law does not protect digital files directly, it offers rights-holders the opportunity to sue for indirect infringement where the file will manufacture an object otherwise protected by a design patent. The limitations to an indirect infringement claim for design patents mirror those of utility patents. Specifically, an accused infringer must have knowledge of the patent and an intent to infringe.[160] Of course, the patent owner also must identify acts of direct infringement, which can be difficult with decentralized 3D printing.

Trademark and trade dress law constitute another avenue for legal control. Trademark law protects source indicating symbols used on or in connection with goods.[161] Under this Article's focus on purely utilitarian objects, trade *dress* law will not be implicated, because trade dress is only protectable when distinctive.[162] Trade*mark* law, however, offers important protections.

Creators can include trademarks within their digital files such that the mark would appear on the 3D printed product. Assuming the requirements of trademark protection are met, the creator would enjoy protection against competitors who sold physical items bearing the creator's trademark.[163] But the protection may not extend to sales of digital files bearing the trademarks, because the Supreme Court's decision in *Dastar Corp. v. Twentieth Century Fox Film Corp.*[164] mandates that the Lanham Act's phrase "origin of goods" "refers [only]

159 Of course, they can be moved into subfolders so that they do not decorate (or clutter, depending on the perspective) the screen.

160 *See* Global-Tech Appliances, Inc. v. SEB S.A., 563 U.S. 754, 765–66 (2011).

161 *See* 15 U.S.C. § 1127 (2012) (defining trademark).

162 *See* Wal-Mart Stores, Inc. v. Samara Bros., Inc., 529 U.S. 205, 212–16 (2000) (holding that product design must be distinctive to enjoy trade dress protection and that it cannot be inherently distinctive).

163 *See* 15 U.S.C. §§ 1114, 1125.

164 539 U.S. 23 (2003).

to the producer of the tangible goods that are offered for sale, and not to the author of any idea, concept, or communication embodied in those goods."[165] As Mark McKenna and I have argued in depth, *Dastar*'s central holding dictates that courts cannot consider the internal content of digital files (including trademarks within the digital file) when determining direct trademark infringement.[166] In proper circumstances, however, courts can hold purveyors of digital files liable as indirect trademark infringers, assuming the requisite elements are shown, including knowledge that the downstream user will commit trademark infringement.[167]

On the other hand, trademarks can play a powerful role for creators of digital files when the mark appears external to the digital file. For example, many Internet intermediaries that host digital manufacturing files prominently display the username of the entity that created each file.[168] That name serves as an explicit source indicator to consumers. Customers will come to appreciate that certain usernames correlate with high-quality files and may return to that source for future purchases. Trademark law protects those source indications, and anyone falsely using another's username will risk trademark infringement liability.[169]

Besides design patents and trademarks, trade secret law can provide some protections.[170] A trade secret is information that "derives independent economic value . . . from not being generally known to, and not being readily ascertainable by proper means [and that is] the subject of efforts that are reasonable under the circumstances to maintain its secrecy."[171] Thus, to qualify for trade secret protection, the owner would need to keep the thing a secret. This requirement largely disqualifies those who make their digital files publicly available. But for those who want to keep their files "in house," trade secret laws can help protect owners who are willing to put forth reasonable efforts to maintain secrecy. Even if a creator keeps its digital files in house,

165 *Id.* at 37.

166 Mark P. McKenna & Lucas S. Osborn, *Trademarks and Digital Goods*, 92 NOTRE DAME L. REV. 1425, 1430–56 (2017); Lucas S. Osborn, *Trademark Boundaries and 3D Printing*, 50 AKRON L. REV. 865, 877–80 (2016) [hereinafter Osborn, *Trademark Boundaries*]; *see also* Mark P. McKenna, Dastar*'s Next Stand*, 19 J. INTELL. PROP. L. 357, 365–66 (2012).

167 *See* Inwood Labs., Inc. v. Ives Labs., Inc., 456 U.S. 844, 853–54 (1982).

168 *See, e.g.*, Lewisite, *Laboratory Pipette*, THINGIVERSE (Oct. 1, 2013), https://www.thingiverse.com/thing:159052/#files (offering a 3D printable file for a pipette and prominently displaying the creator's name, "lewisite").

169 *See* McKenna & Osborn, *supra* note 166, at 1453, 1467–69.

170 Trade secrets are protected largely on a state-by-state basis, and forty-seven states have adopted a version of the Uniform State Trade Secrets Act (UTSA). UNIF. TRADE SECRETS ACT (UNIF. LAW COMM'N 1985). Recently Congress enacted the Defend Trade Secrets Act of 2016, Pub. L. No. 114-153, 130 Stat. 376, but that law explicitly preserves existing state law. 18 U.S.C. § 1836(f) (2012).

171 UNIF. TRADE SECRETS ACT § 1(4).

however, if the output of those files is available to the public (such as by purchasing a 3D printed part), trade secrecy protection may be lost if one can reverse engineer or independently create the digital file based off the purchased item.[172]

Outside of the IP realm, contract law can provide creators control over files. Paradigmatically, contracts represent private agreements between two parties who have mutually agreed to terms.[173] Free market economies value freedom to contract for many reasons, including beliefs about individual autonomy and the efficiency of private ordering.[174] For purposes of this Article, contract law's most relevant doctrines include notice and privity. As a doctrine, notice relates to ensuring that those entering into a contract have been alerted to the presence of the contract's terms.[175] A court generally will not presume a party's assent to terms for which it has not received adequate notice.[176] The doctrine, privity, generally requires parties to be directly connected by contract in order to have the right to sue.[177] Though there are exceptions for third party beneficiaries of a contract and for *sellers*' breaches of warranty involving injury,[178] the doctrine continues to have relevance, especially to downstream file recipients.[179]

Technology allows creators to circumvent privity problems by creating a "pop-up" screen that requires any subsequent user to agree to the terms imposed by the original creator.[180] Like servitudes that run with property or chattels, these terms purport to establish obligations binding on any user of the file.[181] The law traditionally has disfavored servitudes on personal chattels,[182] so the extent to which such terms are binding is unclear, though courts uphold many of them. Additionally, where a file implicates an IP right, there is confusion as to whether the breach of a contract provision leads to liability not only for breach of

172 *See id.* § 1 cmt. (indicating that proper means of discovering a trade secret include reverse engineering and independent invention).

173 *See, e.g.*, RESTATEMENT (SECOND) OF CONTRACTS § 17 (AM. LAW. INST. 1981) ("[T]he formation of a contract requires a bargain in which there is a manifestation of mutual assent to the exchange . . . .").

174 *See, e.g.*, Lucas S. Osborn, *The Leaky Common Law: An "Offer to Sell" as a Policy Tool in Patent Law and Beyond*, 53 SANTA CLARA L. REV. 143, 147 (2013).

175 *See, e.g.*, Specht v. Netscape Commc'ns Corp., 306 F.3d 17, 29–30 (2d Cir. 2002) (requiring notice of the terms before the user will be bound).

176 *Id.*

177 *See* 18 RICHARD A. LORD, WILLISTON ON CONTRACTS § 52:38 (4th ed. 2017).

178 *See id.*

179 *See, e.g.*, Robert P. Merges, *The End of Friction? Property Rights and Contract in the "Newtonian" World of On-Line Commerce*, 12 BERKELEY TECH. L.J. 115, 119–20 (1997); Sharon K. Sandeen, *A Contract by Any Other Name Is Still a Contract: Examining the Effectiveness of Trade Secret Clauses to Protect Databases*, 45 IDEA: J.L. & TECH. 119, 147 (2005).

180 *See* Molly Shaffer Van Houweling, *The New Servitudes*, 96 GEO. L.J. 885, 930–32 (2008).

181 *Id.* at 931.

182 *Id.* at 906.

contract, but also for infringement of the IP.[183] This Article notes but does not attempt to resolve these uncertainties, and relies instead on the common sense observation that however courts resolve them will make contractual protections either stronger or weaker. Regardless of the outcome, contracts will continue to play an important role.

Despite all the uncertainty surrounding contract provisions as they relate to digital files, one certainty is that a user must have notice of the terms.[184] Notice becomes crucial if anyone removes the terms from the file such that downstream recipients receive the file without notice of or assent to the terms: such recipients will be free from the contractual obligations. This can significantly weaken the power of contracts for those seeking to control downstream uses.

The weaknesses and uncertainties of contractual provisions will lead creators to consider using extralegal protection avenues. Specifically, technological protection measures (TPM) can include digital rights management (DRM), file comparison methods, and file tracking methods. DRM can control the access, use, and distribution of files through encryption.[185] Many see DRM as an important part of 3D printing's future, and companies have even patented DRM strategies.[186] In addition, file comparison methods use sophisticated algorithms to compare two files to see if one is a copy of the other. File tracking methods allow a party to track where a particular file (including copies thereof) have been sent, downloaded, and used.[187] Another TPM is a model whereby the seller does not sell the file to the buyer, but only

---

183 *See, e.g.*, Impression Prods., Inc. v. Lexmark Int'l, Inc., 137 S. Ct. 1523 (2017) (holding that authorized sales of patented products exhausted patent rights in the product, but not clearly addressing when and whether leases of products would exhaust patent rights); Kirtsaeng v. John Wiley & Sons, Inc., 568 U.S. 519 (2013) (holding that an authorized, foreign sale of copyrighted books exhausted the copyright protection for those books); John F. Duffy & Richard Hynes, *Statutory Domain and the Commercial Law of Intellectual Property*, 102 VA. L. REV. 1 (2016); Orly Lobel, *From Status to Contract in Intellectual Property Law*, 96 B.U. L. REV. 869 (2016); Guy A. Rub, *Copyright Survives: Rethinking the Copyright-Contract Conflict*, 103 VA. L. REV. 1141 (2017); Van Houweling, *supra* note 180.

184 Thomas M.S. Hemnes, *Restraints on Alienation, Equitable Servitudes, and the Feudal Nature of Computer Software Licensing*, 71 DENV. U. L. REV. 577, 594 (1994).

185 *See, e.g.*, Julie E. Cohen, *DRM and Privacy*, 18 BERKELEY TECH. L.J. 575, 580–88 (2003) (describing various types of DRM).

186 *See, e.g.*, U.S. Patent No. 8,286,236 (issued Oct. 9, 2012). The patent, titled "Manufacturing Control System," contains claims directed to the concept of associating digital manufacturing files with authorization codes. *Id.* A machine (e.g., a 3D printer) will not print an object unless it receives the file's authorization code and the code indicates the file is eligible to be printed (e.g., it is lawfully purchased). *Id.*

187 *See* Andre, *MarkAny Develops DRM and Piracy Protection for 3D Print Files*, 3DERS.ORG (Mar. 31, 2016), http://www.3ders.org/articles/20160331-markany-develops-drm-and-piracy-protection-for-3d-print-files.html (describing TPM such as "Feature Extraction, which is capable of extracting information from a particular design and examining it against other similar designs to better prevent piracy; Digital Forensics, a feature which essentially watermarks digital designs and can track ownership information if a leak does occur").

streams the data to the buyer's 3D printer for a single print.[188] Much like streaming a movie, with this technology the buyer never retains the digital file and thus cannot copy it or share it with others.

Of course, technologically sophisticated users can get around TPM. Codes can be cracked, tracking software can be removed, and streamed data can be captured and then shared. Although the Digital Millennium Copyright Act prohibits circumvention of some DRM, the prohibition only applies to works protected by copyright law.[189] Thus, it would not be unlawful to circumvent DRM that protects noncopyrightable files.[190]

This Part provided an overview of the legal doctrines and technological means most salient to controlling various digital works, and considered the legal and practical boundaries of these doctrines. The next Part analyzes how the law should integrate and take account of these doctrines and boundaries to channel works to the appropriate protection.

III. NORMATIVE CHANNELING

Untethered from the strictures of legal doctrine, this Part turns to how the law should treat digital works, with special attention to channeling the works to the appropriate IP regime (or perhaps away from IP altogether). The law currently treats many digital works in largely the way it should. Copyright law covers digital movies, songs, and art, as one would expect given the extensive creativity inherent in such works.[191] But utilitarian application programs and digital

188 *See* Tom Simonite, *Copy Protection for 3-D Printing Aims to Prevent a Piracy Plague*, MIT TECH. REVIEW (Aug. 27, 2013), http://www.technologyreview.com/news/518591/copy-protection-for-3-d-printing-aims-to-prevent-a-piracy-plague.

189 17 U.S.C. § 1201(a)(1) (2012) ("No person shall circumvent a technological measure that effectively controls access to a work *protected under this title*." (emphasis added)).

190 On the other hand, some companies have made the argument that part of the TPM itself is a copyrightable work such that the sale of circumvention devices violates the DMCA's anti-trafficking provision regarding access controls under 17 U.S.C. § 1201(a)(2). *See* Chamberlain Grp., Inc. v. Skylink Techs., Inc., 381 F.3d 1178 (Fed. Cir. 2004). The anti-trafficking provisions are designed to prevent someone from creating or distributing programs that will circumvent TPMs if those programs were "primarily designed" or have "only limited commercial significant purpose or use other than to circumvent" TPMs that protect copyrighted works. Thus, if a given TPM protected access to only a proportionally few noncopyrighted files, trafficking in a circumvention program would violate the DMCA. If, on the other hand, the TPM protected proportionally many noncopyrighted works, the circumvention program would not be "primarily designed" or have "only limited commercially significant purpose or use other than to circumvent" TPMs that protected copyrighted works. *See* 17 U.S.C. § 1201(a)(2). *Compare Chamberlain*, 381 F.3d at 1202 ("We conclude that 17 U.S.C. § 1201 prohibits only forms of access that bear a reasonable relationship to the protections that the Copyright Act otherwise affords copyright owners."), *with* MDY Indus., L.L.C. v. Blizzard Entm't, Inc., 629 F.3d 928, 950 (9th Cir. 2010) (refusing to read a nexus requirement into the statute).

191 That is not to say that the current copyright term is the optimal length, but that is an analysis beyond the scope of this Article.

manufacturing files of utilitarian objects contain minimal creativity, and protecting them with a copyright system designed to incentivize creativity risks misallocating the IP system's powers.[192]

Any undertaking to assess proper IP protection and channeling must bear in mind that our economic system operates on a background assumption of freedom to copy. "In general, unless an intellectual property right such as a patent or copyright protects an item, it will be subject to copying."[193] Further, "free exploitation of ideas will be the rule, to which the protection of a federal patent [or other IP] is the exception."[194] Following the incentive rationale that undergirds most of the U.S. IP system, the law should seek to protect digital files from copying if such protection is necessary to maintain adequate incentives for people to create and disseminate them. Absent IP or other barriers, the cost of digital copying is virtually zero. Thus, creators likely need some appropriability mechanism to recoup their costs to maintain incentives to create.[195] But that does not necessarily mean creators need IP laws.

A. *Utilitarian Digital Manufacturing Files*

One set of computer programs (broadly defined), digital manufacturing files, require careful analysis. To reemphasize an earlier point, if the file will manufacture a creative object, copyright law does and should provide protection. But files that will manufacture purely utilitarian objects require a more nuanced analysis.

Whether patent law should protect digital manufacturing files of utilitarian objects is in some ways straightforward. Because the files are utilitarian in nature, they fit comfortably within the patent system. Assuming that the underlying physical objects otherwise meet the requirements for patentability such as novelty and nonobviousness,[196] extending robust patent protection to the files aligns with the patent system's policy parameters.[197] For this reason, I believe that courts or

---

192 *See, e.g.*, Jeanne C. Fromer, *Should the Law Care Why Intellectual Property Rights Have Been Asserted?*, 53 HOUS. L. REV. 549, 587–88 (2015); Reichman, *supra* note 7, at 802.

193 TrafFix Devices, Inc. v. Mktg. Displays, Inc., 532 U.S. 23, 29 (2001).

194 Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989).

195 *See* Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575 (2002).

196 This is an important caveat. In no way should patent law protect files that will manufacture known or obvious things. A person does not need a patent's strong incentive to digitize a known or obvious object. Such a patent would block the progress of science by imposing barriers to noninventive files.

197 For an inquiry into whether the decreased innovation costs associated with digital manufacturing suggest that patents in this area may benefit from recalibration, see generally Osborn et al., *supra* note 10.

Congress should adopt either Dan Brean's proposal for patent claims directed to digital manufacturing files[198] or Tim Holbrook's and my proposal for a doctrine of digital patent infringement.[199]

True, the likelihood of a legislative or judicial adoption of such proposals is uncertain at best. At the same time, it is important to recognize that current patent law provides protection for files in at least two ways. First, through direct infringement against those who "make" a file covered by a *Beauregard* claim.[200] Second, through indirect infringement against those who knowingly sell files that will print patented objects.[201] These incentives, though perhaps sub-optimal, are better than nothing.

Given the current lack of adequate patent protection for digital manufacturing files of inventive objects, and the fact that patents protect only novel and nonobvious inventions, courts will be tempted to protect files via copyright. On the whole, I think this is a mistake, though the consequences would be varied. Copyright protection would, for example, fill a gap for those patentable inventions whose value is eroded by difficulties of patent enforcement against digital files. But copyright protection for files would extend far beyond patentable objects and potentially encompass all files for utilitarian objects.

Copyright protection is about incentivizing *creativity*, not utilitarian inventions.[202] The miniscule creativity, if it may be called that, embodied in digital manufacturing files requires no exogenous stimulus.[203] Using copyright law to foster digital manufacturing files is thus misusing copyright law[204]; it is transposing the copyright system's

198 Brean, *supra* note 142, at 848–63.

199 Holbrook & Osborn, *supra* note 124, at 1353–69.

200 *See supra* text accompanying notes 141–50.

201 *See supra* text accompanying note 132.

202 *See* Viva R. Moffat, *The Copyright/Patent Boundary*, 48 U. RICH. L. REV. 611, 611–12 (2014).

203 The effort—or sweat of the brow—required to make the file might require some stimulus, but that effort is not geared toward generating creativity and is not protectable in the United States. *See* Feist Publ'ns, Inc., v. Rural Tel. Serv. Co., 499 U.S. 340, 359–60 (1991). Other countries continue to endorse a sweat of the brow doctrine. *See* Directive 96/9/EC, of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 O.J. (L 77) (protecting databases). U.K. law traditionally endorsed a version of the sweat of the brow doctrine (i.e., originality means a result of author's own skill, labor, judgment, and effort). *See, e.g.*, Indep. Television Publ'ns Ltd. v. Time Out Limited Ltd. & Elliot [1984] Ch 64 (Eng.). But recent European Union decisions have put pressure on that view. *See, e.g.*, Case C-5/08, Infopaq Int'l A/S v. Danske Dagblades Forening, 2009 E.C.R. I-6569; Football Dataco Ltd. v. Yahoo! U.K. Ltd., C-604/10, March 1, 2012 (ECJ); Andreas Rahmatian, *Originality in UK Copyright Law: The Old "Skill and Labour" Doctrine Under Pressure*, 44 INT'L REV. INTELL. PROP. & COMPETITION L. 4, 6 (2013) (arguing that it is not clear how much E.U. law has changed U.K. law).

204 By misuse I do not necessarily mean unjustifiable as a matter of innovation policy generally, because copyright protection may be the best available option among viable alternatives. Rather, I mean that protecting these utilitarian files does not follow from the purposes of copyright law. *See, e.g.*, David G. Luettgen, *Functional Usefulness vs.*

policy-balancing to a utilitarian realm for which it was not designed.[205]

On the other hand, copyright law used to protect maps and charts, which were primarily utilitarian works, without regard to creativity.[206] And copyright protects most computer software, much of which is primarily utilitarian and thus a poor fit for copyright theory. But we have reached a relative détente with most software because many believe *some* protection is needed against literal software copying to maintain utilitarian incentives, and thin copyrights seem to do the trick.

One objection to using copyright law might be that its extremely long term—currently life of the author plus seventy years for most works[207]—results in overprotection. While the term is long, copyright law has a salutary feature in that independent creation will not give rise to liability.[208] Moreover, for works based on noncopyrighted subjects (mountains, wrenches, etc.), a second artist is free to copy the noncopyrighted subject.[209] For files of utilitarian objects, this means that copyright law (if it is assumed to apply) will not prevent a second party from creating its own file of the exact same object, as long as it does so from scratch.[210] In reality therefore, copyright for files offers practical protection only for the time and effort it takes another party

---

Communicative Usefulness: Thin Copyright Protection for the Nonliteral Elements of Computer Programs, 4 TEX. INTELL. PROP. L.J. 233, 252 (1996) ("Copyright law should not provide any protection to computer programs for the simple reason that computer programs are not within the domain of copyright."); *cf. Feist*, 499 U.S. at 359–60 (rejecting a "sweat of the brow" rationale for protecting factual compilations that lacked a modicum of creativity); Comput. Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 712 (2d Cir. 1992) ("Generally, we think that copyright registration—with its indiscriminating availability—is not ideally suited to deal with the highly dynamic technology of computer science. Thus far, many of the decisions in this area reflect the courts' attempt to fit the proverbial square peg in a round hole. . . . While incentive based arguments in favor of broad copyright protection are perhaps attractive from a pure policy perspective, ultimately, they have a corrosive effect on certain fundamental tenets of copyright doctrine." (citing Lotus Dev. Corp. v. Paperback Software Int'l, 740 F. Supp. 37, 58 (D. Mass. 1990))).

205 *See, e.g.*, H. SUBCOMM. ON INTELLECTUAL PROP. & THE ADMIN. OF JUSTICE, 102 CONG., PATENT-COPYRIGHT LAWS OVERLAP STUDY 88 (Comm. Print 1991) (stating that protection of functionality "is assigned to patents where a much more rigorous test must be undergone and the barriers to entry, in terms of time, cost, and complexity, are higher"); Viva R. Moffat, *Mutant Copyrights and Backdoor Patents: The Problem of Overlapping Intellectual Property Protection*, 19 BERKELEY TECH. L.J. 1473, 1512–13 (2004); *cf.* Reichman, *supra* note 7, at 830–32 (arguing against allowing the output of CAD files to claim copyright protection on a theory that the output is a joint work with the copyrightable file).

206 *See, e.g.*, Weinreb, *supra* note 33, at 1181–83.

207 17 U.S.C. § 302 (2012).

208 *See, e.g.*, Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936).

209 Osborn, *Limits of Creativity*, *supra* note 38, at 63 n.181.

210 Even assuming protectable creativity in the file, the creativity is in the arrangement of the various commands and text, not in the resulting utilitarian object (e.g., a hammer). As long as the second person bases her file on a physical hammer and does not copy the code verbatim, there is no copyright infringement. The same is true for software performing utilitarian functions.

independently to create the same file. Thus, one might ask, what is the harm of permitting copyright protection?

One response is that even the modest costs of creating digital manufacturing files from scratch impedes proliferation. 3D printing technology heralds a new era of numerous, global, rapid, and incremental improvements that in the aggregate amount to a flood of innovation. Allowing others freely to copy the files reduces friction and speeds the cycle. True, users can independently create the same utilitarian file, but this slows progress and is often wasteful.[211] And uncertainty as to who has what rights may lead to foregone opportunities.

Even granting those objections, one might argue that copyright protection has similar effects in the realm of traditional software, and yet protection persists. But digital manufacturing files' longer useful life, manipulability, and ease of copying distinguish them from traditional application software. Laypeople will more easily copy, alter, and build upon digital manufacturing files as compared to traditional software. Though it is not prohibitively difficult to copy traditional software, many users probably do not know how to (i.e., many laypeople will not know where to find the pertinent files). Comparatively, copying a digital manufacturing file is as easy as copying an MP3 file. More pointedly, whereas most laypeople would not know how to modify application programs, CAD environments make it relatively easy to modify a digital manufacturing file.

Laypeople's ability to easily copy and modify digital manufacturing files will lead to copious accidental infringement if copyright protection exists. Copyright protection attaches automatically, which means an uncountable number of protected files would circulate the Internet.[212]

---

211 *See* Stephen Breyer, *The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs*, 84 HARV. L. REV. 281, 348 (1970); Joseph Farrell, *Standardization and Intellectual Property*, 30 JURIMETRICS J. 35, 49 (1989) ("[I]t is inefficient to protect the aspects of an innovation that, for efficiency, should be imitated; it is also inefficient to protect the arbitrary choices whose commercial value is created solely by the network incentives to imitate—and to protect the useful ideas only indirectly by protecting these ancillary innovations. Such protection not only seems likely to have adverse consequences on compatibility, but also protects only indirectly and haphazardly the useful ideas, the costs of whose creation intellectual-property policy is meant to cover."); Weinreb, *supra* note 33, at 1179 ("In the context of works that have only functional value, a prohibition of lazy copying is the equivalent of a requirement simply of variation, which, as far as the works themselves are concerned, might be regarded as socially useless and wasteful."). It is possible that, forced to recreate the file from scratch, a second-comer might discover an improvement, but it is unclear how necessary independent creation is to the process of generating improvements. It may be that copying (and thus obtaining) the file more quickly and cheaply allows an imitator to study the file and the physical object more quickly and thus to improve it.

212 The phenomenon is not limited to the United States. Copyright protection attaches automatically for all signatories to the Berne convention, which includes most countries. *See* Berne Convention for the Protection of Literary and Artistic Works art. 5(1), Sept. 9, 1886, 102 Stat. 2853, 828 U.N.T.S. 221. Inexpensive access to utilitarian files may take on a more urgent

Additionally, infringement does not require intent. It requires copying, but the act of copying a file, even absent any knowledge of copyright protection, will constitute infringement.

The absence of an intent requirement raises another normative dimension. Unlike MP3 files, news stories, and movies, where society understands, however imperfectly, that copyright protections exist, laypeople are unlikely to expect that copyright protects digital manufacturing files of utilitarian objects. Of course, if we decide the files should be protected by copyright for other reasons, then ignorance of the law is no excuse to infringement.

But given the questionable grounds for protecting the files with copyright, the costs of litigation push further against granting copyright protection. Any litigation entails obvious financial and emotional costs, and copyright litigation is no exception. Further, the presence of innumerable copyright-protected files coupled with unsuspecting and unwitting infringers is a recipe for copyright "trolls" and social discontent. Much as they have done with Internet news content and movies,[213] "trolls" can acquire rights to digital files and sue unsuspecting infringers. Regardless of who sues them, people become outraged when sued for things they do not understand to be wrong. Observers of such litigation likewise become angry. The result would likely be a metaphorical black eye for the copyright system.

Moreover, digital manufacturing files differ from many software applications in that the former will enjoy longer useful lives. Many software applications enjoy a relatively short useful life before they are obsolete. This rapid obsolescence renders the majority of the software's copyright term inconsequential: no one cares enough to copy the software after it is useless. Thus, the window for copyright infringement is short, and concerns about an overly long copyright protection period largely disappear for pragmatic reasons. Digital manufacturing files of useful objects, in contrast, will typically enjoy long lives. A hammer or wrench will likely be just as useful one hundred years from now as today (assuming the file format has not become obsolete). The files' long lives mean that the long copyright term is salient. An innocent individual ninety-five years from now might accidentally infringe the copyright. The logistics of trying to determine which utilitarian files are protected by copyright would be next to impossible in many cases.

In sum, copyright protection for purely utilitarian manufacturing files is not only a poor fit doctrinally, but also in many ways

character for less wealthy countries. *See, e.g.*, J.M. Pearce et al., *3-D Printing of Open Source Appropriate Technologies for Self-Directed Sustainable Development*, 3 J. SUSTAINABLE DEV. 17, 17–18 (2010).

213 *See, e.g.*, Matthew Sag, *Copyright Trolling, an Empirical Study*, 100 IOWA L. REV. 1105, 1111–13 (2015) (discussing copyright trolls).

normatively. One may query whether copyright protection is the best available option to offer *some* form of protection, in which case the utilitarian argument for copyright protection would persist. As explained in the following Sections, however, copyright protection is not needed to incentivize these creations.

When examining the dynamics of noncopyright/patent protection for digital manufacturing files, it is helpful to distinguish between files for simple devices versus those for highly complex devices. The need for and methods of appropriability for each category will differ.

1. Relatively Simple Digital Manufacturing Files

Files for simple utilitarian devices will generally be easy to create and will require little investment of time or money. Correspondingly, they need little incentive, in the form of appropriability mechanisms, to foster their development, even where the costs of copying are essentially zero. This suggests that copyright protection may not be needed.

Indeed, despite our system's emphasis on monetary incentives, many people create for nonmonetary reasons. These include the joy of creation, a desire to help others, and a desire to garner reputational rewards.[214] For many simple files, nonmonetary incentives will help or even sufficiently encourage creation and dissemination. Evidence for this phenomenon abounds in the open hardware movement[215] and on websites such as thingiverse.com, which offer printable files for free.

Monetary incentives can of course further encourage creations. Assuming the files do not enjoy protection under copyright or patent law, other legal, normative, and technological means exist through which the creator can monetize a creation. For relatively simple files, nonlegal appropriability mechanisms will play a prominent role.

The first nonlegal mechanism is well known: lead time advantage. Digital copying is instantaneous, suggesting lead time might be zero.[216] In fact, the copyist faces an informational asymmetry from not knowing which files are worth copying and selling. The copyist must often wait to figure out which files are popular before deciding to copy them.[217]

---

214 *See, e.g.*, Jeanne C. Fromer, *Expressive Incentives in Intellectual Property*, 98 VA. L. REV. 1745, 1760 (2012); Osborn et al., *supra* note 10, at 1228–29.

215 *See, e.g.*, Daniel K. Fisher & Peter J. Gould, *Open-Source Hardware Is a Low-Cost Alternative for Scientific Instrumentation and Research*, 1 MOD. INSTRUMENTATION 8, 8–9 (2012); Joshua M. Pearce, *Building Research Equipment with Free, Open-Source Hardware*, SCI., Sept. 14, 2012, at 1303.

216 *See, e.g.*, Reichman, *supra* note 7, at 835–37 (arguing for sui generis protection for digital works to create lead time). The works at the center of Professor Reichman's study generally required much more investment to create as compared to simple digital manufacturing files.

217 On the other hand, technology allows wholesale copying of another's content on an essentially real-time basis. *See* Craigslist Inc. v. 3Taps Inc., 942 F. Supp. 2d 962, 966 (N.D. Cal.

During this time, the original creator can make a financial return on the file.

Second, community norms may also allow creators to earn money for their simple files. A copyist must find an appropriate platform through which to sell the copied file and notify would-be purchasers of that channel. The copyist may not be able to use the same platform as the original creator because moderator rules or community norms may preclude or frown upon copies. Moreover, some purchasers may prefer to buy from the original creator even if it costs more. If so, the original creator may enjoy continued sales on the original platform (though admittedly less than in the absence of competition).[218] Where the costs of creation are small, such sales may be sufficient incentive to create.

Third, TPM can prevent or at least slow the copying of files and provide creators with tracking information to discover those who breach contractual restrictions.[219] TPMs are not perfect, and dedicated hackers can circumvent them.[220] But circumvention likely does not pose an existential threat to manufacturing files for relatively simple objects. In most cases, a would-be copier would only bother to circumvent DRM if the file was already selling well (who wants to access or disseminate worthless files?). By that time, the creator has earned a decent return on a minimal investment and can continue to sell directly to those who want to buy from the originator.

Besides nonlegal appropriability regimes, the legal system outside of utility patent and copyright law offers avenues for remuneration. For example, design patent law—which, as discussed, requires less creativity than copyright law—offers protection to utilitarian objects embodying ornamental design features.[221] It is true that *purely* utilitarian objects should not qualify for design protection, but the low threshold for ornamentality means that a fair number of objects will qualify.[222]

As compared to copyright protection's flaws discussed above, design patents offer certain advantages. First, to obtain a design patent, the design must be novel and nonobvious,[223] a more rigorous standard that will limit protection to fewer files than copyright.[224] In addition, the

---

2013) (discussing allegations that defendant republished Craigslist's online advertisements by scraping the listings "in real time, directly from the Craigslist website" so as to "essentially replicate[] the entire Craigslist website"). Such technology may divert some sales instantaneously, but only to those who know of and patronize the copier's marketplace.

218 There is also the possibility of seeding rival sites with corrupt files that appear to be the copycat file, though this might contravene some people's sense of ethics.

219 *See supra* notes 185–88 and accompanying text (discussing TPMs).

220 *See, e.g.*, David Fry, *Circumventing Access Controls Under the Digital Millennium Copyright Act: Analyzing the SecuROM Debate*, 2009 DUKE L. & TECH. REV. 5.

221 *See* 35 U.S.C. § 171(a) (2012).

222 *See supra* note 153 and accompanying text (discussing ornamentality).

223 35 U.S.C. §§ 102–03.

224 Because design patent protection will extend to fewer files than if the law protected all

term, fifteen years from the date of filing,[225] is far shorter than the copyright term. Thus, files will enter the public domain more quickly, allowing others to use and build upon them freely. On the other hand, although copyright law's formal term is longer, its practical term is much shorter because independent creation is a defense in copyright, but not in design patent infringement.[226]

Assuming that design patent law is well calibrated or even needed to incentivize ornamental design, propositions not free from doubt,[227] extending some protection to digital manufacturing files of ornamental objects makes sense.[228] Note, however, that design patents suffer from weaknesses similar to utility patents because they do not cover files in the abstract.[229] Mere file transfers, therefore, should not constitute direct infringement. And although indirect infringement claims are available against purveyors of digital files, they may underprotect the right holders who must prove knowledge and intent to infringe. Again, assuming the design patent system is well calibrated, one could argue to extend design patent protection to the files directly, just as I argued should be done with utility patents.[230]

In addition to design patents, trademark law can provide creators with protections, though there are limits. As discussed in Section II.C, trade dress protection will not apply to purely utilitarian objects, and trademark protection may not extend to trademarks appearing "inside" the digital manufacturing files under *Dastar*.[231] As I have argued elsewhere, ignoring marks inside of a digital file comports with trademark law's concerns for consumer confusion and avoids overlap

files via copyright, some may argue that copyright protection would be necessary to fill the gap. For reasons already discussed, I think the argument is unpersuasive.

225 *See* 35 U.S.C. § 173.

226 *See* Roger D. Blair & Thomas F. Cotter, *Strict Liability and Its Alternatives in Patent Law*, 17 BERKELEY TECH. L.J. 799, 800–01 (2002).

227 *See* Orit Fischman Afori, *Reconceptualizing Property in Designs*, 25 CARDOZO ARTS & ENT. L.J. 1105, 1134–35 (2008) (arguing design patent protection is too broad); Barton Beebe, *Intellectual Property Law and the Sumptuary Code*, 123 HARV. L. REV. 809, 862 (2010) (arguing that design protection laws, including design patent laws "are probably the clearest examples we have of the 'functional transformation' of intellectual property law into a body of law being used not simply to 'promote the Progress,' but also, and in tension with that goal, to preserve our system of consumption-based differentiation in the face of copying technology that threatens to undermine it"); Daniel H. Brean, *Enough Is Enough: Time to Eliminate Design Patents and Rely on More Appropriate Copyright and Trademark Protection for Product Designs*, 16 TEX. INTELL. PROP. L.J. 325, 330–53 (2008) (arguing that the design patent system is no longer needed because of growth in trade dress and copyright protection).

228 Primarily for the utilitarian reasons that justify the design patent system as a whole. One could also justify design patent protection to prevent another regime from filling a perceived void. *See* Reichman, *Legal Hybrids*, *supra* note 51, at 2464 (arguing that underprotection for designs has historically led to the aggrandizement of copyright law to protect what design law should protect).

229 See *supra* note 140 and accompanying text.

230 *See supra* notes 196–99 and accompanying text.

231 Dastar Corp. v. Twentieth Century Fox Film Corp., 539 U.S. 23 (2003).

with other IP laws.[232]

Yet trademark law has an important role to play in protecting consumers' associations with the trademarks (often usernames) adopted by file creators and website hosts. Creators and hosts can establish reputations as sources for quality manufacturing files because good files require attention to detail if they are to result in a functioning printed object.[233] In the ocean of files available on the Internet, many purchasers will be willing to pay a premium for a trusted source.[234] As a result, the marks used by creators and websites will reduce consumer search costs by allowing consumers to rely on the marks as short-hand for indicators of quality.[235] If another party adopts the same username or website name, material consumer confusion can result.[236] Trademark protection will also incentivize creators to invest in creating quality files (and sites to host quality files) because the reputational benefits will inure to the mark holder.[237]

Trade secrecy offers another potential avenue for protection, but it seems an unlikely candidate for relatively simple mass-distributed files. As its name implies, trade secret protection requires that the thing protected remain a secret. But when a creator shares an STL or similar file for the world to see, secrecy is lost.[238] A creator could try to circumvent this problem by distributing the file only in object code[239] or by streaming the file directly to the user's printer. But mass distributing the file in object code will often be impractical because object code needs to be calibrated to a particular 3D printer, rendering the file useless for other 3D printers.[240] More importantly, the seller generally

---

232 McKenna & Osborn, *supra* note 166, at 1451–56; Osborn, *Trademark Boundaries*, *supra* note 166, at 886–92.

233 *See, e.g.*, *Identifying and Repairing Common Mesh Errors*, SIMPLIFY3D, https://www.simplify3d.com/support/articles/identifying-and-repairing-common-mesh-errors (last visited Mar. 8, 2018).

234 *Cf.* Gady Epstein, *Mass Entertainment in the Digital Age Is Still About Blockbusters, Not Endless Choice*, ECONOMIST (Feb. 11, 2017), http://www.economist.com/news/special-report/21716467-technology-has-given-billions-people-access-vast-range-entertainment-gady ("Paradoxically, enabling every individual and product on the planet to find a market has made it next to impossible for the market to find them."). Copiers can, however, earn reputations for quality copies, thus reducing the impact of reputational returns to original creators.

235 *See* McKenna & Osborn, *supra* note 166, at 1460; Osborn, *Trademark Boundaries*, *supra* note 166, at 889.

236 *See* McKenna & Osborn, *supra* note 166, at 1467–69; Osborn, *Trademark Boundaries*, *supra* note 166, at 889.

237 *See* Osborn, *Trademark Boundaries*, *supra* note 166, at 889.

238 *Cf.* Warehouse Sols., Inc. v. Integrated Logistics, L.L.C., 610 F. App'x 881, 885 (11th Cir. 2015) (rejecting trade secret claim to a computer program's look and feel and functionality, stating that dissemination of the software to users "necessarily revealed the information [plaintiff] alleges to be secret (i.e., the program's 'features and functions')").

239 Courts have maintained the trade secrecy status of program files' source code when the file is only distributed in object code. *See, e.g.*, Q-Co Indus., Inc. v. Hoffman, 625 F. Supp. 608, 617–18 (S.D.N.Y. 1985).

240 *See* Osborn, *Limits of Creativity*, *supra* note 38, at 32.

must show the buyer an image of the device before the buyer can decide to purchase it, and the disclosure of the picture likely destroys trade secrecy protection for simple devices. Finally, even if a creator streams the file to the printer, a purchaser can likely reverse engineer the file by simply studying the printed object. If a purported trade secret is easily discoverable, it will not constitute a trade secret.[241]

A would-be trade secret holder could attempt to avoid the loss of secrecy by forcing the purchaser to agree by contract to a no-reverse-engineering clause, but this will not likely work. Even if the clause is enforceable, if a bystander who is not bound by the clause can easily understand how to make the object, secrecy will be lost.[242] More controversially, contract clauses that prohibit reverse engineering pit competition law, including trade secrecy law's endorsement of reverse engineering, against the policy in favor of freedom to contract. Generally, clauses that prohibit reverse engineering are enforceable under *contract* law.[243] But the act of reverse engineering and use of the information gleaned therefrom will not necessarily constitute *trade secret* misappropriation.[244]

From an incentive standpoint, trade secret protection for relatively simple files seems unnecessary and undesirable because the creators expend little effort making them. Allowing trade secret protection for files that are widely shared or easily reverse engineered makes little sense doctrinally or normatively. Trade secret protection can last

---

241 *See* UNIF. TRADE SECRETS ACT § 1 cmt. (UNIF. LAW COMM'N 1985) ("Often, the nature of a product lends itself to being readily copied as soon as it is available on the market."); Sandeen, *supra* note 179, at 135.

242 Agreements to keep things confidential might be enforced as a matter of contract but should not create a trade secret when there is no secret. *See* Sandeen, *supra* note 179, at 144 ("[T]he problem with many trade secret clauses, particularly those that are included in online terms of use agreements, is that the information to be protected was not secret at the time the alleged agreement was entered into. In the event the information was secret at some point in time, it quickly lost its secrecy when it was widely distributed without adequate efforts to maintain its secrecy. The fact that the information may have been distributed pursuant to a blanket confidentiality agreement contained in a terms of use agreement does not change this result because contracts cannot create trade secrets."); *see also* UNIF. TRADE SECRETS ACT § 7(b) (stating that the UTSA does not affect contractual remedies).

243 *See, e.g.*, Bowers v. Baystate Techs., Inc., 320 F.3d 1317, 1325–26 (Fed. Cir. 2003) ("[P]rivate parties are free to contractually forego the limited ability to reverse engineer a software product under the exemptions of the Copyright Act."); Davidson & Assocs. v. Internet Gateway, 334 F. Supp. 2d 1164 (E.D. Mo. 2004), *aff'd sub nom.* Davidson & Assocs. v. Jung, 422 F.3d 630 (8th Cir. 2005). *But see* David A. Rice, *Public Goods, Private Contract and Public Policy: Federal Preemption of Software License Prohibitions Against Reverse Engineering*, 53 U. PITT. L. REV. 543, 624–26 (1992) (arguing for limits on no-reverse-engineering clauses).

244 *See, e.g.*, Aqua Connect, Inc. v. Code Rebel, L.L.C., No. CV 11-5764-RSWL (MANx), 2012 WL 469737, at *4–8 (C.D. Cal. Feb. 13, 2012) (rejecting trade secret claim where plaintiff argued defendant used "improper means" by reverse engineering in violation of a standard form contract because reverse engineering is not improper means, but noting that the same acts may give rise to a breach of contract claim); Sandeen, *supra* note 179, at 144.

indefinitely.[245] If courts upheld mass-marketed contractual terms creating trade secrets where none otherwise exist, society would lose much of its ability to use and build off of these files.[246] In addition, the incongruity between a legal right based on secrecy and society's practical experience with the files and objects as widely available would likely lead to a normative backlash.[247] Trade secrecy is thus a poor fit for mass-marketed, simple design files.

The most accessible form of legal protection for laypeople may be contracts. Creators can insert various clauses into the terms of sale, such as price, warranties, disclaimers, etc. Generally, courts will enforce parties' private arrangements as long as notice of terms is given and the terms are not unconscionable or contrary to clear public policy.[248] Each of these conditions to contractual enforceability, however, can pose hurdles.

Providing notice of terms to direct purchasers or lessees presents little problem because the seller can provide the terms prior to the purchase. If that purchaser resells or gives the file away for free to others, however, the downstream purchasers may not have notice of the original seller's terms. Because the original seller is not in privity with downstream transferees, the seller generally has no breach of contract action against them.[249] Sellers may attempt to circumvent this by adding "pop up" contracts to the file that will force downstream users to agree to the same terms. This strategy may work against some, but all it takes is one user to strip the terms from the file, after which subsequent recipients of that version will take the file without notice of the original contractual terms.[250] Even assuming pop-up terms remain in files, the sheer number of files, each of which may have its own unique terms, presents information processing problems and potentially exponential transactional costs.[251] People are willing to invest only so much time studying those terms, especially for low-value items.

Aside from notice problems, some contract terms may be unenforceable because they contravene public policy. Terms that

---

245 *See, e.g.*, Patrick Soon & Rebecca Bellow, *The Top Four Advantages of Trade Secret Protection*, WHGC, https://www.whglawfirm.com/Top-4-Advantages-of-Trade-Secret-Protection.shtml (last visited Mar. 8, 2018).

246 *See* Sandeen, *supra* note 179, at 154 (noting that false assertions of trade secret rights hampers competition).

247 *Cf. id.* at 152–53 (noting wrongful assertions of trade secrecy are against public policy).

248 For support of this general statement, see, e.g., Carolyn Edwards, *Freedom of Contract and Fundamental Fairness for Individual Parties: The Tug of War Continues*, 77 UMKC L. REV. 647, 647–53 (2009).

249 *See, e.g.*, RESTATEMENT (SECOND) OF CONTRACTS § 17 (AM. LAW INST. 1981) (requiring manifestation of assent); Merges, *supra* note 179, at 119. The person removing the terms may be breaching the contract.

250 *See, e.g.*, Merges, *supra* note 179, at 122 (noting the possibility that contractual terms can be stripped out); Rub, *supra* note 183, at 1213 (noting ways to avoid contractual terms).

251 *See* Van Houweling, *supra* note 180, at 914–16.

purport to limit the purchasers' rights, such as "single use only" or "no resale" provisions, conflict with venerable public policies against servitudes and restraints on alienation.[252] Courts have historically strongly disfavored such restraints and servitudes (restraints that purport not only to bind the immediate purchaser, but also to "run with the goods"),[253] although that view has evolved.[254]

IP rights have complicated the restraints and servitudes analysis,[255] but under this Article's view, most simple digital manufacturing files for purely utilitarian works will not enjoy any IP protection.[256] Although the lack of IP rights removes one layer of complexity and weakens the enforceability of restraints and servitudes, the remaining legal framework is complex and evolving.[257] A full analysis and critique of this body of law is beyond the scope of this Article, but a few points deserve attention.[258]

Most importantly, the granularity and flexibility of contracts suggest that they should play a central role in the protection of digital files.[259] Concurrently, a commitment to competition should guide the judicial approach. Contracts, if granted complete freedom, can embody private legislation[260] that interferes with IP regimes.[261] Contractual

---

252 *See, e.g.*, Kirtsaeng v. John Wiley & Sons, Inc., 568 U.S. 519, 539 (2013) (discussing the first sale doctrine in copyright law); JOHN CHIPMAN GRAY, RESTRAINTS ON THE ALIENATION OF PROPERTY 244 (2d ed. 1895) (stating that restraints on alienation "are inconsistent with that ready transfer of property which is essential to the well-being of a civilized community, and especially of a commercial republic").

253 *See, e.g.*, Van Houweling, *supra* note 180, at 906–14; *see also* Daryl Lim, *Self-Replicating Technologies and the Challenge for the Patent and Antitrust Laws*, 32 CARDOZO ARTS & ENT. L.J. 131, 200 (2013).

254 *See, e.g.*, Glen O. Robinson, *Personal Property Servitudes*, 71 U. CHI. L. REV. 1449, 1455–60 (2004) (reviewing cases); Alfred C. Server & William J. Casey, *Contract-Based Post-Sale Restrictions on Patented Products Following Quanta*, 64 HASTINGS L.J. 561, 622–25 (2013).

255 Server & Casey, *supra* note 254, at 625–35 (proposing an approach to assess the enforceability of contract-based post-sale restrictions under state law); Van Houweling, *supra* note 180, at 910–14.

256 For a hint at the complexities of the contract-IP interface, see *supra* note 183 and accompanying text.

257 *See generally* Robinson, *supra* note 254 (arguing for a liberalization in the law of personal property servitudes).

258 It is worth noting that one particular restraint, a clause prohibiting copying or the transfer of copies of the file, has no analog in the world of tangible property. If I sold you a physical widget, you could not effortlessly make exact copies of it (unless you were a magician). With digital files, however, copying is immediate and costless, reducing lead time advantages.

259 *See, e.g.*, Richard Epstein, Comment, *Notice and Freedom of Contract in the Law of Servitudes*, 55 S. CAL. L. REV. 1353 (1982) (arguing in favor of a strong freedom to contract); Merges, *supra* note 179, at 118–29 (noting ways in which contractual agreements can lead to efficient outcomes in cyberspace).

260 *See* Friedrich Kessler, *Contracts of Adhesion—Some Thoughts About Freedom of Contract*, 43 COLUM. L. REV. 629 (1943) (describing how contracts of adhesion can act as private legislation).

261 *See, e.g.*, David Nimmer et al., *The Metamorphosis of Contract into Expand*, 87 CALIF. L. REV. 17, 63 (1999) ("[I]f an author uses contract law to enlarge that monopoly to apply to

rights can infect multitudes of files with myriad terms, such that the files become over-encumbered and people cannot efficiently utilize and build off of them.[262]

Enforcement of servitude-like contractual restraints in works not otherwise protected by IP, if widely adopted, would recreate a type of IP regime, but without the corresponding benefits.[263] If the works do not qualify for congressionally determined IP protection, contract law should not be given such free reign as to mimic those rights, which could dampen socially beneficial uses and subvert a competitive economy,[264] not least because private parties do not take account of externalities created by private agreements, such as limits on follow-on innovation.[265] By failing to qualify for existing IP protections, society has already decided that the seller's arguments in favor of needed protections are outweighed by policies of free competition. This is especially true where the files are easy to create and require little incentive.

Of course, contracts only bind the parties that have consented to them, and the existence of even numerous contracts will not create a shadow IP regime. Discerning the limits of contracts has proved elusive, but a couple of observations are noteworthy. First, a more fully mature antitrust law guards against many anti-competitive practices.[266] Second, many courts have upheld such contractual restrictions,[267] and we have

---

exploitations beyond its congressionally sanctioned orbit, she is behaving illegitimately."); Maureen A. O'Rourke, *Drawing the Boundary Between Copyright and Contract: Copyright Preemption of Software License Terms*, 45 DUKE L.J. 479, 556 (1995) ("[T]he contractual use restrictions that set up 'private' copyright law seem fundamentally at odds with the policy of promoting the free flow of information."); Reichman, *supra* note 7, at 827–28.

262 *See* Merges, *supra* note 179, at 123 ("[M]any assets in the digital economy will conceivably become so encumbered that potential value-adding future users will be frustrated."); *see also* MARGARET JANE RADIN, REINTERPRETING PROPERTY 114 (1993) (arguing that "it is efficient to impose enough restraints now to prevent grantors from tying up resources for the future in ways that seriously reduce the scope of the free market"); *cf.* Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998) (noting underuse problems when too many rights holders can block people from using a resource).

263 *See* Sandeen, *supra* note 179, at 152–53 (arguing that contractual agreements to treat non-trade secrets as trade secrets is against public policy).

264 Here, I am put in the situation of arguing against private ordering in the name of free markets. This is not a new dilemma, and indeed exists in the long-standing disapproval of servitudes and restraints on alienation.

265 *See, e.g.*, Julie E. Cohen, Lochner *in Cyberspace: The New Economic Orthodoxy of "Rights Management,"* 97 MICH. L. REV. 462, 538–58 (1998); Mark A. Lemley, *Beyond Preemption: The Law and Policy of Intellectual Property Licensing*, 87 CALIF. L. REV. 111, 170 (1999).

266 *See* Robinson, *supra* note 254, at 1494–1515.

267 *See, e.g.*, Celeritas Techs., Ltd. v. Rockwell Int'l Corp., 150 F.3d 1354, 1359 (Fed. Cir. 1998) (involving a business-to-business contract); Universal Gym Equip., Inc. v. ERWA Exercise Equip. Ltd., 827 F.2d 1542, 1550 (Fed. Cir. 1987) (stating, in a business-to-business deal limiting defendant's use of information gleaned from reverse engineering, "[p]arties to a contract may limit their right to take action they previously had been free to take"); DB Riley, Inc. v. AB Eng'g Corp., 977 F. Supp. 84, 89 (D. Mass. 1997) (holding that plaintiff, in a

yet to see anything like a shadow IP regime.[268] Relatedly, courts tend to enforce restraints in business-to-business contracts more strictly than in consumer transactions.[269] Viral contracts of adhesion invite additional judicial scrutiny because they can proliferate exponentially on the Internet, and they call into question the nature of assent.[270]

At the same time, concerns over stifling webs of contract terms are mitigated somewhat by the ease with which one can independently create a similar digital manufacturing file. Without IP protection for the files, when licensing terms become too burdensome third parties can create competing files. Or a party might be willing to breach its contract and provide the file, without contractual limitations, to others. Contractual remedies are typically less generous than in IP, [271] perhaps making people more willing to break a contract than infringe on IP. For example, contractual remedies are compensatory in nature, not punitive, and generally must be proved to a reasonable certainty.[272] Copyright remedies, on the other hand, can include either "the copyright owner's actual damages and any additional profits of the infringer" or statutory damages of up to $150,000 per infringed work.[273]

Happily, this Article need not solve some of the seemingly intractable issues in contract law. Rather, it is enough to point out that contracts provide an avenue for appropriability in the absence of IP rights, and that avenue can be modulated depending on the outcome of the debates just described. Given lead-time and reputational advantages available to creators, even weak contract rights will provide a proportional return to files of modest complexity.

---

business-to-business deal, demonstrated a likelihood of success on its breach of contract claim regarding confidentiality even though the information was not a trade secret).

268 *See generally* Rub, *supra* note 183 (arguing that courts have moved toward accepting that contractual restrictions are not preempted by copyright law under 17 U.S.C. § 301(a) and that this acceptance has not had significant effect on the public domain).

269 *See* Pamela Samuelson, *Possible Futures of Fair Use*, 90 WASH. L. REV. 815, 859–60 (2015) ("As part of a confidentiality agreement between a startup and a big firm, for example, the startup's insistence on a contractual restriction on reverse engineering . . . would very likely be respected. The same restrictions in a mass-market license agreement for software might be treated quite differently.").

270 *See, e.g.*, Robert A. Hillman & Jeffrey J. Rachlinski, *Standard-Form Contracting in the Electronic Age*, 77 N.Y.U. L. REV. 429 (2002); Arthur Allen Leff, *Unconscionability and the Code—the Emperor's New Clause*, 115 U. PA. L. REV. 485 (1967); W. David Slawson, *Standard Form Contracts and Democratic Control of Lawmaking Power*, 84 HARV. L. REV. 529 (1971); Van Houweling, *supra* note 180, at 933–35 (detailing notice and information-cost processing issues with software license agreements).

271 *See, e.g.*, Maureen A. O'Rourke, *Rethinking Remedies at the Intersection of Intellectual Property and Contract: Toward a Unified Body of Law*, 82 IOWA L. REV. 1137, 1142–43 (1997).

272 RESTATEMENT (SECOND) OF CONTRACTS § 355 (AM. LAW. INST. 1981) ("Punitive damages are not recoverable for a breach of contract . . . ."). "A term fixing unreasonably large liquidated damages is unenforceable on grounds of public policy as a penalty." *Id.* § 356(1).

273 17 U.S.C. § 504 (2012).

The upshot of this analysis of simple digital manufacturing files is clear. For a file without IP protection, a creator whose simple, purely utilitarian (yet not patentable) creation becomes a huge hit would likely lose significant income due to copying. Stronger or weaker contract enforcement can modulate the losses. But instances of "jackpot" creations would likely be extremely rare. It may happen every once in a while, but the more frequent scenario is a file that enjoys modest sales correlative to the creator's modest efforts. It is certainly true that the prospect of "winning the jackpot" with one's simple utilitarian file might increase incentives to make such files, but it is not clear that this extra incentive is needed.

2. Complex Digital Manufacturing Files

Digital manufacturing files for complex utilitarian devices will become increasingly prevalent. Already companies are producing jet engine parts with 3D printers,[274] and fully printed engines may follow.[275] Obviously, more complex files will require more upfront investments of time and energy. As compared to the simple devices analyzed above, these complex files will thus require stronger appropriability mechanisms to induce their development.

As already discussed, patent law can protect new and nonobvious inventions, but many 3D printable complex devices will fall outside of patent law's strenuous requirements.[276] Hence, copyright law might serve as a useful gap filler to incentivize creators incurring high costs. As before, however, because these files will print purely utilitarian devices, they will lack the modicum of creativity copyright law requires: a complex utilitarian file may be thought of as nothing more than a combination of many simple files. And where the combination is done for purely utilitarian reasons, zero plus zero equals zero in terms of copyright law's required creativity.

This is not worrisome, though, because the need for copyright protection for more complex files is far from certain, as can be seen by studying the market dynamics for the files. More complex items are likely to be specially designed for individual or small groups of users, typically business users. Transaction costs decrease where the numbers of buyers and sellers are relatively small because they generally have an

274 GE GLOBAL RESEARCH (Aug. 14, 2017), https://www.geglobalresearch.com/blog/3d-printing-creates-new-parts-aircraft-engines.

275 Mike Keller, *These Engineers 3D Printed a Mini Jet Engine, Then Took It to 33,000 RPM*, GE REPORTS (Sept. 5, 2016), http://www.gereports.com/post/118394013625/these-engineers-3d-printed-a-mini-jet-engine-then.

276 Design patents, too, can provide protection if the object satisfies the statute's ornamentality requirement.

easier time finding each other and tend to interact repeatedly. A low transaction cost environment in turn makes private ordering—individually negotiated contracts—a particularly appropriate avenue for control and remuneration.[277]

Individually negotiated contracts can be tailored to the parties' specific needs and often do not involve the bargaining power disparities—and resulting judicial scrutiny—associated with standardized consumer contracts.[278] Specialized parts are also less likely to be resold downstream (because they are customized to the initial buyer's needs), alleviating some concerns about servitudes that run with files. Creators can, therefore, ably recoup their costs through contracts and initial sales to the users.

In addition, the limited number of customers allows the seller to police the contract's performance more easily. The seller will likely be able to identify a breaching party, and the damages involved with complex files are probably more significant than with simple files, thus justifying the expenses of litigation. More pragmatically, the breaching party is likely to be relatively wealthy and thus can actually pay a judgment.

In many ways, the market for complex digital manufacturing files is reminiscent of the earlier years of software development. In that context, then-professor Stephen Breyer argued cogently that copyright protection was not necessarily needed simply because there was a large difference between the cost of producing an initial work and the cost of copying it.[279] He showed that most application programs were tailored to individual customer needs, allowing for direct relationships and diminishing the chances that third parties would even want to copy the programs.[280] In fact, Pam Samuelson points out that most software sold in the modern era is either developed in-house or for custom uses.[281] The same is true for many complex digital manufacturing files. A file for a Ford Taurus engine will likely not be much help to General Motors.

Breyer also noted that many programs were sold as packages that came with documentation and promises for continued services and updates, allowing the seller to profit from an ongoing relationship based on its expertise.[282] Digital manufacturing technology allows companies

---

277 *See* Osborn, *Bits and Atoms*, *supra* note 4, at 595.

278 *See, e.g.*, WERNER Z. HIRSCH, LAW AND ECONOMICS: AN INTRODUCTORY ANALYSIS 150–51 (2d ed. 1984).

279 Breyer, *supra* note 211, at 344. As an initial matter, Breyer pointed out that the software industry had flourished without software protection. *Id.*

280 *Id.* at 345.

281 Samuelson, *Uneasy Case*, *supra* note 1, at 1777 ("[S]eventy percent of the total investment in the development of software in the United States in the early twenty-first century is either custom-developed software or software that firms develop for their internal uses.").

282 Breyer, *supra* note 211, at 345.

continuously to update their products in response to technological enhancements or changes in market demands. As a result, sellers of digital manufacturing files may enjoy similar long-term relationships with their buyers.

Even where computer programs were sold "off the shelf," Breyer observed that where the buyers are relatively few in number, the seller could recoup its development costs by charging high prices.[283] The same can be true for many digital manufacturing files. If the seller creates the file especially for a single or small group of buyers, pricing the sales to recoup the costs is relatively straightforward.

Digital manufacturing files differ from traditional software because the file creator can keep the file in-house and sell only the physical embodiment of the device.[284] The added control of keeping the file in-house decreases the need for legal protections.[285] Decreases, but not eliminates. Buyers will often be able to reverse engineer physical parts cheaply using 3D scanners, which can scan the object and generate a digital manufacturing file based on the scan.[286]

Like with software, many companies will develop digital files for internal use.[287] These files' specificity limits the need for IP controls if they would be useless outside of the company. Even where the files might be valuable to others, contractual provisions forbidding employees to disclose company files will provide protection.

The need to protect confidential company information raises a protection mechanism that will complement private ordering: trade secrets. Complex files provide a better fit for trade secret protection because they (and the devices they print) are not susceptible to immediate and effortless reverse engineering. Complex devices are quintessential subjects for trade secret protection.[288] Trade secrets, therefore, can provide a good protective mechanism in appropriate circumstances.[289]

Finally, TPMs can provide an additional layer of protection for

---

283 *Id.* at 346.

284 Software (and even hardware) can now be delivered as a service from the cloud in a manner analogous to selling only a finished product. *See* Osborn et al., *supra* note 10, at 1198–1200.

285 Samuelson, *Uneasy Case*, *supra* note 1, at 1779 (stating, in the cloud computing context, "[i]f no one but the developer of such software ever has access to a machine-executable form of the program, copyright protection is arguably unnecessary").

286 *See, e.g.*, *Capture*, 3D SYSTEMS, http://www.geomagic.com/en/products/capture/overview (last visited Mar. 8, 2018). Although some devices, such as those with many internal moving parts, are not easily scanned.

287 *See* Samuelson, *Uneasy Case*, *supra* note 1, at 1777 n.241 (stating that thirty-six percent of software expenditures were for internal company uses).

288 *See, e.g.*, Rockwell Graphic Sys., Inc. v. DEV Indus., Inc., 925 F.2d 174 (7th Cir. 1991) (involving printing press parts, including drawings of the same).

289 Trade secrets are susceptible to reverse engineering. Regarding this possibility and the ability of parties to contract around it, see *supra* notes 242–44 and accompanying text.

files.[290] Although they are not foolproof, they can prevent less sophisticated parties from using files in ways against the seller's wishes. They will play an important role in those complex files that are distributed to a wider audience.

In sum, complex digital files for purely utilitarian objects do not provide a strong case for copyright protection. Patents, trade secrets, contracts, and TPMs provide a web of protections for many of these files. This conclusion is bolstered by the existence of a robust "open hardware" movement.[291] The free, open-source hardware movement "provides the code for hardware, including the bill of materials, schematics, instructions, computer-aided drafting ('CAD') designs, and other information needed to recreate a physical artifact."[292] That people are willing to develop and provide these files for free supports the conclusion that strong copyright protections are not needed to provide adequate incentives to create.[293]

B. *Digital Files for Application Software*

This Section turns from digital manufacturing files to a subset of application software—relatively simple programs that perform purely utilitarian functions.[294] An example is a pinch-to-zoom feature for a smart phone. In addition to the character of the program, the manner in which the program is written is considered. Specifically, this Section considers how new modularized programming environments impact IP protection and channeling.

The debate about the appropriate protection regime for software has existed for decades, and only so much can be added to what has already been said.[295] Although protecting utilitarian software with

---

290 *See supra* notes 185–88 and accompanying text (discussing TPMs).

291 *See, e.g.*, Rhys Jones et al., *RepRap—the Replicating Rapid Prototyper*, 29 ROBOTICA 177, 177 (2011); Fisher & Gould, *supra* note 215, at 8–9; Pearce, *supra* note 215, at 1303–04.

292 Osborn et al., *supra* note 10, at 1202–03.

293 Ironically, the lack of copyright protection for digital manufacturing files may upset assumptions of the open hardware movement. Like open source software, open hardware licenses purport to control downstream users' rights with respect to the files. They may, for instance, require attribution or prohibit commercialization. These licenses rely on copyright law to provide "teeth" to the agreement. One who breaks the contract can become a copyright infringer, which often gives rise to much larger damages. *See* Jacobsen v. Katzer, 535 F.3d 1373, 1380 (Fed. Cir. 2008). In addition, the presence of a copyright assuages some of the concerns with servitudes.

294 Excluded from analysis are programs that contain creative audiovisual output, because they will enjoy copyright protection.

295 *See, e.g.*, Menell, *supra* note 30 (arguing for sui generis protection for programs); Oddi, *supra* note 30 (arguing that programs should be protected by patent law, not copyright law); Samuelson et al., *supra* note 30 (critiquing copyright protection of software and arguing for sui generis protection for programs).

copyright is often a mismatch given such software's overwhelming utilitarian features, for a time it seemed the debate had reached somewhat of a détente in the courts.[296]

Granting the creator a copyright for her life plus an additional seventy years always appeared disproportionate to the effort involved, much less the creativity. Nevertheless, copyright protection was tolerated in large part because it only protects programs against one who directly copies the code, or in some cases the organization. A competitor is free to create a copycat program from scratch that implements all of the program's utilitarian features. Thus, in essence, copyright law only gives developers a lead-time advantage over competitors who, in the absence of copyright prohibitions, could copy the software instantly. Additionally, software protection was clearly "thin," filtering out functional design elements and protecting only against verbatim code copying and certain golden nuggets of creative overall design.[297]

Indeed, software came to enjoy not only copyright protection, but also other forms of IP protection. Rather than channeling a work to one regime, multiple regimes covered different aspects.[298] Courts began openly permitting patents for software after the Supreme Court upheld a patent for a software-implemented invention in *Diamond v. Diehr*.[299] Courts also allowed trade secret protection for mass-distributed software because the seller only released the unintelligible (to humans) object code, which is difficult to reverse-engineer.[300]

Whatever calm may have been reached was temporary, however. Software patents are under attack after *Alice*.[301] In the copyright context, the Federal Circuit recently bucked the trend of other circuits and granted copyright protection to seemingly functional aspects of software.[302] Simultaneously, commentators have redoubled the attacks

---

296 *See* Samuelson, *Uneasy Case*, *supra* note 1, at 1775 (noting that "software copyright law stabilized" toward the end of the twentieth century).

297 *See* Comput. Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 710 (2d Cir. 1992) ("Once a court has sifted out all elements of the allegedly infringed program which are 'ideas' or are dictated by efficiency or external factors, or taken from the public domain, there may remain a core of protectable expression. In terms of a work's copyright value, this is the golden nugget.").

298 *See* Pamela Samuelson, *Strategies for Discerning the Boundaries of Copyright and Patent Protections*, 92 NOTRE DAME L. REV. 1493, 1517–21 (2017) (discussing the "segmentation approach" in which different IP regimes protect different aspects of a work).

299 450 U.S. 175 (1981).

300 *See, e.g.*, Data Gen. Corp. v. Grumman Sys. Support Corp., 825 F. Supp. 340, 359 (D. Mass. 1993); Q-Co Indus. v. Hoffman, 625 F. Supp. 608, 617–18 (S.D.N.Y. 1985).

301 Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2352 (2014) (holding that a method of intermediated settlement was not patent eligible even if computer implemented); *see supra* notes 134–39 and accompanying text (discussing the decision's effects on software patents).

302 Oracle Am., Inc. v. Google Inc., 750 F.3d 1339, 1356–64 (Fed. Cir. 2014) (finding Oracle's declaring code to constitute copyrightable subject matter unaffected by merger or scenes a

on the desirability of software copyrights.[303]

Into this melee step two features involved in many modern programs that are the focus here: simple programs performing purely utilitarian functions and simple programs created using modularized programming environments. A given program may contain one or both of these features, and each will be addressed in turn.

As I use the term, simple programs refer to those that a programmer can create in a relatively short time, from a few hours to a few days. By definition, these programs do not require much effort, and thus need proportionally less incentive in the form of IP or other protection. The points of analysis here largely mirror those for relatively simple digital manufacturing files, though two exceptions to the comparison deserve mention. First, program files are slightly harder to copy than digital manufacturing files because many lay users will not know where to find the appropriate files on their phones or computers. Second, courts will perceive these program files to be like traditionally copyrighted software, and thus inertia will incline them to grant copyright protection. Even so, copyright, which is a poor fit doctrinally and theoretically, is not needed if other appropriability mechanisms provide adequate incentives.[304]

A second feature that impacts copyrightability is the presence of modularized programming environments. Programmers have long been able to call on certain subroutines, but newer environments have greatly simplified the coding process. These environments allow users to avoid directly typing virtually any code for some programs. Instead, they select icons that visually represent functions they want to implement, and then simply supply certain parameters to complete the "code." For instance, if I wanted to create a pop-up window for a smart phone, I would select the desired window and simply add the text that I want to appear in the box. This is similar to drawing in a CAD environment: the CAD file creator typically does not type any code directly. Rather, he draws a picture, which the software translates into code.

The modularized coding interface abstracts the coding practice, removing it one or more levels from the literal code. Because courts emphasize that software copyrights most clearly protect the literal code typed by the user, abstracting the code raises immediate questions as to whether any protectable expression remains.[305] It is of course possible for the structure, sequence, and organization of a program to garner

---

faire).

303 *See* Samuelson, *Uneasy Case*, *supra* note 1, at 1775–81.

304 *See supra* notes 84–100 and accompanying text (discussing copyright protection).

305 *See* Comput. Assocs. Int'l v. Altai, Inc., 982 F.2d 693, 703–12 (2d Cir. 1992) (assuming that the literal code, which the programmer drafted, was protectable and implementing an abstraction-filtration-comparison test to test what else, if anything, was protectable).

copyright protection, but only if it includes a modicum of creativity that does not merge with the expression.[306] For relatively short programs, there may be no such creativity. This requires a case-by-case analysis, but the important point is that copyright may not provide protection, something courts have been hesitant to recognize in relation to software.[307]

If copyright protection is not available, one must next analyze whether other IP laws provide protection. Whether utility patents[308] will be available to those programs that are novel and nonobvious is not clear in the wake of *Alice*. Assuming the programs are truly nonobvious, patent protection would seem at first blush to be a natural fit. Yet, it may be that the Supreme Court has implicitly decided that the effort required to create many software inventions does not need patent law's strong incentive.[309] If software inventions do not require much effort to create and commercialize, then patents may harm innovation by slowing dissemination and follow-on innovation.[310] Thus, the case for patents for these programs is ambivalent.

Courts almost universally recognize trade secret protection in favor of the *source* code for computer programs distributed in *object* code form.[311] Although the source code can be a trade secret, the object code cannot when it is widely distributed.[312] Thus, when a creator widely distributes its program in object code format, it loses trade secret protection for the object code. And if the object code is not a trade secret, a third party can use and distribute it without misappropriating a trade secret, even if the related source code is a trade secret.[313] Hence,

306 *See, e.g.*, *id.*

307 *See supra* note 32.

308 Design patents will not be available where the software has no ornamental output. 35 U.S.C. § 171 (2012) (requiring the design to be "ornamental").

309 *See* Osborn et al., *supra* note 10, at 1250 (positing that the Supreme Court targeted software patents in part from a belief that the inventions do not require the patent incentive).

310 *See id.* at 1225 (noting the harmful effects of patents); *see also* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 870 (1990) ("[B]road patents could discourage much useful research.").

311 *See, e.g.*, Q-Co Indus. v. Hoffman, 625 F. Supp. 608, 617 (S.D.N.Y. 1985) (recognizing trade secret protection for source code and stating, "[t]he source code of the VPS-500 program is not accessible to the public").

312 *See, e.g.*, Trandes Corp. v. Guy F. Atkinson Co., 996 F.2d 655, 663 n.8 (4th Cir. 1993) ("In [normal] cases, the owner of the software cannot claim trade secret protection for the object code because its disclosure to the public destroyed its secrecy."); *Q-Co Indus.*, 625 F. Supp. at 617 ("Only the object code is publically available . . . ."); Videotronics, Inc. v. Bend Elecs., 564 F. Supp. 1471, 1476 (D. Nev. 1983) ("[W]here such a computer program is made readily available to the public such as . . . here, its contents may not be deemed a trade secret unless access to it is actually treated as a secret . . . .").

313 *See* Beacon Wireless Sols., Inc. v. Garmin Int'l, Inc., 894 F. Supp. 2d 727, 733 (W.D. Va. 2012) (holding that because the defendants did not have access to the relevant technical details, "the defendants did not use or otherwise misappropriate these technical details when they utilized the plaintiffs' telematics hardware to test and develop the interface specifications and the software resident on the [devices]"); Silvaco Data Sys. v. Intel Corp., 109 Cal. Rptr. 3d 27, 34

trade secret protection for uncopyrighted software is sometimes very weak. A third party can costlessly copy the object code and make it immediately available to others.[314] Normally, copyright law provides protection against copying the object code, but this Article has posited that no copyright protection will be available.

Here again, sellers can attempt to contract around the absence of copyright protection and the weakness of trade secrets. The seller can insist on a contract term that prohibits transferees from copying, distributing, and reverse engineering the object code. The tradeoffs and points of contention here are similar to those discussed with respect to digital manufacturing files, and thus will not be reiterated.[315] In short, contractual terms will typically bind directly negotiating parties and may sometimes bind downstream parties who have notice of the terms. Anywhere along the chain of distribution, however, the terms may be stripped out, and downstream recipients on the notice-free programs will likely not be bound by contract. Thus, contractual provisions can provide a developer with lead-time advantage, which in many cases will be sufficient to recoup the modest investment poured into the program's creation. Further, contract remedies may be available for parties who breach the terms.

A few other dynamics of software, relevant to simple and complex programs alike, deserve mention. The ability to deliver software as a service helps users to maintain additional control.[316] As with digital manufacturing files, TPMs play a role in slowing the advent of copycat programs and can help identify those who breach contractual terms.[317]

Finally, empirical evidence suggests that copyrights are not highly important to many software businesses. For instance, high technology entrepreneurs rated copyright protection as between slightly and moderately important in securing competitive advantage from their technology innovations.[318] Where the user spends little time and money creating a program, the need for strong protections is even less than for

(Cal. Ct. App. 2010) (holding that "[o]ne does not, by executing machine-readable software, 'use' the underlying source code; nor does one acquire the requisite knowledge of any trade secrets embodied in that code").

314 If needed or desired, third parties can also reverse engineer the source code, though this is expensive and time-consuming. *See* Samuelson & Scotchmer, *supra* note 195, at 1613.

315 *See supra* text accompanying notes 242–73 (discussing protection by contract).

316 *See* Samuelson, *Uneasy Case*, *supra* note 1, at 1779 ("If no one but the developer of such software ever has access to a machine-executable form of the program, copyright protection is arguably unnecessary.").

317 *Id.* at 1780.

318 *See* Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1289–90 (2009). They rated first-mover advantage most highly. Copyrights were roughly equal to other methods such as secrecy, trademarks, and complimentary assets, and were more important than patents. *Id.* It is possible that copyright and other mechanisms are more important to software companies after the Supreme Court weakened patent protection in the area.

traditional startups.[319]

In sum, simple software programs may not require strong copyright or patent protections. One obvious difficulty becomes where to draw the line between "relatively simple" programs, which do not get copyright protection, and more complex ones, which do. We draw this line in other contexts, including literary texts,[320] and there is no reason we cannot do the same with software programs.

C. *Files Containing Lockout Codes*

If the previous analysis convinces courts to eschew granting copyright protection to purely utilitarian files, it is not unreasonable to expect that some creators will search for ways to obtain copyright protection. As mentioned, creators may try to append extraneous material, such as nonexecutable comments or creative images within the files.[321] This material would pose no purpose other than to attempt to garner copyright protection for otherwise uncopyrightable files. It would thus serve as a type of lockout code.[322]

Granting copyright protection for purely utilitarian files based on lockout codes raises concern that copyright law is trammeling on the province of patent law. The patent system "embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years."[323] Allowing creators to hijack copyright law to protect files of purely utilitarian objects would upset the carefully crafted patent system.[324]

Courts should thus refuse to provide copyright protection for lockout codes in this context. Preferably, courts faced with lockout

---

319 Note, however, that sellers of mass-marketed software continue to rely on copyright to battle copycats. *See* Samuelson, *Uneasy Case*, *supra* note 1, at 1781 n.268. Where programs require more upfront investment, stronger protection will be needed to incentivize creation. But IP protections can also overprotect, and one would expect self-interested businesses to leverage IP even after they have made the necessary profit to incentivize continued creation.

320 *See, e.g.*, Morrissey v. Proctor & Gamble Co., 379 F.2d 675 (1st Cir. 1967) (determining that instructional text for a sweepstakes entry did not enjoy copyright protection).

321 *See supra* notes 101–03 and accompanying text.

322 *See supra* notes 104–07 and accompanying text.

323 Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989).

324 Sega Enters. Ltd. v. Accolade, Inc., 977 F.2d 1510, 1526 (9th Cir. 1992) ("If disassembly of copyrighted object code is per se an unfair use, the owner of the copyright gains a de facto monopoly over the functional aspects of his work—aspects that were expressly denied copyright protection by Congress. 17 U.S.C. § 102(b). In order to enjoy a lawful monopoly over the idea or functional principle underlying a work, the creator of the work must satisfy the more stringent standards imposed by the patent laws."); Moffat, *supra* note 202, at 612 ("Delineating the boundary between copyright and patent law is thus fundamentally important to the federal intellectual property regime and to the goals of the patent system in particular.").

codes would find as a matter of law that the expression merges with its function.[325] This approach provides a bright-line rule that minimizes uncertainty and litigation expenses by allowing a defendant a clear and quick defense. It thus frees downstream users to utilize and build off of utilitarian files without fear of copyright repercussions, enhancing the public's benefit from technological use and development. In contrast, fair use or misuse would require a more searching inquiry and provide less certainty ex ante.[326]

That being said, courts may sometimes have difficulty determining whether comments in a file's code are being used purely as lockout codes or are instead good faith attempts to educate downstream users of certain file features.[327] If the comment is a poem, chances are it was placed there as a lockout code. But a shrewd creator might include step-by-step comments in his file that look to be (and may be) informative, but subjectively intend them to act solely as a lockout code.

Given the difficulty in ascertaining the intent behind a file's extra content, courts may have to engage in the sometimes difficult task of distinguishing between legitimate content and mere lockout codes. Industry customs can help. The author's discussions with various 3D printing specialists reveal that creators of design files (e.g., CAD or DWG) often contain genuine explanatory text for future users, along with other extraneous material. On the other hand, it is extremely rare for such comments to exist in manufacturing-ready (STL) or machine-instruction (GCODE) files, not least because the translation software strips such material from design files during conversion.[328] The general lack of comments in manufacturing-ready files is important because that is the format most often used when sharing files.

Current practices notwithstanding, users desiring control will look to insert potentially copyrightable material in their files, but courts cannot read minds to decipher intent. Thus, courts should institute rules that ensure copyright law will not prevent access to the purely utilitarian aspects of the files. One option is simply to ignore the copying of comments altogether. Another is to use the more individualized fair use analysis.[329] A drawback of fair use is the case-

---

325 *See* Lexmark Int'l, Inc. v. Static Control Components, Inc., 387 F.3d 522, 544 (6th Cir. 2004) ("[A] poem in the abstract could be copyrightable. But that does not mean that the poem receives copyright protection when it is used in the context of a lock-out code.").

326 *See supra* notes 111–21 (discussing fair use and misuse). Misuse can have an important role in egregious cases because misuse (until purged) can render the copyright unenforceable against the public, providing further certainty ex ante. *See* Lasercomb Am., Inc. v. Reynolds, 911 F.2d 970 (4th Cir. 1990).

327 *Cf.* Fromer, *supra* note 192, at 590–92 (noting the difficulty in ascertaining motives and offering alternative options).

328 A user could go into a STL or GCODE file and add comments if desired, as shown in Part I.

329 *See supra* notes 111–18 and accompanying text (discussing fair use).

specific, indeterminate nature of the analysis, which fails to provide ex ante certainty. Fear of liability or litigation costs may deter otherwise permissible uses. Hence, to protect the proper roles of copyright and patent law, courts applying fair use should consistently find uses are *presumptively* fair. A copyright claimant could rebut the presumption upon showing the defendant obtained a material benefit from the nonexecutable material. To minimize costs and uncertainty, courts should make the fair use determination in these types of cases as early as possible during litigation.

Although this Article is aggressive against lockout codes, there is a distinction between the lockout codes discussed herein and those familiar from cases like *Lexmark*.[330] In traditional lockout code cases, the defendant circumvented the lockout code to obtain interoperability with an unprotected system. The defendant used the interoperability to create independently made works, such as new video games (*Sega*) or printer cartridges (*Lexmark*). The defendant thus may have appealed to the courts' consciences as industrious firms fostering independent creativity or production.

In contrast, with digital files, the defendant may simply be copying the file to use it verbatim. For example, if I have access to your file that prints an engine part, I might use it simply to print the part, not to make my own add-on part. This is a distinction without consequence. Though the direct copier is perhaps not as sympathetic as the follow-on innovator, copying is at the core of a competitive economy. "In general, unless an intellectual property right such as a patent or copyright protects an item, it will be subject to copying."[331] Pejorative labels, such as "lazy copier," betray a normative assessment that is at odds with the prevailing view in free markets, which is that "free exploitation of ideas will be the rule, to which the protection of a federal patent [or other IP] is the exception."[332] Courts may miss this point because the files themselves, and the physical objects they may manufacture, are not typically subject to free copying like ideas and business strategies. But they should realize that the digital era is maturing to the point where earlier practices decrease in salience.

Besides, some who copy the files will make improvements, either to the files directly or using the files as tools to perform other meaningful tasks. Though not a necessary condition to the permissible copying of utilitarian files, the possibility of downstream improvements provides further justification.

---

330 *Lexmark*, 387 F.3d at 544.

331 TrafFix Devices, Inc. v. Mktg. Displays, Inc., 532 U.S. 23, 29 (2001).

332 Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989). *See generally* Mark. A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031 (2005) (arguing against overprotective intellectual property laws).

CONCLUSION

This Article provides doctrinal clarity and theoretical depth to how courts should approach IP protection and channeling for digital files. Although the law correctly channels many files, such as songs and movies into copyright protection, an increasing number of files do not belong under copyright's umbrella. Instead, other appropriation mechanisms, including lead time, contracts, and TPM, will provide sufficient incentives. Courts will have difficulty seeing this because of an historical tendency to push digital works into copyright. But it is important that they do see it; innovation rates depend on it.