GO (EN)FISH: DRAWING CAD FILES FROM THE PATENT ELIGIBILITY POOL

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ABSTRACT

In the near future, the Federal Circuit will grapple with the subject matter eligibility, under § 101 of the Patent Act, of Computer Aided Design (CAD) files—software that powers 3D printers and contains the design prototype a printer additively manufactures. Where the Federal Circuit comes down on whether or not CAD files are patent-eligible will have serious innovation and economic policy implications. This paper analyzes CAD files' patent eligibility by uniquely employing two model claims—one for a 3D printed boomerang and the other 3D printed electronic circuitry with increased computing power—to assess how courts today would likely interpret draft substantive claims.

Section 101 jurisprudence has been in a state of flux following the Supreme Court's pivotal decision in Alice Corp v. CLS Bank Int'l, which in extending Mayo Collaborative Servs. v. Prometheus Collaborative Labs.'s nebulous two-step subject matter eligibility test to all classes of patents, led to the invalidation of hundreds of software patents. However, recently the Federal Circuit has struck a

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better-defined patent-eligibility equilibrium in a string of cases beginning with Enfish v. Microsoft. This paper builds on both the § 101 and 3D printing scholarship by demonstrating how the Federal Circuit's patent-eligibility equilibrium has taken root following Enfish, and how additive manufacturing innovators and patent practitioners can rely on these judicial determinations in crafting CAD file design prototypes. In the face of the Federal Circuit's ensuing patent-eligibility determination—a decision that will have far-reaching ramifications for 3D printing and unforetold future software formats—this paper charts a definitive path towards reliability in 3D printing software eligibility.

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INTRODUCTION

Software, quite literally, powers the Information Age economy. Yet, as society shifts from operating in the analog world to the digital realm, the American legal system has managed patent eligibility for software innovations in fits and starts. The Supreme Court's pivotal, unanimous decision in *Alice Corp. v. CLS Bank Int'l* in 2014 was met with great fanfare and hope that the decision would clarify what constitutes an eligible software patent. Patent practitioners' desire for certainty was unfulfilled however, as *Alice* left undefined core terminology and offered minimal guidance on particular types of software eligible for patent protection. Specifically, the Supreme Court built on the two-

part judicial test for patent-eligible subject matter first articulated in *Mayo Collaborative Servs. v. Prometheus Labs.* in 2012. The judicial test's ill-defined and open-ended manner has resulted in district courts and the Federal Circuit muddling through their analyses and scores of software patents being struck down as invalid.

A trio of recent decisions at the Federal Circuit signal a potential shift in the software patent eligibility jurisprudence towards increased patentability, or perhaps an attempt to stymie the bleeding of software patent invalidation from uncertain judicial standards. *Enfish v. Microsoft*, *TLI Communications v. AV Automotive* and *McRO v. Bandai Namco Games America* have all built on the *Mayo-Alice* framework by looking towards the software patent's specific claimed improvement in computer functionality and the software arts. Further, these cases offer guidance and commentary on what constitutes "abstractness" and whether or not a physical component or computer are required in a valid software patent claim.

While the law has been in a state of flux, the march of technological progress has continued onward. In particular, additive manufacturing, more commonly referred to as 3D printing, has become a player in the industrial manufacturing space and engineering intensive industries.[2] Indeed, even personal hobbyist 3D printers have hit retail shelves in recent years. Novel intellectual property issues have arisen in the wake of 3D printing, and patents currently exist on many additive manufacturing methods. Yet, little analysis has been conducted on the patentability of the software that powers 3D printers. Termed CAD files, an abbreviation of "computer-aided design," these pieces of software contain the user's design that the device ultimately prints out layer by layer. CAD files are firmly in the digital

[2] JEREMY RIFKIN, THE THIRD INDUSTRIAL REVOLUTION: HOW LATERAL POWER IS TRANSFORMING ENERGY 117-18 (2011).

world, but the design and resulting printed object are themselves tangible, physical items unrelated to computing and the software arts. This raises fascinating questions concerning software patent eligibility of a claimed CAD file and specific design prototype associated with the file in a legal regime grappling with questions of abstractness and physicality.

Part I of this paper opens with the mechanics of 3D printing, the specific qualities of CAD files, and the unique infringement concerns that leave many players in the space—excluding end users—shielded from liability.[3] Part II details the unsettled state of the law surrounding software patent eligibility following the Supreme Court's landmark decision in *Alice v. CLS Bank*. This section further describes the subsequent Federal Circuit case law developments in *Enfish v. Microsoft*, *TLI Communications v. A.V. Automotive* and *McRO v. Activision Publishing*. Part III analyzes the patentability of CAD file design prototypes under the new software eligibility regime and in light of these recent judicial decisions. This analysis builds on the scholarship relating to 3D printing patent infringement and patentability that followed the *Alice* decision. In particular, this discussion opens with two model CAD patent claims on *In re Beauregard* style computer readable medium claims in an effort to sketch in with examples on what the § 101 scholarship has left undefined. Part IV considers the software patent debate over the role of patents in promoting or stifling software innovation—including the impact of patent assertion entities—and thinks through the patent eligibility implications for emerging software file formats (e.g. virtual and augmented reality). The conclusion weighs the legal and policy issues, and provides a suggested way

[3] Timothy Holbrook, *How 3D Printing Threatens Our Patent System*, THE CONVERSATION (Jan. 6, 2016, 6:06 AM), https://theconversation.com/how-3d-printing-threatens-our-patent-system-52665 [http://perma.cc/U68L-ZQFH].

forward for software patent eligibility in the 3D printing context and beyond that respects the patent bargain between offering a monopoly incentive to innovate and enriching the public domain through new technological developments.

I. PART I – BUILDING BLOCKS OF 3D PRINTING

With attention-grabbing headlines and prophetic, hand-wringing law review articles, the age of the 3D printer has nearly arrived. In fact, the technology powering 3D printing is not entirely new, having been in circulation since the late 1970s and early 1980s.[4] However, what is new and different are the multi-faceted uses that have shifted additive manufacturing technology away from hobbyists' playthings and towards industrial application and consumer goods. Despite much of the hype, particularly in the consumer realm, examples abound of 3D printing's deployment in the field including: a new variety of rotary press style 3D printing producing light-emitting wallpaper, solar panels, electronics and semiconductors, jet engines,[5] bridges, buildings, furniture, lighting effects,[6] and even revolutionary developments for nutrition beginning to show promise with printed food.[7]

As innovation shifts from the purely digital realm of computing towards this hybrid world of 3D printing, spanning the physical and digital realms, for policy and legal reasons it is essential to consider the ramifications of leaving a whole segment of this growing industry unpatentable. Much the same as how computers were the

[4] ANGELA DALY, SOCIO-LEGAL ASPECTS OF THE 3D PRINTING REVOLUTION 5 (2016).
[5] *Printed Electronics - On a Roll*, ECONOMIST, Jul. 30, 2016, at 63.
[6] *3D printing - A Bridge to the Future*, ECONOMIST TECH. Q., Sept. 5, 2015, at 13.
[7] Sophia Hollander, *What Are You Printing for Dinner?*, WALL ST. J. (June 9, 2016, 11:23 AM), http://www.wsj.com/articles/what-are-you-printing-for-dinner-1465485827 [https://perma.cc/JM99-SFEY].

operational base that software patents ultimately came to be recognized for powering—as innovation in the software field drove the modern economy—3D printers can similarly be thought of as the base. Therefore, the patentability of the underlying CAD files, with great potential for innovation, must be considered.

A. 3D Printing Primer

To conceptualize 3D printing, a term that evokes high technology and perhaps science fiction,[8] imagine a great Renaissance master hunched over a marble slab, slowly, repeatedly chiseling away at his design. For centuries, sculpted works were created through this subtractive process; an artisan would remove, layer by layer, pieces of the physical material to reveal an inner creation. 3D printing, formally labeled additive manufacturing, flips this process on its head.[9] Rather than whittle away at an unformed slab, 3D printing progressively builds upward as an unforetold number of horizontal layers are printed and stacked upon one another to form the crafted product. Much the same as how a traditional 2D printer sprays ink through tiny nozzles and a laser printer employs a heated fuser to dry wet ink, 3D printers spray liquidated physical materials—such as melted plastic, ores, or even cells, amongst any number of other materials—onto a surface.[10] Subsequently, lasers are utilized to form a hardened item.[11]

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[8] DALY, *supra* note 4, at 4 (discussing how "[c]onceptual precursors to 3D printers can be found in science fiction, especially the *Star Trek* Replicator.").
[9] Filemon Schoffer, *3D Printing Technologies Explained*, TECHCRUNCH (Sept. 6, 2016), https://techcrunch.com/2016/09/06/3d-printing-technologies-explained/ [http://perma.cc/XV2G-GPDN].
[10] Deven R. Desai & Gerard N. Magliocca, *Patents, Meet Napster: 3D Printing and the Digitization of Things*, 102 GEO. L. J. 1691, 1695 (2014).
[11] *Id.*

Typically, the additive manufacturing process involves four principal steps. First, an individual designs a three-dimensional rendering of an object using CAD software.[12] CAD software has been utilized by engineers for decades; the standard programs come in a variety of professional and commercial editions that permit users to tinker with vectors in a graphical design interface.[13] Alternatively, an individual can run a 3D scanner over a real-world, physical item to render it into a digital item.[14] In either instance, the resulting object design is then encoded into a digital CAD file.[15]

At this point, the CAD file is then converted into an advanced file type, usually a Standard Tessellation Language ("STL") file,[16] which defines and details the three-dimensional surface of the item.[17] The STL file effectively serves as the digital intermediary between a user's computer and a 3D printer. Next, the user hits send within the CAD program to transmit and upload the converted STL file to a 3D printer, alongside instructions of how to print each layer. The 3D printer will then slice the design into hundreds, or oftentimes thousands, of printable two-dimensional horizontal layers.[18] Finally, the 3D

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[12] Paula-Mai Sepp, Anton Vedeshin, & Pawan Dutt, *Intellectual Property Protection of 3D Printing Using Secured Streaming, in* THE FUTURE OF LAW AND ETECHNOLOGIES 81, 83 (Tanel Kerikmäe & Addi Rull eds., 2016).

[13] *See id.* at 84.

[14] BIBI VAN DEN BERG, SIMONE VAN DER HOF & ELENI KOSTA, 3D PRINTING: LEGAL, PHILOSOPHICAL AND ECONOMIC DIMENSIONS 15 (2015).

[15] *Id.*

[16] Sunny Sahota, *CAD File Formats and How to Export Them for 3D Printing*, FICTIV/HWG (Jul. 9, 2015), https://hwg.fictiv.com/design/how-to-prepare-cad-files-for-3d-printing [https://perma.cc/PN2D-T2BX].

[17] Desai & Magliocca, *supra* note 10, at 560 n.32.

[18] HOD LIPSON & MELBA KURMAN, FABRICATED: THE NEW WORLD OF 3D PRINTING 80 (2013).

printer prints the designed item out, one layer successively on top of another, blending the numerous layers into a unified whole.[19]

B. Intellectual Property Intersection

The multiple steps and machinations involved in the 3D printing process boil down to four points of potential patentability.[20] One option already employed by industrial giants and scientific outfits is to patent the 3D printing techniques, and additive manufacturing systems.[21] Another option for inventors is to seek patents on the physical materials, resins, and underlying bases needed for printing. An inventor could also claim the end product being 3D printed. Lastly, and the focus of this paper, a potential patentee could seek protection on the CAD instruction files containing the item design prototype and resultant instructions for a 3D printer.

Turning to CAD files in particular, at a base level a CAD file is a digital blueprint for a physical item.[22] CAD programs and the resultant digital design files have been in use by engineers and hobbyists for decades.[23] Yet, in an

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[19] *Id* at 80-81.

[20] Elizabeth D. Ferrill, Benjamin T. Sirolly, & E. Robert Yoches, *Securing IP Rights in a 3D-Printing World*, FINNEGAN (Dec. 18, 2013), http://www.finnegan.com/resources/articles/articlesdetail.aspx?news=d262620e-11d2-4033-9b5b-6b29bb1345d6 [https://perma.cc/45GQ-HYYW].

[21] Indeed, analysts and observers believe that the expiration of many of these patents has led to the sudden rise in 3D printing activity. *See generally* Jelor Gallego, *A Host of Soon-to-be-Expired Patents are Set to Revolutionize 3D Printing*, FUTURISM (May 17, 2016), http://futurism.com/expiring-patents-set-to-improve-3d-world/ [https://perma.cc/FTU3-M7ZJ].

[22] *See generally* David Cohn, *Evolution of Computer-Aided Design*, DIG. ENG'G (Dec. 1, 2010), http://www.digitaleng.news/de/evolution-of-computer-aided-design/ [https://perma.cc/6639-VJTT].

[23] *See generally* DAVID E. WEISBERG, THE ENGINEERING DESIGN REVOLUTION (2008).

ascendant era of 3D printing, CAD files are much more than digital designs for physical items. Rather, CAD files in the province of a 3D printer are akin to a music .mp3 file or a .mov film, ready for instant play on iTunes. With just a few keystrokes a user is able to upload and print out his or her customized design as embodied in the digital predecessor CAD file.[24] In this sense, a CAD file design prototype straddles the digital and physical worlds, empowering an individual in receipt of a CAD file with the ability to produce virtually anything encoded.[25] What is more, as society increasingly turns to 3D printing for economic innovation, CAD file design prototypes will increasingly be recognized as both the design and inventive component of additive manufacturing, much like software's role in computing. Indeed, this development is already underway today, as the majority of new products are conceived in digital three-dimensional form in CAD software.[26]

C. Additive Manufacturing's Particular Patent Infringement Concerns

Much ink has been spilled about the unique infringement concerns brought about by 3D printing. Against this backdrop, the question over CAD file design prototype patentability is that much more urgent. In a typical infringement arrangement in which the 3D printed end product is patented, an individual would download and 3D print an infringing item, possibly for personal consumption or sale. Under that scenario, the individual is

[24] Lucas S. Osborn & Timothy R. Holbrook, *Digital Patent Infringement in an Era of 3D Printing*, 48 U.C. DAVIS L. REV. 1319, 1331 (2015).
[25] Lucas S. Osborn, *Regulating Three-Dimensional Printing: The Converging Worlds of Bits and Atoms*, 51 SAN DIEGO L. REV. 553, 559-62 (2014).
[26] *Product Design - The Replicator,* ECONOMIST, May 28, 2016, at 71.

the sole direct infringer.[27] Alternatively, an individual could independently design a CAD file of a patented item and share that design online to other individuals, who themselves 3D print the infringing item.[28]

Under either scenario, any CAD file website repository or digital distributor,[29] or even the 3D printer manufacturer, would likely not be found liable even under indirect infringement theories due to the heightened knowledge requirement.[30] For induced infringement liability to extend to these middlemen under § 271(b), the patentee would have to demonstrate that the intermediaries were willfully blind or had prior knowledge of the patent.[31] Likewise, if contributory infringement liability under § 271(c) is to stick, the item's producer must have known about the patent at issue and then either sold or offered to sell that component to another individual.[32] Practically, a patentee would have significant difficulty litigating against an infringing user printing patented items at home or privately. In addition, § 271(c) carves out an exemption for components with "substantial noninfringing use[s]."[33] A CAD design prototype could be tinkered with for recreational purposes or re-purposed entirely for a noninfringing use like scientific research. Thus, the indirect infringement routes are practical nonstarters in the 3D printing environment.

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[27] Sam Dillon, *Infringement by Blueprint: Protecting Patent Rights in a World of Low-Cost 3D Printing*, 42 AIPLA Q.J. 429 (2014).
[28] Tabrez Y. Ebrahim, *3D Printing: Digital Infringement & Digital Regulation*, 14 NW. J. TECH. & INTELL. PROP. 37, 53-54 (2016).
[29] THINGIVERSE, http://www.thingiverse.com/ (last visited June 23, 2017).
[30] Davis Doherty, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J.L. & TECH. 353, 360-1 (2012).
[31] 35 U.S.C. § 271(b) (2012); Dillon, *supra* note 27, at 445.
[32] 35 U.S.C. § 271(c) (2012).
[33] *Id.*

Accordingly, patents claiming the actual 3D printed product have diminished practical utility because these patents can only be asserted against individual end-users who are directly infringing or inducing intermediaries who actively and knowingly encourage infringement.[34] However, this is the case because the patented item shifts forms, from digital to physical, between transmission and printing. If an inventor held a patent claim to the CAD file design itself, the inventor would be able to more easily assert rights against distributors and other intermediaries who deal in CAD files as direct infringers.

II. PART II – ALICE AND THE NEW SOFTWARE PATENT ORDER

A. Abstraction Analyzed

Software, at a base level, is simply a digital smattering of 0's and 1's that instruct a machine how to perform a certain objective.[35] In spite of software's elegant simplicity, or rather perhaps due to it, software patent eligibility and associated issues have bedeviled the patent system for the past four decades.[36] Over this timespan, a rich software patentability jurisprudence has developed, as the pendulum for software patent eligibility has swung back and forth between a fairly permissive approach and a

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[34] Daniel Harris Brean, *Asserting Patents to Combat Infringement via 3D Printing: It's No "Use"*, 23 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 771, 804 (2013).

[35] *See generally* CHARLES PETZOLD, CODE: THE HIDDEN LANGUAGE OF COMPUTER HARDWARE AND SOFTWARE (1999).

[36] *See generally* Parker Hancock, *Software Patents at the Supreme Court*, VANDERBILT J. ENT. & TECH. L. BLOG (Mar. 30, 2014), http://www.jetlaw.org/2014/03/30/software-patents-at-the-supreme-court/.

currently more restrictive standard.[37] After a flurry of activity in recent years, there does seem to be some settling down now, as the Supreme Court has not taken up any cases on subject matter eligibility this term, possibly signaling a shift towards letting the Federal Circuit and lower courts sort through the muddle.[38] All the while, the software patent eligibility debate has played out during a time when innovative software has uprooted virtually every industry.

To assess the unsettled state of software patentability, one must begin with § 101. This section defines patentable subject matter as "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."[39] Within the four broad § 101 categories of potentially patentable inventions, software has historically been recognized[40] as a process under § 100(b)'s definitional section.[41] As the legislative history indicates, Congress drafted § 101 expansively, permitting as patent-eligible "anything under the sun that is made by man."[42]

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[37] *See* Jeffrey A. Lefstin, Peter S. Menell, & David O. Taylor, Final Report of the Berkeley Center for Law & Technology Section 101 Workshop: Addressing Patent Eligibility Challenges (October 9, 2017). Berkeley Technology Law Journal, 2018 Forthcoming.

[38] Dennis Crouch, *Not Eligible: Supreme Court Denies All Pending Subject Matter Eligibility Petitions,* PATENTLYO (Oct. 3, 2016), http://patentlyo.com/patent/2016/10/eligible-eligibility-petitions.html [https://perma.cc/2ZD8-TJTP].

[39] 35 U.S.C. § 101 (2012).

[40] *See e.g.*, Gottschalk v. Benson, 409 U.S. 63, 67-8 (1972).

[41] 35 U.S.C. § 100(b) (2012) ("process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material.").

[42] *S. Rep. No. 1979, 82d Cong., 2d Sess., 5* (1952).

However, courts have long found three critical exceptions or limitations inherent in § 101. The Supreme Court, for over 150 years,[43] has held that under § 101 "'laws of nature, natural phenomena, and abstract ideas' are not patentable."[44] The Supreme Court's chief rationale behind the exclusionary principles stems from field preemption concerns.[45] Specifically, the Supreme Court sought to prevent the monopolization of nature and aimed to disallow a patent grant from constraining prospective innovation.[46] Further, although these § 101 exceptions are not statutorily spelled out, the Supreme Court has found it "consistent with the notion that a patentable process must be 'new and useful.'"[47]

These exceptions necessitate that a software patent claim do not fall into the realm of abstraction to be patent-eligible pursuant to § 101. For instance, software claimed in its purely algorithmic form is patent-ineligible.[48] In addition, the Supreme Court has prohibited the circumvention of patenting abstract ideas by limiting the use of a software formula to a specific technological realm.[49] Rather, an invention claiming an abstract idea must be inventive, not routine or conventional, to be patent-eligible.[50] Yet, for all of the Supreme Court's certainty in finding an abstract exemption in § 101, the Supreme Court

[43] O'Reilly v. Morse, 56 U.S. 62 (1854); Le Roy v. Tatham, 55 U.S. 156 (1853).
[44] Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 71 (2012) (citation omitted).
[45] Alice Corp. Pty. v. CLS Bank Int'l, 134 S. Ct. 2347, 2354 (2014).
[46] Mayo Collaborative Servs., 566 U.S. at 85.
[47] Bilski v. Kappos, 561 U.S. 593, 601-2 (2010); *See infra* Part III.
[48] Gottschalk v. Benson, 409 U.S. 63, 71 (1972) (finding a patent application for an algorithm to convert binary-coded decimal numerals into pure binary code was not a process pursuant to § 101).
[49] Parker v. Flook, 437 U.S. 584, 590-592 (1978).
[50] *Id.* at 591.

has struggled to consistently define "abstraction."[51] Indeed, the Supreme Court appears to have settled on defining abstraction on an ad hoc, case-by-case basis, depending on the challenged invention before the Court.[52] An additional wrinkle in the abstractness discussion lies in the Supreme Court's recognition that a broad interpretation of the exclusionary principle would eviscerate patent law because all inventions viewed at a broad level of generality represent abstract ideas.[53] Accordingly, patent eligibility is found when the proper balance is struck between providing an incentive to innovate and not impeding the flow of knowledge permitting and promoting invention.[54] Part III applies this standard to determine whether CAD file design prototype claims are new, useful processes within § 101, or rather the invention claims an abstract idea.[55]

B. Software at the Supreme Court

In 1981, the Supreme Court in *Diamond v. Diehr* found that this patent eligibility balance was properly struck for the first time in the software context.[56] In *Diehr*, the patentee claimed a software algorithm that guided a heating process for synthetically curing rubber.[57] The Supreme Court determined the claim was not "an attempt to patent a mathematical formula, but rather [was] an industrial process for the molding of rubber products."[58] Even though the claim involved a widely known mathematical equation, the

[51] Enfish, LLC v. Microsoft Corp., 822 F.3d 1327, 1334 (Fed. Cir. 2016).
[52] U.S. Patent and Trademark Office, July 2015 Update: Subject Matter Eligibility at 3 (2015).
[53] Mayo Collaborative Servs., 566 U.S. at 71.
[54] *Id.* at 92.
[55] Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2109 (2013).
[56] Diamond v. Diehr, 450 U.S. 175, 187 (1981).
[57] *Id.*
[58] *Id.* at 192-3.

Supreme Court held the industrial process was patentable subject matter, and not just because the claimed process utilized a computer.[59] Hinting at two future cornerstones of software patent eligibility, the Supreme Court noted that the software algorithm answered an unsolved technological problem in the industry and further transformed the mathematical process into an invention application.[60]

The *Diehr* decision heralded an era of increased software patentability and protection, which coincided with the software boom and increased filings in the field.[61] This era was largely unbroken until the Supreme Court's decision in *Bilski v. Kappos* in 2010.[62] In *Bilski*, the Supreme Court refocused its attention on § 101's prohibition against patenting abstract ideas and summarily rejected a software-implemented business-method patent.[63] While *Bilski*'s holding was narrow, denying a patent for hedging energy industry investments, and pertained more to the Federal Circuit's flawed patentability analysis methodology, the case marked a sea-change in the Supreme Court's overall attitude towards software patent eligibility.

After articulating theoretical groundings for patentable subject matter in *Bilski*, the Supreme Court went further in *Mayo* by crafting a two-step eligibility framework to "[distinguish] patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts."[64] At step one, courts ask whether the claim describes a process, machine, manufacture, or composition of matter

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[59] Alice Corp. Pty., 134 S. Ct. at 2358 (2014).

[60] *Id.*

[61] Robert Hunt & James Bessen, *The Software Patent Experiment*, FED. RES. BANK PHILADELPHIA 24 (2004).

[62] Bilski, 561 U.S. at 593 (2010).

[63] *Id.* at 597-98, 612.

[64] Alice Corp. Pty., 134 S. Ct. at 2355.

and if that claim is directed to a patent-ineligible concept.[65] If the claim is not directed at a patent-ineligible concept, such as an abstraction, then the invention is patentable. However, if the claim is directed at a patent-ineligible concept, courts move to step two and determine whether additional elements or an inventive concept "'transform the nature of the claim' into a patent-eligible application."[66] At this second step, courts address the claims both in combination and individually. If a claim recites an abstract idea, the invention must contain additional features demonstrating that the claimed invention is not a crafty lawyer's drafting exercise around patenting an abstract idea.[67]

While *Mayo* greatly informed the abstractness concept by providing the two-step eligibility framework, that case only grappled with a medical diagnostic test's patentability.[68] Arguably then, *Mayo* pertained solely to the nature of natural phenomenon judicial exemptions to § 101. It was not until 2014, in *Alice,* that a software patent again wound its way to the Supreme Court and allowed justices to tackle the abstraction exception directly. The judicial result was a groundswell. In *Alice*, the Supreme Court effectively expanded *Mayo*'s patent eligibility framework from merely pertaining to laws of nature to all categories of patentability exemptions under § 101.[69]

In *Alice*, the issue was whether a piece of Alice Corporation's computer-implemented escrow algorithm was patent-eligible or covered an abstract financial transactions idea.[70] The Supreme Court utilized the *Mayo* framework.

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[65] *Id.* at 2350 (citing Mayo Collaborative Servs., 566 U.S. at 67-8).
[66] *Id.* at 2355 (quoting Mayo Collaborative Servs., 566 U.S. at 67).
[67] *Id.* at 2357 (citing Mayo Collaborative Servs., 566 U.S. at 72, 78-80).
[68] Mayo Collaborative Servs., 566 U.S. at 67.
[69] John Clizer, *Exploring the Abstract: Patent Eligibility Post Alice Corp v. CLS Bank*, 80 MO. L. REV. 537, 540-1 (2015).
[70] Alice Corp. Pty., 134 S. Ct. at 2351-2.

At step one, the Court found the software patent claims to be abstract, being directed at a banking concept known for decades: intermediated settlement or escrow.[71] The court analogized Alice's escrow software to *Bilski*'s risk hedging software, holding that the risk hedging software was abstract.[72] At step two, Alice's patent failed to transform the abstract idea into an inventive concept because the "mere recitation of a generic computer cannot transform a patent-ineligible abstract idea into a patent-eligible invention."[73] The court's commentary here provided significant guidance that claiming a computer does not change *Mayo* step two's analysis. Alice Corporation's employment of a computer to run escrow software did not contain an inventive concept because the escrow program could have been carried out on existing computers.[74] However, for all of the additional guidance afforded in the decision, the Supreme Court declined to define "something more" stating that the court "need not labor to delimit the precise contours of the 'abstract ideas' category in this case."[75]

C. Alice's Aftermath

The *Alice* court's aversion to fleshing out "abstraction" has hounded the lower courts, and an inordinately high number of software patents[76] have been stricken down.[77] In the intervening years, the Federal Circuit has worked to provide guidance to practitioners and

[71] *Id.* at 2356.
[72] *Id.*
[73] *Id.* at 2358.
[74] *Id.* at 2357.
[75] *Id.*
[76] Steven Lundberg, *Alice v. CLS Bank Software Patents Scorecard, Two Years Later*, NAT'L L. REV. (Aug. 29, 2016).
[77] Jasper L. Tran, *Two Years After Alice v. CLS Bank*, 98 J. PAT. & TRADEMARK OFF. SOC'Y, 354, 358 (2016).

clarity to courts over the Supreme Court's hazy judicial framework for abstraction. This task was necessarily done on a case-by-case, and claim-by-claim, basis.[78] For instance, in *DDR* the Federal Circuit found a software patent directed at an abstract idea of generating a composite website, but held the claim was patentable as it solved a problem online wherein a "third-party merchants…'lure[d] the [host website's] visitor traffic away'…when they clicked on the merchant's advertisement."[79] By contrast, in *Digitech* a process patent for organizing information through algorithmic relation was found to be wholly abstract and without an inventive concept.[80]

Then, after two years of judicial stop and start, the Federal Circuit came down with its groundbreaking decision in *Enfish*, simultaneously shifting the software patent eligibility jurisprudence and stemming the flow of ineligibility.[81] In *Enfish*, the software patents at issue claimed a database indexing technique that stored and searched computer data faster and more effectively.[82] The Federal Circuit reversed the district court and found these software claims were not directed at the abstract idea.[83]

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[78] Enfish, LLC v. Microsoft Corp., 822 F.3d 1327, 1334 (Fed. Cir. 2016) (stating "The Supreme Court has not established a definitive rule to determine what constitutes an 'abstract idea' sufficient to satisfy the first step of the *Mayo*/*Alice* inquiry. Rather, both this court and the Supreme Court have found it sufficient to compare claims at issue to those claims already found to be directed to an abstract idea in previous cases.").

[79] DDR Holdings, LLC, v. Hotels.com, L.P., 773 F.3d 1245, 1248 (Fed. Cir. 2014).

[80] Digitech Image Techs., LLC v. Elecs. For Imaging, Inc., 758 F.3d 1344, 1350 (Fed. Cir. 2014).

[81] For an interesting patent eligibility case analysis tool in light of recent decisions, *see Decoding Patent Eligibility Post-Alice*, FENWICK & WEST LLP (2016), https://www.fenwick.com/pages/post-alice.aspx [https://perma.cc/D8FE-MUW3]

[82] Enfish, 822 F.3d at 1333.

[83] *Id.* at 1330.

Rather, the Federal Circuit used the Supreme Court's language in *Alice* and re-formulated the step one initial abstraction inquiry to ask "whether the focus of the claims is on the specific asserted improvement in computer capabilities . . . or, instead, on a process that qualifies as an 'abstract idea' for which computers are invoked merely as a tool."[84] The *Enfish* court returned to the idea presented in *Mayo* that abstraction exists at some generalized level in all patents, and stated that "the 'directed to' inquiry therefore, cannot simply ask whether the claims *involve* a patent-ineligible concept, because essentially every routinely patent-eligible claim involving physical products and actions involves a law of nature."[85]

In practice, this shift invigorated step one, disallowing all software patent claims from being found abstract and having to proceed to the inventive concept analysis in step two.[86] Indeed, that was the result for the contentious software patents at issue in *Enfish*. At step one, the *Alice* court had mentioned that a software patent's claimed improvements to a technological process or a computer's functionality could permit the software claim to escape the abstractness exemption.[87] The Federal Circuit honed in on this language and underscored how Enfish's patent solved a problem in the software arts and specifically boosted computing storage as well as processing time.[88] Specifically, the Federal Circuit rejected

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[84] *Id.* at 1335-6.
[85] Enfish, 822 F.3d at 1335.
[86] Derek C. Stettner et al., *Federal Circuit and USPTO Turn Corner on Software Patent Eligibility*, NAT'L L. REV. (May 25, 2016). Prior to *Enfish*, this had often been the judicial outcome even if the patent was subsequently found to embody an inventive concept permitting patentability.
[87] Enfish, 822 F.3d at 1335.
[88] *Id.* at 1339. The Federal Circuit distinguished from the facts of *Alice*, because there the petitioner had effectively conceded that their escrow

the notion that all computer-related improvements are inherently abstract, in the context of both hardware—detailing examples like chip architecture and LED displays—and software.[89] Accordingly, the Federal Circuit ended its analysis at step one because the software claims were not directed towards an abstract idea, but were directed at a specific solution to a technological problem.[90]

In addition, in *Enfish* the Federal Circuit detailed two factors that may come to play a significant role in software patent eligibility jurisprudence. First, the court underscored how a general-purpose computer was not tacked onto the software claim post-hoc in an attempt to patent a mathematical algorithm or basic economic practice.[91] Yet, importantly the Federal Circuit stated that the mere fact that Enfish's database software runs on a general-purpose computer does not mean the claim fails to satisfy under § 101.[92] Second, the Federal Circuit made a related point that simply because the software did not claim a physical component as part and parcel of its technological improvement, the claims were likewise not ineligible under § 101.[93] The court acknowledged that software innovation is often not "defined by particular physical features but rather by logical structures and processes."[94] In conjunction, these two clarifications colored in some of *Alice*'s unfilled sketch.

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software idea was abstract. For this reason the "Court did not need to discuss the first step of its analysis at any considerable length."

[89] *Id.* at 1335 (stating "software can make non-abstract improvements to computer technology, just as hardware improvements can, and sometimes the improvements can be accomplished through either route.").

[90] *Id.* at 1339.

[91] Enfish, 822 F.3d at 1338.

[92] *Id.*

[93] *Id.* at 1339.

[94] *Id.*

Indeed, the guidance afforded by *Enfish* readily charted a new jurisprudence for the Federal Circuit and lower courts to follow. In particular, this jurisprudence was demonstrated in the *Enfish* companion case *TLI Communications*. In *TLI Communications*, a software patent claiming a system and method for shooting, sending, and organizing digital images was found directed at the abstract concept of storing and classifying images digitally.[95] Having failed at step one, the Federal Circuit found no inventive concept at step two, as the patentee simply claimed common-place physical hardware and software components such as a phone, server, and image analysis unit.[96] Much like adding a general-purpose computer, TLI Communications' addition of a telephone network was not enough to permit patentability and did not meaningfully improve computer functionality.[97]

More recently in *McRO*, the Federal Circuit adhered to the *Enfish* strictures and upheld a 3D animation automation software patent at *Alice* step one.[98] Specifically, McRO patented a software improvement that automated 3D animation methods previously performed manually.[99] Instead of claiming a general-purpose computer, McRO focused its software patent on specific software rules that governed animated characters' lip synchronization and facial expressions.[100] McRO's software both improved on a manual animation problem in the software arts, and did not merely involve incorporating a computer to improve the technological process.[101] *McRO*

[95] In re TLI Comm. LLC Pat. Litig., 823 F.3d 607, 609 (Fed. Cir. 2016).
[96] *Id.* at 612.
[97] *Id.* at 612-13.
[98] McRO, Inc. v. Bandai Namco Games Am. Inc., 837 F.3d 1299, 1316 (Fed. Cir. 2016).
[99] *Id.* at 1307.
[100] *Id.* at 1307-08.
[101] *Id.* at 1314.

suggests that the Federal Circuit appears to be reaching an eligibility equilibrium in following *Enfish's* instructions at *Alice* step one and focusing on an invention's technological improvement or ability to solve an issue in the software arts.[102]

III. PART III – CONSIDERING CAD FILE PROTOTYPE'S PATENTABILITY

A. CAD Claims

While software patent eligibility has ebbed and flowed as the judicial system struggles to sift through the abstractness morass, software innovation has continued unabated. In particular to the 3D printing industry, a whole range of CAD file design prototypes have been developed with the rise of consumer-driven additive manufacturing platforms like MakerBot, Thingiverse, and Shapeways.[103] Conventional CAD file designs for household items and appliances such as chairs, mugs, and silverware abound

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[102] Of note, this past November, in *Amdocs (Isr.) Ltd. v. Openet Telecom, Inc.*, the Federal Circuit held that accounting software, used to calculate the bill for network communications usage, was patent eligible under § 101. *Amdocs (Isr.) Ltd. v. Openet Telecom, Inc.*, 841 F.3d 1288, 1306 (Fed. Cir. 2016). In particular, the *Amdocs* court found the software, and associated distributed architecture hardware, contained an "unconventional technological solution" to the computer network-specific problem of grappling with immense data flows. *Id.* at 1300. Interestingly, the panel majority in *Amdocs* seemingly glossed over *Alice* step one, assuming arguendo that the software patents were directed at an abstract idea. *Id.* Critics, and Judge Reyna in dissent, contended that the panel majority altogether skipped *Alice* step one. For this reason, my analysis does not hone in on *Amdocs* as it remains to be seen whether the case is more than just a one-off decision in § 101 jurisprudence.

[103] MAKERBOT, https://www.makerbot.com/ (last visited June 23, 2017); THINGIVERSE, https://www.thingiverse.com/about/ (last visited June 23, 2017); SHAPEWAYS, http://www.shapeways.com/ (last visited June 23, 2017).

online, readily available for download.[104] What's more, ground-breaking prototypes are increasingly under development utilizing CAD software programs and subsequently appearing online for distribution.

This section analyzes the patentability of CAD file design prototypes in light of the burgeoning developments in software patent eligibility jurisprudence. The analysis does not consider CAD files' patentability as a class of file formats, but rather whether the CAD file in conjunction with the claimed prototype design encoded in the file is patent-eligible as a software process.[105] For purposes of comparison within this analysis, two hypothetical inventions are posited. Invention A comprises a CAD file design prototype that produces routine hardware (a boomerang) and Invention B consists of a CAD file design prototype that produces an inventive product (electronic circuitry). Below are drafts of the representative claims:

Invention A

A computer-implemented method for digitally designing a physical, wooden toy boomerang, executing on a computer and 3D printing device the steps of:

designing a wooden toy boomerang with two standard, curved wings in the shape of an airfoil, connected at an angle;

encoding a boomerang design into a digital CAD file;

[104] 833 results matching "mug" as of October 2, 2017 via http://www.thingiverse.com/search?q=mug&sa= [https://perma.cc/NK99-XRCH].

[105] For interesting discussion on this as within the copyright realm see Lucas S. Osborn, *Of PhDs, Pirates and the Public: Three-Dimensional Printing Technology and the Arts*, 1 TEX. A&M L. REV. 812 (2014).

converting a encoded CAD file into a three-dimensional surface rendering STL file;

transmitting a three-dimensional surface rendering STL file and printing instructions to a 3D printing device;

additively manufacturing a designed wooden toy boomerang by the 3D printing device.

Invention B

A computer-implemented method for digitally designing a physical piece of electronic circuitry, with augmented storage capacity and processor speed, executing on a computer and 3D printing device the steps of:

designing an electronic circuit with interconnected transistors to form logic gates, the interactions of which allow for increased random-access memory, integrated on a silicon chip;

encoding an electronic circuit design into a digital CAD file;

converting an encoded CAD file into a three-dimensional surface rendering STL file;

transmitting a three-dimensional surface rendering STL file and printing instructions to a 3D printing device;

additively manufacturing a designed electronic circuit by the3D printing device.

To zero in on the § 101 analysis, this section assumes no § 102 or § 103 issues arising from hypothetical CAD Invention A and B. However, Part III's closing component discusses the jurisprudential mash-up between § 101, novelty, and non-obviousness concerns. While many CAD file design prototypes currently consist of

commonplace household items as exemplified by Invention A, which would likely raise serious patentability issues of novelty and non-obviousness, this is not necessarily the case going forward.[106] Indeed, Invention B has effectively been developed as electronic circuitry is currently being printed,[107] a 4D printed item that changes shape over time to mimic natural processes and ultimately grow organs has been devised,[108] and an entire field in 3D bioprinting has emerged.[109] Even downloadable prototypes to print personal 3D printer upgrades exist within the additive manufacturing space.[110]

Apart from the specific CAD file infringement concerns detailed in Part I, CAD file design prototype patent eligibility should be considered as a matter of

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[106] Dillon, *supra* note 25, at 442.

[107] Hal Hodson, *3D-printed phones herald world of instant electronic everything*, NEW SCIENTIST (Jun. 22, 2016), https://www.newscientist.com/article/mg23030790-100-3d-printable-smartphones-herald-world-of-embedded-electronics/ [https://perma.cc/G2MJ-52N5].

[108] Jacob Aron, *Glowing 4D-printed flowers could pave way for replacement organs,* NEW SCIENTIST (Jan. 25, 2016), https://www.newscientist.com/article/2075104-glowing-4d-printed-flowers-could-pave-way-for-replacement-organs/ [https://perma.cc/66NS-CQDK].

[109] John F. Hornick & Kai Rajan, *The 3D Bioprinting Patent Landscape Takes Shape as IP Leaders Emerge,* 3D PRINTING INDUS. (Jul. 7, 2016), https://3dprintingindustry.com/news/3d-bioprinting-patent-landscape-takes-shape-ip-leaders-emerge-84541/ [https://perma.cc/W3F7-ZNET]. Bioprinting brings with it a whole host of patentability concerns, in light of the Supreme Court's *Myriad* decision, but perhaps comparable 3D printed matter to CDNA could be patent eligible as the court determined "we hold that a naturally occurring DNA segment is a product of nature and not patent eligible merely because it has been isolated, but that cDNA is patent eligible because it is not naturally occurring."

[110] Davis Doherty, *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, 26 HARV. J.L. & TECH. 358 n.36 (2012).

innovation policy. If increasing segments of the economy involve commercial 3D printing and industrial additive manufacturing, inventors and practitioners alike would be remiss to categorically ignore this technology's embodied innovative heart: CAD file prototypes.

B. Borderline Beauregard

In the mid-1990's, as software began to dominate the economic landscape, inventors in the digital space sought increased options to patent their software because they faced a distinct infringement issue, along the same lines of CAD file infringement concerns outlined in Part I.[111] Chiefly, the sole direct patent infringers in the computing realm are the end users executing the software.[112] While end user infringement is a concern, these end users do not comprise the lion's share of commercial patent infringement, or at the very least do not have the deepest pockets. Distributors and middlemen were largely shielded from patent infringement suits because software code only operates when executed. Software patentees sought a means to file lawsuits against these software middlemen and distributors who traded in the digital goods, but never themselves executed the software.[113]

To combat these shortcomings, software proprietors employed a new claim drafting technique. Rather than claim the software code, inventors sought patents for code on a computer-readable medium, for instance a floppy disk, CD-ROM, or hard drive.[114] Software proprietors argued

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[111] ORG. FOR ECON. CO-OPERATION & DEV., PATENTS & INNOVATION: TRENDS & POLICY CHALLENGES 24 (2004); *see also supra* Part I.
[112] Doherty, *supra* note 110, at 429-30.
[113] Dillon, *supra* note 25, at 448.
[114] Andrei Iancu & Jeremiah Helm, *Code on Disks and Hat Tricks – Is Computer Software on a Medium Really Patentable?*, 90 J. PAT. & TRADEMARK OFF. SOC'Y 97, 98 (2008).

that this turned the code into an article of manufacture.[115] Computer-readable medium claims were challenged in a case before the Federal Circuit in 1995 in what was widely viewed as an industry test case: *In re Beauregard*.[116] Therein, an inventor claimed a floppy disk in addition to the underlying software encoded on the disk.[117] Initially the Patent and Trademark Office ("PTO") rejected the inventor's claim, relying on the printed matter doctrine, which generally disallows patents on inventions claiming printed text or character arrangements.[118] As the invention awaited appellate review, a new Solicitor of the PTO took the reins and found software embodied in a computer readable medium to be patentable subject matter.[119] The Federal Circuit never heard oral arguments and, in an unpublished opinion, dismissed the claim.[120] Subsequently the PTO withdrew its § 101 rejection and the claim was mooted by the Federal Circuit.[121]

Thereafter, software patentees relied on Beauregard claims to patent software processes encompassed by or residing in computer-readable media like floppy disks.[122] Importantly, the software code is not what is being patented in a Beauregard claim; since floppy disks and comparable computer readable media are readily found in the prior art, an inventor utilizing a Beauregard claim gains patent protection over the claimed software process being executed on a computer-readable medium typically

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[115] *Id.*
[116] In re Beauregard, 53 F.3d 1583, 1584 (Fed. Cir. 1995).
[117] *Id.*
[118] John R. Thomas, *Of Text, Technique, and the Tangible: Drafting Patent Claims Around Patent Rules*, 17 J. MARSHALL J. COMPUTER & INFO. L. 219, 244 (1998).
[119] Thomas, *supra* note 108, at 245.
[120] In re Beauregard, 53 F.3d 1583, 1584 (Fed. Cir. 1995).
[121] Iancu & Helm, *supra* note 114, at 100.
[122] Thomas, *supra* note 108, at 270.

consisting of a software storage apparatus.[123] Another way to conceptualize software encoded on a computer-readable medium is as a blueprint.[124] While the code does not—on its face—express the software's functionality, the simple act of inserting the computer readable medium into a computer and running the software results in the blueprint's operation.[125]

In many ways, a CAD file is akin to a floppy disk, CD-ROM, flash drive, or other Beauregard-style computer-readable medium. All of these computer-readable media, including CAD files, are found in the prior art. Both floppy disks and CAD files store software instructions and transmit executable code to a user computing machine. In the case of a CAD file, the file format itself is the storage medium encompassing a design prototype that a 3D printing computer accesses and executes. For these reasons, the CAD file and accompanying executable design, encoded in a software process, could theoretically be patented in a Beauregard claim. Much the same as how the software process per se isn't being claimed in a Beauregard claim, the CAD file patent claim would not simply cover design instructions to 3D print the item.[126] Solely claiming design instructions would likely run afoul of the printed matter doctrine. Rather, the CAD file and associate design would be claimed as a computer-readable medium.

For CAD files in particular, a Beauregard-style claim could help the inventor avoid the patent-defeating printed matter doctrine,[127] the PTO's initial patent-eligibility concern from *In re Beauregard.* While long

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[123] Dillon, *supra* note 25, at 449-450.
[124] Thomas, *supra* note 108, at 271.
[125] *Id.*
[126] Nicole A. Syzdek, *Five Stages of Patent Grief to Achieve 3D Printing Acceptance*, 49 U.S.F. L. REV. 335, 353 (2015).
[127] 1 Donald S. Chisum, CHISUM ON PATENTS § 1.02(4) (2017).

criticized, the printed matter doctrine has returned in the scholarship, if not in case law, due to its analogy to software code on a computer-readable medium.[128] The printed matter doctrine is a judge-made rule that disallows patenting recorded information, such as printed words or numerals, without any purposeful relationship to an embodying structure.[129] Specifically, an invention claiming printed matter fails for falling into the abstract judicial exemption to § 101.[130] Printed matter is not itself patentable, yet patent eligibility is boosted if the claimed printed matter is functionally related to the substrate.[131] So long as a relationship exists between the substrate and the printed matter, patentability is possible.[132]

Beauregard claims have been controversial since their inception, not least due to the case's messy procedural history. Yet, as recently as the *Alice* decision, the Supreme Court has put its official imprimatur on Beauregard claims in considering computer-readable mediums for patent eligibility. However, in *CyberSource Corp. v. Retail Decisions, Inc.*, the Federal Circuit laid down an important patentability premise for Beauregard claims that may have defanged potential software claiming abuses.[133]

The Federal Circuit determined that "[r]egardless of what statutory category ('process, machine, manufacture, or composition of matter,' 35 U.S.C. § 101) a claim's language is crafted to literally invoke, we look to the underlying invention for patent eligibility-purposes."[134] In this sense, a Beauregard claim cannot be deployed as a sly

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[128] Iancu & Helm, *supra* note 105, at 118.
[129] Brean, *supra* note 32, at 805.
[130] Iancu & Helm, *supra* note 105, at 117.
[131] *Id.* at 118.
[132] *Id.*
[133] CyberSource Corp. v. Retail Decisions, Inc., 654, F.3d 1366, 1375 (Fed. Cir. 2011).
[134] *Id* at 1374.

work-around for patent ineligible matters, for instance claims that fall into the judicial exemption for laws of nature, natural phenomena, and abstractness. Accordingly, the below analysis turns to the underlying inventions in Inventions A and B.

C. Alice Step One: Invention A

To properly assess a CAD file prototype's patentability, the *Mayo-Alice* framework governs when looking towards the underlying invention irrespective of a Beauregard claim.[135] CAD files are software which could readily fall into the subject matter eligibility exemption for abstraction that courts have long recognized.[136] As *Enfish* instructed, software patentability can be found in the software or hardware contexts.[137] In the additive manufacturing context then, *Enfish* has opened up the route to claiming a CAD file design prototype and not the resulting printed invention.[138] *Alice* step one begins by asking whether the patent is directed at a judicial eligibility exemption, such as whether or not the CAD file prototype embodies an abstract idea. If the CAD file prototype is not directed at an abstract idea, then the claim is patent-eligible. However, if the software patent is directed at an abstract idea, then courts proceed to *Alice* step two, detailed in the section below.

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[135] For purposes of this analysis, I just use "the *Alice* framework" to describe the patent eligibility test first articulated in Mayo Collaborative Servs.

[136] *See* Part II above.

[137] Enfish, 822 F.3d at 1346.

[138] *See* U.S. Patent and Trademark Office, Recent Subject Matter Eligibility Decisions *(Enfish, LLC v. Microsoft Corp.* and *TLI Communications LLC v. A.V. Automotive, LLC)* (May 19, 2016), https://www.uspto.gov/sites/default/files/documents/ieg-may-2016_enfish_memo.pdf. Per the PTO's guidance "the improvement does not need to be defined by reference to 'physical' components."

Regrettably, the Supreme Court has not clearly defined what comprises an abstract idea, perhaps due to the impossible nature of the task. Instead, the Supreme Court and the Federal Circuit have taken the approach of comparing the claims at issue to claims previously found to be abstract.[139] Indeed, the PTO has issued guidance supporting this claim comparison standpoint on defining abstraction.[140] The PTO has readily broken down abstraction into four principal categories: (1) fundamental economic practices, (2) certain methods of organizing human activity, (3) mathematical relationships and formula, and (4) "an idea 'of itself.'"[141]

Prior to the Federal Circuit's *Enfish* decision, courts assumed that the vast majority of software patent claims were necessarily directed at an abstract idea under *Alice* step one.[142] Yet, *Enfish* instructed that software patents are not *all* inherently abstract, necessitating evaluation under *Alice* step two, or else "the exceptions to § 101 [would] swallow the rule."[143] The *Alice* step one inquiry applies a filter to software claims "based on whether 'their character

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[139] Enfish, 822 F.3d at 1334.

[140] U.S. Patent and Trademark Office, July 2015 Update: Subject Matter Eligibility at 3 (2015), https://www.uspto.gov/sites/default/files/documents/ieg-july-2015-update.pdf ("Because the courts have declined to define abstract ideas, other than by example, the 2014 IEG instructs examiners to refer to the body of case law precedent in order to identify abstract ideas by way of comparison to concepts already found to be abstract.").

[141] *Id.* at 4-5.

[142] *E.g.*, Enfish, 822 F.3d at 1335-6; Manual of Patent Examining Procedure § 2103.03 ("Thus, examiners are reminded that software and business methods are not excluded categories of subject matter. For example, software is not automatically an abstract idea. While some software may include an abstract idea (such as a step that employs a mathematical relationship), further analysis of the claim as a whole would be required to determine eligibility.")

[143] Enfish, 822 F.3d at 1335, 1337 (emphasis added).

as a whole is directed to excluded subject matter.'"[144] For both Inventions A and B from above, *Enfish*'s instruction tips the scales against patent ineligibility due to abstractness, if ever so slightly. Still, *Alice* step one acts as a meaningful gatekeeper to ineligible software patent subject matter.

At *Alice* step one, Invention A, which claims a CAD file design prototype of a boomerang, is arguably directed at the abstract idea of a boomerang toy design. In assessing what the abstract idea both is and directed to, courts and examiners hone in on the inventor's claims to suss out the delineated item being claimed.[145] The analysis then turns towards on whether that abstract idea fits into one of the four principal disallowed categories as identified by the courts and defined by the PTO.

A boomerang toy design could first be considered as a fundamental economic practice. Mankind has for centuries sought various means of entertainment—and diversion from our hardscrabble existence—by devising games and crafting material playthings. Much like how an escrow clearing house account was found to be a fundamental economic concept dating back to the 1800's or earlier,[146] a boomerang design has been in existence for thousands of years.[147] In particular, a boomerang design has a storied history beginning with the aboriginal people and spreading across continents and various cultures.[148]

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[144] *Id.* at 1335 (quoting Internet Patents Corp. v. Active Network, Inc., 790 F.3d 1343, 1346 (Fed. Cir. 2015)).
[145] Alice Corp. Pty., 134 S. Ct. at 2355.
[146] Alice Corp. Pty., 134 S. Ct. at 2356 (citing Yesha Yadav, *The Problematic Case of Clearinghouses in Complex Markets*, 101 GEO. L.J. 387, 406-412 (2013); J. HULL, RISK MANAGEMENT AND FINANCIAL INSTITUTIONS 103-104 (3d ed. 2012)).
[147] PHILIP JONES, BOOMERANG: BEHIND AN AUSTRALIAN ICON 6 (1996).
[148] ROBERT CREGO, SPORTS AND GAMES OF THE 18TH AND 19TH CENTURIES 246 (2003).

While the term "fundamental" is supposed to be "used in the sense of being [a] foundational or basic" economic concept such as a contract formation, the PTO guidance further delineates that the term is employed "not in the sense of *necessarily* being 'old' or 'well-known.'"[149] Much of the evidence provided in *Alice* in support of escrow being an abstract idea, in the form of old textbooks and articles, drew on escrow's core economic dealings and how the concepts age.[150] Accordingly, a boomerang's longevity and place in the human psyche lends itself to viewing the toy as a fundamental, core sociocultural device. Yet, boomerang toy design does not seem economically fundamental when compared to practices like forming a contractual relationship[151] or hedging.[152]

Assessing the remaining principal categories delineated by the PTO, a method of organizing human activity doesn't quite fit with the notion of boomerang toy design, despite an instance where managing a game of bingo was found to be directed at an abstract idea.[153] Rather than claim the game itself, *Planet Bingo*'s patent addressed the game's management, bringing it in line with other patents directed at abstract ideas in this category like

[149] U.S. Patent and Trademark Office, *supra* note 129, at 4 (emphasis added).
[150] *Id.* at 6.
[151] buySAFE, Inc. v. Google, Inc. 765 F.3d 1350, 1355 (Fed. Cir. 2014).
[152] Bilski, 561 U.S. at 3231 (2010) (citing In re Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (Rader, J., dissenting).
[153] Planet Bingo, LLC v. VKGS, LLC, 576 Fed. Appx. 1005, 1008-9 (Fed. Cir. 2014).

meal planning,[154] buying additional in-game items,[155] and structuring a marketing company or sale force.[156]

Boomerang toy design seems to fit an idea "of itself," such as thinking, because this category mostly pertains to mental processes that "can be performed in the human mind, or by a human using a pen and paper."[157] Boomerang toy design is readily accomplished by an individual designer hand-sketching specifications on a pad of paper. Yet, case law in the idea "of itself" category pertains to organizing data,[158] sifting through vast quantities of information,[159] and using this data or information to select from an array of options.[160] While this does not necessarily mean that boomerang toy design is not an idea "of itself," there is not a case on point to readily analogize to, as necessitated by the courts and the PTO.

Perhaps the best abstraction fit lies in the mathematical relationships and formulas category. CAD software is designed around utilizing mathematical equations, rules, and formulas on digital grids to design an item.[161] The underlying CAD software is comprised of mathematical algorithms that perform repeated in-program calculations which permit a designer to tweak a prototype in three dimensions. If designing a boomerang on CAD

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[154] Planet Bingo, 576 Fed. Appx. at 1006; DietGoal Innovations, LLC v. Bravo Media, LLC, 33 F. Supp. 3d 271, 274 (S.D.N.Y. 2014), *aff'd without opinion*, 599 Fed. Appx. 956 (Fed. Cir. 2015).

[155] Gametek LLC v. Zynga Inc., Nos. CV 13-2546 RS, CV-13-3089-RS, CV-13-3472-RS, CV-13-3493-RS, 2014 WL 1665090 at *1 (N.D. Cal. Apr. 25, 2014), *aff'd without opinion*, 597 Fed. Appx. 644 (Fed. Cir. 2015).

[156] In re Ferguson, 558 F.3d 1359, 1361 (Fed. Cir. 2009).

[157] CyberSource, 654 F.3d at 1372.

[158] Digitech Image Techs., 758 F.3d at 1350.

[159] CyberSource, 654 F.3d at 1370.

[160] SmartGene, Inc. v. Advanced Biological Labs., 555 Fed. Appx. 950, 952 (Fed. Cir. 2014).

[161] *See generally* Y. GARDAN, MATHEMATICS AND CAD: VOLUME 1: NUMERICAL METHODS FOR CAD (2012).

necessarily utilizes mathematical constructs, then CAD software is comparable to "computing a price for the sale of a fixed income asset and generating a financial analysis output,"[162] an algorithm for determining the "optimum number of times a sales representative for a business should visit each customer,"[163] or even a "formula describ[ing]…directional radio activity."[164] These arrangements all rely on the underlying mathematical algorithm to produce an output in the software patentee's respective field. In this sense, Invention A is directed at an abstract idea and permitting a patent grant would monopolize the field, preempting future follow-on innovative development in the toy field.

Invention A likely faces an uphill climb towards patent eligibility for a much different reason. In *Enfish*, the Federal Circuit found the re-formulated *Alice* step one question to ask "whether the claims are directed to an improvement to computer functionality versus being directed to an abstract idea, even at the first step of the *Alice* analysis."[165] Invention A encompasses a CAD file and associated boomerang design prototype; nothing claimed improves on a generic computer's functionality as a tool. The hypothetical claim would not, for instance, boost a computer's memory, improve performance time, or generally solve a problem in the software arts. Rather, Invention A covers a basic boomerang prototype, simply in updated wrapping: a new technological medium. As groundbreaking as 3D printing may be, Invention A still

[162] Graff/Ross Holdings, LLP v. Federal Home Loan Mortg. Corp., 892 F. Supp. 2d 190, 197, *aff'd without opinion*, 604 Fed. Appx. 930 (Fed. Cir. 2015).
[163] In re Maucorps, 609 F.2d 481, 482 (C.C.P.A. 1979).
[164] *See* Mackay Radio & Tel. Co. v. Radio Corp. of America, 306 U.S. 86 (1939).
[165] Enfish, 822 F.3d at 1335.

likely represents an abstract idea employing the computer as a tool, versus a definitive improvement in computing.

D. Alice Step One: Invention B

By contrast, Invention B, covering a CAD file and encoded electronic circuitry prototype, presents a starkly differing analysis. At *Alice* step one, a court would again query whether the software patent is directed at an abstract idea.[166] Bearing in mind Invention B's specific claim language, a court would reasonably ask whether Invention B is directed towards the abstract idea of electronic circuitry design, *i.e.* whether electronic circuitry design is an abstract concept. This categorical analysis would closely track, but not completely follow, the above for Invention A, considering the overlap in CAD design concept. The idea "of itself" and method of organizing human activity categories would similarly be inapplicable for being more tied to organizing data and managing human relationships, respectively.

The fundamental notion of an economic practice again can be utilized to assess the centrality and longevity of such practice to mankind's basic socioeconomic operations. While a much more recent development in human history, integrated circuitry design has been practiced for decades, since the mid-twentieth century.[167] Unlike forming a contractual relationship in *buySAFE*[168] or a hedging risk in *Bilski*,[169] electronic circuitry design work is a specific, precise engineering feat. Rather than a basic lofty principle or a fundamental tenant undergirding a

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[166] Alice Corp. Pty Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014).
[167] FRANCO MALOBERTI & ANTHONY C. DAVIES, A SHORT HISTORY OF CIRCUITS AND SYSTEMS 67 (2016).
[168] buySAFE,. 765 F.3d at 1355.
[169] Bilski, 561 U.S. at 595.

macroeconomic system, electronic circuitry design is a tangible art relied upon heavily by industry. Accordingly, Invention B's focus on electronic circuitry design is likely not directed at an abstract idea. However, Invention B would run into the same concern over being categorized as comprising mathematical relationships and formulas. CAD software may never escape these concerns because the underlying software runs on formulaic operations.[170] However, an inventor's engineering feats required to design electronic circuitry within CAD goes above and beyond simply plugging in a mathematical equation.

Critically, *Enfish* provides two further favorable points for Invention B's patent-eligibility. First, the Federal Circuit's reformulated *Alice* step one abstraction analysis—focusing on whether or not the claimed patent improves on computing technology—bodes well for Invention B escaping the abstraction exemption. Electronic circuitry powers contemporary computing machines, in devices ranging from servers to databases and desktops. In many ways, electronic circuitry is akin to a human's skeletal frame and internal organs, the physical framework that sends and receives signals permitting a computer's proper operation. Invention B specifically increases computing storage and boosts processor time, thus improving on previously existing technology and a computer's functionality. These reasons cut against finding Invention B abstract.

In addition, *Enfish* affords a second patent-eligibility favoring foothold for Invention B, as chip design is specifically mentioned as an example hardware improvement that courts would not be found abstract. As the court noted, "some improvements in computer-related technology when appropriately claimed are undoubtedly not abstract, such as a *chip architecture*, an LED display,

[170] *See generally* GARDAN, *supra* note 152.

and the like."[171] In addition, Invention B can be analogized to the self-referential table software patent at issue in *Enfish*, which improved on computer memory retrieval and storage.[172] Invention B claims improved electronic circuitry that boosts computing power and enhance a computer's processing power. As such, Invention B fits snugly into the *Enfish* examples and likely would avoid falling into the realm of abstraction.

Invention B's patent-eligibility is seemingly unhampered by the two other *Enfish* teachings. First, the fact that the invention runs on a general-purpose computer does not outright doom the software patent.[173] This instruction presents an interesting question in the context of 3D printing and the burgeoning additive manufacturing field: are computers that operate 3D printing software, with a CAD program operating and communicating with a 3D printer, considered general-purpose computers for purposes of the *Alice* framework? The term "general-purpose computer" has only loosely been defined in the case law thus far as being distinct from a special purpose computer "programmed to perform particular functions."[174] Currently, a standard desktop running a traditional operating system can be utilized by an individual to 3D print an item. In this sense, Invention B could be run on an average computer. Yet, how the general-computer consideration takes into account a 3D printer add-on is not readily apparent. Either way additive manufacturing computers are conceived of, Invention B passes the eligibility threshold. Additionally, *Enfish* states that a claim is not patent ineligible simply because a claimed

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[171] Enfish, 822 F.3d at 1335 (emphasis added).
[172] *Id.* at 1336.
[173] *Id.* at 1338.
[174] In re Alappat, 33 F.3d 1526, 1545 (Fed. Cir. 1994); *see also* Aristocrat Techs. Austl. PTY Ltd. v. Int'l Game Tech., 521 F.3d 1328, 1333 (Fed. Cir. 2008).

improvement does not reference a physical component.[175] While a patentee could certainly claim the resulting 3D printed item, there are practical patenting concerns to doing so, and this paper's analysis focuses specifically on the software component. Nonetheless, Invention B sidesteps these abstractness concerns.

All in all, Invention B features a technological improvement, rather than a software patent claiming an ordinary computing capacity. The comparable non-abstract claim referenced in *Enfish*, pertaining to chip architecture, further supports a finding that Invention B is not directed at an abstract idea. However, Invention A's focus on toy boomerang design is conceivably directed at a more abstract concept, in practice for centuries, that does not improve on computing technology or fix a problem in the software arts. The two claims appear headed down opposite paths at the abstractness exemption fork in the road.

E. Alice Step Two: Invention A

Regardless of whether Inventions A and B are found to be directed at an abstract idea under *Alice* step one, considering step two allows for a fuller analysis. Indeed, *Enfish* hints that close cases concerning a claim's abstraction should proceed to step two for clarity.[176] *Alice* step two instructs a court considering an abstract patent claim to determine whether the claim includes an "inventive concept" that sufficiently transforms the nature of the claim to a patent-eligible invention.[177] An inventive

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[175] Enfish, 822 F.3d at 1339.

[176] *Id.* ("We recognize that, in other cases involving computer-related claims, there may be close calls about how to characterize what the claims are directed to. In such cases, an analysis of whether there are arguably concrete improvements in the recited computer technology could take place under step two.").

[177] Alice Corp. Pty., 134 S. Ct at 2357.

concept consists of claims "sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the ineligible concept itself."[178] Courts consider the claims individually and in an ordered combination,[179] to determine whether the claims do more than merely instruct a practitioner to implement an abstract idea on a generic computer.[180]

For this step two analysis, assume both Invention A and B are directed at abstract ideas. To determine whether or not Invention A contains more than an ineligible concept, *Alice* and *DDR* provide the analytic parameters.[181] In *Alice*, the patentee's creation and maintenance of escrow accounts on a computer were "well-understood, routine, conventional" activities known industry-wide.[182] Consequently, these basic functions performed on generic computers, were not found to contain an inventive concept.[183] Certainly, a boomerang design is known within the toy and sporting industries, having been crafted for so many years. However, a boomerang design is likely not as common-place an activity as an electronic escrow account. The analysis appears to turn on the degree the claimed activity is regularly conducted on a computer. A boomerang design is still largely a hand-crafted art done alternatively over a computer apparatus. Therefore, invention A must present more than an ineligible concept at step two.

On the other end of the eligibility spectrum, in *DDR*, a patent claiming a system to generate a combined

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[178] *Id.* at 2355 (quoting Mayo, 132 S. Ct. at 1294).
[179] *Id.*
[180] *Id.* at 2359.
[181] *See* Alice Corp. Pty., 134 S. Ct. 2347 (2014); DDR, 773 F.3d 1245 (Fed. Cir. 2014).
[182] Alice Corp. Pty., 134 S Ct. at 2359 (citing Mayo Collaborative Servs., 132 S. Ct. at 1294).
[183] *Id.* at 2357, 2360.

website featuring content from a host and third-party merchant site did more than "recite the performance of some business practice known from the pre-Internet world along with the requirement to perform it on the Internet."[184] The patent was found to contain an inventive concept because it solved a website host's problem of displaying a third party merchant's wares while retaining visitor traffic, and as a result was patent eligible subject matter.[185]

Invention A arguably overcomes any number of design problems relating to a hand-crafted, or inferior mass-produced, boomerang's precision, uniform production, and performance. Yet, courts' finding of an inventive concept in the software arts centers on the patent "claim[s] in practice amount[ing] to 'significantly more' than a patent on an ineligible concept," like an unimproved abstract idea in general purpose computing. [186] Invention A represents an advance in boomerang design over the hand-crafted or machine, but non-additive manufactured variety, but this benefit does not directly claim more than an ineligible concept at *Alice* step two. Indeed, Invention A's 3D printed design embodies the implementation of an abstract idea on a computer that *Alice*'s framework guards against. Conversely, in *DDR*, a computer was not found to be a patentability detriment because it was necessarily involved to overcome a computer network-specific problem.[187] Here, Invention A recites a CAD file powering a 3D printer not out of necessity to resolve an additive manufacturing issue but as the inventive advance itself.

DDR further elaborates on this point by considering the claims in an ordered combination.[188] In particular, the

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[184] DDR, 773 F.3d at 1257.
[185] *Id.* at 1259.
[186] 1255-6 (citing Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355, 189 L. Ed. 2d 296 (2014)
[187] *Id*. at 1257.
[188] *Id.* at 1255.

claims read in conjunction did not merely recite routine, conventional Internet usage.[189] Rather, the combined claims recited additional features that detailed "a specific way to automate the creation of a composite web page by an 'outsource provider' that incorporate elements from multiple sources in order to solve a problem faced by website on the Internet."[190] Invention A's CAD file and associated design prototype, even considered in combination, recite typical 3D printer usage. The additive manufacturing process would simply not work without a CAD file input; a 3D printer would sit collecting dust if the software design components were not incorporated into the production process. Accordingly, Invention A, read in combination or individually, does not solve a computing problem or perform any operation differently than what occurs in the typical 3D printing context. Invention A would likely fail at *Alice* step two for not being transformative or containing an inventive concept that takes the software claims outside the realm of abstraction.

F. Alice Step Two: Invention B

Invention B yields a starkly different analysis under *Alice* step two. To begin, Invention B must contain more than a patent-ineligible concept. Additive manufacturing is readily performed by industrialists, consumers, and hobbyists in the field today.[191] Analogizing to the natural law exemption construct, in *Ariosa*, a method of preparing

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[189] *Id.* at 1259.
[190] *Id.*
[191] *See e.g.*, Amy O'Leary, *3-D Printers to Make Things You Need or Like*, N.Y. TIMES (June 19, 2013), http://www.nytimes.com/2013/06/20/technology/personaltech/home-3-d-printers-to-make-things-you-need-or-just-like.html; Steven Kurutz, *Bringing 3-D Power to the People*, N.Y. TIMES (Mar. 26, 2014), https://www.nytimes.com/2014/03/27/garden/bringing-3-d-power-to-the-people.html?_r=0.

and detecting genetic sequences was claimed in an invention performed on a newly discovered natural surface.[192] The *Ariosa* court found these scientific steps did not claim more than a patent-ineligible concept because this medicinal method had long been known and practiced in the scientific community.[193] Similarly, Invention B features an additive manufacturing process typified in the 3D printing field. The CAD file design component of the additive manufacturing process likely is not, on its own, a patent-eligible concept.

Adding a natural law to a known method, or an abstract idea to the 3D printing context, is not sufficient to render claims patent-eligible.[194] Invention B's electronic circuitry design process is assumedly abstract for purposes of this step two analysis. Thus, Invention B's abstract idea and process claim faces a steep climb to be found to contain more than a patent-ineligible concept. Analogizing again to the natural law exemption construct, in *Rapid Litigation*, a freezing process for preserving cells for later use was found patent-eligible as having an inventive concept.[195] In *Rapid Litigation*, the new freezing process was a scientific discovery that fell within the judicially crafted natural law exemption.[196] However, prior scientific discoveries indicated that the cells at issue could only be frozen once and survive; the inventive freezing process utilized cells capable of living through multiple freezes and subsequently solved an industry problem.[197] In much the same way, Invention B's claims of an electronic circuitry

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[192] Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d at 1371, 1373-4 (Fed. Cir. 2015).
[193] *Id.* at 1377-8.
[194] Mayo Collaborative Servs., 132 S. Ct. at 82.
[195] Rapid Litig. Mgmt. v. CellzDirect, Inc. 827 F.3d 1042, 1052 (Fed. Cir. 2016).
[196] *See* Rapid Litig. Mgmt., 827 F.3d at 1048.
[197] *Id.* at 1045.

design component in combination contains more than a patent-ineligible concept for several reasons. First, echoing *Alice* step one, the resultant printed electronic circuitry could solve industry problems with computing storage and processing time. Second, like the double freezing process in *Rapid Litigation* that had less loss of cell viability, Invention B potentially recites an improved technological process for designing electronic circuity via 3D printing software. These weigh in favor of a finding that Invention B covers something more than a patent-ineligible concept.

However, Invention B's performance of electronic circuitry design on a 3D printer does not necessarily entail an improved technological process. While "each of the claims' individual steps . . . known independently in the art does not make the claim unpatentable," a claim exclusively reciting "'well-understood, routine, conventional activity already engaged in by the scientific community' will not be patent eligible."[198] Looking to *Mayo*, the *Rapid Litigation* court held that medical diagnostic and drug administration steps were commonplace in the medical field, and simply claiming an additional natural law concept was not enough for patent eligibility.[199] In this light, performing electronic circuitry design on a 3D printer seems no different than standard industry practice. Yet, a new combination of steps detailing a new 3D printing process, even though known previously or in common usage, could be found to contain more than a patent-ineligible concept.

Alice also instructs that a patent must claim more than just the implementation of an abstract idea on a computer to contain an inventive concept.[200] Invention B pertains to increasingly routine and well understood activities in circuitry design and additive manufacturing, but a strong counter-argument can be made that 3D printing

[198] *Id.* at 1049 (quoting Mayo Collaborative Servs., 132 S. Ct. at 1298).
[199] Rapid Litig. Mgmt., 827 F.3d at 1052.
[200] Alice Corp. Pty., 134 S. Ct. at 2355.

is far from a conventional process in 2017. More specifically, electronic circuitry design resulting from additive manufacturing is an even more recent phenomenon.

Analogizing to *Bascom*, the court found that the abstract idea of a customizable online content filtering tool did contain an inventive concept beyond employing routine computer technology.[201] Principally, the *Bascom* invention claimed a newly designed filtration tool, which afforded specific improvements over online communication networks, rather than simply implement an abstract concept on a computer.[202] Comparably, Invention B can be viewed as covering a device similar to the filtering tool; Invention B recites the 3D printing equipment in the same way the *Bascom* invention details computers to build the end product.[203] All software patents are not ineligible simply because they require a computer to operate.[204] Likewise, additive manufacturing should not be found patent-ineligible simply because it needs a 3D printer to run.

The inventive concept inquiry then shifts to the claims, individually or in combination, describing how the patent's desired result is achieved.[205] In *Bascom*, the patent claims individually recited "generic computer, network and Internet components, none of which is inventive by itself."[206] Yet, Bascom specifically did not assert inventing those standard computing components, nor did its specification contend those computing elements were

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[201] Bascom Glob. Internet Servs., Inc. v. AT&T Mobility, LLC, 827 F.3d 1341, 1352 (Fed. Cir. 2016).
[202] *Id.* at 1348-9.
[203] *See Id.* at 1344.
[204] *See e.g.*, Enfish, LLC v. Microsoft Corp., 822 F.3d 1327, 1338 (Fed. Cir. 2016) ("Moreover, we are not persuaded that the invention's ability to run on a general-purpose computer dooms the claims.")
[205] Elec. Power Grp., LLC v. Alstom S.A., 830 F.3d 1350, 1353 (Fed. Cir. 2016).
[206] Bascom, 827 F.3d at 1349.

inventive.[207] Instead, Bascom's claims as a combination contained an inventive concept.[208] By comparison, in *Electric Power Group*, the patent claims did not "require any nonconventional computer, network, or display components… but merely call for performance of the claimed information collection, analysis, and display functions 'on a set of generic computer components' and display devices."[209] At both the individual and combined claim level, the *Electric Power Group* patent lacked an inventive concept as it simply recited generic computing data collection.

Invention B falls somewhere between the *Bascom* and *Electric Power Group* guideposts. At the individual claim level, Invention B necessarily recites standard 3D printing equipment to successfully perform additive manufacturing design work. Invention B's claims could be analogized to *TLI Communications*, wherein a telephone unit and server were claimed, but found to be merely providing the environment on which the software patent's abstract ideas of image storage and classification functionalities were carried out.[210] Invention B would have to guard against this line of rejection by arguing that its focus is on an improvement in computing technology, as opposed to reciting a generic telephone unit. Further, while Invention B would necessarily recite the 3D printer, the patent would not claim the 3D printer as the invention itself. Per *Bascom*, this fact alone—reciting a generic-computer, similar to the increasingly commonplace 3D printing workstations—should not be dispositive of Invention B's patentability.[211] Still, Invention B does not

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[207] *Id.*
[208] *Id.* at 1350.
[209] Electric Power Grp., 830 F.3d at 1355.
[210] In re TLI Commc'ns LLC Patent Litig., 823 F.3d 607, 611 (Fed. Cir. 2016).
[211] Bascom Global Internet Servs., 827 F.3d at 1349-52.

individually recite any nonconventional 3D printing technological components. CAD files and the 3D printing equipment are not being claimed as part of the invention, but are recited as standard equipment necessary for additive manufacturing. As *Electric Power Group* instructs, this should have some negative bearing on Invention B's patentability. The individual claims come out as a wash, then, and the claims in combination must be considered.

Taken together, Invention B recites a process for 3D printing an electronic circuitry prototype. Unlike the power grid monitoring invention in Electric Power Group, which "did not require an arguably inventive set of components or methods, such as measurement devices or techniques, that would generate new data," Invention B transforms the design prototype into an inventive piece of electronic circuitry.[212] Akin to the resultant online filtering device in Bascom, the end result of Invention B is a workable printed prototype that improves computer speed and functionality. Consequently, while Invention A is limited to a relatively standard software component applied on a generic computing device, Invention B likely contains an inventive concept. Invention B not only improves on computing technology and solves storage issues, but its claims, when read in combination produce an invention beyond simply claiming computer-enabled software.

G. Diehr Straits

Another avenue for Inventions A and B to pursue in support of patentability involves analogizing to *Diamond v. Diehr*. While decided more than three decades before *Alice*, *Diamond v. Diehr* provides a potentially suitable framework for Inventions A and B, considering both involve industrial processes. Indeed, parties regularly cite

[212] Electric Power Grp., 830 F.3d at 1355.

to *Diehr* to support patentability[213] as a type of patent-eligibility alternative framework.

In *Diehr*, the Supreme Court assessed whether an algorithm-enabled, computer-implemented process to cure synthetic rubber was patent-eligible. The claims detailed an industrial process that transformed raw rubber into a cured form, wherein the computer ran an algorithm lessening the occurrence of over or under-curing the rubber.[214] While the Supreme Court stated that the computer was not necessary to cure the rubber, the computer did play a role in resolving an industry concern.[215] Further, the court noted how industrial processes have historically been found patent-eligible, and if the computer-implemented mathematical formula is in furtherance of patent law's aims —such as protecting industrial processes— then the mathematical claim can satisfy § 101.[216]

Considering Inventions A and B, processing rubber is no more complex an industrial process than designing a boomerang, and certainly equivalent to or less complex than electronic circuitry design. The algorithm guiding the rubber curing process is similarly comparable to the CAD file design prototypes undergirding Inventions A and B's 3D products. In *Diehr*, the algorithm had to be enabled via software, in much the same way as how lines of software code comprise the underlying designed item in a CAD file. The resulting industrial design processes exemplified by Inventions A and B thus appear to be patent-eligible by direct comparison.

Further, *Diehr* presciently acknowledged an inherent limitation against insignificant post-solution activity, disallowing crafty patent attorneys from drafting

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[213] *Id.* at 1355.
[214] Diamond v. Diehr, 450 U.S. 175, 177 (1981).
[215] *Id.* at 187.
[216] *Id.* at 184.

around patentable subject matter exemptions.[217] This notion is akin to an inventive concept found in *Alice* step two. *Diehr* stated that the algorithm, without more, could not have been claimed for fear of monopolizing the field.[218] For the reasons discussed above, Invention A likely does not contain significant post-solution activity, whereas Invention B provides an inventive solution to computing problems. As such, Invention B presents a viable parallel to *Diehr* whose patentability effort would benefit by making a direct case analogy to the predecessor two steps analyzing an industrial process.

H. Preemption Possibilities & Pitfalls: Alice "Step 3"

Concerns over preemption have begun to play a critical role in Federal Circuit software patent eligibility jurisprudence. In many ways, these overarching concerns can be thought of as a third step in the *Alice* framework, albeit one the PTO[219] and the Federal Circuit has held is not part of the § 101 eligibility test.[220] Courts examining patent subject matter eligibility have repeatedly stated that claims must be "more than a drafting effort designed to monopolize" the abstract idea.[221] At minimum then, courts have recognized the economic policy implications of permitting a patent on an idea that would preempt the field.

The *Diehr* Court stated that while the inventor's claimed process utilized a famous mathematical algorithm, the inventors had not sought to preempt the equation's use; noting, "[r]ather, they seek only to foreclose from others

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[217] *Id.* at 191-2.
[218] *Id.* at 200.
[219] United States Patent and Trademark Office , *supra* note 129.
[220] Rapid Litig, 827 F.3d at 1052 (Fed. Cir. 2016) ("while pre-emption is not the test for determining patent-eligibility… it is certainly the 'concept that undergirds…§ 101 jurisprudence.").
[221] Alice Corp. Pty., 134 S. Ct. at 2358 (2014).

the use of that equation in conjunction with all of the other steps in their claimed process."[222] In practice, this determination meant that the patent allowed Diehr to install rubber in pores, close a mold, repeatedly determine the rubber's temperature and recalculate the appropriate cure time, and open a press at the proper time. The inventors were not able to claim, and subsequently sue others for infringement, over the wide-spread use of a mathematical equation in any number of industrial processes.[223] Specifically, the Supreme Court was worried about the follow-on effects if they afforded patent-eligibility.

The Federal Circuit has articulated its preemption concerns in a comparable, yet slightly different manner. Principally, the court is concerned with the "distinction between ends sought and particular means of achieving them, between desired results (functions) and particular ways of achieving (performing) them."[224] This results-process dichotomy draws a sharp distinction between patenting a particularized solution to a problem and patenting an abstract idea claiming to a resolve a problem generally.[225] The former is generally patent-eligible and the latter tends to be found patent-ineligible. The court's underlying concern pertains to innovation; patenting a specific solution encourages "further innovation in the form of alternative methods for achieving the same result."[226] By contrast, patenting an abstract idea would monopolize all possible solutions and "inhibit[] innovation by prohibiting other inventors from developing their own solutions to the problem without first licensing the abstract idea."[227]

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[222] Diehr, 450 U.S. at 187.
[223] *Id.* at 214.
[224] Electric Power Grp., 830 F.3d at 1356 (Fed. Cir. 2016).
[225] *Id.* at 1354.
[226] *Id.* at 1356.
[227] *Id*.

To assess preemption of Inventions A and B, courts "look to whether the claims in these patents focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery."[228] Inventions A and B could most easily avoid preempting their respective fields by claiming specific structures that do not cover all possible approaches.[229] In *McRO*, the patents covering software that automatically animated lip synchronization for videogame characters, contained patent-eligible claims focused on the specific technological improvement.[230] McRO's inventors did not claim the end result of wholly automating animation, but instead left room for other software engineers to improve on the process. Similarly, Invention A should recite only the specific CAD design prototype for a boomerang and printing production methodology. Invention B should similarly limit the patent's scope to the electronic circuitry CAD design prototype and printing production methodology. Further, Invention B should not be directed at the concept of all 3D printed electronic circuitry design, but the precise prototype associated with the CAD file.

Above all, for Inventions A and B to be patent-eligible, the claims must be drafted in a manner that does not entirely monopolize an abstract idea, permitting other firms to design around the patent.[231] Reciting a "discrete implementation of the abstract idea" is a best practice against a claim preempting all subsequent innovative developments.[232] In addition, Inventions A and B should

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[228] McRO, Inc. v. Bandai Namco Games Am. Inc., 837 F.3d 1299, 1314 (Fed. Cir. 2016).
[229] *Id.*
[230] *Id.* at 1316.
[231] Rapid Litig. Mgmt., 827 F.3d at 1052.
[232] Bascom Global Internet Servs., 827 F.3d at 1350.

shy away from functional, result-focused claim drafting language which the Federal Circuit has repeatedly found patent-ineligible.[233]

I. Anticipated Artisans: Injecting § 102 & § 103 Concerns Into § 101

Another component outside of the *Alice* framework, but which is increasingly necessary in judicial determinations of § 101 patent eligibility, is whether a skilled artisan would be expected to develop a CAD file design prototype—not fully anticipated—as a function of the artisan's laborious, but routine work. Traditionally, § 102 novelty and § 103 obviousness standards would account for these anticipation and skilled artisan elements.[234] *Diehr* highlights the rigid barriers that formerly cornered off § 101 analysis stating, "The questions of whether a particular invention meets the 'novelty' requirements of 35 U.S.C. § 102 or the 'nonobviousness' requirements of § 103 do not affect the determination of whether the invention falls into a category of subject matter that is eligible for patent protection under § 101."[235] However, the courts have increasingly blurred the line in subject matter eligibility cases between § 101, § 102, and § 103 considerations, incorporating standards from the latter two statutory standards into the *Alice* framework.

Fast forward three decades and the Supreme Court in *Mayo* details how "in evaluating the significance of

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[233] Electric Power Grp., 830 F.3d at 1356.

[234] Bilski, 561 U.S. at 602 ("In order to receive patent protection, any claimed invention must be novel, § 102, nonobvious, § 103, and fully and particularly described, § 112. These limitations serve a critical role in adjusting the tension, ever present in patent law, between stimulating innovation by protecting inventors and impeding progress by granting patents when not justified by the statutory design.").

[235] Diamond v. Diehr, 450 U.S. 175, 185-91 (1981).

additional steps, the § 101 patent-eligibility inquiry and, say, the § 102 novelty inquiry might sometimes overlap," albeit with the qualifier "[b]ut that need not always be so."[236] In particular, the *Alice* step two inventive concept analysis imports § 102 and § 103 considerations. As *Bascom* instructed, "The inventive concept inquiry requires more than recognizing that each claim element, by itself, was known in the art… an inventive concept can be found in the non-conventional and non-generic arrangement of known, conventional pieces."[237] In *Mayo*, the court evaluated the medical diagnostic patent's inventive concept above and beyond the "well-understood, routine, conventional activity" in a manner comparable to reject patent eligibility under § 102.[238] Ultimately, the *Mayo* court held that the medical diagnostic patent's three steps "add[ed] nothing specific to the laws of nature other than what is well-understood, routine, conventional activity, previously engaged in by those in the field."[239]

In this sense, the Supreme Court was indirectly contemplating both whether the medical diagnostic components were in the prior art and practiced by skilled artisans in the field. *Bilski* and *Myriad* shared similar concerns over whether hedging and genes, respectively, were in the prior art. Comparably, the software patent eligibility cases analyze whether the claimed patent improves on a generic computer in the prior art. For instance, *Alice* inquires whether "each step does no more than require a generic computer to perform generic

[236] Mayo Collaborative Servs., 132 S. Ct. at 1304 (2012); *but see* Rapid Litig. Mgmt., 827 F.3d at 1052 ("patent-eligibility does not turn on ease of execution or obviousness of application. Those are questions that are examined under separate provisions of the Patent Act.").
[237] Bascom Global Internet Servs., Inc., 827 F.3d at 1350.
[238] Mayo Collaborative Servs., 132 S. Ct. at 1294.
[239] *Id. at* 1292.

computer functions."[240] Considering additive manufacturing, the above discussion posits that standard 3D printing equipment is firmly in the prior art. The inventive concept tracks the above analysis and builds from generic 3D printing computer equipment and looks for something more. Invention A's boomerang CAD file prototype design would likely not be found to contain an inventive contribution at the point of novelty. Invention B's electronic circuitry design embodied in a CAD file would contain an incentive concept not found in the prior art.

Non-obviousness concerns arise by extension of the inventive concept analysis. In looking for "non-conventional and non-generic arrangement[s]" courts are inherently asking whether it would be obvious for a skilled artisan to put together the invention drawing from the prior art. For both Inventions A and B, assembling a CAD file seems obvious in light of computer-aided design work being conducted for decades. Invention A's boomerang design on its face seems particularly straightforward for a skilled artisan to craft in CAD, while Invention B's more inventive electronic circuitry design likely clears the obviousness bar.

IV. PART IV – SOFTWARE PATENT POLICY WARS & ADDITIVE INNOVATION

A. The Great Software Patent Debate

The rise of the software industry over the past several decades resulted in extraordinary growing pains for the patent system accustomed to analog inventions.[241] The

[240] Alice Corp. Pty., 134 S. Ct. at 2359 (2014).
[241] *See generally* Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 8 (2001).

digital realm proved to be contentious for software patentability and fertile ground for patent trolls.[242] Now, with the arrival of additive manufacturing to the innovation scene, these concerns could extend to the 3D printing industry.

As an initial matter, questions arise over whether software patents, as a matter of policy, should be permitted at all. Several contentious issues surround software patentability that have a direct parallel to CAD design prototype software. Typical arguments against software patents principally include that software consists of little more than basic mathematical algorithms overlaying the 0s and 1s comprising the source code.[243] CAD files are no different, involving mathematical operations to encompass the range of a human user's design input.[244] As discussed in depth above, courts have long recognized mathematical operations as embodying little more than an abstract idea or a basic building block of human logic. If software is little more than strings of mathematical algorithms, then combining software sequences into a larger whole should not be any more patent-eligible than an individual part; as the expression goes, anything multiplied by zero is still zero.

Another chief argument against software patentability stem from software's tendency to promote so-called patent thickets.[245] Patent thickets generally are an

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[242] Susan J. Marsnik & Robert E. Thomas, *Drawing a Line in the Patent Subject-Matter Sands: Does Europe Provide a Solution to the Software and Business Method Patent Problem?*, 34 B.C. INT'L & COMP. L. REV. 227, 228-29 (2011).
[243] Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1123 (1990).
[244] WEISBERG, *supra* note 21, at 2-5.
[245] Wendy H. Schact, *Patent Reform: Issues in the Biomedical and Software Industries*, CONG. RESEARCH SERV., (2006), [https://perma.cc/ARM4-S7BC].

"overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees."[246] As software increasingly creeps into everyday consumer electronics and appliances, the patent thicket issue has become increasingly pronounced. Consider a smartphone, a ubiquitous device with a multitude of associated software components, any number of which can be claimed in a patent.[247] Navigating through a veritable web of rights, ownership claims, and associated issues can disincentive-ize subsequent research and development in the field. 3D printers are not yet as commonplace in the laboratory or in households as smartphones, but the potential to claim scores of software technology powering the machines could one day be tempting for defensive and strategic monetization purposes. The follow-on effects of building up additive manufacturing patent reserves could throttle research and development in this groundbreaking industry's infancy. Indeed, the prophesized next industrial revolution[248] could fail to materialize.

Lastly, software patent detractors argue that even in the absence of patentability, open source software products, services, and communities exist and thrive. One notable example, the open source operating system Linux, has a devoted following of thousands of users with regular software updates. Similarly, MakerBot, one of the largest 3D printing commercial services, has an extensive online design community called Thingiverse.[249] On Thingiverse,

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[246] Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, INNOVATION POL'Y AND THE ECON. (2001).
[247] Schact, *supra* note 245, at 11.
[248] *See generally* CHRIS ANDERSON, MAKERS: THE NEW INDUSTRIAL REVOLUTION (2012).
[249] THINGIVERSE, https://www.thingiverse.com/about/ (last visited June 23, 2017) [https://perma.cc/U9XK-HRLR].

users can upload CAD designs, share models, and join groups with robust discussion boards. In this jointly professional engineering and hobbyist environment that encourages Creative Common licenses, over 640,580 3D models have been uploaded, all absent any CAD prototype patent protection. Needless to say, 3D printing inventive activity has continued at an un-interrupted clip despite the lack of intellectual property incentives. A necessary counter to the flurry of open source activity is to question a hobbyists' genuine innovative output. While tinkering for its own sake may inherently be societally valuable, the patent system was constitutionally designed to further the progress of the arts. Accordingly, a patent's monopoly grant is only awarded when an invention is a novel advance over the prior art. Patent protection may not be necessary to encourage a garage engineer to casually manipulate CAD design prototypes by night to craft a trinket; yet, new industrial applications requiring massive resources to design and develop may need a patent's exclusionary grant to make a firm's investment worthwhile.

On the other hand, a sizable portion of American innovation today results from the software sector, or in products containing software components. Exhibit A: 3D printing. Disallowing software patents generally, and on CAD design prototypes in particular, would shut down a whole avenue of protection for a highly innovative sector driving the post-industrial economy. Policy attempts to treat one economic sector's patentability differently than the rest could have serious repercussions.[250] For start-up software enterprises this could be particularly detrimental. Venture capital firms often look to whether a start-up has a patent, particularly as many digital offerings are hard to

[250] *See generally* John R. Thomas, *Tailoring the Patent System for Specific Industries*, CONG. RESEARCH SERV. (2015), [https://perma.cc/J43X-588U].

price and project earnings going forward.[251] Further, the public disclosure requirement at the heart of the patent bargain is beneficial to developing industries.[252] Absent software patent protection, a CAD designing firm could keep a prototype close to the vest as a trade secret throttling industry growth. Patent disclosures foster innovative ecosystems and have led to the development of geographic clusters with positive spillover economic effects.[253] Without a patent's public disclosure, the Silicon Valley of 3D printing may not arise.

B. Trolling in Three Dimensions

However, permitting software patentability gives rise to the second policy concern, that the floodgates will be open to patent assertion entities, colorfully labeled "patent trolls," filing frivolous lawsuits asserting dubious patent claims.[254] Patent litigation already shuffles around billions of dollars between firms, as innovation is shunned for patents used offensively in litigation as a business strategy.[255] The particular concern with software patents is that these claims are overwhelmingly utilized by patent trolls with extraordinarily high rent-seeking costs associated, typically between $300,000 and $2,500,000 in

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[251] Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?* 83 TEX. L. REV. 961 (2005).
[252] John R. Thomas, *Patents on Methods of Doing Business*, CONG. RESEARCH SERV. (2000), [https://perma.cc/A5DP-MLQM].
[253] Jonathan Rothwell et al., *Patenting Prosperity: Invention and Economic Performance in the United States and its Metropolitan Areas*, BROOKINGS (2013), [https://perma.cc/FS36-MMJY].
[254] Brian T. Yeh, *An Overview of the "Patent Trolls" Debate*, CONG. RESEARCH SERV. (2013), [https://perma.cc/7VGG-T3U8].
[255] Charles Duhigg & Steve Lohr, *The Patent, Used as a Sword*, N.Y. TIMES, Oct. 7, 2012, http://www.nytimes.com/2012/10/08/technology/patent-wars-among-tech-giants-can-stifle-competition.html?mcubz=0 [https://perma.cc/3KAY-NL7E].

litigation.[256] Indeed, a recent multi-year study released by the Federal Trade Commission found that more than 75% of the patents involved in lawsuits filed by patent assertion entities included software claims.[257] Further, an overwhelming number of defendants, pegged at 93%, were related to software patents,[258] although a range of industries like retail trade were impacted.[259] And a majority of all patents held by patent assertion entities related to software, computers, and communications subcategories of technology.[260] Software firms are specifically targeted due to the large number of components, many of which are claimed by patents and typically comprise an invention utilizing software.[261] Patent trolls take advantage of these patent thickets to prevent products from coming to market, or holdup the technology firms until a fee is paid.[262] Software's iterative nature, wherein each development directly builds on a prior version or bit of code, further exacerbates patent trolling issues.[263]

If CAD design prototype are permitted to be patented the potential for patent trolling exists on all sorts of low grade software patents. Much like how patents of questionable validity were issued at the dawn of the Internet—thinking towards one-click-shopping style

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[256] AM. INTELLECTUAL PROP. LAW. ASS'N, REPORT OF THE ECONOMIC SURVEY 35 (2013) (for cost of defending against non-practicing entity in patent litigation through the end of discovery), [https://perma.cc/M5T3-UB7C].
[257] FEDERAL TRADE COMMISSION, PATENT ASSERTION ENTITY ACTIVITY: AN FTC STUDY (2016), [https://perma.cc/27F8-932K].
[258] U.S. GOV'T ACCOUNTABILITY OFF., GAO-13-465, INTELLECTUAL PROPERTY: ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY (2013).
[259] FEDERAL TRADE COMMISSION, *supra* note 255.
[260] *Id.*
[261] Iancu & Helm, *supra* note 105, at 101.
[262] *Id.*
[263] *Id.*

software patents[264]—firms producing CAD design prototypes could patent low-hanging fruit. These could then be "employed as a bargaining tool to charge exorbitant fees to companies that seek to buy licenses to practice the patent."[265] For instance, if Invention A was granted a patent, the patent holder could shake down boomerang toy design firms which are in the business of designing these products in CAD. Perhaps more troubling, patent trolls could go after individual hobbyists on a wide-scale, detected using a particular CAD prototype.

However, patent trolling concerns are mitigated by the fact that no 3D printed product would be claimed to escape § 102 and § 103 issues, significantly narrowing a user's liability over a design and not possessing or using the 3D printed product. Additionally, the patent thicket issue would be diminished, as software patent claims would only extend to the CAD design prototype software file, rather than an unforetold number of claims encompassing a technological invention like a smartphone. Lastly, 3D printing patent troll concerns are mitigated by the reality that patent infringement suits are designed to reach infringing individuals, irrespective of their awareness. For better or worse, this is how the patent system is designed to operate.

C. Napster for Everything

The potential for wide-spread patent infringement, along the lines of what music and movie file-sharing did to the copyright industry, could have an extreme impact on intellectual property.[266] Digital CAD files, embodying the 3D printed item prototype, are now available for public

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[264] Carl Shapiro, *Patent System Reform: Economic Analysis & Critique*, 19 BERKELEY TECH. L.J. 1017, 1019 n.3 (2004).
[265] Iancu & Helm, *supra* note 105, at 101.
[266] Desai & Magliocca, *supra* note 9.

download from central servers.[267] An individual user can download a file to his or her hard drive, make a potentially infinite number of digital copies into the future, with minimal or no loss of file quality, and share the digital file with any number of other online users.[268] If each CAD design prototype is patented, the infringement counts could be massive. If the digital music copyright wars were any indication, patent rights could become incredibly difficult to enforce en mass. This begs the question of whether patent rights should be limited in this additive manufacturing area. For reasons discussed above, it seems nonsensical to completely forgo intellectual property rights in a field at the brink of widespread innovation in manufacturing, industrial design, and consumer goods.

V. CONCLUSION: PATENTED PRINTING POSSIBILITES

In the debate over 3D printing software patentability, more than CAD file design prototypes and additive manufacturing are at stake; future software formats in virtual and augmented reality, bioprinting, and beyond hang in the balance. Forgoing patentability on CAD design prototypes would leave an entire swath of industry promising revolutionary industrial developments wholly unprotected. By contrast, Congress could pass legislation specifically clarifying software patent eligibility status to certain inventions and afford CAD design prototypes patent-eligible status under § 101. Yet, neither of these routes are realistic for reasons of political economy. Instead, the judicial system presents the best path forward for determining CAD design prototype patentability. Indeed, the Federal Circuit has seemingly struck a patent-eligibility equilibrium that would allow viable CAD design prototype claims to meet §

[267] THINGIVERSE, https://www.thingiverse.com/about/ (last visited June 23, 2017) [https://perma.cc/U9XK-HRLR].
[268] Osborn, *supra* note 97, at 818.

101 standards, while overbroad software patents would be filtered out.

While it often seems as though the federal judiciary is muddling through software patent eligibility determinations, the Federal Circuit has nearly reached a practicable, consistent set of standards for § 101 determinations. The Supreme Court's hazy *Mayo-Alice* framework has been duly filled in by the Federal Circuit, providing needed clarity to practitioners and inventors. *Enfish* emboldened *Alice* step one and prevented the bottom from falling out of software patent eligibility. A veritable assortment of Federal Circuit decisions in *TLI Communications*, *McRO*, *Rapid Litigation*, *Bascom*, and many others have helped clarify the outer reaches of abstraction and the *Alice* step two. Further clarity from the PTO, Supreme Court, and Federal Circuit itself, over what specifically constitutes an abstract idea and an inventive concept would be inordinately beneficial. Nonetheless, a software invention that analogizes away from fundamental economic practices, methods of organizing human activity, an idea of itself, and mathematical formulas at *Alice* step one, and that solves a problem in the software arts without simply employing general function computers at *Alice* step two, will likely pass patentability muster.

For CAD design prototypes, this judicially crafted approach splits the baby for inventions comparable to Inventions A and B. A routine design like the boomerang in Invention A would likely face issues at both *Alice* steps one and two. Whereas an innovative item imagined in Invention B, which improves on computing technologies, would likely be patent-eligible for containing an inventive concept. As a matter of patent fairness, this outcome seemingly strikes the proper balance in affording patent incentives to innovate within 3D printing, without granting monopoly rights potentially subject to patent trolling over trivial printed items. The patentability approach for Inventions A and B

directly mirrors the Federal Circuit's preemption concerns. Allowing patents on a particularized solution incentivizes innovation over alternative methods and designs to achieve the same result. A blanket prohibition on CAD prototype patents could impede the development of any subsequent resource-intensive CAD prototypes, including future file formats. Therefore, in the face of 3D printing's ensuing revolution, the patent system should stay the course and follow the Federal Circuit's § 101 principles taking shape.