Semiotics 101: Taking the Printed Matter Doctrine Seriously†

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The printed matter doctrine is a branch of the section 101 doctrine of patent eligibility that, among other things, prevents the patenting of technical texts and diagrams. The contemporary formulation of the doctrine is highly problematic. It borders on incoherency in many of its applications, and it lacks any recognized grounding in the Patent Act. Yet, despite its shortcomings, courts have not abandoned

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the printed matter doctrine, likely because the core applications of the doctrine place limits on the reach of the patent regime that are widely viewed as both intuitively "correct" and normatively desirable. Instead of abandoning the doctrine, courts have marginalized it. They have retained the substantive effects of the printed matter doctrine but avoided analyzing it whenever possible.

This Article adopts a different approach: it takes the printed matter doctrine seriously. It reinterprets the printed matter doctrine as the sign doctrine, revealing both the conceptual coherence hidden in the doctrine's historical applications and the doctrine's as-of-yet unnoticed statutory grounding. The key to this reconceptualization is recognizing that the printed matter doctrine is in effect already based on semiotic principles. The printed matter doctrine purports to be about information, but it is actually about signs. It purports to curtail the patenting of worldly artifacts, but it actually curbs the reach of patent protection into mental representations in the human mind. To support these arguments, this Article offers a course in "Semiotics 101": a semiotics primer strategically targeted on the principles that prove to be relevant to the section 101 doctrine of patent eligibility.

This Article also examines one unexpected consequence of taking the printed matter doctrine seriously and adopting a semiotic framework. It reconsiders the patentability of a class of software inventions which are defined here as "computer models." As a matter of semiotic logic, the routine patentability of newly invented computer models under the contemporary patent eligibility doctrine cannot be reconciled with the categorical unpatentability of mechanical measuring devices with new labels under the printed matter doctrine.

INTRODUCTION

The contemporary printed matter doctrine restricts the products of human ingenuity that can be patented under section 101 of the Patent Act.[1] Roughly stated, it dictates that "information recorded in [a] substrate or medium" is not eligible for patent protection—regardless of how nonobvious and useful it is—if the advance over the prior art resides in the "content of the information."[2] For example, the printed matter doctrine prevents an inventor from claiming a diagram or text explaining how to perform a technological procedure. A technical diagram is an artifact of human ingenuity that satisfies the major statutory requirements for patent protection. Among its attributes, it can be both useful—it helps a technologist to perform the procedure more quickly, reliably, and precisely—and nonobvious—a person having ordinary skill in the art may not have been motivated to make the diagram before the inventor's discovery. However, the printed matter doctrine prevents a patent claiming this type of diagram from issuing. Similarly, the printed matter doctrine prevents an inventor from claiming an old machine with new labels, regardless of the nonobviousness of what the labels mean and the utility of the relabeled machine to society. The advance over the prior art is understood to reside not in the mechanics of the machine, but rather in the content of the information conveyed by the labels.

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1. The Federal Circuit grounds the printed matter doctrine alternately in 35 U.S.C. §§ 101 & 103, but there is no principled basis for the statutory distinction. *See infra* Part I.B.

2. 1 DONALD S. CHISUM, CHISUM ON PATENTS § 1.02[4], at 1-25 to -26 (2009).

The Court of Appeals for the Federal Circuit has repeatedly stated that "'[a] "printed matter rejection" . . . stands on questionable legal and logical footing.'"[3] The infirmities of the printed matter doctrine are notorious and numerous. For example, the doctrine is arguably more exception than rule, as many types of information with newly invented content are patentable.[4] It also employs a "point of novelty" or "patentable weight" approach that runs against the most recent pronouncements on the doctrine of patent eligibility by the Supreme Court and the Federal Circuit.[5] The Patent and Trademark Office (PTO) dresses up legal fictions as factual truths to enforce it, especially in the context of software-on-disk claims.[6] Additionally, it has no recognized statutory grounding, as section 101 of the Patent Act simply states, in relevant part, that inventors may patent a "process, machine, manufacture, or composition of matter."[7]

Furthermore, the printed matter doctrine plays a marginal role, at best, in the common explanations of how the patent regime works, likely in large part because nobody can explain how the printed matter doctrine works. It receives only passing mention in most patent law casebooks used to teach the next generation of patent lawyers.[8] The Federal Circuit and the PTO frequently label their printed matter opinions as "unpublished" and "nonprecedential," respectively, so that the opinions cannot be cited as precedent.[9] Perhaps most strikingly, the Federal Circuit simply ignored the printed matter doctrine when it recently took the bold step of announcing en banc a new "machine-or-transformation test" for patentable subject matter in *In re Bilski*.[10] It proclaimed the machine-or-transformation test to be the "sole" test for patent eligibility without considering the continued validity of the printed matter doctrine.[11] Over the last half century, courts abandoned many restrictions on patent

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3. *In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re* Gulack, 703 F.2d 1381, 1385 n.8 (Fed. Cir. 1983)).

4. *See infra* Parts I.A.1 & 3.

5. *See infra* Part I.A.4.

6. *See infra* notes 89–93 and accompanying text.

7. 35 U.S.C. § 101 (2006). *See infra* Part I.B.

8. One popular casebook dismisses the printed matter doctrine with a single note, stating that "like the mental steps doctrine, the printed matter rule also appears to have declined in importance." ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 141 (4th ed. 2007). Another casebook fails to even mention the printed matter doctrine. *See* F. SCOTT KIEFF, PAULINE NEWMAN, HERBERT F. SCHWARTZ & HENRY E. SMITH, PRINCIPLES OF PATENT LAW: CASES AND MATERIALS (4th ed. 2008).

9. *See, e.g.*, *In re* Smith, 70 F.3d 1290 (Fed. Cir. 1995) (unpublished table decision); *Ex parte* Shanahan, No. 2004-2334, 2005 WL 191069 (B.P.A.I. Jan. 1, 2005). Parties may cite unpublished opinions issued after January 1, 2007, as precedent. FED. R. APP. P. 32.1. In the Federal Circuit, however, judges may refer to unpublished opinions in new opinions only to note the persuasiveness of the reasoning, not as "binding precedent." FED. CIR. R. 32.1(d).

10. 545 F.3d 943 (Fed. Cir. 2008) (en banc), *cert. granted sub nom.* Bilski v. Doll, 129 S. Ct. 2735 (2009). The Supreme Court has accepted certiorari to review the Federal Circuit's decision in *Bilski*, so the validity of the machine-or-transformation test remains unsettled as of the publication of this Article. Bilski v. Doll, 129 S. Ct. 2735 (2009).

11. *Bilski*, 545 F.3d at 955–56 ("[T]he machine-or-tranformation test, properly applied, is the governing test for determining patent eligibility of a process under § 101."). Furthermore, the claim "as a whole" approach to patent eligibility mandated in *Bilski* overtly conflicts with the "point of novelty" or "patentable weight" approach that structures the printed matter

eligibility that were not understood to have explicit moorings in section 101 and were often difficult to administer.[12] However, the implicit consensus best practice with respect to the printed matter doctrine appears to be not to eliminate the doctrine outright, but simply to tidy up appearances by sweeping the doctrine under the rug whenever possible and hiding its conceptual poverty.

Breaking from the implicit consensus, this Article argues that the PTO, the courts, and commentators should take the printed matter doctrine seriously. Taking a cue from the doctrine's staying power, they should recognize that the printed matter doctrine does important work in restricting the set of artifacts of human ingenuity that can be patented. They should embrace it as a central feature of a well-tempered patent regime. The difficulty with this approach, of course, is the open recognition of an unruly doctrine that "stands on questionable legal and logical footing."[13] This Article, therefore, initially confronts and resolves this difficulty. It reveals the hidden conceptual coherence and statutory grounding of the printed matter doctrine, providing it with a sound legal and logical footing and demonstrating how to take it seriously.

The key move in this reconceptualization is to recognize that the printed matter doctrine is not really about "information" and its "content" at all.[14] Rather, the printed matter doctrine is based on *semiotic* principles. Semiotic analysis is most commonly associated with expression and culture, and it may therefore seem at first glance to be more relevant to other forms of intellectual property such as trademarks and copyrights.[15] However, this Article takes the original approach of viewing technological inventions through a semiotic lens and demonstrates that patent scholars and practitioners, too, have much to learn from semiotics.[16] Semiotics is the study of the *sign*, and a sign exists whenever something stands for something else to somebody.[17] Texts and diagrams are archetypal examples of signs, but signs are not limited to such conventional writings. The invention of new signs contributes in many ways to the "Progress of [the] useful Arts" that the patent regime is by constitutional

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doctrine. *See infra* notes 94–98, 108–27 and accompanying text.

12. *See infra* note 145.

13. *In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re* Gulack, 703 F.2d 1381, 1385 n.8 (Fed. Cir. 1983)) (internal quotation marks omitted).

14. *See supra* note 2 and accompanying text.

15. The foremost example of scholarship on semiotics and intellectual property is Barton Beebe, *The Semiotic Analysis of Trademark Law*, 51 U.C.L.A. L. REV. 621 (2004). Other intellectual property scholars address semiotic issues in substance, if not in name, in copyright scholarship. *See, e.g.*, Justin Hughes, *"Recoding" Intellectual Property and Overlooked Audience Interests*, 77 TEX. L. REV. 923, 952–63 (1999) (discussing whether copyright should grant an author the right to influence and stabilize the meaning of her work to the public).

16. Patent scholarship has employed the philosophy of language—a discipline that can be thought of as a specialized branch of semiotics—to shed light on how the language in a patent claim describes things and actions. *See, e.g.*, Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 536–53 (2008); Craig Allen Nard, *A Theory of Claim Interpretation*, 14 HARV. J.L. & TECH. 1 (2000); Kristen Osenga, *Linguistics and Patent Claim Construction*, 38 RUTGERS L.J. 61 (2006); Margaret Jane Radin, *The Linguistic Turn in Patent Law* (2005) (draft on file with author). To date, however, no patent scholarship has employed semiotics to examine the nature of the newly invented things and actions that can be described by a valid patent claim.

17. *See infra* note 167.

design intended to promote.[18] A close examination of the nature of the property interests in newly invented signs that the patent regime sanctions should therefore be an intuitively promising undertaking for anyone interested in understanding the reach of patent protection.

One of the most fundamental insights of semiotic analysis is that semiotic meanings are not intrinsic in worldly things.[19] They are not literally "content" in the sense of being contained within the molecules that comprise a printed diagram. Rather, semiotic meanings result from active processes of interpretation that occur in people's minds.[20] Printed diagrams, wind vanes, and medical symptoms are all meaningful in a semiotic sense because they are components of signs: they are objects or events that mean something other than their intrinsic structure to interpreting minds. The semiotic meanings of scribbles on paper and spots on human skin are not predetermined by their formal or functional properties. They are meaningful to us because our interpreting minds have the capacity to understand that worldly things represent other things (worldly or not) and because we have learned social conventions that fix what they represent. This Article argues that the printed matter doctrine turns this descriptive observation about the mind-centric nature of semiotic meaning into an instrumental rule for limiting the reach of patent-eligible inventions. Couched in a semiotic framework, the printed matter doctrine can be reconceptualized as the *sign doctrine*. It dictates that an invention is ineligible for patent protection if the invention is a newly invented sign and the advance over the prior art resides only in the mind of an interpreter.[21] Standing alone, newly invented semiotic meanings are not eligible for patent protection. Similarly, attaching new semiotic meanings to old worldly things does not make the worldly things patentable. Whereas the information-centric formulation of the printed matter doctrine purports to curtail the patenting of artifacts and events that exist in the extra-mental world of extension, its semiotic reformulation reveals that its actual function is to restrict the reach of patent protection into the human mind.

In the core printed matter cases—that is, the cases in which the inventions are identified as information recorded on substrate, and the relevance of the contemporary printed matter doctrine is already self-evident—the sign doctrine and its semiotic framework do not significantly disrupt the status quo of patent eligibility.[22] In other words, the problem with the contemporary printed matter doctrine is not that the PTO and the courts have frequently reached incorrect outcomes in core cases. Rather, the problem is the gap between what courts are saying and what they are doing. Courts lack the conceptual tools to describe how and why they are reaching their outcomes. The contemporary printed matter doctrine is plagued by doctrinal exceptions and legal fictions because the PTO and the courts are attempting to achieve semiotically

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18. U.S. CONST. art. I, § 8, cl. 8.

19. *See infra* text accompanying notes 175–77.

20. *See infra* text accompanying note 175. The mind-centric definition of semiotics employed in this Article follows the approach of noted semiotics scholar Umberto Eco, but it is not the only possible definition of the proper semiotic field. *See infra* Part II.C.

21. This Article refers to the reconceptualized doctrine alternatively as the sign doctrine and the printed matter doctrine couched in a semiotic framework.

22. *But see infra* text accompanying notes 249–55 (discussing some historical printed matter cases that the semiotic framework cannot explain).

motivated ends without employing semiotic concepts to draw the needed distinctions. The semiotic framework that structures the sign doctrine is therefore a conceptual apparatus that enables courts to both explain what they are doing when they employ the printed matter doctrine and justify why they are doing it. The semiotic framework dispels the conceptual incoherence of the printed matter doctrine by shifting the doctrine's conceptual focus from information and its content to signs and the mental representations that they entail.

In addition to providing conceptual clarity, the reconceptualization of the printed matter doctrine in a semiotic framework has another important role to play in the core printed matter cases: it reveals the doctrine's otherwise-absent statutory grounding. The key move here is to recognize the importance of interpreting the text of section 101 in light of the structure of the Patent Act in general and its disclosure provisions in particular. The printed matter doctrine plays a critical, although not commonly recognized, role in shaping the deep structure of the patent regime: it protects the disclosure side of the "duality of claiming and disclosing" from privatizing incursions by claims.[23] In enacting the Patent Act, Congress did not simply create privately held rights to exclude. It did not unilaterally bestow benefits upon inventors who generate technological progress. Rather, it structured the patent regime as a "bargain" in which inventors and the public exchange valuable rights.[24] The public, via the federal government, grants an inventor limited rights to exclude others from making, using, or selling the claimed embodiments of an invention, and, as the "quid pro quo of the right to exclude," the inventor discloses newly discovered information that she otherwise could have kept secret.[25] Importantly, the disclosure obligations are not merely obligations to publicize information in the weak sense of making information known to the public. The disclosure obligations require a patent applicant to publicize information in a strong sense—to give the public a use privilege in the invention *qua* knowledge, free of the strings of property. Disclosures are "additions to the general store of knowledge" or public domain that must be free for all to use from the moment of their publication so as to "stimulate ideas and the eventual development of further significant advances in the art."[26] But for the printed matter doctrine, however, the disclosure side of the duality of claiming and disclosing would collapse. Couched in a semiotic framework, the printed matter doctrine prevents the worldly artifacts that represent knowledge to human minds from being patentable inventions when the advance over the prior art solely lies in the "stuff" that is represented in the mind. If patent disclosures are to generate a public domain of knowledge, this is precisely the type of advance that should be free for all to use, and it therefore should not be the type of invention that is eligible for patent protection. A semiotically oriented printed matter doctrine allows courts to see through an inventor's attempts to pass off an advance in

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23. Graeme B. Dinwoodie & Rochelle Cooper Dreyfuss, *Patenting Science: Protecting the Domain of Accessible Knowledge*, *in* THE FUTURE OF THE PUBLIC DOMAIN: IDENTIFYING THE COMMONS IN INFORMATION LAW 191, 193 n.4 (Lucie Guibault & P. Bernt Hugenholtz eds., 2006).

24. Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 63 (1998); Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989).

25. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 484 (1974).

26. *Id.* at 481.

knowledge that must be disclosed and publicized as a patentable "process, machine, manufacture, or composition of matter."[27]

To repeat, the semiotic framework allows the printed matter doctrine to be taken seriously because it conceptually clarifies and statutorily legitimizes the core printed matter cases. However, this is only half of the story. If taken seriously, a semiotic framework for the printed matter doctrine would also have prescriptive bite outside of the core printed matter cases. The historical printed matter doctrine has focused on artifacts that superficially resemble information recorded on a substrate, but semiotics as a discipline provides no reason to restrict the application of the sign doctrine to such artifacts. Semiotics posits that signs pervade our environment.[28] By shifting the focus of the printed matter doctrine away from information to signs, a semiotic framework for the printed matter doctrine brings into question the patent eligibility of some inventions that escaped scrutiny under the traditional printed matter doctrine.

To illustrate the impact of the shift from the conventional printed matter doctrine to the sign doctrine—that is, a shift in conceptual focus away from information and its content to signs and their mental representations—this Article addresses the patent eligibility of one specific type of software invention: the *computer model*. As defined in this Article, computer models are signs: they exist when programmed computers are understood by their human users to represent (i.e. model) real-world systems.[29] For a simple example of a computer model, assume that a researcher discovers that the concentrations of two chemicals are inversely correlated in human blood: a high level of chemical A indicates that a patient has a low level of chemical B, and vice versa.[30] The researcher could seek a claim to a programmed computer: "a computer device for diagnosing a chemical B deficiency that correlates a high level of chemical A with a low level of chemical B."[31] This claim describes a computer model: the claimed programmed computer is useful because it is understood by its human users to model a real-world system, and it is nonobvious because the way in which the real-world system functions was unexpected at the time of the invention. Under the contemporary doctrine of patent eligibility as articulated by the Federal Circuit in either *State Street Bank & Trust Co. v. Signature Financial Group*[32] or *In re Bilski*,[33] this newly invented computer model would likely be viewed as a relatively uncontroversial, patent-eligible claim.[34] However, semiotic analysis suggests a hard second look. The tangible artifact described by the claim is not the computer model in its entirety, but rather a *programmed computer*—a computer executing a mathematical function with

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27. 35 U.S.C. § 101 (2006).

28. *See infra* note 191.

29. *See infra* Part IV.B.

30. This simplistic example is a variation of the facts presented in *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124 (2006) (Breyer, J., dissenting from the dismissal of the writ of certiorari as improvidently granted).

31. *See infra* notes 294, 325–29 and accompanying text (addressing this variant).

32. 149 F.3d 1368, 1373 (Fed. Cir. 1998) (articulating the "useful, concrete, and tangible result" test for patent eligibility).

33. 545 F.3d 943, 961–63 (Fed. Cir. 2008) (en banc), *cert. granted sub nom.* Bilski v. Doll, 129 S. Ct. 2735 (2009) (articulating the "machine-or-transformation" test for patent eligibility).

34. *See infra* Part IV.C.

semantically meaningless variables.[35] More specifically, allowing for a degree of simplification, it is a computer programmed to execute the formula $y = 1 / x$. Such a programmed computer was presumptively old in the art at the time the researchers made their discovery about the inverse correlation between chemicals A and B in human blood. The computer model invention at issue is therefore simply a shift in what the programmed computer represents to its human user. The meanings of the variables y and x are not formal or functional properties of the programmed computer in and of itself. All that needs to occur for the old programmed computer to function as a new sign and model the newly discovered real-world system of chemicals in human blood is for a human computer user to change her mind about the meaning of the programmed computer. The computer user need only posit that x represents chemical A and that y represents chemical B to use the newly invented computer model. This computer model is therefore a close semiotic cousin of a printed technical diagram with new text and, even more so, it is like an old machine with new textual labels. Under the sign doctrine, it is a product of human ingenuity that should not be eligible for patent protection because, first, it is a sign and, second, the only advance over the prior art resides in the mind of a human interpreter.

This Article proceeds in four principal parts. Part I reviews the contemporary printed matter doctrine, highlighting its internal conceptual incoherence, its awkward fit with other patent law doctrines, and its lack of a statutory grounding. Parts II and III make the arguments that allow the printed matter doctrine to be taken seriously. Part II offers a course in "Semiotics 101": a semiotics primer strategically targeted on the principles that prove to be relevant to the section 101 doctrine of patent eligibility. Part III illustrates the virtues of reconceptualizing the printed matter doctrine as the sign doctrine in the core printed matter cases. The semiotic framework offers a conceptually coherent explanation for the rough contours of the outcomes that the PTO and the courts are already reaching in these cases. It also points the way to a textual grounding for the printed matter doctrine in the Patent Act. Part IV examines an unexpected consequence of taking the printed matter doctrine seriously. It turns from the core printed matter cases to technologies that function as signs but are not intuitively understood to be information recorded on a substrate. More specifically, Part IV employs semiotic analysis to suggest that the patentability of certain types of programmed computers under section 101 may need to be reconsidered. In particular, it argues that the routine patentability of computer models under the contemporary doctrine of patent eligibility and the categorical unpatentability of old mechanical devices with new labels under the printed matter doctrine cannot be reconciled as a matter of semiotic logic.

I. THE INFORMATION-CENTRIC PRINTED MATTER DOCTRINE

This Part summarizes the contemporary printed matter doctrine. Part I.A focuses on conceptual infirmities, demonstrating that the doctrine is, at its best, more exception than rule and, at its worst, an accumulation of unacknowledged, yet plainly evident, legal fictions. Part I.B turns to statutory mysteries, illustrating that the courts have not

35. This Article employs the term "programmed computer" as a semiotic term of art to differentiate it from a computer model. *See infra* notes 294–95 and accompanying text.

identified how the printed matter doctrine is anchored in the Patent Act. Part I.C notes the lack of any calls for eliminating the printed matter doctrine despite the doctrine's conceptual infirmities and statutory mysteries. It argues that the widespread acceptance strongly suggests that the printed matter doctrine performs a much-needed function in that it excludes certain useful and nonobvious products of human ingenuity from the patent regime.

A. Doctrinal Infirmities

As its name suggests, the printed matter doctrine had its historical origins in the technology of printing characters and images on paper. The Court of Customs and Patent Appeals (CCPA) stated in *In re Russell* that the printed matter doctrine meant that "[t]he mere arrangement of printed matter on a sheet or sheets of paper, in book form or otherwise, [did] not constitute" an invention that was eligible for patent protection.[36] Today, books, ledgers, and technical diagrams remain paradigmatic examples of the products of human ingenuity that are patent ineligible because of the printed matter doctrine. However, as technology progressed through the twentieth century, courts recognized that the printed matter doctrine should not be tied to a specific technology. A recording of a book on a magnetic tape is no different in principle than a stack of printed papers in between hard covers, so the existence of printing per se could not remain the lynchpin of the doctrine.[37] Courts therefore generalized the printed matter doctrine into a technology-neutral rule which states that claims to "information recorded in any substrate or medium" cannot be patented when it is the "content" of the information that differentiates the claimed subject matter from the prior art.[38]

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36. *In re* Russell, 48 F.2d 668, 669 (C.C.P.A. 1931); *accord In re* Sterling, 70 F.2d 910, 912 (C.C.P.A. 1934); *see also In re* Reeves, 62 F.2d 199, 200 (C.C.P.A. 1932). The CCPA heard appeals from the PTO before the creation of the Federal Circuit in 1982.

37. *See, e.g.*, *Ex parte* Carver, 227 U.S.P.Q. (BNA) 465, 467 (B.P.A.I. 1985) (bringing the printed matter doctrine to bear on cassette tapes and finding them to be patent-eligible subject matter).

38. 1 CHISUM, *supra* note 2, § 1.02[4]. The value of the history of the printed matter doctrine in understanding the doctrine's contemporary state is easy to overstate. The courts' track record is not perfect; there are exceptional cases in which the printed matter doctrine probably should have invalidated a claim but did not. *See, e.g.*, Rand, McNally & Co. v. Exchange Scrip-Book Co., 187 F. 984 (7th Cir. 1911) (holding a railroad scrip-book with coupons expressed in monetary value rather than in miles to be a patentable invention). Furthermore, even ignoring errant data points, there is no coherent narrative arc to describe the doctrine's historical evolution. *See* Morton C. Jacobs, Note, *The Patentability of Printed Matter: Critique and Proposal*, 18 GEO. WASH. L. REV. 475 (1950) (teasing several themes out of the historical printed matter cases). For example, the printed matter doctrine originated as a corollary of the exclusion of business method from patent eligibility, *id.* at 476, but the business methods exclusion is today defunct, at least as an express subject-matter-specific exception. *Bilski*, 545 F.3d at 960. Similarly, the printed matter doctrine and the mental steps doctrine were once recognized as two sides of the same coin. *See, e.g.*, *Ex Parte* Jenny, 1961 WL 7968 (B.P.A.I. June 30, 1960) (employing principles established in the mental steps doctrine to craft the printed matter doctrine). Although the courts continue to apply the printed matter doctrine, they abandoned the mental steps doctrine during their struggle with the patent eligibility of

Regardless of how simple this rule about recorded information and its content may seem, it is anything but clear in its application. Part I.A.1 illustrates that the printed matter doctrine does not govern the patentability of many inventions that are readily understood to be information with content, and Part I.A.2 considers the Federal Circuit's unsuccessful attempt to resolve this problem by restricting the printed matter doctrine to recorded information that is not processed by machines. These first two subparts employ DNA molecules and software recorded on tangible media as paradigm examples of inventions that present conceptual difficulties for the contemporary printed matter doctrine. Part I.A.3 addresses the long-standing functional-relation exception to the printed matter doctrine. Part I.A.4 examines the patentable-weight approach to patent eligibility that structures the printed matter doctrine.

1. Some Recorded Information Is Patentable

One conceptual wrinkle in the contemporary printed matter doctrine is that it only applies to a small subset of the tangible artifacts that are intuitively understood to be recorded information with new content.[39] Many artifacts that are readily identified as information with new content remain eligible for patent protection under the printed matter doctrine. If the printed matter doctrine means what its rhetoric actually says about barring the patenting of information based on its content, then it is difficult to understand why the printed matter doctrine does not produce a much larger exclusion from patent eligibility.

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computer software and programmed computers. *In re* Musgrave, 431 F.2d 882, 890 (C.C.P.A. 1970).

39. To avoid unnecessary confusion, one definition of information should be identified at the outset and recognized as irrelevant to the type of information that is at issue in the printed matter doctrine. Claude Shannon is widely credited with developing "information theory"—a mathematical theory for "measuring the amount of information that a particular code or channel [can] transmit." J. Mingers, *The Nature of Information and Its Relationship to Meaning*, *in* PHILOSOPHICAL ASPECTS OF INFORMATION SYSTEMS 74 (R.L. Winder, S.K. Probert & I.A. Beeson eds., 1997); *see generally* FRED I. DRETSKE, KNOWLEDGE AND THE FLOW OF INFORMATION 3–39 (1981) (offering a readable overview of Shannon's information theory). Shannon's information theory addresses information in a purely quantitative fashion. It has nothing to do with the "content" of information in the sense of its meaning. As Shannon himself stated, "[f]requently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem" addressed by information theory. CLAUDE E. SHANNON & WARREN WEAVER, THE MATHEMATICAL THEORY OF COMMUNICATION 31 (1949) (emphasis in original). In terms of Shannon information, both the rolling of an eight-sided die to determine who jumps out of a plane first and the running of a race between eight evenly matched horses are informationally equivalent events. *See* DONALD M. MACKAY, INFORMATION, MECHANISM AND MEANING 56–57 (1969) ("Communication engineers [working with Shannon information] have not developed a concept of information at all. They have developed a theory dealing explicitly with only one particular feature or aspect of messages . . . their unexpectedness or surprise value."). Shannon's theory should be called the "mathematical theory of communication" in order to avoid confusion with a theory about information in which semantic content is relevant, as it is in the printed matter doctrine. Luciano Floridi, *Information*, *in* THE BLACKWELL GUIDE TO THE PHILOSOPHY OF COMPUTING AND INFORMATION 352–53 (L. Floridi ed., 2003).

For example, consider claims to isolated and purified DNA molecules that reflect the sequence of nucleotides in genes expressed in living cells. The patentability of isolated and purified DNA is uncontroversial, at least under the printed matter doctrine.[40] Yet, DNA is commonly described as nothing more than genetic information—a "code" or "blueprint" for the proteins and RNA molecules that constitute living organisms.[41] DNA is information embedded in a substrate of nucleotides strung together to form a molecule, rather than in the form of printing on paper.[42] Furthermore, it is the informational content of a DNA molecule that differentiates it from the prior art of other DNA molecules. The linear sequence of nucleotides in an expressed gene encodes the structure of the proteins and RNA molecules that the cellular machinery involved in the processes of transcription (the copying of DNA into mRNA) and translation (the production of proteins from mRNA templates) will produce.[43] Different DNA sequences deterministically yield different proteins, making DNA molecules instances of information with different content. The difference between a newly isolated and purified strand of DNA and prior art DNA molecules resides in the content of the DNA-as-information, that is, in the protein-building instructions that the DNA molecule provides to the cellular machinery.[44]

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40. The fact that printed matter challenges have not been brought against gene patents does not mean that the patent eligibility of isolated and purified molecules of DNA under section 101 is uncontroversial. *See, e.g.*, Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office, 669 F. Supp. 2d 365, 397–98 (S.D.N.Y. 2009) (arguing that DNA claims are not eligible for patent protection because they are natural phenomena). Additionally, the permissive nature of the standard for assessing the nonobviousness of gene patents established by the Federal Circuit has been questioned, Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827, 836 (1999) (arguing that the status of DNA as both "a chemical compound" and "more fundamentally" as "a carrier of information" should influence the court's decisions about the nonobviousness of DNA), and the statutory utility requirement invalidates some patents claiming gene fragments, *In re* Fisher, 421 F.3d 1365, 1378 (Fed. Cir. 2005).

41. *See* Stephen M. Downes, *Biological Information*, *in* THE PHILOSOPHY OF SCIENCE: AN ENCYCLOPEDIA 64, 64 (Sahotra Sakar & Jessica Pfeiffer eds., 2005) (reviewing the origins of the concept of genetic information).

42. Rebecca S. Eisenberg, *Molecules vs. Information: Should Patents Protect Both?*, 8 B.U. J. SCI. & TECH. L. 190, 196 (2002) (discussing the dual status of DNA as information and molecule).

43. *See generally In re* O'Farrell, 853 F.2d 894, 895–99 (Fed. Cir. 1988) (offering a basic primer on transcription and translation).

44. In the chemical and biochemical fields, DNA is the low-hanging fruit of the argument that the restrictions on patentability imposed by the printed matter doctrine do not apply to all instances of recorded information with content. However, it is arguably a conceptual error to frame DNA as unique in raising the question of whether molecules are information with content. There is an interesting debate over what could be called DNA exceptionalism: is DNA different from other molecules in that it is a "code" or "blueprint" for the cell, or is it simply one information bearer among the many information-bearing molecules implicated in a cell's metabolic pathways? *See* Downes, *supra* note 41, at 64. The critique of DNA exceptionalism demonstrates that the DNA-is-information argument can be generalized into an everything-is-information argument, making the rhetorical focus of the printed matter doctrine on information and its content even more problematic. *Cf.* Dan L. Burk, *The Problem of Process in Biotechnology*, 43 HOUS. L. REV. 561, 582–88 (2006) (discussing the difficulty of using the

The artifacts described by software-on-disk claims are another, and perhaps even more intuitive, example of recorded information with new content that is patentable under the contemporary printed matter doctrine.[45] By the early 1990s, both method claims describing the steps performed by computers executing software and apparatus claims describing computers programmed with software were frequently held to be eligible for patent protection.[46] However, courts found that the manufacture and sale of copies of computer software embedded on disks did not directly infringe either method or apparatus claims, so patent applicants sought the additional protection offered by software-on-disk claims.[47] When confronted with the issue in its opinion in *In re Beauregard*, the PTO initially resisted issuing software-on-disk claims under the printed matter doctrine.[48] Under the information-centric rhetoric of the printed matter doctrine, this conclusion seems reasonable. Computer software is self-evidently information recorded on a medium. (If software recorded on a disk is not recorded information, what is?) Furthermore, the difference between the software-on-disk claims and the prior art resides in the content of the recorded information. Before the Federal Circuit reviewed the PTO's decision in *Beauregard*, however, the PTO gave way on this point, announcing that it would treat "computer programs embodied in a tangible medium, such as floppy diskettes" as patentable subject matter under section 101.[49] The Federal Circuit has not ruled on this interpretation of the printed matter doctrine.

2. Only Machine-Processed Information Is Patentable?

In *In re Lowry*, the Federal Circuit attempted to explain why the printed matter doctrine does not apply in general to all recorded information, or in particular to computer-readable "information stored in a memory."[50] It interpreted the printed matter cases as factually limited to "'novel arrangements of printed lines or characters, useful and intelligible only to the human mind.'"[51] Inversely, it interpreted the printed matter doctrine to have "no factual relevance where 'the invention as defined by the claims

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concept of information to limit the scope of what can be patented).

45. For an argument that analogizes the patentability of software-on-disk inventions and isolated and purified DNA molecules, see D.C. Toedt, *Software as "Machine DNA": Arguments for Patenting Useful Computer Disks Per Se*, 77 J. PAT. & TRADEMARK OFF. SOC'Y 275, 276 (1995) ("Program- and data-storage devices encoding computer programs and data seem to be closely analogous to DNA sequences, which are routinely patented.").

46. *See, e.g.*, Arrhythmia Research Tech., Inc. v. Corazonix Corp., 958 F.2d 1053, 1060 (Fed. Cir. 1992) (holding that method and apparatus claims directed to the analysis of EKG signals described statutory subject matter under section 101).

47. *See* Vincent Chiappetta, *Patentability of Computer Software Instruction as an "Article of Manufacture": Software as Such as the Right Stuff*, 17 J. MARSHALL J. COMPUTER & INFO. L. 89, 110–11 (1998) (discussing the advantages of software-on-disk claims for patentees).

48. *See* 53 F.3d 1583, 1583 (Fed. Cir. 1995); Chiappetta, *supra* note 47, at 120.

49. *Beauregard*, 53 F.3d at 1584. *But see infra* text accompanying notes 55–58 & 89–93 (discussing limitations that the PTO has placed on the patentability of *Beauregard* claims).

50. 32 F.3d 1579, 1583 (Fed. Cir. 1994).

51. *Id.* (quoting *In re* Bernhart, 417 F.2d 1395, 1399 (C.C.P.A. 1969)); *see also In re* Jones, 373 F.2d 1007, 1013 (C.C.P.A. 1967) ("Certainly, there is no 'printing' in this case in the form of words or other symbols intended to convey intelligence to a reader . . . . The user of the disc is not supposed to contemplate it as he would a mathematical table, weighing scale chart, or the like in order to derive some information.").

requires that the information be processed not by the mind but by a machine.'"[52] In gross, the Federal Circuit set up a dichotomy of machine-processed and human-intelligible information, and it limited the restrictive effect of the printed matter doctrine to the latter.

At first glance, this machine-versus-mind structure for the printed matter doctrine seems to resolve the puzzle of the patentability of both software-on-disk and isolated-and-purified DNA claims.[53] A human being cannot look at either a computer disk or a DNA molecule with naked eyes and "read" it. Both are embodiments of information which must be processed by machines to unlock the content of the information. Information recorded on a computer disk must trigger a response in a general-purpose computer through a deterministic process. DNA functions as an information-bearing molecule in a cell because it triggers a response in an organic machine through the processes of transcription and translation.[54] However, upon closer inspection, the notion that the printed matter doctrine simply does not apply to any information that must be processed by a machine—whether mechanical (e.g., punch cards in a weaving loom), electronic (e.g., software on a disk), or organic (e.g., DNA)—does not describe the ends that are being reached through the application of the printed matter doctrine. In seeking to explain the puzzle of why some information is patentable, it creates two new puzzles which are just as troubling: the *first-then* and *both-and* puzzles.

First, in comparison to the exception from patent eligibility that the printed matter doctrine is presumed to generate, the notion that the printed matter doctrine does not apply to any information that must be processed by a machine is fatally underinclusive. Many artifacts at the heart of what cannot be patented under the contemporary printed matter doctrine involve information that must be processed by a machine before being intelligible to humans. For example, a book recorded on a magnetic tape is information that must be initially processed by a machine, as humans do not read magnetic tapes.[55] Taken literally, a printed matter doctrine that accepts as patentable all information that must be processed by a machine would uphold a claim to an audio book on a cassette tape conveying useful and nonobvious technological information to a listener. Similarly, *Beauregard* claims may describe either computer programs that are viewed as giving the computer new functionality (".exe" files, for short) or digitized versions of human-readable printed matter, such as books or instruction manuals (".txt" files for short).[56] The ".txt" files are not meaningfully different from audio tapes. They are information that must be initially processed by a machine, which in this instance is a computer programmed with software such as a word processor or a music player, so they are not "'novel arrangements of printed lines or characters, useful and intelligible

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52. *Lowry*, 32 F.3d at 1579. *But cf. infra* note 254 (noting that, in a semiotic framework, the language in *Lowry* limiting the printed matter doctrine to indicia intelligible to the human mind was not necessary to the holding).

53. *See supra* Part I.A.1.

54. *See supra* text accompanying notes 41–44.

55. *See supra* note 37 and accompanying text (noting that the printed matter doctrine applies to cassette tapes).

56. The concept of a ".txt" file is not intended to be limited to files that display text. As used here, a recording of a song as an MP3 to be played on a portable music player is also a ".txt" file.

only to the human mind.'"[57] Nonetheless, they are not eligible for patent protection. In sum, the Federal Circuit has in effect proposed a dichotomy between information that must be processed by machines, to which the printed matter doctrine is inapplicable, and information that can only be understood by the human mind, to which the printed matter doctrine applies. This approach misses the mark because the printed matter doctrine should apply to some information that is first processed by a machine and that then becomes intelligible to humans. The relevant distinction is a distinction between two types of functionality that the information triggers in a machine, and this is not a distinction that can be captured by querying whether the information must be processed by a machine.[58]

Second, the two categories of information that the Federal Circuit identifies in *Lowry* exclude the most interesting and the most problematic type of information. *Lowry* suggests how courts applying the printed matter doctrine should address both information that must be processed by a machine (ignore it) and information that is only intelligible to the human mind (scrutinize it to see if it is the content of the information that is the advance over the prior art).[59] However, many examples of recorded information that are today routinely held to be patentable suffer from a both-and problem: they can be both processed by machines and intelligible to human minds at the same time. Computer software ".exe" files are examples *par excellence* of the both-and problem. Computer software on a disk can both be processed by a machine to generate a particular type of functionality, and, when displayed on a screen or printed out on paper as source code, it is intelligible to computer programmers as a kind of language.[60] DNA, too, is both-and information. The information in a DNA molecule can be processed by the cellular machinery that gives rise to transcription and translation, *and*, when fed through a sequencer, it is intelligible to a human mind.[61] Even a punch card can both cause a programmable weaving loom to execute a particular design and be intelligible to a knowledgeable industrial weaver who has learned how to read punch cards. A simple dichotomy of information that is either processed by machines or intelligible to the human mind ignores the both-and problem with which the printed matter doctrine must grapple.

3. The Functional-Relation Exception

Another wrinkle in the printed matter doctrine is an exception to the doctrine's rule of exclusion that has a pedigree almost as long and well established as the default rule

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57. *Lowry*, 32 F.3d at 1583 (quoting *In re* Bernhart, 417 F.2d 1395, 1399 (C.C.P.A. 1969)).

58. *See infra* text accompanying notes 89–93 (describing the doctrine that the PTO has developed to distinguish ".txt" files from ".exe" files).

59. *See supra* text accompanying notes 50–52.

60. *See* Dan L. Burk, *Patenting Speech*, 79 TEX. L. REV. 99, 101–05 (2000) (considering the implications for patent law of treating software as speech by programmers to other programmers); Chiappetta, *supra* note 47, at 141–43 (discussing an "implementation" and "language" dichotomy in software). Technically, software suffers from a combination of the first-then and both-and problems, as the software recorded on a disk is not intelligible to a computer programmer as code until after it has been processed by a machine.

61. DNA molecules, too, suffer from a combination of the first-then and both-and problems.

itself. The exception is today referred to as the functional-relation exception: a claim encompassing printed matter may be patentable if the information is "functionally related" to the substrate.[62] This exception applies even if the content of the printed matter must be considered to demonstrate that the printed matter is an advance over the prior art.

Courts initially developed the exception through a series of cases in which claims to human-readable printed matter shared a factual theme: the printed matter was designed to be physically torn apart or punched in new ways.[63] In these ticket-tearing cases, the invention clearly lay at least in part in "[t]he mere arrangement of printed matter on a sheet or sheets of paper" and thus fell under the default rule of exclusion of the printed matter doctrine.[64] However, when the improvements that differentiated the claimed inventions from the prior art resided in a combination of the structural qualities of the substrate and the physical location of the printing on the substrate in relation to those structural qualities, the courts upheld claims to printed matter per se.

For example, in *Cincinnati Traction Co. v. Pope*,[65] the Sixth Circuit addressed a claim to a book of streetcar transfer tickets with three physical sections separated by perforations.[66] Each ticket had a stub attached to the book, a coupon in the middle, and a transfer ticket at the loose end.[67] The tickets allowed the company to restrict the use of transfers issued in the morning to the morning hours and prevent the use of morning transfers in the evening.[68] The conductor could issue morning transfer tickets without the coupons and afternoon transfer tickets with the coupons, and the company would only accept transfer tickets in the evenings with the coupons attached.[69] Furthermore, the tickets allowed railroad companies to monitor their conductors more closely.[70] Because the coupons from morning transfers would still be attached to the stubs remaining in conductors' ticket books, the company could ensure that conductors did not conspire with the passengers and issue afternoon transfers in the morning.[71] The Sixth Circuit upheld the claim under the printed matter doctrine, stating that the claimed invention "clearly involves physical structure" and that "[t]he presence of

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62. *In re* Gulack, 703 F.2d 1381, 1386 (Fed. Cir. 1983); *see also In re* Miller, 418 F.2d 1392, 1396 (C.C.P.A. 1969).

63. *See, e.g.*, Cincinnati Traction Co. v. Pope, 210 F. 443 (6th Cir. 1913) (transfer tickets); Flood v. Coe, 31 F. Supp. 348 (D.D.C. 1940) (price tags on garments); Mitchell v. Int'l Tailoring Co., 170 F. 91 (C.C.S.D.N.Y. 1909) (device for advertising goods); Benjamin Menu Card Co. v. Rand, McNally & Co., 210 F. 285 (C.C.N.D. Ill. 1894) (combined menu and meal check); *cf.* Boggs v. Robertson, 13 U.S.P.Q. (BNA) 214 (D.C. 1931) ("[W]here the paper or physical body upon which the matter is printed is designed to be used with the printed matter, as by tearing apart or punching, it becomes . . . an actual physical article of manufacture within the terms of [the Patent Act].").

64. *In re* Russell, 48 F.2d 668, 669 (C.C.P.A. 1931).

65. 210 F. 443.

66. *Id.* at 444–45.

67. *Id.*

68. *Id.* at 445.

69. *Id.*

70. *Id.* at 444.

71. *Id.* at 444–45.

conventional indications and legends [on the structure] does not rob the structure of patentability."[72]

Flood v. Coe[73] provides another example of a ticket-tearing case. The claimed invention was a ticket for tagging garments in retail stores.[74] Prior-art tickets were divided horizontally into two sections, each of which contained printing descriptive of both the garment to which the ticket was attached and the price of the garment.[75] Upon sale, one section remained attached to the garment and one section was torn off and retained by the retailer.[76] The claimed invention improved upon the prior-art tickets in three ways: it made the division between the two sections vertical, it placed the price at the very bottom of both vertical sections, and it left a space in the middle band of the ticket, above the price and below the description of the garment.[77] The benefit of the new ticket was that the prices could be torn off the bottom and new prices could be written in each of the columns in the blank space (now at the bottom of the ticket), without removing the ticket from the garment and without interfering with the descriptions. The District Court for the District of Columbia upheld the claim as a patentable invention, stating that the arrangement of printed matter on a substrate is patentable when "[t]here is a definite and decided relationship between the physical structure [of the substrate] and the printed matter" or "there is a cooperative relationship between the printed indicia and the structural features" of the substrate.[78]

In more recent cases, what was originally described as a *structural*-relation exception to the printed matter doctrine in the ticket-tearing cases has morphed into a *functional*-relation exception. The facts and holdings in these more recent functional-relation cases are impossible to describe with a single, overarching narrative. The functional-relation exception has become malleable to the point of not having any identifiable form at all. Today, it is a doctrine that places few hard constraints on legal decision makers and instead gives them access to rhetoric that allows them to reach the outcomes in printed matter cases that they believe are correct.

The shift in rhetoric from a structural- to a functional-relation exception occurred in *In re Miller*.[79] In *Miller*, the CCPA addressed a claim to measuring cups and spoons in which the advance over the prior art resided in the mislabeling of the measuring receptacles to facilitate the making of fractionated recipes.[80] For example, in a set of spoons collectively labeled the "one half recipe" set, the one-half teaspoon measure was labeled as the "1 teaspoon" measure, meaning that a chef would automatically half the recipe if she were to use the measures with labels corresponding to the amounts listed in the recipe.[81] While acknowledging that there was no new structural relationship between the substrate (the spoons) and the printed labels, the CCPA upheld the claims because it found "a new and unobvious functional relationship"

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72. *Id.* at 446–47.
73. 31 F. Supp. 348 (D.D.C. 1940).
74. *Id.* at 348–49.
75. *Id.*
76. *Id.*
77. *Id.* at 349.
78. *Id.*
79. 418 F.2d 1392 (C.C.P.A. 1969).
80. *Id.* at 1393–95.
81. *Id.* at 1394−95.

between the spoons and the labels.[82] What the CCPA seems to have been focused on is the nonobvious relationship between the utility of the substrate (the spoon's utility in measuring ingredients) and the content of the human-readable printed matter (the meaning of the factually incorrect labels). In *Miller*, the key to the functional relationship appears to have been the fact that the content of the human-readable printed matter was a property of the substrate. Furthermore, the relationship was nonobvious because the property was a fictitious one, namely a size other than the actual size of the spoon.

In *In re Gulack*,[83] the Federal Circuit upheld a claim under the functional-relation exception to the printed matter doctrine that the CCPA had minted in *Miller*.[84] The claim described an entertainment or education device consisting of a band or ring with a series of numbers printed thereon.[85] The numerical series had a cyclical nature: each successive number was related to the previous one by a specified mathematical relationship, and the "last" number in the series had this same relationship to the "first," meaning that there were in fact no last or first numbers in the series.[86] Mathematically speaking, the numbers formed an endless loop.[87] The Federal Circuit held the printed matter to be functionally related to the substrate because "the digits exploit[ed] the endless nature of the band."[88] In *Gulack*, the key to the functional relationship appears to have been the isomorphism of nature of the mathematical relationships among the numbers and the physical, spatial arrangement of the printed indicia on the band. Under this reasoning, simply printing the numbers in a circle on a piece of paper would seem to be patentable subject matter because the functional relationship between the mathematical sequence of numbers and the printed indicia is preserved.

Most recently, the PTO has seized on the functional-relation exception to the printed matter doctrine as a means of justifying differential treatment for *Beauregard* claims describing ".txt" and ".exe" files.[89] The PTO has declared that there are two types of descriptive material that can be put onto computer disks: functional and nonfunctional.[90] As the names suggest, functional descriptive material is described as "structurally and functionally interrelated to the medium" on which it is recorded, whereas nonfunctional descriptive material is described as lacking a functional relationship to its medium.[91] The PTO posits that ".exe" computer programs, like e-book readers, are functional descriptive material and that ".txt" files, like e-books themselves, are nonfunctional descriptive material.[92] The dichotomy of functional and nonfunctional descriptive material allows the PTO to achieve the intuitively desired

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82. *Id.* at 1396.
83. 703 F.2d 1381 (Fed. Cir. 1983).
84. *Id.*
85. *Id.* at 1382–84.
86. *Id.*
87. *Id.* at 1386–87.
88. *Id.* at 1387.
89. *See supra* notes 56–58 and accompanying text.
90. Examination Guidelines for Computer-Related Inventions, 61 Fed. Reg. 7478, 7481 (Feb. 28, 1996) [hereinafter Examination Guidelines].
91. *Id.*
92. *Id.*

end result of making ".exe" files patent eligible and ".txt" files patent ineligible. The only problem with the functional-nonfunctional dichotomy is that it doesn't exist: there is no difference as a matter of fact between the data-disk relationship that exists when the data is a ".txt" e-book and when the data is an ".exe" e-book reader.[93] However important the distinction between an e-book file and an e-book reader is to patent law as a normative matter—and however "correct" the end result of the PTO's distinction between patentable, functional descriptive material and unpatentable, nonfunctional descriptive material may seem—the PTO's interpretation of the functional-relation exception to printed matter doctrine in *Beauregard* claims is conceptually bankrupt and has no grounding in factual reality.

4. The Patentable-Weight Approach

A patentable-weight approach to patent eligibility is implicit in the default rule of the printed matter doctrine under which "information recorded in any substrate or medium" cannot be patented when it is the "content" of the information that differentiates the claimed subject matter from the prior art.[94] The printed matter doctrine does not categorically bar the patenting of any artifact that comprises information recorded on a substrate or medium. Rather, it only bars the patenting of information when the difference between the claimed subject matter and the prior art lies in the content of the information.[95] Couched in the rhetoric commonly used by courts, the printed matter doctrine means that the content of the information cannot be given "patentable weight" in the assessment of the claim's novelty or nonobviousness (unless, of course, the information is functionally related to the substrate).[96] If the claim describes an improvement over the prior art without any consideration of the content of the printed matter—that is, without giving the printed matter any weight—then the subject matter described by the claim can be patented. However, if the content of the information is the only locus of the invention—that is, the content of the information must be given patentable weight in order to demonstrate that the claim describes a novel and nonobvious improvement over the prior art—then the claim is not eligible for patent protection under section 101.[97] In other contexts, such as the now dormant or defunct "mental steps" doctrine, this same approach to patent eligibility is referred to as a "point of novelty" approach: if the content of the information is the point of novelty (or nonobviousness) that demonstrates that the entire claim is a novel and

93. *See* John R. Thomas, *Of Text, Technique, and the Tangible: Drafting Patent Claims Around Patent Rules*, 17 J. MARSHALL J. COMPUTER & INFO. L. 219, 260 (1998) (asserting that the distinction is "simply a misstatement of fact").

94. 1 CHISUM, *supra* note 2, § 1.02[4].

95. In colloquial terms, the printed matter doctrine bars the patenting of information when the invention resides in the content of the information.

96. The CCPA seems to have first used this rhetoric in *In re* Miller, 418 F.2d 1392, 1395–96 (C.C.P.A. 1969).

97. Because it mixes together concepts of patent eligibility, novelty, and nonobviousness, the printed matter doctrine is sometimes applied under the auspices of sections 102 and 103 rather than section 101. *See infra* notes 136–41 and accompanying text.

nonobvious advance over the prior art, then the claim does not describe a patentable invention.[98]

The patentable-weight approach to patent eligibility is today commonly viewed as conceptually problematic for two distinct reasons. First, it leads to the counterintuitive conclusion that the status of an artifact or method as patentable subject matter is contingent on the content of the prior art. Second, it runs against the grain of the claim-as-a-whole approach that both the Supreme Court and the Federal Circuit today accept as the dominant approach to doctrine of patent eligibility.

The status of an object or method as patentable subject matter is usually presumed to be capable of being determined in a binary, yes-or-no fashion simply by examining the object or method itself. Whether an object or process either is, or is not, a "process, machine, manufacture, or composition of matter" that is eligible for patent protection under section 101[99] is a status inherent in the object or method, and the historical context in which an invention occurs is presumed to be irrelevant to the identification of patent eligibility.[100] In other words, patent eligibility under section 101 is presumed to be an "intrinsic" property of the claimed artifacts, not a "relational" property of the claimed artifacts that is contingent on the historical context in which an invention occurs.[101] Statutorily, the same point can be made by noting that both the novelty of an invention under section 102 and its nonobviousness under section 103 are presumed to be irrelevant to the invention's eligibility for patent protection under section 101.[102]

The patentable-weight approach to patent eligibility challenges these presumptions. The way in which the patentable-weight approach undermines these presumptions is easiest to see when the printed matter doctrine is brought to bear on a claim describing a mechanical device, such as a scale for weighing objects, with textual labels. A mechanical scale is a clear example of an object that falls within the category of a "machine" in section 101.[103] Under a patentable-weight approach to patent eligibility, the scale is eligible for patent protection if the claim is limited in scope to scales with a nonobvious mechanism for translating the weight of the object into the position of a pointer. However, if the advance over the prior art in a later claim resides in a new set of indicia placed next to the pointer of the same scale, then the scale is no longer patent eligible at this later point in time under the printed matter doctrine with its patentable-weight approach.[104] The advance over the prior art resides in the content of the printed

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98. *In re* Musgrave, 431 F.2d 882, 889 (C.C.P.A. 1970) (describing the "point of novelty" approach to patent eligibility under the mental steps doctrine in the course of abandoning the mental steps doctrine).

99. 35 U.S.C. § 101 (2006).

100. Diamond v. Diehr, 450 U.S. 175, 189–91 (1981); *In re* Bergy, 596 F.2d 952, 959–64 (C.C.P.A. 1979).

101. The "intrinsic" properties of a thing are properties that are "entirely about that thing," whereas the "relational" or "extrinsic" properties of a thing are properties that "may depend, wholly or partly, on something else" other than the thing at issue. David Lewis, *Extrinsic Properties*, 44 PHIL. STUD. 197, 197 (1983). Patent eligibility is a relational property of the claimed subject matter under a patentable-weight approach to section 101 because patentability turns on the historical context in which a thing is situated.

102. *Diehr*, 450 U.S. at 189–91; *Bergy*, 596 F.2d at 959–64.

103. 35 U.S.C. § 101 (2006).

104. The later claim is a scale-plus-labels claim, whereas the earlier claim was simply a scale

matter. Because of the awkward nature of the resulting statutory conclusion—an assertion that the same scale that earlier had been a section 101 "machine" is no longer a section 101 "machine" at a later point in time—courts have become wary of a patentable-weight approach to section 101 doctrine.

Although the counterintuitive consequences of the patentable-weight approach are most apparent in the context of machines with labels, they are also present even when claims describe printed matter per se. For example, consider a piece of paper with writing on it that conveys a specific idea.[105] If the fibrous structure of the paper or the chemical composition of the ink is novel and nonobvious in relation to the prior art, then the artifact is eligible for patent protection as a "manufacture" under section 101.[106] The inventor would want to claim either the paper or the ink generically. However, she could also file a dependent claim to the paper or ink in a form that conveys the specific idea (a diagram claim), and the public would not be any worse off if such a dependent claim were to issue. Regardless of the scope of the claim, the artifact is eligible for patent protection. However, if neither the fibrous structure of the paper nor the chemical composition of the ink is novel and nonobvious in relation to the prior art, then the diagram claim is not eligible for patent protection under the printed matter doctrine. The identical artifact is a patent-eligible "manufacture" under section 101 if one set of prior art is presumed, but it is not patent eligible if another set of prior art is presumed. Just as with the machine-plus-label claim, the self-same artifact can be patentable subject matter when the prior art is relatively impoverished and unpatentable subject matter when the prior art is more developed. Because of the patentable-weight approach, the printed matter doctrine always makes patent eligibility a "relational" rather than "intrinsic" property of the claimed artifacts.[107]

Not only does the patentable-weight approach to patent eligibility counterintuitively make the status of an artifact as patentable subject matter contingent on the historical context in which an invention occurs, it also runs against the grain of the claim-as-a-whole approach to patent eligibility that predominates in the most judicial applications of section 101 doctrine. Despite the lack of any direct support in the text of the Patent Act, the Supreme Court has stated repeatedly that "laws of nature, natural phenomena, and abstract ideas" are not eligible for patent protection under section 101.[108] To implement this prohibition, the Court has distinguished two types of claims implicating

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claim. However, even the scale-plus-labels claim would be a patentable "machine" under section 101 if it were to be filed as a dependent claim on the earlier date on which the mechanical operation of the scale was nonobvious. At this earlier time, the scale-plus-labels claim would depend from the independent scale claim, and allowing the scale-plus-labels claim to issue would not deprive the public of any rights that it would otherwise possess.

105. *See, e.g.*, *infra* text accompanying notes 154–55 (discussing a hypothetical claim to a diagram based on its content).

106. 35 U.S.C. § 101 (2006).

107. *See supra* note 101. There is one type of claim that is per se unpatentable under the printed matter doctrine: a claim that only recites limitations describing the content of printed matter. Here, the patent applicant is by definition alleging that it is the content of the printed matter that differentiates the claimed invention from the prior art. However, the notion that a particular type of claim is per se unpatentable is different from the notion that the artifacts described by the claim are per se unpatentable.

108. Diamond v. Diehr, 450 U.S. 175, 185 (1981); *see also* Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (stating that "laws of nature, physical phenomena, and abstract ideas" are not patent eligible).

newly discovered "laws of nature."[109] Claims to "laws of nature" in the abstract are not patent eligible under section 101, but claims describing applications of "laws of nature" in new products and processes are patent eligible.[110] The claim-as-a-whole approach to patent eligibility is one tool that the Court has developed to distinguish abstract claims from applied ones.

For example, in *Diamond v. Diehr* the Court addressed "whether a process for curing synthetic rubber which includes in several of its steps the use of a mathematical formula and a programmed digital computer is patentable subject matter under 35 U.S.C. § 101."[111] The Court had already identified a mathematical formula as a "law of nature,"[112] so the question presented was whether the claim to the computer-assisted process of curing rubber that employed a mathematical formula to calculate the optimal cure time described a "law of nature" in the abstract.[113] The Court emphatically stated that the proper focus was on the nature of the claim "as a whole."[114] The claim at issue described a process of curing rubber "beginning with the loading of a mold with raw, uncured rubber and ending with the eventual opening of the press at the conclusion of the cure."[115] The curing of rubber is a traditionally patentable process, so the Court held that the claim as a whole was a patentable application of whatever "laws of nature" were implicated in the method's computer-executed steps.[116]

In *Diehr*, the Court not only used a claim-as-a-whole approach to patent eligibility, but it also expressly dismissed the idea of using a patentable-weight or point-of-novelty approach.[117] The Court stated that it is impermissible to query whether the point of novelty of a claimed invention resides in a newly discovered "law of nature" and to invalidate the claim as unpatentable subject matter if it does.[118] It stated that "[i]n determining the eligibility of [a] claimed process for patent protection under § 101, . . . claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis."[119]

To reinforce the need for the claim-as-a-whole approach on a pragmatic level, the Court highlighted the potential for a point-of-novelty approach, if "carried to its extreme," to undermine the patentability of the chemical and biochemical inventions that lie at the heart of traditionally patentable subject matters.[120] Because the chemical arts at a deep level are based on nothing but the "natural principles" of the periodic

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109. The distinction between the categories remains unclear, so "laws of nature" is employed here as a shorthand for all of the categories.

110. *Diehr*, 450 U.S. at 188, 191–92.

111. *Id.* at 177.

112. *Id.* at 186.

113. *See id.* at 191–92.

114. *See id.* at 192.

115. *Id.* at 184.

116. *Id.*

117. *Id.* at 188–89, 192.

118. *Id.* at 188.

119. *Id.* at 188. *But see* Parker v. Flook, 437 U.S. 584 (1978) (relying on reasoning that strongly resembles the methodology prohibited in *Diehr* to invalidate a patent claim under section 101).

120. *Diehr*, 450 U.S. at 189 n.12.

table of elements, the patentability of many inventions in the chemical arts would be threatened by a point-of-novelty approach carried to its extreme.[121] If the therapeutic property of a drug is a "natural principle" of a drug, then new-use claims for the drug arguably would not recite patentable subject matter under a point-of-novelty approach to patent eligibility for "natural principles."[122]

The claim-as-a-whole approach to patent eligibility articulated in *Diehr* has had a strong impact on the Federal Circuit. In its recent *en banc* decision in *In re Bilski*,[123] the Federal Circuit announced a new machine-or-transformation test for patent eligibility that focuses on the tangibility of the claimed invention considered as a whole.[124] Roughly captured, the machine-or-transformation test states that claims are eligible for patent protection only if they are tied to a particular machine or if they change an article into a different state or thing.[125] *Bilski* reaffirms that the printed matter doctrine is the black sheep of the doctrine of patent eligibility. It positions the machine-or-transformation test as the "sole" test for patent eligibility under section 101, placing the continued vitality of the printed matter doctrine in limbo.[126] It states categorically that the claim-as-a-whole approach articulated in *Diehr* must govern all inquiries into patent eligibility, raising questions about the viability of the patentable-weight approach without which the printed matter doctrine would be unrecognizable.[127] Whether the printed matter doctrine has survived *Bilski* would seem to be an open question. If it has survived, it has done so largely because it has been swept under the rug and conveniently overlooked.

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121. *See* Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 135 (1948) (Frankfurter, J., concurring); Dan L. Burk, *Biotechnology and Patent Law: Fitting Innovation to the Procrustean Bed*, 17 RUTGERS COMPUTER & TECH. L.J. 1, 26–33 (1991).

122. Brief for 22 Law and Business Professors as Amici Curiae Supporting Appellants, at 17–18, *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (en banc) (No. 2007-1130) 2008 WL 1842281.

123. *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (en banc), *cert. granted sub nom.* Bilski v. Doll, 129 S. Ct. 2735 (2009).

124. *Id.* at 954.

125. *Id.* at 961–63.

126. *Id.* at 955–56. The Federal Circuit framed its analysis in *Bilski* as a case that was about construing the word "process" in section 101. *Id.* at 949. It is therefore plausible to argue that *Bilski* does not apply to object claims describing a "machine, manufacture, or composition of matter" that are most commonly at issue in the core printed matter cases. 35 U.S.C. § 101 (2006). However, this formalistic argument is tenuous. The Supreme Court has generalized from the status of object claims under section 101 to develop rules for method claims. *See* Gottschalk v. Benson, 409 U.S. 63, 67–68 (1972). Furthermore, the printed matter doctrine applies to method claims that implicate the reading and comprehension of text by a human interpreter. King Pharms., Inc. v. Eon Labs, Inc., 593 F. Supp. 2d 501, 513–14 (E.D.N.Y. 2009).

127. *Bilski*, 545 F.3d at 958. Despite its categorical statement, however, the Federal Circuit left open the possibility of a point-of-novelty approach coming in through the back door by noting that the machine or transformation implicated in the claim "must impose meaningful limits on the claim's scope" and "must not merely be insignificant extra-solution activity." *Id.* at 961–62.

B. Statutory Mysteries

The Patent Act does not expressly mention either the printed matter doctrine or a restriction on the patentability of information. In part for this reason, the Federal Circuit has repeatedly noted that "[a] 'printed matter rejection' . . . stands on questionable legal and logical footing."[128]

The portion of section 101 that is understood to give rise to the doctrine of patent eligibility states that inventors may patent a "process, machine, manufacture or composition of matter."[129] There are two interpretive techniques conventionally employed to wring congressional intent from this text, and neither supports the printed matter doctrine. First, the plain meaning of the words that mark the four categories can be dispositive. For example, the Federal Circuit has held that a claim to a "signal" not embedded in a tangible storage medium is not eligible for patent protection because the statutory category "manufacture" encompasses only tangible artifacts.[130] This statutory, plain-meaning strategy cannot support the printed matter doctrine. Not only are books articles of manufacture, the printed matter doctrine governs the patent eligibility of information embedded on substrates such as mechanical scales (machines), toys (manufactures), or sheets of plastic (compositions of matter), all of which are clearly within the plain meanings of the statutory categories.[131] Second, the doctrine of patent eligibility has been indirectly grounded in section 101 through the Supreme Court's statement that "laws of nature, natural phenomena, and abstract ideas" are "[e]xcluded from such patent protection."[132] These three judicially crafted exclusions from patent eligibility do not support the printed matter doctrine either. The "laws of nature" and "natural phenomena" exclusions prevent patents from encompassing things that are simply discovered in nature and dusted off by man, not invented by man.[133] The "content" of the information at issue in printed matter cases is not only about the discovery of natural things. It is typically about man-made inventions, such as the

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128. *In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re* Gulack, 703 F.2d 1381, 1385 n.5 (Fed. Cir. 1983)) (internal quotation marks omitted). The Federal Circuit in *Lowry* and *Gulack* was discussing the status of the printed matter doctrine as an artifact of section 103, but the same questions pertain to the status of the printed matter doctrine as an artifact of section 101.

129. 35 U.S.C. § 101 (2006).

130. *In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007).

131. *But see* 1 CHISUM, *supra* note 2, § 1.02[4] ("Under traditional doctrine, 'printed matter' by itself did not constitute a 'manufacture.'"). In the context of the infringement provision in section 271(g), the Federal Circuit has interpreted the word "manufacture" as a verb to exclude "the production of information." Bayer AG v. Housey Pharms., Inc., 340 F.3d 1367, 1371–72 (Fed. Cir. 2003). In the context of the infringement provision in section 271(f), the Supreme Court has interpreted the word "component" to exclude software "in the abstract" because it is equivalent to the "design information presented in a blueprint." Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 449–52 (2007). However, the Court also held that software recorded on a tangible medium was a "component." *Id.*

132. Diamond v. Diehr, 450 U.S. 175, 185 (1981).

133. *See* Parker v. Flook, 437 U.S. 584, 593 & n.15 (1978) (stating that these exclusions from patent eligibility address discoveries that simply reveal relationships that have always existed in nature). For the purposes of the argument made here, the author brackets his skepticism about the solidity of the invention/discovery dichotomy.

molecular structure of a chemical that does not exist in nature or a method of using the man-made chemical. The naturalist bias in the exclusions of "laws of nature" and "natural phenomena" from patent eligibility means that these exclusions cannot support the printed matter doctrine. The prohibition on claims to "abstract ideas" does have an intuitive resonance with the printed matter doctrine, and it comes the closest to a source of support for the doctrine.[134] However, the printed matter doctrine turns its back on the claim-as-a-whole approach to patent eligibility that the Court has stated must be used to identify impermissible claims to "abstract ideas" (as well as both "laws of nature" and "natural phenomena").[135] The problem addressed by the printed matter doctrine is that the point of novelty of an invention is an abstract idea, not that the claim as a whole describes an abstract idea.

On top of the lack of statutory support for the printed matter doctrine in the language that establishes the four categories in section 101—or, perhaps precisely because of it—the printed matter doctrine has an unstable statutory locus. The doctrine has long had an ambiguous status as an artifact of both the novelty analysis of section 102 and the patent-eligibility analysis of section 101.[136] Today, the practice seems to be that claims describing books or computer disks that intuitively describe information

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134. The exclusion of abstract ideas from patent eligibility is complicated by an ambiguity in the notion of an abstract idea. In a first set of "abstract idea" cases, the prohibition on patenting abstract ideas bars the patenting of a claim that is too broad because its scope is defined only by an abstract idea. For example, in *O'Reilly v. Morse*, Morse's famous claim eight impermissibly sought to privatize all "use of . . . electro-magnetism, however developed for marking or printing intelligible characters, signs, or letters, at any distances." 56 U.S. (15 How.) 62, 129 (1853). Every individual embodiment within Morse's claim eight is arguably tied to a tangible, nonabstract machine (overlooking ESP), but the claim attempts to impermissibly privatize an abstract idea because the outer bounds of the claim are established with reference to an abstract idea. Here, the problem is that the language used to delineate the claim relies on an abstract idea. In contrast, in a second set of cases, the abstract-ideas exclusion seems to bar the patenting of immaterial processes such as human thought. *In re* Comiskey, 554 F.3d 967, 979 (Fed. Cir. 2009) ("However, mental processes—or processes of human thinking—standing alone are not patentable even if they have practical application."). Here, the claim language may be drawn very narrowly—it may describe one very specific mental process in great detail—but the "stuff" described by the claim, namely a mental process, is simply too abstract in some way to be patented. Thus, there is an ambiguity in the notion of an abstract idea: Is the impermissible abstractness located in the describing language or in the things and actions that the language describes? This ambiguity between describing language and the "stuff" described by language has parallels in many other patent law concepts. *See, e.g.*, Collins, *supra* note 16, at 502–03 (noting that the notion of the "scope" of a claim in patent law can invoke either the meaning of the describing language—meaning-scope—or the size of the set of things that the language describes—thing-scope). The abstract-ideas exclusion has greater resonance with the printed matter doctrine when abstractness is taken as a property of the stuff described rather than a property of the describing language.

135. *See supra* notes 108–22 and accompanying text (contrasting the patentable-weight approach of the printed matter doctrine to the claim-as-a-whole approach); *cf.* Comiskey, 554 F.3d at 979 (holding that "a claim that involves both a mental process [that is, an abstract idea] and one of the other categories of statutory subject matter (i.e., a machine, manufacture, or composition) may be patentable under § 101").

136. *See, e.g.*, *In re* Sterling, 70 F.2d 910 (C.C.P.A. 1934) (finding that the same claims to printed matter were neither novel nor patentable subject matter).

recorded on a substrate per se are analyzed under section 101,[137] while claims describing printed matter on, or in combination with, conventionally patentable machines and manufactures are analyzed under either the novelty provisions in section 102 or the nonobviousness provisions in section 103.[138] The reason for this statutory schizophrenia is likely the counterintuitive result of bringing a patentable-weight approach to patent eligibility to bear on machines and manufactures: it is awkward to recognize that a device is a patent-eligible "machine" when its mechanics are nonobvious but that the same device with labels is no longer a "machine" if the content of the labels is the only difference from the prior art.[139] However, splitting the printed matter doctrine between section 101 and sections 102 and 103 raises more questions than it resolves. The same counterintuitive result still exists when the patentable-weight approach to patent eligibility is brought to bear on the claims that are today analyzed under section 101 because they are intuitively viewed as describing recorded information per se. A disk with specific information recorded thereon is a statutory "manufacture" when the structure of the disk is a patentable improvement over the prior art, but it is no longer a "manufacture" when it is the content of the information that differentiates the disk from the prior art.[140] It makes no sense to shift only part of the printed matter doctrine to section 103. Furthermore, the text of section 103—unlike the text of section 101—expressly states that the nonobviousness analysis must be conducted by looking at "the subject matter as a whole."[141] Selectively ignoring certain limitations that differentiate a claimed invention from the prior art would therefore seem to be yet more problematic on a statutory level under section 103 than it would be under section 101. No other doctrine is administered as a hybrid of section 101 and sections 102 and 103, so the split reinforces the impression that the printed matter doctrine is the ugly duckling of contemporary patent law.

C. Normative Desirability

Given the doctrinal and statutory shortcomings of the printed matter doctrine, it is unsurprising that the Federal Circuit believes that "[a] 'printed matter rejection' . . . stands on questionable legal and logical footing."[142] For similar reasons, commentators have questioned the doctrine's future viability.[143] What is surprising, however, is that

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137. *See, e.g.*, Examination Guidelines, *supra* note 90, at 7481.

138. *See, e.g.*, *In re* Ngai, 367 F.3d 1336 (Fed. Cir. 2004) (applying the printed matter doctrine as a part of a section 102 novelty analysis to a claim to a kit of chemicals in combination with written instructions); *In re* Gulack, 703 F.2d 1381 (Fed. Cir. 1983) (applying the printed matter doctrine as part of a section 103 nonobviousness analysis to a claim to a circular band with printed indicia). Judge Linn of the Federal Circuit has even suggested that the printed matter doctrine should be applied as part of the utility doctrine of section 101. *In re* Nuijten, 500 F.3d 1346, 1365–67 (Fed. Cir. 2007) (Linn, J., concurring in part and dissenting in part).

139. *See supra* notes 103–07 and accompanying text.

140. *See supra* notes 105–07 and accompanying text.

141. 35 U.S.C. § 103(a) (2006).

142. *In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re* Gulack, 703 F.2d 1381, 1385 n.5 (Fed. Cir. 1983)) (internal quotation marks omitted).

143. *See, e.g.*, 1 CHISUM, *supra* note 2, § 1.02[4], at 1-26 ("A question of interest is whether

there have been so few calls for the outright elimination of the printed matter doctrine from inventors who seek broader patent protection.[144] There have been vocal critics—both judicial and nonjudicial—of many other historical and contemporary limits on patent-eligible subject matter.[145] In contrast, there are no lobbyists before Congress, litigants in courtrooms, or judges at the bench arguing that the printed matter doctrine should simply be taken off the books right now.[146] The frailty of the printed matter doctrine should, in theory, make it an easy target for any inventor and patentee who wants to internalize a larger share of the welfare benefits that her invention offers to society. Yet, there is no gathering wave of sentiment against the contemporary printed matter doctrine. There is no angry mob outside of the PTO demanding that technical diagrams or e-book files be eligible for patent protection when the content of the information conveyed is useful, novel, and nonobvious.

There is a lesson to be learned from this relatively uncontroversial persistence of the core of the printed matter doctrine, despite its conceptual and statutory shortcomings. Although far from an analytical proof, the simple persistence of the printed matter doctrine strongly suggests that the doctrine restricts patentable subject matter in a manner that reflects widely shared understandings of what patent protection should be, and that it rests on normative justifications that should not be lightly dismissed.[147] The fact that the Federal Circuit has marginalized the printed matter doctrine, but has not outright eliminated it, should be taken as a clue that the effect of the doctrine has significant normative value, even if that value has not yet been articulated with precision.[148] In sum, the contemporary printed matter doctrine displays an odd

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and to what extent the traditional exception for printed matter will survive in view of court decisions that are critical of non-statutory exceptions to the four categories of patentable subject matter."); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1672 (2003) ("The Federal Circuit eliminated the long-standing rule against patenting business methods in 1998, and the related 'printed matter' doctrine is on uncertain footing as well." (footnote omitted)).

144. One reason for this silence may be the relatively low economic stakes of printed matter cases involving board games and the like. *See* R. Carl Moy, *Statutory Subject Matter and Hybrid Claiming*, 17 J. MARSHALL J. COMPUTER & INFO. L. 277, 279 (1998). Another reason may be that the patent ineligibility of core printed matter claims is so intuitive and self-evidently correct that inventors realize that such claims will never issue.

145. *See, e.g.*, *In re* Musgrave, 431 F.2d 882 (C.C.P.A. 1970) (criticizing and abandoning the mental steps doctrine); Donald S. Chisum, *The Patentability of Algorithms*, 47 U. PITT. L. REV. 959 (1986) (criticizing the exclusion of algorithms in the abstract from patent eligibility). Many amicus briefs were filed in the Supreme Court in *In re Bilski* by representatives of the software, biotech, and accounting industries suggesting that the Federal Circuit's "machine-or-transformation" test interpreted patent eligibility too narrowly. *See, e.g.*, Brief of Amicus Curiae Novartis Corp. Supporting Petitioners, Bilski v. Doll, No. 08-964 (U.S. filed Aug. 6, 2009) (arguing against restrictions on patent eligibility in biotechnology).

146. *But see* Andrew F. Knight, *A Potentially New IP: Storyline Patents*, 86 J. PAT. & TRADEMARK OFF. SOC'Y 859, 863–64 (2004) (arguing that storyline patents are eligible for patent protection because the printed matter doctrine "rests on shaky legal authority and, in any event, has been whittled away to an archaic common law has-been").

147. *Cf.* Thomas F. Cotter, *A Burkean Perspective on Patent Eligibility*, 22 BERKELEY TECH. L.J. 855, 858 (2007) (arguing that "some of the traditional limitations on patentable subject matter . . . may yet have much to recommend them").

148. A normative justification of what the PTO and the courts are doing when they apply the printed matter doctrine is beyond the scope of this Article. However, the justification tracks the

amalgam of conceptual incoherence and normative acceptance, of statutory aloofness and self-evident correctness.

To the extent that the printed matter doctrine is under any kind of attack today, the most common argument is not designed to expand patent-eligible subject matter by removing the restrictions on patent eligibility that are traditionally attributed to the printed matter doctrine. Rather, the argument is that the printed matter doctrine is the appendix of the patent regime: it is a superfluous doctrinal organ that no longer plays any role in restricting the scope of patent protection because all of the artifacts that it excludes from the patent regime would be excluded by the other, well-established validity doctrines—such as novelty,[149] nonobviousness,[150] and utility[151]—if only they were given the chance to do their jobs.[152] Whatever its merits when brought to bear on some of the other strands of the section 101 doctrine of patent eligibility, however, this appendix argument is unconvincing with respect to the printed matter doctrine. The printed matter doctrine has substantive bite. It restricts the set of novel, nonobvious, and useful artifacts of human ingenuity that are eligible for patent protection. Most importantly for the arguments presented in this Article, it restricts the reach of patent

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justification of why the knowledge conveyed by a patent disclosure must remain free for all to use *qua* knowledge, even during the term of a patent. *See infra* Part III.C (arguing that the printed matter doctrine is an implicit negative corollary of the patentee's statutory disclosure obligations).

The outcomes reached by courts in the printed matter cases can also be justified indirectly by framing the printed matter doctrine as a channeling doctrine that allocates responsibilities among different intellectual property regimes. *Cf.* Dastar Corp. v. Twentieth Century Fox Film Corp., 539 U.S. 23, 34 (2003) (limiting the application of the Lanham Act to avoid creating a "species of mutant copyright law"). The "essence" of copyright, "[w]hat has distinguished copyright from other forms of intellectual property, [and] what has been at its base but not at the base of others," is arguably "that the *content* of a copyrighted work has always had some nonfunctional aesthetic, informational, or entertaining qualities which are communicated to a human audience." Pamela Samuelson, *CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form*, 1984 DUKE L.J. 663, 749 (1984) (emphasis in original). *But see id.* at 753 (noting that copyrights in machine-readable computer software run counter to this rule). Perhaps copyright law, including its idea/expression dichotomy, should have the sole authority to determine the public/private balance with respect to what lies at its core, namely to the "informational . . . qualities" of the "content" that a work "communicate[s] to a human audience." *Id.* at 749. For copyright law to be the final arbiter of that public/private balance, the printed matter doctrine must keep patent protection out of the mix. *Cf.* Dennis Karjala, *Distinguishing Patent and Copyright Subject Matter*, 35 CONN. L. REV. 429, 448–49 (2003) (arguing that the definition of a "useful article" in copyright law should be employed to limit the subject matter of both copyright and patent).

149. 35 U.S.C. § 102 (2006).

150. *Id.* § 103.

151. *Id.* § 101.

152. For an example of this appendix argument directed at the doctrine of patent eligibility in its entirety, see Michael Risch, *Everything Is Patentable*, 75 TENN. L. REV. 591, 606–09 (2008) (articulating a "rigorous patentability" standard for patent eligibility); *see also* Burk & Lemley, *supra* note 143, at 1642–44 & n.235 (arguing that the role played by the historical section 101 case *O'Reilly v. Morse* is today performed by the disclosure doctrines); F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 108 (2003); Kristen Osenga, *Ants, Elephant Guns, and Statutory Subject Matter*, 39 ARIZ. ST. L.J. 1087, 1088 (2007) (addressing computer software in particular).

protection into technical texts and diagrams in a manner that the other validity doctrines do not.[153]

For a simple example, consider a hypothetical claim to a printed diagram that enables a doctor to diagnose a disease.[154] A researcher discovers that the concentrations of two chemicals are inversely correlated in human blood: a high level of chemical A indicates that a patient has a low level of chemical B, and vice versa. This discovery paves the way for a new method of testing for a deficiency of chemical B: detecting a chemical B deficiency by correlating a high level of chemical A with a low level of B. Assume that the researcher seeks to claim something like "a device for determining the existence *vel non* of a chemical B deficiency consisting of a diagram" that encompasses the diagram illustrated in Figure 1:

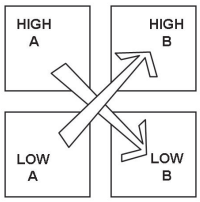

Figure 1

This claim describes a core example of an artifact that is not a patent-eligible invention under the printed matter doctrine: the artifact is printed matter per se, and the invention resides in the "content" of the printed matter.[155]

Absent the printed matter doctrine, however, it is difficult to identify with certainty any doctrine that would invalidate the claim to the technical diagram.[156] The claimed

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153. With respect to patent claims describing paintings, songs, and fictional novels, the appendix argument has a greater intuitive resonance. *Cf.* Risch, *supra* note 152, at 633–35 (addressing the patentability of "Books, Art, and Music"). It is true that the artistic creations that are the archetypes of copyrightable subject matter lack the type of technical utility possessed by the archetypes of patentable subject matter such as drugs and methods of manufacturing or using drugs. *Cf.* Karjala, *supra* note 148, at 448–49. However, in the mechanical arts, human amusement, entertainment, or aesthetic satisfaction is frequently accepted as a statutory utility. *Cf. In re* Dembiczak, 175 F.3d 994, 1002–03 (Fed. Cir. 1999) (upholding the nonobviousness of a claim to a trash bag with a jack-o'-lantern depicted thereon); *infra* note 163 (noting the inability of the utility doctrine to query whether the advance over the prior art is statutorily useful). It is therefore unclear why the amusement provided by a painting to its viewer would not be a statutory utility, too.

154. In this hypothetical, the discovery is derived from *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124, 125–26 (2006) (Breyer, J., dissenting from the dismissal of the writ of certiorari as improvidently granted); *cf. supra* text accompanying notes 30–35 (discussing the same discovery). However, there was no claim to a printed diagram at issue in *Laboratory Corp.*

155. *See supra* note 38 and accompanying text (defining the printed matter doctrine).

156. The exercise of guessing what a court without recourse to the printed matter doctrine would do if faced with a diagram claim should be taken with a grain of salt. Because there is a

diagrams are novel based purely on their intrinsic structural properties, as nobody had any motivation to make the claimed combination of text, boxes, and arrows before the researcher arrived at her discovery.[157] Furthermore, the claimed diagrams are nonobvious if their content is nonobvious. They produce an unexpected result: they convey unexpected information to a reader.[158] Finally, the invention also has utility of the kind required by the patent statutes.[159] Utility cases like *Brenner v. Manson*[160] and *In re Fischer*[161] forbid patent applicants from patenting a new chemical before there is a believable guess about a practical and specific use for the chemical.[162] The diagram suffers from no such uncertainty: it is useful because it can help a doctor diagnose a specified disease in a particular patient in a more reliable manner than relying on memory alone would produce.[163]

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widespread consensus that printed diagrams should not be eligible for patent protection, *see supra* text accompanying notes 145–46, courts would in all likelihood contort some doctrine—any doctrine, if necessary—to deny patent protection to printed diagrams. The point made in the following text is only that there is nothing in the internal logic of the validity doctrines that precludes the patenting of a printed diagram. A printed diagram should present an easy case of something that cannot be patented, but—absent the printed matter doctrine in some form—the case is an awkward one.

157. Novelty would be practically assured if the full names of the chemicals were to be printed on the diagram.

158. *See In re* O'Farrell, 853 F.2d 894, 903–04 (1988) (noting the importance of unexpected results in the nonobviousness analysis).

159. Richard Gruner has argued that artifacts that are not patentable under the printed matter doctrine lack statutory utility: "[W]here new content is recorded in printed matter, no patentable invention is created because the . . . utility of the newly created printed matter rest[s] in features other than the structure or functional attributes of the entity created." Richard S. Gruner, *Intangible Inventions: Patentable Subject Matter for an Information Age*, 35 LOY. L.A. L. REV. 225, 404 (2001); *cf. In re* Nuijten, 500 F.3d 1346, 1365–67 (Fed. Cir. 2007) (Linn, J., concurring in part and dissenting in part) (suggesting that the printed matter doctrine should be a part of the utility doctrine). This argument misses the mark. The utility of a printed diagram does reside in part in its structural and functional features: the structure of a printed diagram allows an interpreter to find it meaningful, and the function of a printed diagram is to convey information to an interpreter. Furthermore, the utility of many useful artifacts rests in part in features other than the artifacts' intrinsic properties. For example, the utility of a DNA molecule rests in large part in the structural and functional features of the cellular machinery of transcription and translation. *See supra* note 43 and accompanying text.

160. 383 U.S. 519 (1966).

161. 421 F.3d 1365 (Fed. Cir. 2005).

162. *Brenner*, 383 U.S. at 533–36; *Fischer*, 421 F.3d at 1369–78.

163. The utility doctrine also cannot fill the role played by the printed matter doctrine because there is no precedent in the utility doctrine for the patentable-weight analysis that lies at the heart of the printed matter doctrine. *See supra* notes 94–98 and accompanying text. A kit of chemicals plus a sheet of written instructions clearly has statutory utility because the chemicals are useful. However, due to the patentable-weight analysis of the printed matter doctrine, the combination is not patentable if the difference between the prior art and the claimed invention resides in the "content" of the information conveyed by the printed matter. *In re* Ngai, 367 F.3d 1336, 1339 (Fed. Cir. 2004) (invalidating a claim to a kit of chemicals plus instructions on how to use them under the printed matter doctrine when the advance over the prior art resided in the instructions).

In sum, the printed matter doctrine is not superfluous. If the artifacts that it excludes from patent protection are to remain beyond the reach of the patent regime, legislative or judicial actors must actively craft a patent doctrine to exclude them. No matter how counterintuitive the notion of a patent regime in which printed diagrams are patentable might be, there is nothing "natural" or inevitable about the effects of the printed matter doctrine.[164] The effects of the printed matter doctrine are so familiar and intuitive that it may be tempting to take the doctrine for granted. However, the knowledge that constitutes the public domain of patent disclosure will be free only if courts take the active step of enforcing the printed matter doctrine.[165]

II. SEMIOTICS 101

This Part offers an introductory course in "Semiotics 101."[166] Part II.A explores the triadic model of the sign, commonly associated with Charles Sanders Peirce. Part II.B presents Peirce's threefold taxonomy of signs. Part II.C emphasizes a common restriction on the proper domain of semiotic analysis that places the human mind at the center of semiotic inquiry.

A. Peirce's Triadic Sign

Semiotics is the study of signs, and signs are entities that involve something standing for something else to somebody.[167] To conceptualize the operation of a sign, Peirce and his followers posit a triadic model of the sign.[168] They argue that every sign

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164. *But cf.* R. Polk Wagner, *Information Wants to Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 1005–09 (2003) (arguing that the knowledge spillovers of intellectual property protection are inevitable).

165. *See infra* Part III.C (arguing that printed matter doctrine is an implicit negative corollary of a patentee's disclosure obligations).

166. Semiotics is a sprawling discipline with many competing conceptual frameworks. This Part does not attempt a comprehensive introduction to semiotics. *See, e.g.*, WINFRIED NÖTH, HANDBOOK OF SEMIOTICS (1990). Nor does it attempt a neutral or objective introduction comprised of the most commonly discussed or widely shared principles in the discipline. *See, e.g.*, DANIEL CHANDLER, SEMIOTICS: THE BASICS (2002). It does not purport to exhaust the utility of semiotics as a tool to understand legal processes. *See, e.g.*, Susan W. Tiefenbrun, *Legal Semiotics*, 5 CARDOZO ARTS & ENT. L.J. 89, 96 (1986) (proposing a definition of "legal semiotics"). This Part only presents "Semiotics 101" in a very narrow sense with the pun fully intended: it is a strategically chosen introduction to the basic principles of semiotics (a 101-level course) that the author believes to be the most fruitful background to lead to an explanation of how a semiotic framework can structure the printed matter doctrine (a section 101 doctrine).

167. CHANDLER, *supra* note 166, at 13 ("Anything can be a sign as long as someone interprets it as 'signifying' something—referring to or *standing for* something other than itself."); UMBERTO ECO, A THEORY OF SEMIOTICS 17 (1976) ("[A] sign [is] *everything* that, on the grounds of a previously established social convention, can be taken as *something standing for something else*."); CHARLES W. MORRIS, FOUNDATIONS OF THE THEORY OF SIGNS 3 (1938) ("[A] sign refers to something for someone."); CHARLES SANDERS PEIRCE, COLLECTED PAPERS § 2.228 ("A sign . . . is something which stands to somebody for something in some respect or capacity.").

168. *Cf. infra* note 177 (presenting the competing dyadic model of the sign). Working in the

involves three distinct components: a *sign-vehicle*, an *interpretant*, and a *referent*.[169] The Peircean sign is commonly depicted as a triangle, as in Figure 2:[170]

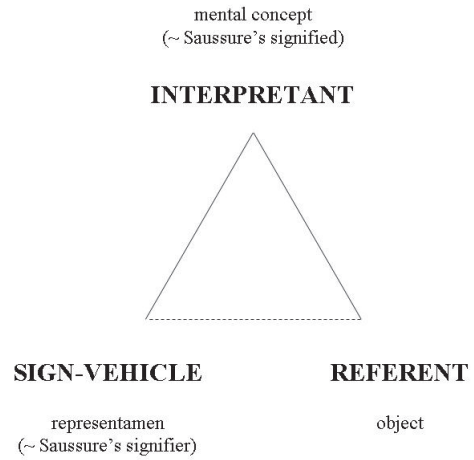

Figure 2

The *sign-vehicle* is the perceptible form of the sign; it is the physical artifact that an interpreter perceives.[171] The particular combination of curves that make up the letter

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late 1800s and into the early 1900s, Peirce originated discussion of the triadic model in modern semiotics, but triadic models of the sign can be traced back to antiquity. *See* W.C. Watt, *Semiotics*, § 1, *in* 8 ROUTLEDGE ENCYCLOPEDIA OF PHILOSOPHY 676 (Edward Craig ed., 1998). Scholars who have adopted a triadic model of the sign have built on Peirce's work in divergent ways, so there is considerable disagreement on the substantive "details of the triadic analysis even among those who accept that all three components . . . must be taken into account." 1 JOHN LYONS, SEMANTICS 99 (1977). This Article culls details from Peirce and his interpreters, sacrificing historical accuracy and fine distinctions for brevity and readability when the lost nuances are not relevant to the semiotic framework for patent eligibility.

169. Peirce's preferred nomenclature was the *representamen*, the *interpretant*, and the *object*. *See* PEIRCE, *supra* note 167, § 2.228. The terms used in the text of this Article are derived from NÖTH, *supra* note 166, at 89, and they are chosen for their relatively intuitive qualities. (Quotes directly from Peirce's writings in the footnotes, however, use the Peircean terminology.) Departure from Peirce's terminology is par for the course. *See* LYONS, *supra* note 168, at 95 (discussing variations in the terminology used to discuss the triadic model of the sign).

170. *See, e.g.*, C.K. OGDEN & I.A. RICHARDS, THE MEANING OF MEANING 11 (10th ed. 1949); CHANDLER, *supra* note 166, at 30.

171. The sign-vehicle corresponds to the *signifier* in Saussure's dyadic model of the sign. *See infra* note 177. Peirce emphasized that sign-vehicles are both immaterial types and material tokens of those types. *Cf.* PEIRCE, *supra* note 167, § 2.246 (discussing replicas, sinsigns, and legisigns). Because only tokens of signs can be made, used, or sold by people, and lead to the infringement of patent claims, this Article treats the sign-vehicle as a material entity. In other words, this Article discusses semiotics in the context of what Saussure referred to as *parole* (an instance of speech) rather than *langue* (the system of speech). FERDINAND DE SAUSSURE, COURSE IN GENERAL LINGUISTICS 13 (Charles Bally & Albert Sechehaye eds., Roy Harris trans.,

"S" and the formal properties of the dots, dashes, and blank spaces that make up a message transmitted in Morse code are both sign-vehicles, as are the undulating sound waves that convey the sound of the word "dog." The *interpretant* is roughly the concept that the sign-vehicle invokes in the mind of a person for whom the sign is meaningful.[172] The *referent* of a sign is the thing in the world that is described, indicated, or referred to by a sign.[173] Both interpretants and referents are within the ambit of the general term *semiotic meaning* as employed in this Article.[174] For precision, a sign-vehicle will be described as *signifying* its interpretant and *referring to* its referent.

Peirce's sign "involves a rejection of the equation of 'content' and meaning; the meaning of a [sign-vehicle] is not contained within it, but arises in its interpretation" by an interpreter in the form of an interpretant.[175] In other words, the sign-vehicle is not the sign, despite the commonplace nature of the language in which the material sign-vehicle is employed as a synecdoche for an entire sign. Stop-signs-as-artifacts—the physical, red, octagonal things located at intersections—are not signs in and of themselves. They are sign-vehicles and therefore only components of signs. The sign is the combination of the perceived thing (the sign-vehicle), the mental concept that the sign triggers in the mind of an interpreter (the interpretant), and the things or events in the world to which the sign refers (the referents).[176] The sign-vehicle is a particularly

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Duckworth 1983) (1916).

172. PEIRCE, *supra* note 167, § 3.72 ("cognition produced in the mind"); *see also* LYONS, *supra* note 168, at 102 (defining the interpretant as "the mental effect produced by the sign" or "the concept associated with the sign in the triangle of signification"). The interpretant corresponds to the *signified* in Saussure's dyadic model of the sign. *See infra* note 177. The notion that a sign involves a self-contained concept is a misleading simplification of Peirce's interpretant. Peirce considered the interpretant to be a sign unto itself that can only be understood in terms of further interpretants and thus further signs, leading to a process of "unlimited semiosis." CHANDLER, *supra* note 166, at 31–33; *cf.* SAUSSURE, *supra* note 171, at 110–20 (implying that signifieds are structural entities defined only by their *value*—that is, by their relations to other signifieds).

173. *See infra* note 176 (discussing the nature of the referent).

174. Peirce's model demonstrates that signs are wound up with two very different types of meaning. *Sense* is an ideational or mentalistic phenomenon and is lodged in the interpretant, whereas *reference* deals with the worldly things implicated in referents. For a detailed presentation of the distinction between sense and reference, as well as an argument about its relevance in the context of claim construction, see Collins, *supra* note 16, at 536–53.

175. CHANDLER, *supra* note 166, at 32.

176. The presence of the referent in Peirce's model of the sign does not always tie a sign directly to a material thing, an individual thing, or even a thing that exists in the actual world. *See* CHANDLER, *supra* note 166, at 33 (noting that "Peirce's [referent] is not confined to physical things and [that] it can include abstract concepts and fictional entities"); OGDEN & RICHARDS, *supra* note 170, at 9 n.1 (noting that the referent should not be "restricted to material substances"). A sign may indicate a particular thing in the world as its referent—that is, the word "Fido" may refer to my dog. Alternatively, a sign may pick out a class of referents in the world—that is, the word "dog" may refer not to my dog but to the species in general. PEIRCE, *supra* note 167, § 2.232 ("The Objects [of a sign] may each be a single known existing thing . . . or a collection of such things . . . ."). The referent may be perceptible in the actual world, but, alternatively, it may be simply imaginable, as it may be a class without any actual individuals contained within it. MORRIS, *supra* note 167, at 5 ("No contradiction arises in saying that every sign has [a referent] but not every sign refers to an actual existent. . . . [A referent] is not a thing,

useful term for the perceived component of the sign precisely because it wears on its sleeve a warning against the misleading synecdoche.[177]

B. Peirce's Taxonomy of Signs

Peirce was enamored with taxonomies of the sign, and the most famous of his taxonomies is his simple tripartite schema of *symbols*, *icons*, and *indices*.[178] Importantly, there is no one-to-one correspondence between sign-vehicles, interpretants, and referents on the one hand and symbols, icons, and indices on the other. Peirce's taxonomy classifies relationships between the sign's components.[179]

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but a kind of object or a class of objects—and a class may have many members, or one member, or no members. . . . This distinction makes explicable the fact that one may reach into the icebox for an apple that is not there . . . ."); PEIRCE, *supra* note 167, § 2.232 ("The Objects [of a sign] may each be a . . . thing believed formerly to have existed or expected to exist . . . ."). Even attributes or qualities of things—such as the property *blackness*—can be the referents of a sign, as can events—such as "a *killing*." *Id.* § 1.551 (property); *id.* § 2.230 (event); *id.* § 2.232 ("a known quality or relation or fact"). Thus, Peirce technically referred to signs as standing not for objects themselves, but as standing for referents in some respects and identified those respects as the *ground* of the representamen. *Id.* § 2.228 ("The sign stands for something, its *object*. It stands for that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the *ground* of the representamen." (emphasis in original)).

177. Despite the wide-ranging nature of the referent, *see supra* note 176 and accompanying text, the presence of the referent in the triadic model of the sign ties the sign to the world in a way that would not be possible in its absence. In contrast, an alternative dyadic model of the sign popularized by Saussure "brackets the referent." CHANDLER, *supra* note 166, at 16. *See generally* SAUSSURE, *supra* note 171 (postulating a dyadic model of the sign). For Saussure, the sign is the combination of a *signifier* (the analog of the sign-vehicle) and a *signified* (the analog of the interpretant), and the meaning of a signified is determined not by reference to worldly things but only in relation to other mental signifieds. CHANDLER, *supra* note 166, at 18–22. Saussure's model is conspicuous in its absolute neglect of the things for which signs stand, dealing with the signified exclusively as "a concept in the mind—not a thing but a notion of a thing." *Id.* at 16; *see also* OGDEN & RICHARDS, *supra* note 170, at 6 (criticizing Saussure for "neglecting entirely the things for which signs stand"). Thus, while both Saussurian and Peircean models of the sign accommodate meaning-as-sense, only the Peircean model accommodates meaning-as-reference. CHANDLER, *supra* note 166, at 33–34; *cf. supra* note 174 (discussing the distinction between sense and reference).

This Article adopts the triadic model of the sign for three reasons. First, new signs often come into being when researchers discover new facts or formulate new hypotheses about the nature of the actual world, and it is thus useful to be able to talk about the things in the world to which a sign refers when discussing signs as inventions. Second, the referent is a useful descriptive tool for portraying what the Federal Circuit has done in *Bilski*: data are meaningful because they are sign-vehicles, and *Bilski* makes the tangibility of the sign's referent dispositive of patentability. *See infra* notes 317–20 and accompanying text. Third, computer models are meaningful because they are either icons or indices. *See infra* notes 297–303 and accompanying text. It is difficult to discuss these types of signs using a dyadic model of the sign because they implicate the referent by definition. *See infra* notes 186–92 and accompanying text.

178. *See, e.g.*, PEIRCE, *supra* note 167, §§ 2.304, 5.484. The tripartite schema is Peirce's simplest taxonomy, but not his only one. *See* NÖTH, *supra* note 166, at 44 (noting that Peirce postulated 59,049 classes of signs); *id.* at 45 (discussing a ten-category classification).

179. TERENCE HAWKES, STRUCTURALISM AND SEMIOTICS 129 (1977).

1. Symbols

Morse code, traffic lights, and most words, both written and spoken, are meaningful because they function as symbols. A sign is a symbol when the relationship between the sign-vehicle and the referent is ontologically arbitrary.[180] "[T]here is nothing 'treeish' about the word 'tree.'"[181] The word "tree" signifies the concept TREE in the mind of an interpreter and refers to the pulpy, leafy things swaying outside of my window only because of an arbitrary convention known to the interpreter. It is an historical accident that the English word "tree" signifies the concept TREE. The concept TREE could just as well be conveyed by the sign-vehicle "soup" or "urgh" in English, and it is conveyed by other signifiers in other languages, such as "arbre" in French.[182] A symbol is therefore a sign "whose special significance or fitness to represent just what it does represent lies in nothing but the very fact of there being a habit, disposition, or other effective general rule that it will be so interpreted."[183]

2. Icons

Icons involve sign-vehicles that are perceived by an interpreter to have qualities that resemble or imitate their referents.[184] The resemblance is often in visual perception (a stick figure standing for a person or a scale model representing a building) or sound (onomatopoetic spoken words). The resemblance can also exist in terms of the mapping of internal structural or functional relations among parts, making a diagram an icon.[185] Thus, for Peirce, icons include "every diagram, even although there be no sensuous resemblance between it and its [referent], but only an analogy between the relations of the parts of each."[186] Peirce frequently noted the utility of diagrams as aids in the reasoning process.[187]

3. Indices

The index is the least familiar of Peirce's three types of signs. As used in this Article, the index is a sign in which the sign-vehicle is directly connected in some

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180. LYONS, *supra* note 168, at 101 (discussing Saussure's dyadic model of the sign which accommodates only Peircean symbols).

181. CHANDLER, *supra* note 166, at 22.

182. LYONS, *supra* note 168, at 100–01.

183. PEIRCE, *supra* note 167, § 2.299; *see also id.* §§ 2.292, 2.299, 4.447 & 4.531.

184. *Id.* § 2.299 ("[A] quality that [an icon's representamen] has *qua* thing renders it fit to be a representamen [of an icon]."); *id.* ("A sign may be *iconic*, that is, may represent its object mainly by similarity."). Iconicity is a scalar variable, as all icons have some conventional attributes not based on resemblance. CHANDLER, *supra* note 166, at 40–41.

185. PEIRCE, *supra* note 167, § 4.447 ("A geometrical diagram is a good example of an icon.").

186. *Id.* § 2.279; *id.* § 2.282 ("Many diagrams resemble their objects not at all in looks; it is only in respect to the relations of their parts that their likeness consists.").

187. *Id.* § 4.531 ("Icons are especially requisite for reasoning. A Diagram is mainly an Icon, and an Icon of intelligible relations."); *id.* § 4.447 ("A geometrical diagram is a good example of an icon. . . . [I]t is of the utmost value for enabling its interpreter to study what would be the character of such an object in the case any such did exist.").

nomic way to the referent, such as through a natural law or an engineered coupling that generates spatial co-occurrence, temporal sequence, or cause and effect.[188] The shadow on a properly constructed sundial functions as an index because it indicates the time of day: the position of shadow on the slab (the sign-vehicle) refers to the time of day (the referent) and signifies the concept TIME OF DAY (the interpretant) in the mind of a person who is looking at the sundial.[189] When the relevant nomic connection is known to an interpreter, smoke can function as an index of fire, thunder as an index of lightning, a medical symptom as an index of a disease, the position of a wind vane as an index of the direction in which the wind is blowing, and the level of mercury in a thermometer as an index of the temperature at that location.[190]

C. The Lower Threshold of Semiotic Inquiry: Causation Versus Signification

There is no universally agreed-upon limit to the proper domain of semiotic inquiry. How many of the meaningful phenomena in the world are meaningful because they function as signs, and how many are meaningful for other reasons? On what Umberto Eco has called the "upper threshold" on the complexity of the phenomena within the "semiotic field," there is rarely any limit at all: semioticians routinely treat all human endeavors, whether cultural or other, as their sandbox and examine how signs construct the social reality with which we engage.[191] However, there is more disagreement on what Eco calls the "lower threshold."[192] Following Eco, this Article erects a relatively

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188. Elizabeth W. Bruss, *Peirce and Jakobson on the Nature of the Sign*, *in* THE SIGN: SEMIOTICS AROUND THE WORLD 81, 88 (Richard W. Bailey, Ladislave Matejka & Peter Steiner eds., 1978). Bruss describes indexicality as "a relationship rather than a quality. Hence the signifier need have no particular properties of its own, only a demonstrable connection to something else. The most important of these connections are spatial co-occurrence, temporal sequence, and cause and effect." *Id.* Peirce distinguished between "genuine" and "degenerate" indices. PEIRCE, *supra* note 167, § 5.74. The hygrometer is a genuine index. Through "[i]ts connection with the weather" it "actually conveys information." *Id.* "[O]n the other hand any mere land-mark by which a particular thing may be recognized because it is as a matter of fact associated with that thing, a proper name without signification, a pointing finger, is a degenerate index." *Id.* This Article addresses only genuine indices.

189. *Id.* § 2.285; *cf. id.* § 2.286 (noting that a barometer is an index of the likelihood of rain and that a weathercock is an index of the direction of the wind).

190. CHANDLER, *supra* note 166, at 33 (offering these examples among others).

191. ECO, *supra* note 167, at 21. Signs are widely recognized as constructing reality and mediating human experience, but the precise role that signs play in constructing reality is hotly debated. A strong stance is that signs construct reality per se because "there is no external reality beyond sign systems," whereas a more tempered stance suggests that signs construct the reality that we experience and that "studying semiotics can assist us to become more aware of the mediating role of signs and of the roles played by ourselves and others in constructing social realities." CHANDLER, *supra* note 166, at 10–11. Given that patent law and discussions of technological progress traffic in concepts such as the "laws of nature" that are discovered and put to work by inventors, the semiotic analysis of patent law presented here takes the conservative approach and adopts the moderate stance.

192. ECO, *supra* note 167, at 19–21.

high hurdle that must be surmounted to demonstrate the existence of a sign and the presence of a semiotic meaning.[193]

To understand what is at stake in Eco's delineation of the lower threshold of semiotic inquiry, consider two things that can be described as "meaningful" in a colloquial manner. The first is the stop sign discussed above—a clear example of a sign that is meaningful to the mind of a human interpreter.[194] The second is chemical X, a chemical that a bacterium secretes when it is unable to find food and that slows down certain metabolic functions of other bacteria that encounter it. (The evolutionary benefit of the secretion of chemical X is that bacteria conserve energy in a nutrient-poor environment.) In a colloquial sense, it is not jarring to say that chemical X is "meaningful" because of the behavior that the bacterium exhibits when it encounters chemical X. Chemical X can be described as conveying a message that is interpreted by the bacterium to "mean" something along the lines of "time to slow down certain metabolic functions." While both a stop sign and a molecule of chemical X can be described as meaningful, the nature of the meaning that a stop sign has to a driver and the nature of the "meaning" that chemical X has to the bacteria are radically different. Chemical X is "meaningful" to the bacterium only because it triggers a metabolic reaction in the bacterium. The laws of physics on a molecular scale fully explain the nature of the "meaning" that chemical X has to the bacterium as an interpreter. The three-dimensional shape of chemical X and the biochemical properties of the bacterium's receptors and other metabolic pathways fully determine the "meaning" of chemical X—that is, the bacterium's behavior that constitutes the reaction to the presence of chemical X. In contrast, the behavior that the driver displays in response to the stop sign does not exhaust the meaning of the stop sign to the driver. In fact, the driver may comprehend the meaning of a stop sign and yet may display no extroverted behavior at all. The stop sign has meaning to the driver because of the mental state that it triggers in the driver's mind, not because of any action that it causes the driver to take.

Some definitions of the proper domain of semiotics encompass chemical X and describe the meaning that chemical X has to the bacterium as a semiotic phenomenon.[195] Eco, however, defines semiotics more restrictively. He takes the

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193. The embrace of the Peircean triadic sign, rather than the Saussurian dyadic sign, means that this Article already exceeds one common boundary for semiotic inquiry on the lower threshold. *Cf. supra* note 177 (discussing Saussure's dyadic sign). Saussure focused on the study of "the sign . . . as a communicative device taking place between two human beings intentionally aiming to communicate or to express something." ECO, *supra* note 167, at 15. In contrast, Peirce's definition of the sign "does not demand, as part of a sign's definition, the qualities of being intentionally emitted and artificially produced." *Id.* at 15. As a consequence, Peircean semiotics readily accommodates the study of both natural phenomena and human behavior not intentionally emitted by its sender as signs, whereas Saussurian semiotics does not. *See id.* at 14–17.

194. *See supra* notes 175–76 and accompanying text. The technical diagram discussed above is also a good example. *See supra* text accompanying note 154.

195. The field of *endosemiotics*, or signaling between microbiota, defines the semiotic field in this more inclusive manner. Watt, *supra* note 168, at 677 (describing a chemical as conveying the semiotic meaning that "there is a dearth of food hereabouts" to a bacterium). *See generally* THOMAS A. SEBEOK, THE SIGN AND ITS MASTERS (1979) (developing a theory of endosemiotics).

distinction between what a stop sign means to a driver and what chemical X "means" to a bacterium to be the distinction that defines the lower threshold of semiotics. Chemical X is not a sign simply because it causally triggers a behavior in the interpreter. In Eco's terminology, things that are "meaningful" insofar as they cause specified behaviors are *stimuli* or *signals*, not sign-vehicles.[196] Defined in the negative, a sign-vehicle is an entity that acquires meaning through a mechanism other than through deterministic cause and effect. It is "a physical phenomenon which provokes reactions in mechanisms and organisms, *without being the cause of these reactions*."[197] The physical reactions provoked in interpreters by signs—to the extent that there are any extroverted reactions at all by the interpreters—are mediated by minds and mental states. In a positive manner, Eco defines semiotics to involve only the study of things that stand for other things by *social convention*.[198] The key concept is that simply through a social agreement, the semiotic meaning of the stop sign can change. In contrast, the effect of chemical X on the organism cannot change without a change in the chemical composition of the organism. The behavioral response is hardwired into the bacterium. Eco's paradigm examples of interpretants are mental phenomena.[199] Semiotic meaning is a phenomenon that occurs largely, if not solely, when there is a mind in the picture. Minds can employ social conventions to allow one thing to stand for or represent another thing, but it is difficult to comprehend how something that does not qualify as a mind would achieve this end.[200]

Importantly, the world is not neatly divided into the mutually exclusive categories of artifacts that function as sign-vehicles on the one hand and artifacts that function as stimuli and signals on the other. In the most interesting cases of overlap, an article can

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196. ECO, *supra* note 167, at 16, 19.

197. *See* Roscislaw Pazukhin, *The Concept of the Signal*, *in* 16 LINGUA POSNANIENSIS 25, 41 (1972) (defining the term "signal" but employing the same concept that this Article calls a sign) (emphasis added); *see also* NÖTH, *supra* note 166, at 112.

198. *See* ECO, *supra* note 167, at 16, 19 (asserting that "everything can be understood as a sign if and only if there exists a convention which allows it to stand for something else" and that "behavioral responses [that] are not elicited by convention . . . *cannot* be regarded as signs" (emphasis in original)).

199. *Id.* (treating "the human addressee [as] the methodological . . . guarantee of the existence of signification").

200. The mind-centric school of semiotics has a long history. Augustine defined a sign as "a thing which, over and above the impression it makes on the senses, causes something else to come into the mind as a consequence of itself." Watt, *supra* note 168, § 1, at 676. Although Eco does not make this connection, the presence of a mind can be identified through the concept of *intentionality* that is a staple in the intellectual diet of philosophers of the mind. Intentionality is the property of "aboutness" that many mental states possess and that signs are understood to possess in a manner that is derivative of those mental states. *See* Daniel C. Dennett & John C. Haugeland, *Intentionality*, *in* OXFORD COMPANION TO THE MIND 383–86 (1987); JOHN HAUGELAND, HAVING THOUGHT: ESSAYS IN THE METAPHYSICS OF MIND 127–70 (1998). However, an analytical definition of a mind is not critical for the day-to-day operation of a patent regime that adopts a semiotic framework. There is an intuitive difference between minds on the one hand and the mechanical and biological things on the other that will prove dispositive in the vast majority of patent cases. A small set of cases involving claims to zoosemiotics (the study of animals' use of signs), reflexive reactions by humans, and artificial intelligences yet to be defined will prove to be the exceptions to this rule.

come to signify to an interpreting mind the very behavior that it already causes an interpreter to perform. Things that are already signals and stimuli can become sign-vehicles as well, and they can support semiotic meanings once a social convention and a mind come into play. Chemical X can be a stimulus that *causally triggers* a reaction in a bacteria and a sign-vehicle that both *signifies* the concept of that behavior in the mind of a microbiologist and *refers to* the worldly behavior itself.

The status of an artifact as both a stimulus and a sign-vehicle can often be traced to the fact that the type of sign at issue is an index rather than an icon or a symbol. In an index, the sign-vehicle is nomically linked to the referent.[201] Chemical X is the sign-vehicle of an index because its presence in a culture of bacteria is linked to slower metabolic processes in the bacteria as cause is nomically linked to effect. However, it is critical to keep the status of chemical X as a stimulus and the status of chemical X as an index distinct. Causation and signification cannot be collapsed into a single process. Chemical X must function as a stimulus to give rise to indexical meaning,[202] but it may function as a stimulus without giving rise to indexical meaning. Indexical meaning arises only when humans come to understand the cause-and-effect relationship between chemical X and the bacteria's behavior and establish a social convention based on it.[203] Chemical X has been a stimulus that causes a bacterium to slow down its metabolism ever since natural selection chose bacteria that responded to chemical X in this fashion. However, chemical X has only functioned as a sign-vehicle and referred to the slowing-down of the bacteria's metabolic functions since the date on which a biologist discovered the causal relationship and communicated it to others. Only at this point is "this relationship . . . made conventional" and the "*semiotic convention* . . . established."[204] Thus, according to Eco, "[t]here is a sign every time a human group decides to use and to recognize something as the vehicle of something else," even if that something caused the something else to actually occur before the human group established its convention.[205] Chemical X takes on a semiotic meaning as an index only when, to a human observer, chemical X (sign-vehicle) refers to the agent causing slowing-down of the bacteria (referent) and signifies the mental concept BACTERIAL METABOLISM IS SLOWING DOWN (interpretant).

The importance of maintaining a distinction between the indexical meaning of a thing functioning as a sign-vehicle and the nonsemiotic "meaning" of the same thing functioning as a stimulus can also be seen in the ability of the two types of meaning to

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201. *See infra* Part II.B.3.

202. Or, at least, it must be correlated to the slowing down of the bacteria's metabolism in some way, even if the nomic link is not a direct relationship of cause and effect. *See supra* text accompanying note 188 (noting that nomic, correlative covariation can also lay the foundation for an index).

203. *Cf.* PEIRCE, *supra* note 167, § 2.299 ("The [sign-vehicle of the] index is physically connected with its object; they make an organic pair, but the interpreting mind has nothing to do with this connection, *except remarking it, after it is established*." (emphasis added) (footnote omitted)).

204. ECO, *supra* note 167, at 17 (emphasis in original). To differentiate the conventional relationships that are semiotic from the nonconventional relationships that are not, Eco coins a distinction between *codes* and *s-codes*. *Id.* at 36–38 (emphasis added).

205. *Id.* at 17.

change independently. As described by a scholar who has adopted a broader definition of the semiotic field:

> [w]hat Eco describes is . . . the shift from natural semiosis to its cultural interpretation, which is a shift between two levels of semiosis. While events of natural semiosis remain unaffected by cultural conventions, their interpretation changes with time and culture. Even that mode of interpretation which comes closest to reality of the facts of natural semiosis, namely, scientific explanation, is still affected by culture, as the changes in the world models of physics show. In archaic times, for example, lightning was once understood as the gesture of a supernatural being. Modern meteorology explains it as an electrical phenomenon.[206]

The semiotic meaning of chemical X may change over time, even if the physiological effect that it causally triggers in a bacterium remains unchanged. For example, assume that future scientists discover that the slowing down of the metabolic processes of the bacteria leads to a spike in the concentration of chemical Y, the nutrient on which bacteria feed and that is going uneaten. If high concentrations of chemical Y are dangerous for human health, then the high concentration of chemical X which previously signified BACTERIAL METABOLISM IS SLOWING DOWN now signifies LOCATION UNFIT FOR HUMAN HABITATION as well. Although the underlying "natural phenomena" and "laws of nature" that are wound up in the cause-and-effect relationships remain unchanged, the social conventions that layer semiotic meanings on top of them are man-made constructs that can shift and evolve with some degree of independence.

III. RECONCEPTUALIZING THE CORE PRINTED MATTER CASES

Limiting its scope to the core printed matter cases—that is, the cases in which the inventions are intuitively identified as information recorded on a substrate and the potential relevance of the contemporary printed matter doctrine is already clear—this Part demonstrates that the printed matter doctrine is in its effect, if not its rhetoric, already sensitive to semiotic principles. Part III.A articulates the sign doctrine by reinterpreting the printed matter doctrine in semiotic terms, and it emphasizes that the job that the printed matter doctrine is tasked to perform is to limit the incursion of patent protection into the representational processes of the human mind. Part III.B illustrates that the sign doctrine and its semiotic framework resolve many of the incoherencies of the contemporary, information-centric printed matter doctrine. Part III.C argues that semiotic reasoning points the way to a firm grounding for the printed matter doctrine in the Patent Act. Part III.D demonstrates that the patentable-weight approach to patent eligibility should be understood as a feature, not a bug, of the printed matter doctrine when it is reinterpreted as the sign doctrine and understood to achieve semiotically motivated ends.

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206. NÖTH, *supra* note 166, at 213–14.

A. The Sign Doctrine: From Information and Content to Signs and Interpretants

The idea that the core printed matter cases involve signs is not a stretch. Printed matter, such as a diagram for diagnosing a chemical B deficiency discussed above,[207] is clearly meaningful, and the components of Peirce's triadic sign can be readily identified.[208] The physical printed matter itself—the formal patterns of markings on the page perceived by a reader—is the sign-vehicle. The referent is the state of affairs in the world for which the sign-vehicle stands—the actual concentrations of chemicals A and B in a patient's blood. The interpretant is the set of mental concepts that form in the mind of the reader/interpreter of the diagram: it is the mental understanding of what the world is and how it functions that the reader may gain from exposure to the printed matter. All three of these components together make up the sign; the sign is the combination of the sign-vehicle, the interpretant, and the referent. Critically, and despite the misleading shorthand in which everyday language describes the printed matter itself as a sign (for instance, a stop sign), the printed matter as an artifact viewed in isolation is the sign-vehicle, not the sign in its entirety.[209] The sign-vehicle has "content" only in a loose sense of the word. The sign-vehicle does not contain its semiotic meaning within its physical structure. It has a semiotic meaning because it directly signifies a mental interpretant in the mind of an interpreter and indirectly, via the interpretant, refers to a referent that exists in the world.[210]

What precisely has the researcher who seeks protection for the diagram contributed to technological progress? Each component of the sign must be considered independently, at least at first. Concerning the referent, the researcher has made what the Supreme Court identified as a "discovery" rather than a patentable invention.[211] The inventor has discovered a new property of human blood in the actual world, namely that the concentrations of chemicals A and B are inversely related. This correlation presumably existed in human blood before the researchers undertook their research. All that the researchers have done is to recognize the existence of the referent in the world and "reveal[ed] a relationship that has always existed."[212] However, the researchers have a much stronger argument to having invented, not simply discovered, the interpretant. Prior to the researchers' work, no human mental state existed in which the inverse correlation between chemicals A and B was the object of thought. The mental interpretant of the correlation between chemicals A and B that forms in the mind of the human interpreter of the diagram may be novel, nonobvious, and useful.[213]

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207. *See supra* text accompanying notes 154.

208. *See supra* notes 170–71 and accompanying text (presenting Peirce's triadic sign).

209. *See supra* notes 175–77 and accompanying text (discussing the misleading synecdoche).

210. *See supra* notes 175–77 and accompanying text (noting that the meaning of a sign is not contained within the sign-vehicle).

211. Parker v. Flook, 437 U.S. 584, 593 & n.15 (1978).

212. *Id.* at 593 n.15. Many signs have man-made entities, rather than natural phenomena, as their referents. For example, in the rhetoric of *Parker v. Flook*, a diagram depicting the structure of a man-made chemical depicts the results of an invention, not simply the results of a discovery. Under a semiotic framework, the status of the referent as an invented or discovered entity is irrelevant.

213. Whether the interpretant is novel and nonobvious hinges upon the nature of the

Finally, concerning the sign-vehicle, the researchers may have done either of two different things, depending upon the content of the prior art. They may have piggy-backed on existing social conventions and manufactured a new sign-vehicle to signify to an interpreter the concept corresponding to the newly discovered referent. Alternatively, they may have repurposed an existing sign-vehicle, enabling an interpreter to associate a newly invented interpretant—and, indirectly, a newly discovered referent—with the existing sign-vehicle. Any single claim may encompass sign-vehicles of both types. In either case, however, the nonobviousness of the sign turns entirely on the nonobviousness of the interpretant. The sign-vehicle is either a preexisting entity or an entity that is nonobvious to make only because the interpretant that it signifies is nonobvious.

The basic effect of reinterpreting the printed matter doctrine in a semiotic framework is to shift courts' focus away from information and its content and toward signs and their interpretants during the analysis of the types of products of human ingenuity that can and cannot be patented. When the printed matter doctrine is reconceptualized in a semiotic framework and recast as the sign doctrine, the core printed matter cases can be seen to follow a simple rule: *a claim that describes a sign is not eligible for patent protection if the sole locus of the nonobvious improvement over the prior art resides in a mental state*. Semiotically framed, what courts are already doing under the banner of the printed matter doctrine—but not what they are saying they are doing—is invalidating claims that describe a sign in which the only nonobvious advance over the prior art resides in the processes that occur in the minds of interpreters.[214] It is the interpretant of a sign, not the content of information more broadly, that cannot be given patentable weight.

B. Curing Doctrinal Infirmities

A semiotic perspective on the evolution of the printed matter doctrine suggests that courts erred in their choice of the doctrine's technology-neutral formulation.[215] The doctrine was originally aimed at printing on paper, but this technology-specific focus proved to be unsustainable. Courts took printed matter to be an archetype of information with content when they should have taken printed matter to be an archetype of a sign with an interpretant. Once couched in terms of information, the printed matter doctrine was destined to be conceptually incoherent. The printed matter doctrine lost its coherence because neither the PTO nor the courts had access to the semiotic concepts that are required to describe the semiotically motivated distinctions they intuitively realized that they needed to make in the core printed matter cases. To exclude the types of inventions that did not comport with widely shared notions of what should be patented, the PTO and the courts allowed the effect of the printed matter doctrine to veer off sharply from its information-centric rhetoric. What they did

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discovery at issue. If the researchers were the first to recognize that the correlation might exist, then the interpretant would be novel and possibly nonobvious. However, if the researchers' work simply provided empirical verification for the correlation that had long been hypothesized, then the interpretant might not be novel.

214. *But see infra* notes 248–55 and accompanying text (discussing how a semiotic framework would, if rigorously applied, expand patent eligibility in core printed matter cases).

215. *See supra* notes 36–38 and accompanying text (presenting the evolution of the printed matter doctrine to its contemporary technology-neutral formulation).

diverged from what they said. Reinterpreting the printed matter doctrine as the sign doctrine and embracing a semiotic framework is in large part a valuable exercise because it brings to light the otherwise difficult-to-perceive conceptual coherence in the outcomes that the courts and the PTO are already reaching in many of the core printed matter cases.[216]

1. Interpretants Entail Human Intelligibility

The thesis that the printed matter doctrine is already a doctrine that is in its effects—but not in its rhetoric—based on semiotic principles explains why the Federal Circuit gravitated toward a definition of information and its content that focuses on human intelligibility.[217] Interpretants entail intelligibility in a human mind.[218] A semiotic reformulation of the printed matter doctrine as the sign doctrine embraces the notion that the printed matter doctrine deals with the worldly things that the human mind finds to be meaningful.[219]

Under the sign doctrine, patents that describe sign-vehicles and that grant inventors rights to exclude the public from using signs are commonplace. The sign-vehicles of signs are often the "machine[s], manufacture[s], and composition[s] of matter" that lie at the core of patentable subject matters.[220] The steam engine is the sign-vehicle of a sign that has the industrial revolution as its referent (and the mental understanding of the industrial revolution as its interpretant), yet a patent on the steam engine does not run afoul of the sign doctrine. Television sets routinely display signs that are intelligible to those who are watching, yet they remain patentable inventions under a semiotically oriented printed matter doctrine. Mercury thermometers are useful because the level of mercury in the thermometer serves as the sign-vehicle of an index that has the temperature of the air as its referent, yet thermometers can be patented when they contain improvements in their physical engineering.[221] Ink on paper is a patentable invention when the chemical formula of the ink is useful, novel, and nonobvious.[222] The sign doctrine bars the patenting of a sign only when the sole locus of nonobvious advance over the prior art resides in the sign's interpretant. The steam engine, television set, and thermometer all function as sign-vehicles, but they contain novel and nonobvious improvements in the physical engineering of the sign-vehicle proper.

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216. *But see infra* notes 248–55 and accompanying text (discussing how a semiotic framework would, if rigorously applied, expand patent eligibility in core printed matter cases).

217. *See supra* Part I.A.2.

218. *See supra* notes 172, 198–200 and accompanying text.

219. The semiotic framework explains the historical kinship of the printed matter doctrine and the now defunct or dormant mental steps doctrine that expressly addressed the patentability of human mental processes. *See, e.g.*, *Ex Parte* Jenny, 130 U.S.P.Q. 318 (Pat. Off. Bd. App. 1960) (employing principles established in the mental steps doctrine to refine the printed matter doctrine).

220. 35 U.S.C. § 101 (2006); *cf.* Burk, *supra* note 60, at 113 (discussing the expressive qualities of technology).

221. *See infra* Part IV.A (discussing the patentability of mechanical measuring devices).

222. *Cf. supra* text accompanying notes 105–07.

The key to distinguishing permissible claims to signs from impermissible ones is not to inquire whether the patent claim describes a sign-vehicle but rather to determine whether what is novel and nonobvious is the semiotic meaning that a human interpreter should understand when she perceives a sign-vehicle.[223] The semiotic framework for patent eligibility, therefore, focuses the exclusion from patentable subject matter not generally on meaningful things but specifically on improvements in human understanding itself.

2. Of Signals and Stimuli

The semiotic framework explains why many artifacts that are nothing more than information recorded on a substrate remain patentable under the printed matter doctrine, even when it is the content of the information that is the advance over the prior art.[224] Many artifacts are tangible embodiments of information because they are signals or stimuli, and signals and stimuli pass below the lower threshold of the semiotic field.[225] A signal or stimulus carrying informational content passes below the lower threshold of the semiotic field because its "meaning" or "content" is the behavior that it causes in a biological, mechanical, or electronic interpreter. Its structure can be nonobvious because it has the unexpected property of causing this behavior, and no interpretant or social convention needs to be considered.

All chemicals and biological molecules are stimuli and signals that carry information because they physically cause chemical and biological interpreters to adopt particular states of affairs. In particular, the DNA of an expressed gene is a stimulus: it is the bearer of information in a nonsemiotic sense because a cell is a biological interpreter that responds in a deterministic manner to the presence of the DNA.[226] Thus, "genetic 'codes' are below [Eco's] semiotic threshold, since they are not based on social conventions."[227] Long before the discovery of the genetic code and the advent of molecular biology, DNA molecules bore information without a human interpretant or a sign anywhere in the picture.

Similarly, to the extent that software-on-disk claims are eligible for patent protection under *Beauregard*, it is because the information recorded on the disk serves as a signal that deterministically causes a computer to adopt a particular state of affairs.[228] The binary ones and zeros recorded on an old-fashioned computer punch card or a newfangled USB drive are signals or stimuli: the mechanical or electronic devices into which they are fed are interpreters that, when functioning properly, produce responses through deterministic processes. No interpretants are required for software recorded on a disk to "mean" something in the nonsemiotic sense to a computer as an interpreter.[229]

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223. *See supra* text accompanying note 214.

224. *See supra* Part I.A.1.

225. *See supra* Part II.C.

226. *See supra* notes 41–44 and accompanying text (discussing DNA as a form of information).

227. NÖTH, *supra* note 166, at 213.

228. *See supra* notes 45–49, 56–58, 89–93 and accompanying text (discussing *Beauregard* claims).

229. As Pamela Samuelson stated:

Furthermore, the semiotic framework explains the both-and problem that the contemporary printed matter doctrine is unable to address in a coherent manner.[230] The both-and puzzle arises when an artifact is both a signal/stimulus that causes a behavior in a mechanistic or organic interpreter and a sign-vehicle that signifies an interpretant in the mind of a human interpreter. More specifically, it arises when the sign at issue is an index and the referent of the index is the very behavior that the artifact-as-stimuli causes in the machine or organism.[231] DNA is an example of the both-and problem: it is a stimulus that causes a cell-as-interpreter to produce a protein, and it is a sign-vehicle of an index that signifies the same protein to a molecular biologist who understands the genetic code (through the mediation of a sequencer). Cells and molecular biologists "read" DNA through entirely different mechanisms. Software recorded on a disk is an example of the both-and problem for the same reason. The software is a signal that causes a computer-as-interpreter to perform a particular behavior, and it is a sign-vehicle of an index that signifies the same behavior to a computer scientist who understands the programming language (through the mediation of a decompiler).

In a semiotic framework, both-and artifacts are usually eligible for patent protection. The important question to determine patentability in a semiotic framework is whether the nonobvious advance over the prior art resides solely in a mental act of human understanding, that is, an interpretant in the mind of a human interpreter.[232] Insofar as they function as sign-vehicles, newly invented both-and artifacts will commonly signify novel and nonobvious interpretants, but these interpretants will rarely be the only locus of the advance over the prior art. The physical structure of the both-and artifact will often be nonobvious because of the reaction that it causes in the organic or mechanical interpreter. DNA is an advance over the prior art because of its function as a stimulus: its structure causes a cell to produce a protein. To understand the irrelevance of the interpretant, consider a hypothetical in which human understanding is taken out of the picture. Even if humans did not understand the genetic code, an isolated and purified gene would be patentable because it could be used to provoke a cell to produce a protein. Similarly, software on a disk is an advance over the prior art because its structure causes a computer to exhibit a particular behavior. Even if computer programmers forgot how to read and understand a programming language, the computer software recorded on a disk would remain patentable because it would still cause the machine to exhibit a specific behavior. The status of both-and artifacts as stimuli means that the patent eligibility of the artifacts can be proven even if nonobvious interpretants associated with the artifacts when they function as sign-vehicles for human readers are not given patentable weight.[233]

> There is one very simple but important difference between a book which contains a set of instructions about how to do a particular task and a computer program in machine-readable form which contains a similar, if considerably more elaborate, set of instructions on the same subject: The former informs a human being about how the task might be done; the latter does the task.

Samuelson, *supra* note 148, at 727.

230. *See supra* notes 59–61 (discussing the both-and puzzle).

231. *See supra* note 201 and accompanying text.

232. *See supra* Parts III.A, III.B.1.

233. Depending on the trajectory of the future evolution of technology, there may need to be an exception to the patent eligibility of both-and artifacts. The printed matter doctrine may need

3. Signals that Cause Machines to Generate Sign-Vehicles

The semiotic framework also provides the conceptual tools required to explain the first-then puzzle—the fact that some artifacts, like analog tapes or computer disks encoded with books, must be processed by machines but yet intuitively should not be eligible for patent protection.[234] The same conceptual tools explain the currently inexplicable distinction that the PTO has drawn in *Beauregard* claims between descriptive material that is functionally related to its substrate (an ".exe" file) and descriptive material that is not functionally related to its substrate (a ".txt" file).[235]

In a semiotic framework, a signal embedded on a computer-readable medium is not guaranteed to be patentable simply because it physically causes the computer to exhibit a specific behavior. Both functional descriptive material and nonfunctional descriptive material are signals that cause a behavior in a general-purpose computer. In a semiotic framework, the important question addresses the nature of the behavior that the signals provoke in the computer. Sometimes, the behavior that a signal causes the computer to perform is the production of a sign-vehicle. For terminological clarity, the sign-vehicle produced by the computer-as-interpreter can be called the *secondary sign-vehicle* and the sign in which it participates can be called the *secondary sign*. When a signal causes the production of a secondary sign, there is quite obviously another sign wound up with the claimed invention to which the PTO must pay attention in the patent-eligibility analysis. If the sole advance over the prior art resides in the interpretant signified by the secondary sign-vehicle that a signal causes a machine to produce, the signal is no more eligible for patent protection than a direct claim to the sign-vehicle would be. A claim to a printed book (sign-vehicle) that is nonobvious in relation to the prior art only because of its semiotic meaning is no different from a claim to a computer disk that causes a machine programmed with prior-art software to display the same book (secondary sign-vehicle). The patentable-weight analysis of the printed matter doctrine must apply to any interpretant, regardless of whether the interpretant is associated with

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to incorporate a safety valve that restricts the reach of patent protection that is similar to the merger doctrine in copyright. *See* Morrissey v. Procter & Gamble Co., 379 F.2d 675 (1st Cir. 1967) (holding that original expression may be copied without violating a copyright if the expression is but one of a few ways of expressing an idea). For example, assume that the art of computer programming—and the art of compilers in particular—evolves to the point at which the functions performed by a software program can be described by a computer programmer in plain English and automatically translated into executable object code. In this world, it would be very difficult to use the English language recorded on a computer disk to convey concepts about the computer program without infringing a *Beauregard* claim to the computer program. Any English description of the program that serves as a sign-vehicle that represents the computer's behavior to a human mind would also be a signal or stimuli that causes the computer to perform the behavior. In this future world, sign-vehicles and signals will have merged. If both-and artifacts are patent eligible, the categorical sanctioning of the patentability of both-and artifacts would in effect be the categorical allowance of patents on nearly all of the sign-vehicles that can convey knowledge about the program. If carried over into patent law, the merger doctrine would hold both-and artifacts to be patent-ineligible when a signal must remain beyond the reach of patent protection to ensure that representations of knowledge about an invention reside in the public domain.

234. *See supra* notes 55–58 and accompanying text.

235. *See supra* notes 89–93 and accompanying text.

a sign-vehicle or with the behavior that the claimed subject matter triggers in a machine or organism.

4. Limiting the Exclusion: Newly Engineered Sign-Vehicles

The semiotic framework also enables a reevaluation of the structural- and functional-relation exceptions to the printed matter doctrine in their pre-*Beauregard* applications.[236] Construed in semiotic terms, the printed matter doctrine states that a claim to a sign-vehicle is not eligible for patent protection if the sole locus of the improvement over the prior art resides in the interpretant that it signifies to an interpreter.[237] The negative corollary of this limited rule is that there are many situations in which newly engineered sign-vehicles are eligible for patent protection.

For example, as already discussed, the negative corollary leads to the conclusion that newly engineered sign-vehicles are patent eligible when they have been engineered to possess non-semiotic properties in addition to their semiotic properties. Sometimes, the non-semiotic properties are structural properties of the sign-vehicle itself. A sheet of paper with a specific diagram printed on it is a sign-vehicle that is eligible for patent protection if the chemical composition of the ink in which the diagram is printed is a nonobvious invention.[238] Sometimes, the nonsemiotic properties are the structural properties of the sign-vehicle that deterministically cause reactions in other systems. Newly engineered signals and stimuli are usually patent eligible for this reason despite the fact that they are frequently sign-vehicles as well.[239] In either case, the advance over the prior art resides in a property other than the ability of the sign-vehicle to signify interpretants and, indirectly, refer to referents.

The structural- and functional-relation cases, which are traditionally viewed as exceptions to the printed matter doctrine, populate another category of newly engineered sign-vehicles that are eligible for patent protection under the negative corollary. Sign-vehicles have historically been patentable under the printed matter doctrine when they have been engineered so as to improve the efficiency of the process of signification without an accompanying improvement in what is signified.[240] More specifically, the efficiency gains can occur either on the production side, in which case speakers can generate sign-vehicles more rapidly or with less effort, or on the reception side, in which case speakers can more readily understand the interpretants associated with the sign-vehicles.

The inventions in the structural-relation, ticket-tearing cases are examples of newly engineered sign-vehicles that are eligible for patent protection because of production-side efficiencies.[241] The inventors achieved nonobvious advances in the structural

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236. The arguments in Part III.B.3 above address the functional-relation exception in the context of *Beauregard* claims.

237. *See infra* Part III.A.

238. *See supra* text accompanying note 222.

239. *See supra* Part III.B.2.

240. The notion that the two different signifiers can be associated with the identical signified is semiotically naive. *Cf.* CHANDLER, *supra* note 166, at 17 (noting that, for Saussure, the signified and signifier were as inseparable as two sides of a page). However, it is a useful simplification for understanding the sign doctrine.

241. *See supra* text accompanying notes 63–78.

features of the sign-vehicles that made the sign-vehicles labor-saving devices for sign producers. In *Cincinnati Traction Co. v. Pope*,[242] the inventor of the tripartite ticket did not argue that the referent or the interpretant were newly discovered or invented, respectively. Street railways were using time-limited transfer tickets before the invention of the tripartite ticket at issue.[243] The tripartite ticket was a newly engineered sign-vehicle that allowed streetcar conductors to generate a time-limited transfer ticket more quickly and to increase the verifiability of the tickets that had been issued. Similarly, in *Flood v. Coe*, the tickets for tagging garments in retail stores signified the identical interpretants to customers that prior art garment tickets had signified, but the new spatial arrangement of the printed matter on the substrate reduced the workload of the workers in the retail stores who had to reprice the ticketed merchandise.[244]

In re Gulack and its functional-relation exception from the printed matter doctrine is an example of a claim to printed matter that was patentable because the sign-vehicle was newly engineered to promote reception-side efficiencies in the semiotic process.[245] The "nonobvious" circular configuration for the digits representing the mathematical sequence presumptively made the endless nature of the sequence more readily understandable to the reader.[246] The claimed invention does not convey a newly invented interpretant, as the mathematical sequence (referent) is not put forth as newly discovered and thus the human act of understanding of that sequence (interpretant) is not alleged to be newly invented. Rather, the sign-vehicle has been newly engineered to make it more iconic: in comparison to the prior art, the claimed invention increases the perceived resemblance between the sign-vehicle and the referent.[247] The increase in the perceived resemblance presumptively makes it easier for the interpreter to formulate the proper interpretant that accurately reflects the nature of the referent.

The semiotic reformulation of the structural- and functional-relation exceptions to the printed matter doctrine explains courts' outcomes in most of the pre-*Beauregard* cases in which the exceptions have been invoked to justify the patentability of printed matter: newly engineered sign-vehicles are patentable insofar as they entail production efficiencies or reception efficiencies.[248] However, if taken seriously, it also reveals one area in which the semiotic framework would have prescriptive bite in the core printed

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242. 210 F. 443 (6th Cir. 1913).

243. *Id.* at 444.

244. 31 F. Supp. 348, 348–49 (D.D.C. 1940).

245. 703 F.2d 1381 (Fed. Cir. 1983).

246. Whether the circular configuration was nonobvious raises a question of fact that is beyond the scope of the inquiry here.

247. *See supra* Part II.B.2.

248. *In re Miller* is arguably the exception—a case that held an invention to be patentable under the functional-relation exception to the printed matter doctrine but that should not be patentable under the semiotic framework. 418 F.2d 1392 (C.C.P.A. 1969). *Miller* did not involve a newly engineered sign-vehicle. The inventor simply placed new labels on old measuring spoons that instructed the user how to use the spoons in a particular fashion, something along the lines of "if you are making a half-recipe, use this spoon if the recipe calls for a cup of an ingredient." *See id.* at 1394. If *Miller* qualifies as patent eligible under the printed matter doctrine, then it is difficult to understand why machine-plus-labels are not eligible for patent protection. *See infra* Part IV.A (explaining why old machines with new labels are not eligible for patent protection). Pragmatically, however, *Miller* may be cabined as an exceptional case because it involved factually incorrect labels.

matter cases. More specifically, it suggests one way in which the adoption of the sign doctrine and its semiotic framework might *expand* the set of artifacts of human ingenuity that are eligible for patent protection. Historically, the printed matter doctrine started out as a categorical rule that simply excluded all printed matter from patent eligibility,[249] and some vestiges of this rule remain in the contemporary printed matter doctrine. These vestiges make the exclusion from patent eligibility attributable to the contemporary printed matter doctrine an overinclusive proxy for the exclusion that can be justified on purely semiotic grounds.

For example, concerning production efficiencies, it is semiotically irrelevant whether a claim describes printed matter that is easier to use because it can be physically folded, punched, or torn in a new manner or, alternatively, because the printed matter is simply structured differently in the sense of ink being at different locations on a page. Imagine a bound book of tickets in which a number must be written by the ticket seller on the stub of each ticket. If prior art ticket books had the space for writing the number near the binding of the stubs, a book of tickets with the space near the free end of the stub where the tickets have been removed might be patentable because the numbers would be easier to record.[250] Similarly, documents written in a new form of shorthand would be eligible for patent protection under a semiotic framework because the shorthand results in production efficiencies without affecting what the writing signifies.[251] In linguistic terms, matter printed in newly invented systems of *syntax* should be eligible for patent protection under a sign doctrine that rigorously follows semiotic reasoning, but printed matter should not be patent eligible because it has a newly invented *semantic* meaning.[252]

Concerning reception efficiencies, there are also printed matter inventions that are not eligible for patent protection under the traditional printed matter doctrine that should be eligible for patent protection under purely semiotic reasoning. Perhaps the most important of these inventions historically are documents embodying new methods of arranging and indexing printed matter. The spatial arrangement of printed matter on a sheet can clearly make it easier for an interpreter to understand the printed matter, as can a well-designed index for a book. In several cases that lie at the heart of the printed matter cannon, claims to an index arranged in a particular fashion have been held not to be patentable subject matter.[253] When interpreted as part of a semiotic framework, however, the printed matter doctrine should sanction the patentability of an index arranged in a nonobvious manner. The index does not alter the ideas represented by a book; it does not affect the nature of what the book signifies. It simply provides an

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249. *See supra* text accompanying note 36.

250. The nonobviousness of the physical engineering of the sign-vehicle under section 103 in this simple example is highly questionable.

251. Although the printed matter doctrine was not considered, production efficiencies also explain why the Supreme Court held Morse code itself to be a patentable invention as a "system of signs." *See O'Reilly v. Morse*, 56 U.S. 62, 86, 112 (1853).

252. Syntax is "the structure of phrases and sentences and the constraints on well-formedness of sentences," and semantics is "the meaning of words and sentences." VICTORIA A. FROMKIN, LINGUISTICS: AN INTRODUCTION TO LINGUISTIC THEORY 7 (2000).

253. *See* Jacobs, *supra* note 38, at 480–81 (discussing printed matter cases involving "a new method of arranging or indexing information").

understanding efficiency.[254] For the same reasons, drawings rendered in new systems of perspective or diagrams employing new graphic conventions—that is, new systems of syntax—provide understanding efficiencies that should make them eligible for patent protection under the sign doctrine when its exclusion is narrowly tailored to its semiotic principles.[255]

C. Solving Statutory Mysteries: A Structural Interpretation of Section 101

A semiotic perspective on the printed matter doctrine also reveals how the doctrine is grounded in the Patent Act.[256] When viewed semiotically, the printed matter doctrine is grounded in a *structural* interpretation of section 101—an interpretation that examines the meaning of section 101 within the context of the Patent Act as a whole and its disclosure provisions in particular.[257]

One of the deepest structural principles of the Patent Act is its "duality of claiming and disclosing."[258] Congress did not unilaterally bestow benefits upon inventors who generate technological progress. Rather, it structured the patent regime as a "bargain" in which inventors and the public exchange valuable rights.[259] The public, via the state, grants an inventor limited rights to exclude others from making, using, or selling the claimed embodiments of an invention, and, as the "quid pro quo of the right to

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254. The reconsideration of the historical printed matter cases involving indexes also sheds new light on the Federal Circuit's holding in *In re* Lowry, 32 F.3d 1579 (Fed. Cir. 1994). In *Lowry*, the Federal Circuit upheld a claim to a computer-readable data structure under the printed matter doctrine. *Id.* at 1582–84. *Lowry* is often taken to stand for the fact that the printed matter doctrine does not apply to computer technology in the same way that it applies to traditional print media. *Id.* at 1583 (chastising the PTO for "erroneously extend[ing] a printed matter rejection . . . to a new field . . . ."). However, from a semiotic perspective, the *Lowry* holding does not require a computer-specific exception to the general rule. The computer-readable data structure is an organization of data akin to an index. Under the semiotic framework, new, more efficient electronic organizations of computer-readable data should be patentable because new, more efficient spatial organizations of human-readable data should be patentable, too.

255. *Cf. supra* note 252 and accompanying text (arguing that documents printed in newly invented systems of syntax can be patented without running afoul of a narrowly construed sign doctrine). Despite the fact that improvements in semiotic efficiency do not run afoul of the sign doctrine when it is narrowly tailored to its semiotic principles, there are good reasons not to upset the status quo and recognize them as patent eligible. A bright-line rule that excludes all claims to newly invented printed matter per se simplifies the analysis, as the distinction between inventions in syntax and semantics may not always be self-evident. The overinclusiveness of its exclusion may be justified by invoking the traditional benefit-of-administrability justifications of rules rather than standards. *See* FREDERICK SCHAUER, PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE (1991).

256. *Cf. supra* Part I.B (discussing the doctrine's nonstatutory nature).

257. *See* Kevin Emerson Collins, *Claims to Information qua Information and a Structural Theory of Section 101*, 4 I/S: A J. OF L. AND POL'Y FOR THE INFO. SOC'Y 11, 22–26 (2008), *reprinted in* PATENT CLAIMS: JUDICIAL INTERPRETATION AND ANALYSIS (2009) (discussing a structural interpretation of section 101).

258. Dinwoodie & Dreyfuss, *supra* note 23, at 193 n.4 (2006).

259. Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 63 (1998); Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989).

exclude," the inventor discloses newly discovered knowledge that she otherwise could have kept secret.[260] The disclosure requirements of section 112 of the Patent Act impose an affirmative obligation on the patent applicant.[261] Disclosure runs against the inventor's self interest; it is a "price" that "is *exacted from*" the patentee in return for patent protection.[262] Importantly, the disclosure is not merely an obligation to publicize knowledge in the weak sense of making it known to the public. Disclosures are "additions to the general store of knowledge" that must be free for all to use so as to "stimulate ideas and the eventual development of further significant advances in the art."[263] From the moment of publication, the public is free to use the knowledge that it gains from the disclosure, even in ways that are detrimental to the patentee.[264] Thus, the disclosure obligation requires a patent applicant to publicize knowledge in a strong sense—to give the public a use privilege in the invention *qua* knowledge, free of the strings of property.

The existence of the duality of claiming and disclosing as part of the deep structure of the Patent Act is widely accepted, but its implications have not been fully explored. The duality, and its granting of public privileges of access in particular, cannot be taken for granted. There is no self-enforcing line that separates the resources that can be privatized by a claim and those that must be publicized by the disclosure. Knowledge does not have any inherent "architectural" property that makes it immune from the propertizing effect of patent claims.[265] In a form that is useful to humans, knowledge is not an ethereal, immaterial entity. It is a phenomenon rooted in both the electro-chemical states of our brains and the worldly things that our minds understand to be meaningful.[266] Because of the worldly, material basis of knowledge, the disclosure side of the duality of claiming and disclosing is in jeopardy of being curtailed or eliminated unless there are doctrinal restrictions on the patent eligibility of worldly things and mental processes that are built into patent law. Unless patentable

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260. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 484 (1974).

261. 35 U.S.C. § 112 ¶ 1 (2006).

262. Eldred v. Ashcroft, 537 U.S. 186, 216 (2003) (emphasis in original).

263. *Kewanee Oil*, 416 U.S. at 481.

264. 1 CHISUM, *supra* note 2, § 7.01 ("[O]n issuance . . . the patent immediately increases the storehouse of public information available for further research and innovation."); Timothy R. Holbrook, *Possession in Patent Law*, 59 S.M.U. L. REV. 123, 133 ("[T]he disclosure in the patent is . . . designed . . . to enrich the state of the art contemporaneously with the invention."). Patent law encourages competitors to use the disclosure to "design around existing patents." Intel Corp. v. VIA Techs., Inc., 319 F.3d 1357, 1367 (Fed. Cir. 2003); *see also* Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996). Competitors can design around a patent only if they have free use of the newly invented knowledge conveyed by the patent disclosure. In addition to this preexpiration role, the disclosure also plays a postexpiration role in that it ensures that the public possesses the right to make the claimed invention after expiration. Grant v. Raymond, 31 U.S. (6 Pet.) 218, 247 (1832).

265. LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE 24–29 (1999) (arguing that there is nothing inherent in the architecture of cyberspace that prevents its regulation). *But see* Wagner, *supra* note 164, at 1005–09 (arguing that "perfect control" may be justified in intellectual property because information inevitably escapes the property owner's control and generates externalities).

266. *Cf.* KARL R. POPPER, OBJECTIVE KNOWLEDGE: AN EVOLUTIONARY APPROACH 73–74 (1979) (discussing subjective and objective knowledge).

subject matter is restricted, patentees can dress up the worldly resources that comprise inventive knowledge itself as patentable inventions. Unless patentable subject matter is restricted, patentees can describe in a claim, and thus purport to privatize, the resources that the patentee should be obligated to publicize. Disclosures create a public domain of knowledge only if there are doctrinally enforced limits on the nature of the claims to which inventors are entitled.

A structural interpretation of section 101 allows courts and examiners to enforce those limits and ensure that patent applicants fulfill their disclosure obligations. Structural statutory interpretation requires courts to look to "the structure and purpose of the Act" as a whole when construing statutory language.[267] The duality of claiming and disclosing is a deep, structural principle of patent protection, and section 101 must be construed so as to preserve it.[268] When section 101 is viewed in the context of the Patent Act as a whole, and the disclosure obligations of section 112 in particular, it is clear that there is one category of claims that Congress did not sanction as patent eligible: claims that interfere with the public's free use of "the general store of knowledge" created by patent disclosures.[269]

The sign doctrine is nothing more than a prohibition on patent eligibility that is required to prevent patent applicants from shirking their disclosure obligations. Signs—or, more precisely, signs with newly invented interpretants—are real-world resources that must be free for all to use in order to ensure that the knowledge disclosed in a patent specification remains free for all to use *qua* knowledge. Reconceptualized in semiotic terms, the printed matter doctrine prevents the issuance of a patent when all that the inventor has achieved is an advance in human understanding.[270] This result is mandated by the disclosure side of the duality of claiming and disclosing that structures the Patent Act as a whole.

The fact that the printed matter doctrine is implicit in the structure of the Patent Act as a whole also lowers the stakes of the Federal Circuit's difficult-to-explain application of the doctrine under the dual statutory provisions in sections 101 and 103.[271] The structure of the Patent Act as a whole mandates the existence of the printed matter doctrine, but it does not mandate that courts must construe any section in particular to embody the printed matter doctrine. It is reasonable to think of the printed matter doctrine as an artifact of the section 101 doctrine of patent eligibility because there is a particular type of invention—a newly invented interpretant—which cannot be patented, regardless of how novel, useful, and nonobvious it is. This is the route that this Article has taken, but this choice is more a matter of convenience than necessity. It

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267. N.Y. State Conference of Blue Cross & Blue Shield Plans v. Travelers Ins. Co., 514 U.S. 645, 655 (1995); *see also* WILLIAM N. ESKRIDGE, JR., DYNAMIC STATUTORY INTERPRETATION 118–19 (1994) (discussing Justice Scalia's structural approach to statutory interpretation). The Supreme Court has used a yet more inclusive variant of this canon of structural statutory construction to interpret the Lanham Act in light of other intellectual property laws. *See* Dastar Corp. v. Twentieth Century Fox Film Corp., 539 U.S. 23, 37 (2003) ("[R]eading the phrase 'origin of goods' . . . in light of the copyright and patent laws . . . ."). Reading section 101 in light of the Patent Act is a far less ambitious structural move.

268. *See supra* text accompanying notes 258–66.

269. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974).

270. *See supra* text accompanying note 223.

271. *See supra* text accompanying notes 136–41 and accompanying text.

is also entirely possible to construe sections 102 and 103 in light of the structure of the Patent Act as a whole so as to make the sign doctrine an artifact of the novelty and nonobviousness analyses: in assessing whether a claimed invention embodies an advance over the prior art, courts could ignore any advance that resides solely in newly invented interpretants. When the sign doctrine is grounded in a structural theory of statutory interpretation, its statutory locus is broader than any single statutory provision.

D. Embracing the Patentable-Weight Approach in a Limited Realm

A semiotic framework demonstrates that the patentable-weight approach to patent eligibility is practical and coherent when it is employed as part of the sign doctrine. The patentable-weight approach should be recognized as a feature, not a bug, of the sign doctrine for two reasons.

First, on a conceptual level, the semiotic framework explains why it is appropriate for the patentability of an artifact to hinge on the content of the prior art and thus the historical context in which an invention was made.[272] There is no reason to expect patent eligibility to be an intrinsic property of an artifact in a semiotic framework. Semiotic meanings are not intrinsic properties of artifacts. Semiotic meanings are not contained within artifacts; sign-vehicles do not have "content" in the sense of meanings contained within them.[273] Printed matter is meaningful only because of the mental process of interpretation in the mind of an interpreter. Signs, not sign-vehicles, are the entities within which meanings reside. If a single component of a sign is artificially cabined off from the sign's other components—for instance, if the sign-vehicle is examined in isolation—it should be unsurprising that its eligibility for patent protection depends on something other than that single component's intrinsic properties.

To understand the value of a patentable-weight approach to the doctrine of patent eligibility in the context of semiotically meaningful things, consider the absurd results of taking a claim-as-a-whole approach to patent eligibility seriously. In other words, consider a hypothetical *sign-as-a-whole* approach to patent eligibility. Under a sign-as-a-whole approach, courts would have to take note of all of the components of a sign—the sign-vehicle, the interpretant and the referent—every time an inventor claimed a sign. If any of those individual components described patentable subject matter, then the claim as a whole would describe patentable subject matter. Because every sign has a perceptible sign-vehicle that is an extra-mental thing, every sign would be eligible for patent protection under the sign-as-a-whole approach.[274] Despite their insistence on a claim-as-a-whole approach to patent eligibility, courts have understandably never shown interest in a sign-as-a-whole approach. Such an approach would not reach normatively acceptable ends. Only a patentable-weight approach can effectively prevent the privatization of advances in human understanding.

Second, the use of a patentable-weight approach to structure the sign doctrine does not run afoul of the Supreme Court's insistence in *Diehr* that a claim-as-a-whole approach should guide the section 101 prohibition on the patenting of "laws of

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272. *See supra* notes 99–107 and accompanying text.

273. *See supra* text accompanying note 175.

274. *But see In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007) (holding that perceptible but intangible "signals" are not patentable subject matter).

nature."[275] Statutorily, the two strands of section 101 doctrine derive from entirely distinct modes of statutory interpretation. The interpretation of section 101 in *Diehr* emphasized that sections 102 and 103 are distinct from section 101, and that the word "new" in section 101 should not be construed as a reference to the novelty doctrine.[276] In contrast, the interpretation of section 101 that supports the printed matter doctrine is informed by the structure of the Patent Act as a whole and the disclosure obligations placed on patent applicants.[277] There is no reason to expect the doctrinal rules that derive from distinct modes of interpreting section 101 to adopt the same approach to patent eligibility. The Court's disapproval of the point-of-novelty approach when applied to "laws of nature" expressed in *Diehr* need not pertain to the printed matter doctrine.[278] Pragmatically, the recognition of two statutorily distinct strands of the doctrine of patent eligibility allays the concerns about the mischief that a point-of-novelty approach "taken to its extreme" would cause when preventing the patenting of "laws of nature."[279] The point of novelty approach need only apply to inventions implicating semiotic meanings. It need not govern the patent eligibility of inventions implicating "laws of nature." The claim-as-a-whole approach can continue to determine how patent eligibility is brought to bear on "laws of nature."

IV. QUESTIONING THE PATENTABILITY OF COMPUTER MODELS

When the printed matter doctrine is brought to bear on claims that are conventionally viewed as describing information recorded on a substrate—that is, when the doctrine is employed in the core printed matter cases—the value added by the semiotic framework comes in large part from more coherent explanation of what courts and the PTO are already doing when they apply the printed matter doctrine.[280] With respect to other technologies, however, the semiotic framework has the potential to play a prescriptive role that restricts the set of patent-eligible claims. Semiotic analysis posits that signs pervade our environment.[281] If the printed matter doctrine is about signs, and not recorded information, courts should be on the lookout for claims that run afoul of the printed matter doctrine whenever there are semiotically meaningful things at issue, even if those things do not intuitively resemble recorded information.

This Part considers the impact of the sign doctrine on one technology that is not conventionally understood to be information recorded on a substrate: the computer model.[282] Part IV.A sets the stage by revealing the semiotic logic that has driven the

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275. *See supra* notes 108–27 and accompanying text.

276. Diamond v. Diehr, 450 U.S. 175, 189–91 (1981).

277. *See supra* Part III.C.

278. *See supra* notes108–27 and accompanying text (discussing this disapproval).

279. *See supra* notes 120–22 and accompanying text (discussing this potential for mischief).

280. *But see supra* notes 248–55 and accompanying text (discussing the prescriptive bite of the semiotic framework in core printed matter cases).

281. *See supra* note 191 and accompanying text.

282. This Part does not consider the narrow issue of the patentability of software-on-disk claims which have long been understood to present a challenge for the printed matter doctrine. *See supra* text accompanying notes 89–93, 234–35 (discussing the distinction between functional descriptive material and nonfunctional descriptive material in *Beauregard* claims). Nor does it seek to undermine the patent eligibility of computer software broadly writ. *Cf.* Brief

courts' application of the printed matter doctrine to mechanical measuring devices: new mechanical measuring devices are eligible for patent protection, but old mechanical measuring devices with new labels are not. Part IV.B defines a computer model as a programmed computer in which variables are understood by computer users to stand for real-world systems, and it illustrates that computer models are signs. Part IV.C reviews the Federal Circuit's treatment of computer models as routinely patentable technologies. Part IV.D demonstrates the semiotic error that infects the Federal Circuit's assessment of the patentability of computer models. The Federal Circuit has elided the sign-vehicle and the sign. It has inappropriately reified semiotic meanings into worldly things. As a matter of semiotic logic, the limits that courts impose on the patentability of mechanical measuring devices under the printed matter doctrine cannot be reconciled with the courts' permissive attitude toward the patentability of computer models.

A. Mechanical Measuring Devices and Indexical Meaning

Courts applying the printed matter doctrine recognize the distinction between a new machine and a new set of labels placed on an old machine. For example, in *In re Lockert*,[283] a patent applicant sought to claim a prior-art scale with new printed indicia or labels that instructed the user to think differently about the meaning of the result generated by the scale.[284] For the purpose of simplicity, assume that the scale was a standard weighing device with a pointer on a fulcrum that pointed to a value on a continuous spectrum. The court rejected the claim because the invention resided in "the mere arrangement of printed matter": the claimed invention would be a patentable improvement over the prior art only if the content of the new labels were considered.[285] The actual claim described labels that indicated the amount of postage that was required to mail a package under the newly adopted postal shipping fees,[286] but the claim could have described any labels and the result would have been the same. The claim could, for example, have described labels indicating how far an object would be thrown when placed on a specific catapult. Even if the formula for determining this distance was nonobvious—and thus the information generated by the scale was nonobvious—the claim to the prior-art scale with new indicia would not be eligible for patent protection under the printed matter doctrine because the content of the labels could not be given patentable weight.

Semiotically speaking, a scale is no different than a weather vane, sundial, or mercury thermometer, all of which are canonical examples of indices.[287] Furthermore, in *Lockert*, the only "thing" that the inventor invented was a new interpretant or social convention understood in the mind of the user of the scale. In the old scale without the

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of the Software Freedom Law Center as Amicus Curaie in Support of Respondent, Bilski v. Kappos, No. 08-964 (U.S. filed Oct. 1, 2009) (arguing that software "standing alone" is patent ineligible). Many software inventions remain patentable under the sign doctrine. *See infra* note 326 and accompanying text (differentiating patent-ineligible advances in representation and patent-eligible advances in software engineering).

283. 65 F.2d 159 (C.C.P.A. 1933).

284. *Id.*

285. *Id.* at 161.

286. *Id.* at 159.

287. *See supra* Part III.B.3 (discussing Peircean indices).

new labels, the position of the pointer on the spectrum (sign-vehicle) is nomically correlated to the weight of the object placed on the scale (referent), and it signifies the concept WEIGHT OF THE OBJECT in the mind of the human interpreter of the scale who understands the social convention built on top of the nomic correlation (interpretant).[288] With its new labels, the pointer can function as the sign-vehicle in a new sign. The position of the pointer on the spectrum (sign-vehicle) is now nomically correlated to the cost of mailing the object placed on the scale (referent) in the mind of the human interpreter (interpretant). With yet different labels, the position of the pointer on the spectrum (sign-vehicle) could be nomically correlated to the distance that a particular catapult will throw the object (referent) in the mind of the human interpreter (interpretant). For the scale to mean new things, the only thing that has to change is the social convention that the interpreter uses to associate the sign-vehicle with an interpretant, and thus, indirectly, to link the sign-vehicle to a referent. The pointer on the scale has no single "natural" or intrinsic meaning. The meaning of the scale is not "content" in the sense that it is contained within the scale as an object. What the position of the pointer means to a human interpreter is a semiotic meaning because it resides in the mind of an interpreter and arises from prevailing social conventions.

The semiotic framework not only explains why an old scale with new labels is not eligible for patent protection, it also accommodates the fact that scales with newly invented mechanical devices are "machines" that are eligible for patent protection under section 101, despite the fact that the scales are useful because they give rise to indexical meanings.[289] Sign-vehicles are eligible for patent protection when they have newly engineered nonsemiotic properties.[290] If a patent applicant limits the scope of her claim to a scale with a nonobvious mechanical mechanism for linking the weight of the object placed on the scale to the position of a pointer on a scale, there is an advance over the prior art that resides in the solution to a classic problem of mechanical engineering. The improvement over the prior art lies in the ingenuity of the engineering of the device that gives rise to indexical meaning, that is, the engineering that couples one real-world system (the weight of the object on the scale) to another real-world system (the position of the pointer) in a nomic fashion. The improvement does not reside solely in the interpretant that the sign-vehicle signifies.

In sum, the critical distinction that needs to be drawn to bring the sign doctrine to bear on mechanical measuring devices is the distinction between (a) new semiotic meanings for existing machines and (b) machines with new mechanical engineering that nomically couples distinct systems. In the context of mechanical devices, the distinction is intuitive because it corresponds roughly to the distinction between (a) new labels on old machines and (b) new machines.[291] Because this semiotic distinction is readily grasped, courts have successfully implemented it. They have extended the

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288. The scale gives rise to an index wherein the nomic connection is that the sign-vehicle is caused by the referent. This differentiates the scale from stimuli and signals which can function as indices because the nomic connection is that the sign-vehicle causes the referent. *See supra* note 201 and accompanying text.

289. *See* 35 U.S.C. § 101 (2006).

290. *See supra* text accompanying notes 238–39.

291. *But see infra* note 332 (discussing the borderline cases of novel machines that are nonobvious only because of their semiotic meanings).

semiotic framework for the printed matter doctrine from static books and diagrams to dynamic mechanical machines that give rise to indices. As explored below, however, courts have failed to grasp this basic semiotic distinction in the context of computer-software inventions.

B. Computer Models Are Signs

Mechanical devices are not the only types of section 101 machines that can function as the sign-vehicles of signs. Programmed computers, too, can be meaningful because they are wound up with signs. Specifically, programmed computers can be the sign-vehicles of signs when the behavior of the software program being executed on the computer mimics the behavior of a real-world system.[292] In this situation, a programmed computer functions as a component of a *computer model*.

For a simple example of a computer model, consider the invention of a programmed computer that diagnoses a patient based on an inverse relationship between two chemicals in human blood.[293] Researchers discover that in the real world—that is, in the molecules that actually comprise human blood—a high level of chemical A is correlated with a low level of chemical B, and vice versa. The programmed computer takes as an input a variable that represents the concentration of chemical A (either high or low) and produces as an output a variable that represents the concentration of chemical B (either low or high, respectively). The programmed computer functions as a model in the everyday way in which the word "model" is commonly used: it is built so that its behavior resembles the behavior of a real-world system. Computer models may range from the highly complex (for instance, a computer model for predicting weather) to the extremely simple (for instance, a computer for diagnosing chemical B deficiencies), but the basic concept remains unchanged.

To see that computer models are signs, it is important to draw a distinction between two different entities. First, there is a *programmed computer*: a computer executing a program that manipulates meaningless or semantically empty variables according to certain mathematical rules. Allowing for some simplification, the programmed computer in the device for diagnosing chemical B deficiencies is a computer programmed with software that manipulates variables according to the mathematical rule $y = 1 / x$. Second, there is the computer model in which the behavior of the computer means something to the user of the programmed computer. The variable x means chemical A and the variable y means chemical B—thus the programmed computer models the relationship between chemicals A and B in human blood—only because of interpretants in the minds of computer users. The programmed computer and the computer model must be kept distinct in order to avoid the misleading synecdoche in which sign-vehicles are elided with signs.[294] The programmed computer is only one component of the computer model. The variables' meanings are not

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292. The notion that the key feature of software is the behavior that it provokes in a computer is explored at length in Pamela Samuelson, Randall Davis, Mitchell D. Kapor & J.H. Reichman, *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308 (1994).

293. The discovery that gives rise to this invention is the same discovery discussed above in the text accompanying notes 154–55, but the claimed invention is different.

294. *See supra* text accompanying notes 175–77.

properties that are intrinsic to the computer that is programmed to execute the rule $y = 1 / x$. The computer itself cannot support an interpretant, and it is indifferent to the nature of the data's referents.[295] To the computer, the data are not semiotically meaningful sign-vehicles but rather nonsemiotic signals: they cause the computer to adopt a predetermined internal state of affairs through a physical, causal mechanism.[296] The identical computer program (sign-vehicle) can have a perceived resemblance to, and can therefore be used to model, or stand for, a vast array of different real-world systems (referents). The same programmed computer can mean different things to different users, or even to the same user at different times, if the users associate different interpretants with the programmed computer. All that needs to change for the semiotic meaning of a computer model to change is for the computer user to think about the programmed computer in a different way, associate a new mental interpretant with the computer, and understand that the computer refers to a different real-world system. A programmed computer that executes the formula $y = 1 / x$ can model the relationship between chemicals A and B in human blood or the relationship between the quantity of a young law professor's scholarship and her likelihood of being denied tenure. The meaning of a computer model is semiotic in nature and is thus in the eyes—or, more accurately, the mind—of the beholder.

More specifically, a computer model can be either of two different types of Peircean signs. It can be an icon or an index, depending on whether the data is input into the system through a deterministic process. Initially, assume that the programmed computer is a freestanding calculator in which a user inputs data on a keyboard and a display shows the result. The Peircean icon maps perfectly onto the computer model.[297] The programmed computer is the sign-vehicle. In the example above, this is the electronic device that manipulates data using the formula $y = 1 / x$. The real-world system being modeled is the referent. In the example above, the referents are the amounts of the chemicals A and B in a patient's blood. The interpretation given to the programmed computer by the computer user is the mental interpretant. The computer model is an icon because there is a resemblance perceived by the computer user between the behavior of the real-world system (referent) and the behavior of the programmed computer (sign-vehicle).[298] The resemblance is in the nature of a diagram—a subspecies of an icon—as there is "an analogy between the relations of the parts of each."[299]

Under only slightly modified conditions, computer models can give rise to Peircean indices rather than Peircean icons.[300] If the computerized device that executes the formula $y = 1 / x$ obtains its input data automatically from a chemical analyzer that measures the amount of chemical A in a sample of human blood, then the combination

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295. *Cf. supra* note 200 (arguing that interpretants require intentional mental states and that only minds can possess intentional mental states). The fact that all programmed computers are elaborate Turing machines highlights the semiotically meaningless nature of the data to the computer. *See* J. DAVID BOLTER, TURING'S MAN: WESTERN CULTURE IN THE COMPUTER AGE 43–47 (1984) (explaining Turing machines).

296. *See supra* text accompanying note 196 (defining a signal).

297. *See supra* Part II.B.2.

298. *See supra* note 184 and accompanying text.

299. PEIRCE, *supra* note 167, § 2.279.

300. *See supra* Part II.B.3.

of the chemical analyzer and the programmed computer (the "chemical-detector machine") gives rise to an index. The chemical-detector machine is semiotically analogous to a sundial and a scale.[301] The scale engineers a nomic correlation between properties of the object being weighed and the position of the pointer on the spectrum. Similarly, the chemical-detector machine engineers a nomic correlation between the concentration of chemical A in the blood sample and the value of the computer's output variable. The output variable of the chemical-detector machine is the sign-vehicle of a sign that can have the concentration of chemical B as its referent because the user of the chemical-detector machine understands the social convention that links the sign-vehicle to the referent. The sign-vehicle of an index is meaningful in a semiotic sense only because of a contingent social convention and the interpretant that forms in the mind of an interpreter.[302] As with the scale, the chemical-detector machine can have many different meanings. For example, if further research reveals that a chemical B deficiency is correlated with an increased risk of a heart attack, then the meaning of the machine may change without any change in the intrinsic workings of the machine itself.[303] For the chemical-detector machine to transform from a machine for detecting chemical B deficiencies into a machine for determining the risk of a heart attack, all that needs to change is the interpretant in the mind of the machine's user.

C. The Routine Patentability of Computer Models Under the Contemporary Doctrine of Patent Eligibility

The Federal Circuit views newly invented computer models as routinely patentable inventions. They were all eligible for patent protection under the "useful, concrete and tangible result" test of *State Street Bank & Trust Co. v. Signature Financial Group*,[304] and, if their referents are tangible entities, they remain eligible for patent protection under the more restrictive "machine-or-transformation test" of *In re Bilski*.[305]

In its infamous "useful, concrete and tangible result" test of *State Street Bank*, the Federal Circuit looked to the meaning of the data manipulated as the key determinant of the patent eligibility of programmed computers.[306] *State Street Bank* involved a claim to a Hub and Spoke® data processing system for administering mutual funds in which "mutual funds (Spokes) pool their assets in an investment portfolio (Hub)

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301. *See supra* notes 189, 287.

302. *See supra* notes 201–06 and accompanying text (demonstrating the reliance of indexical meaning on social convention).

303. *Cf.* Kevin Emerson Collins, *Constructive Nonvolition in Patent Law and the Problem of Insufficient Thought Control*, 2007 WIS. L. REV. 759, 818–24 (using this shift in meaning to demonstrate the difficulty of administering a claim based on a social convention).

304. 149 F.3d 1368, 1373 (Fed. Cir. 1998).

305. 545 F.3d 943, 961–63 (Fed. Cir. 2008) (en banc). The Supreme Court has accepted certiorari to review the Federal Circuit's *Bilski* decision, so the validity of the machine-or-transformation test remains unsettled as of the publication of this Article. *See* Bilski v. Doll, 129 S. Ct. 2735 (2009).

306. *State St. Bank*, 149 F.3d at 1373–75. The turn to meaning as the determinant of the patent eligibility of a programmed computer originated in the Federal Circuit's earlier case *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053 (Fed. Cir. 1992).

organized as a partnership."[307] As one of its functions, "the system also allow[ed] for the allocation among the Spokes of the Hub's daily income, expenses, and net realized and unrealized gain or loss."[308] In an oft-quoted passage, the Federal Circuit held that the claimed system of programmed computers was patentable subject matter because the data manipulated by the program had specified meanings that were useful to the computer users.

> Today, we hold that the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces "a useful, concrete and tangible result"—a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.[309]

The programmed computer may manipulate and produce "numbers," but the program is patentable subject matter so long as the scope of the claim is limited to numbers that mean something "such as price, profit, percentage, cost, or loss."[310] Inversely, if a claim implicating a mathematical algorithm is not limited to the manipulation of meaningful data, and thus does not produce data that has a specified meaning, then the claim recites a mathematical idea in the abstract and is not patent eligible.[311] Because the variables manipulated by computer models have specified meanings that are useful to computer users, computer models are categorically patent-eligible subject matter under *State Street Bank*.

The "useful, concrete and tangible result" test was an "anything goes" test for patent eligibility,[312] and *Bilski* represents the Federal Circuit's attempt to rein in patentable subject matter. *Bilski* identifies physicality or tangibility as the hallmark of historically

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307. *State St. Bank*, 149 F.3d at 1370.

308. *Id.* at 1371.

309. *Id.* at 1373.

310. *Id.* at 1375; *see also id.* at 1374 ("[T]he mere fact that a claimed invention involves inputting numbers, calculating numbers, outputting numbers, and storing numbers, in and of itself, would not render it nonstatutory subject matter, unless, of course, its operation does not produce a 'useful, concrete and tangible result.'"). Similarly, discussing *Arrhythmia Research*, the Federal Circuit noted in *State Street Bank* that "the transformation of electrocardiograph signals from a patient's heartbeat by a machine through a series of mathematical calculations constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it corresponded to a useful, concrete or tangible thing—the condition of a patient's heart." *Id.* at 1373. *Accord* AT&T Corp. v. Excel Commc'ns, Inc., 172 F.3d 1352, 1358 (Fed. Cir. 1999) (holding a software claim to be patent eligible because the "PIC indicator represent[ed] information about the call recipient's PIC").

311. *Id.* at 1373 n.4 ("By keeping in mind that the mathematical algorithm is unpatentable only to the extent that it represents an abstract idea, this confusion [about the section 101 mathematical algorithm exception] may be ameliorated."). The Federal Circuit's motivation for adopting meaning as the key indicia of the patent eligibility of programmed computers was to implement the Supreme Court's holding in *Gottschalk v. Benson*, 409 U.S. 63, 70–71 (1972) (holding that claims to mathematical formulas in the abstract are not eligible for patent protection).

312. Cotter, *supra* note 147, at 895.

patentable subject matter, and it deems some products of human ingenuity to be insufficiently tethered to this historical core to merit patent protection.[313] To instrumentalize this tangibility approach, *Bilski* articulates the "machine-or-transformation test" for patent eligibility: a method claim is patent eligible only if: "(1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing."[314] The claim at issue in *Bilski* described a method of entering into contracts in order to hedge "consumption risk."[315] Applying the machine-or-transformation test, the Federal Circuit upheld the PTO's rejection of Bilski's claim. The claimed method neither required a particular machine—the method could in theory be performed with only spoken words and a handshake—nor transformed an article into a different state or thing. It transformed only legal rights, and the Federal Circuit held that legal rights are an abstract construct, not a physical article whose transformation could give rise to a patentable invention.[316]

Bilski did not involve a claim to a programmed computer, but the Federal Circuit nonetheless addressed at length the application of the transformation prong of the machine-or-transformation test to programmed computers.[317] Method claims reciting the operations performed by a software program executed on a general-purpose computer present a particularly interesting problem under the transformation test articulated in *Bilski*. A programmed computer manipulates electronic signals. Are electronic signals sufficiently tangible to qualify as "articles" whose transformation can give rise to a patentable invention under section 101, or are they abstractions like legal rights? To answer this question, the court distinguishes data that are "representative of physical objects and substances" from data that are not (and that are thus representative of either abstractions or nothing at all).[318] The former data "constitute 'articles' such that their transformation is sufficient to impart patent-eligibility under § 101," but the latter data do not.[319] Under the machine-or-transformation test of *Bilski*, computer models are patent-eligible inventions, provided that they model tangible real-world

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313. *In re* Bilski, 545 F.3d 943, 961–63 (Fed. Cir. 2008) (en banc), *cert granted sub nom.*, Bilski v. Doll, 129 S. Ct. 2735 (2009).

314. *Id.* at 954 (Fed. Cir. 2008). The concerns about abstraction and intangibility that give rise to the machine-or-transformation test usually play out in method claims rather than product claims. *But see In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007) (holding that signals are not patent-eligible "articles" under section 101). For this reason, the machine-or-transformation test rarely applies to artifact claims. Claims to programmed computers are an exception to this rule because apparatus and method claims to software inventions are interchangeable. *See infra* note 324.

315. *Bilski*, 545 F.3d at 949. Allowing for some simplification, the claim described a method in which a commodity provider enters into two contracts with two distinct parties: she contracts with a consumer of the commodity who has a given risk position and a third party who has a counter-risk position to that consumer. *Id.* at 964. This simplified description is misleading to the extent that the novelty and nonobviousness of the claim are at issue, but it communicates the basic facts needed to understand the Federal Circuit's holding on patent eligibility.

316. *Id.* at 964.

317. *Id.* at 962–63. The court in *Bilski* chose not to address the application of the machine prong to programmed computers. *Id.* at 962.

318. *Id.* at 963, 964.

319. *Id.* at 962.

systems.[320] In semiotic terms, what the Federal Circuit did in *Bilski* was to focus on the tangibility of the referents of a computer model to assess the tangibility of the claimed invention. It shifted the focus from the physicality of the electrons in a computer processor to the physicality of the things that the electrons represent when the electrons are construed as semiotically meaningful data. The Federal Circuit drew a distinction not between two types of signals-as-artifacts, but rather between two types of data-as-signs.

The Federal Circuit already relied on the semiotic meaning of data as the key indicia of the patent eligibility of a programmed computer in *State Street Bank*.[321] *Bilski* and its overt reliance on the physicality of what the data represent bring this reliance to the surface. The rhetoric of the machine-or-transformation test announced by the Federal Circuit in its *Bilski* opinion practically begs for a semiotic analysis of the patent eligibility of computer software inventions.

D. The Federal Circuit's Semiotic Error

The Federal Circuit has committed a fundamental semiotic error in its analysis of the patent eligibility of newly invented computer models. It has collapsed the sign into the sign-vehicle and thereby reified semiotic meanings into intrinsic properties of worldly things.[322] It has treated an existing programmed computer that has a newly invented meaning to its user as a newly invented, extra-mental artifact.

The Federal Circuit has long recognized that a computer programmed with a new software program is a new machine for the purposes of both the novelty and nonobviousness analysis.[323] If any computer software is to be patentable, this is a necessary doctrinal stance. The underlying ontological presumption is that new software causes small-scale physical changes within the machine—different gates are open at different times, so electrons are moving around in different patterns—that in turn cause the programmed computer to demonstrate new behaviors.[324] The semiotic

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320. In a blog post several days after the *Bilski* decision, the author offered a semiotic description of the machine-or-transformation test using the terminology from the better-known Saussurian model of the sign: "In the language of semiotics, the tangibility analysis has shifted from a concern about the tangibility of the signifier—the physical configuration of matter that forms a symbol—to a concern about the tangibility of the signified—the informational content of or the thing represented by the symbol." Posting of Kevin Emerson Collins to Patently-O, http://www.patentlyo.com/patent/2008/11/professor-colli.html (Nov. 1, 2008, 2:58 P.M.); *cf. supra* note 177 (presenting Saussure's dyadic model of the sign). Technically, however, Saussurian terminology is not up to the task of describing the *Bilski* decision. The machine-or-transformation test turns on the tangibility of the referent, and Saussure employed a dyadic model of the sign that "brackets" the referent. *See supra* note 177. The Saussurian signified resembles the Peircean interpretant. *See supra* note 172. So, there is no such thing as a tangible signified (except insofar as a materialist sees a token of a signified in the synaptic firings of the brain).

321. *See supra* text accompanying notes 306–11.

322. *See supra* notes 175–77 and accompanying text.

323. *E.g.*, *In re* Bernhart, 417 F.2d 1395, 1400 (C.C.P.A. 1969) ("[I]f a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged.").

324. Apparatus claims describing programmed computers and method claims describing the

framework for the printed matter doctrine does not challenge this presumption. Computers with new programs must continue to be recognized as new machines. What is required, however, is a shift to a semiotic perspective on what constitutes a new computer program and thus a new machine.

Consider again the computer model of the inverse relationship between the concentrations of chemicals A and B in human blood.[325] The computer program in this example is software that executes the formula $y = 1 / x$, and the programmed computer is an apparatus that manipulates data using the formula $y = 1 / x$. The first computer programmer to make software that executes the formula $y = 1 / x$ has clearly generated a new machine that may or may not be nonobvious, depending upon the state of the art in computer programming at the time of the invention. In other words, advances in software engineering are patent eligible under the sign doctrine.[326] However, while a computer programmed with new software is a new machine, a new computer model does not necessarily involve a new programmed computer. Even if the programmed computer that executes the formula $y = 1 / x$ is old in the art, the researchers who discover the inverse correlation between chemicals A and B in human blood can lay claim to the invention of a new computer model. They have discovered new referents, and they can instruct users of the programmed computer to understand that the variables x and y signify newly invented interpretants. This discovery/invention is not a patent-eligible invention under the sign doctrine because the only advance over the prior art resides in the mind of a computer user. In sum, under the sign doctrine, it is important to differentiate patent-eligible advances in software engineering from patent-ineligible inventions in what software represents in the minds of its users.

Given the contemporary state of computer technology, only a trivial effort is required to create a programmed computer that executes the formula $y = 1 / x$. In fact, it is almost inconceivable that such a device does not already exist in the prior art. Under the sign doctrine, a contemporary claim to a computer model along the lines of

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execution of software programs on computers are today presumed to rise and fall together. *See, e.g.*, Arrhythmia Research Tech., Inc. v. Corazonix Corp., 958 F.2d 1053 (Fed. Cir. 1992). Historically, however, method claims were viewed less favorably and arbitrary, formalistic distinctions pervaded the standards governing the patentability of software. *See In re* Prater, 415 F.2d 1393 (C.C.P.A. 1969) (rejecting method claims and upholding apparatus claims); Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 9–10 (2001) (discussing the now-defunct doctrine of "magic words").

325. *See supra* text accompanying note 293.

326. Programmed computers can be nonobvious, patentable machines for precisely the same reasons that mechanical measuring devices can be nonobvious, patentable machines. The software engineering required to make a computer execute the formula $y = 1 / x$ may be a nonobvious advance, in the same way that the mechanical engineering required to make a pointer on a scale move in response to the weight of an object may be a nonobvious advance. *See supra* text accompanying notes 289–90. More generally, a newly invented computer model is eligible for patent protection under the sign doctrine if an advance over the prior art in software engineering is required to construct the claimed programmed computer. If the computer model is claimed generically, an advance in software engineering that makes the programmed computer capable of behaving in a manner that is analogous to the newly discovered real-world system (referent) is required for a patent-eligible invention. If the computer model is claimed in a manner that limits the scope of the claim to the use of a particular type of programmed computer, however, only the particular type of programmed computer that is claimed needs to embody an advance over the prior art to achieve patent eligibility.

"an electronic device for measuring the concentration of chemical B in human blood" should therefore not be eligible for patent protection.[327] The meaning of the computer model is not intrinsic in the programmed computer; the only advance over the prior art lies in the minds of computer users. The old programmed computer has a new meaning, and is able to function as a component of a new model, only because of the interpretant that exists in the mind of the computer user and the social convention understood by the user that links the sign-vehicle to the interpretant and referent. However, under *State Street Bank* or *Bilski*, the newly invented computer model would be a patentable invention because the data have specific meanings or they refer to tangible substances, respectively.[328] In the context of computer models, the Federal Circuit has yet to learn the lesson that the "content" of a sign is not truly contained within a sign-vehicle.[329]

Whether the claimed computer model functions as an index or an icon is irrelevant to the patent eligibility analysis. In the indexical computer model, there is a nomic connection between the output of the chemical-detector machine (sign-vehicle) and the real-world system (referent), but the semiotic meaning of the output is lodged in a social convention and a mental interpretant that forms in the mind of the user of the chemical-detector machine.[330] As a matter of semiotic logic, the fact that old mechanical measuring devices with new labels are unpatentable subject matter cannot be reconciled with the fact that indexical computer models are routinely patentable inventions.[331] Presuming that the combination of the chemical analyzer and the programmed computer that executes the formula $y = 1 / x$ is old in the art, all that the inventor has done is put new labels on an old machine, indicating that x means chemical A and y means chemical B.[332]

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327. An inventor could, however, still patent an improved programmed computer that executed the formula $y = 1 / x$ more rapidly or with fewer resources. *See supra* note 326. Therefore, an inventor can claim a computer model of the concentrations of chemicals A and B in human blood if the claim is limited to the use of the improved programmed computer, just like an inventor can claim a scale as an indexical sign if the claim is limited to a scale with an improved mechanism for creating the nomic connection between the weight of the object and the pointer. *See supra* notes 289–90 and accompanying text.

328. *See supra* Part IV.C.

329. *See supra* text accompanying note 175.

330. *See supra* notes 300–03 and accompanying text.

331. *See supra* Part IV.A (discussing the nonpatentability of old machines with new labels).

332. A more difficult problem arises when the chemical analyzer and the programmed computer are both old in the art but the combination of the two is new. In this situation, the invention is novel, but its nonobviousness raises an interesting question. The motivation to combine the chemical analyzer and programmed computer follows directly from the fact that the combination (the chemical-detector machine) can give rise to an index in which the concentration of chemical B in a patient's blood is the referent. When should a nonobvious interpretant render a novel machine nonobvious? This same question complicates the status of newly invented mechanical measuring devices under the sign doctrine. For example, consider the inventor who has discovered the "law of nature" that determines how far a given catapult will throw a stone of a particular weight. *See supra* text accompanying note 286. Now assume as well that prior-art scales were not very good at measuring the weight of catapult stones, perhaps because the basket in which the thing to be weighed was put could not readily accommodate large stones. If the inventor puts new labels on a new scale that can weigh large stones, is the invention patentable under the sign doctrine?

The argument for the patentability of the iconic computer model is even weaker. In the iconic computer model, there is no link at all between the programmed computer (sign-vehicle) and the real-world system (referent) except a combination of convention understood by the interpreter and resemblance perceived by the interpreter.[333] For a mechanical analog of the iconic computer model, consider the "spinner-machine" depicted in Figure 3 made by adding labels to a spinner from a board game for children:

Figure 3

This spinner-machine is a mechanical device that performs a basic mathematical or logical function: it establishes an inverse correlation between two variables. To use the machine, the operator places the tail of the arrow in the box corresponding to the known value of variable A, and the device produces a result indicating the corresponding value of variable B. If variable A is low, then the device determines that variable B is high. Inversely, if variable A is high, then the device determines that variable B is low.

The spinner-machine is a model of a real-world system in the exact same way that the iconic programmed computer that inversely correlates two variables can function as a model of a real-world system. The two machines are semiotically indistinguishable. The spinner-machine and the programmed computer (the sign-vehicles) both stand for the real-world system of chemical concentrations discovered by the researcher (the referents) because of the mental concepts in the minds of the people who use the devices (the interpretants). Viewed as a question of semiotic logic, there is no good semiotic reason why one should be a patentable invention but the other should not. A patent regime in which the spinner-machine is eligible for patent protection is difficult to imagine, however, so the routine patentability of iconic computer models should be treated as suspect at best.

CONCLUSION

The printed matter doctrine is not about information and its content, as the rhetoric of its contemporary judicial formulation suggests. Rather, it is about signs and their interpretants. The printed matter doctrine should therefore be reinterpreted in semiotic terms as the sign doctrine. The sign doctrine requires that claims to meaningful

333. *See supra* notes 297–99 and accompanying text.

artifacts be held ineligible for patent protection if the nonobvious advance over the prior art resides solely in a representation (interpretant) in the mind of an interpreter.

Judicial recognition of a semiotic framework for the printed matter doctrine would have two principal effects. First, the semiotic framework allows the printed matter doctrine to be taken seriously. It provides a conceptually coherent and statutorily justified explanation for the muddled and nonstatutory reasoning that courts and the PTO currently employ in core printed matter cases. Second, the semiotic framework suggests that the Federal Circuit should reconsider the routine patentability of newly invented computer models. When addressing computer models, the Federal Circuit today elides the sign-vehicle with the sign and therefore commits a classic semiotic error: it inappropriately reifies a newly invented semiotic meaning into a new intrinsic property of a tangible, extra-mental artifact. As a result, it sanctions a patent on a meaningful thing even when the only invention at issue resides in the mind of the person who understands the thing's newly invented semiotic meaning. Claims to newly invented computer models literally describe a programmed computer (a sign-vehicle), yet the only inventive aspect of the claimed technology may be a new mental state in the mind of a computer user (an interpretant).