
The Knowledge/Embodiment Dichotomy

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Despite the renewed interest in limits on patent eligible subject matter during the last decade, patent theory and doctrine have to date failed to recognize one of the most fundamental limits on what can be patented: the “knowledge/embodiment dichotomy.” The dichotomy marks a categorical distinction between two types of technological progress, namely patent ineligible advances in knowledge and patent eligible advances in embodiments.

The knowledge/embodiment dichotomy does not exist de dicto in contemporary patent opinions, treatises, or scholarship. However, it does already exist in a rough form as a de facto limit on the reach of patent protection. That is, courts’ and commentators’ failure to acknowledge the dichotomy has been a conceptual failure, not a failure to curb the reach of patent rights. Contemporary patent law provides de facto enforcement of the dichotomy without de dicto recognition through two distinct mechanisms. First, prohibitions on the patenting of mental processes and printed matter provide indirect, fragmentary enforcement of the dichotomy. Second, in the gaps between these fragments, the courts and the PTO improvise. They take doctrines aimed at enforcing unrelated limits on the patent regime and twist them beyond conceptual coherence to fill the gaps. The Supreme Court’s recent opinion in Mayo Collaborative Services v. Prometheus Laboratories, Inc. on the patentability of “laws of nature” and the PTO’s distinction between functional and nonfunctional descriptive material in software-on-disk claims exemplify these doctrinal contortions.

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INTRODUCTION

A wave of controversial cases addressing the reach of patent eligible subject matter under Section 101 of the Patent Act has recently washed through the Patent and Trademark Office (“PTO”) and the courts.¹ Yet, despite all of the attention these cases have garnered, the conceptual framework that structures how courts, scholars, and practitioners understand the doctrine of patent eligibility has a gaping hole. Patent doctrine and theory have overlooked a fundamental limit on the reach of patent protection. The oversight has not resulted in the routine issuance of patents that should not have issued; it has not led to valid patents that regularly exceed the overlooked limit. Rather, the oversight has been conceptual in nature: the limit does not exist *de dicto* in patent doctrine or theory despite the fact that it does already exist (at least in a rough form) as a *de facto* limit on what can today be patented. This Article identifies this unacknowledged limit on patent eligible subject matter and rectifies the patent community’s collective conceptual failure. It also argues that openly recognizing the limit as a *de dicto* part of black-letter patent law would explain several recent developments in patent law that are otherwise inexplicable, creating conceptual coherence in patent law in areas in which today there is none.

The hidden limit on patent eligible subject matter builds on a factual distinction between two categorically different types of technological progress or advance. On the one hand, there is an *advance in technological knowledge*, or a “knowledge-advance” for short. As defined herein, a knowledge-advance is a newly generated “piece” or “bit” of propositional knowledge which, in turn, is a newly created

¹ See, e.g., *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2116–19 (2013) (holding isolated genomic DNA to be patent ineligible subject matter); *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1296–98 (2012) (holding a diagnostic method to be patent ineligible subject matter); *Bilski v. Kappos*, 130 S. Ct. 3218, 3229–31 (2010) (holding a process for hedging risk to be patent ineligible subject matter); *CLS Bank Int’l v. Alice Corp.*, 717 F.3d 1269, 1285–89, 1311–13 (Fed. Cir. 2013) (en banc) (holding programmed computers, but not methods of executing programs on computers, to be patent eligible subject matter); *Classen Immunotherapies, Inc. v. Biogen IDEC*, 659 F.3d 1057, 1058 (Fed. Cir. 2011) (holding methods for evaluating and improving immunization schedules to be patent eligible subject matter); *In re Comiskey*, 554 F.3d 967, 969–70 (Fed. Cir. 2009) (holding “a method and system for mandatory arbitration involving legal documents” to be patent ineligible subject matter); *In re Nuijten*, 500 F.3d 1346, 1348 (Fed. Cir. 2007) (holding a signal claim to be patent ineligible subject matter). The Supreme Court’s grant of certiorari and Justice Breyer’s dissent from the Court’s dismissal of certiorari as improvidently granted in *Laboratory Corp. of America Holdings v. Metabolite Laboratories, Inc.*, 548 U.S. 124 (2006), arguably sparked this renewed judicial interest in patent eligibility.

justified true belief about the world.² The beliefs that a better mousetrap uses a spring, that a molecule with a certain molecular structure is a good window cleaner, and that mixing chemicals *A* and *B* creates chemical *C* are all knowledge-advances. On the other hand, there is an *advance in embodied technology*, or simply an “embodiment-advance.” Embodiment-advances are roughly what Yochai Benkler has called new “information-embedded goods.”³ They include both new objects (e.g., devices that catch mice, molecules that clean windows, pharmaceutical pills, and programmed computers) and new processes (e.g., methods of mixing chemicals, methods of using pills to treat a medical condition, and methods of conducting business). Both knowledge-advances and embodiment-advances are integral components of technological progress. Furthermore, the two are often tightly intertwined in that they occur simultaneously or in rapid succession. For example, new knowledge that a better mousetrap uses a spring in a particular manner likely either leads to or is caused by the creation of an actual, working mousetrap that uses a spring in that manner. Nonetheless, despite this interdependence, the resources that constitute a knowledge-advance are something altogether different from the resources that constitute an embodiment-advance. New knowledge of a mousetrap and a new trap that can catch mice are different entities. They are not manifest in the world in the self-same material stuff. A new technological embodiment is not simply a particularized species of new knowledge, nor is new technological knowledge a new kind of highly abstract or general embodiment. They are ontologically distinct types of advances in the state of technology.

The overlooked limit on patent eligible subject matter is a legal rule that is layered on top of the ontological distinction between the knowledge-advances and embodiment-advances that compose technological progress: knowledge-advances are not patent eligible inventions, despite how novel, nonobvious, and useful they may be. Because embodiment-advances can be patent eligible, this Article coins the name “the knowledge/embodiment dichotomy” to refer to the previously unnamed limit.⁴

² The term “knowledge” has been used in many ways. See *infra* text accompanying notes 17–21.

³ YOCHAI BENKLER, *THE WEALTH OF NETWORKS* 311–15 (2006). Benkler’s taxonomy uses the label “information” to refer roughly to the resource that this Article refers to as knowledge. See *infra* text accompanying notes 29–32.

⁴ The name is intended to create an association with idea/expression dichotomy of copyright law because the copyright dichotomy is already widely recognized as a foundational limit on an intellectual property right. However, unlike the idea/expression dichotomy, the knowledge/embodiment dichotomy does not address a

Underneath its shiny, new name, the limit on patent eligible subject matter enforced by the knowledge/embodiment dichotomy should be both familiar and intuitive, at least in its broad strokes, to anyone who is familiar with the “duality of claiming and disclosing” that lies at the heart of patent law.⁵ Patent law promotes technological progress by creating incentives for private parties to invest in innovation. It generates these incentives through welfare internalization—the same mechanism that is at work in most all property regimes. More specifically, it allows an inventor to claim some portion of the new resources that he or she contributes to technological progress, and it grants an inventor exclusive rights for a limited term to the claimed resources. In theory, the social planner could take the logic of welfare internalization to its limit when designing a patent regime: she could allow an inventor to claim all of the novel technology that an inventor creates.⁶ This property-maximalist route, however, is not the route that the patent regime has taken. The resources that constitute newly created knowledge never constitute the *res* of a patent right. Rather, patent law’s disclosure requirements make knowledge-advances freely available to all comers from the date of a patent application’s publication and throughout the patent’s term. Disclosures turn knowledge-advances into public spillovers of the private patent rights that vest in claimed embodiment-advances. The knowledge/embodiment dichotomy is simply the legal doctrine that prohibits an inventor from opting out of his disclosure requirement and crafting claim language that encompasses his knowledge-advances.

One common initial reaction to the knowledge/embodiment dichotomy may be the sentiment that the dichotomy is a self-enforcing truism and there is no need to have a legal doctrine that enforces it. Knowledge-advances by their very nature may appear to be beyond the reach of property rights, and the free availability of new technological knowledge may therefore seem like an inevitable feature of all possible patent regimes.⁷ However, the assumption that new knowledge is

levels-of-generality problem. See *infra* Part II.C.

⁵ 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).

⁶ That is, the social planner could take an “if value, then right” approach. See Rochelle Cooper Dreyfuss, *Expressive Genericity: Trademarks as Language in the Pepsi Generation*, 65 NOTRE DAME L. REV. 397, 405 (1990).

⁷ R. Polk Wagner, *Information Wants to Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 999 (2003). A variant on the argument that enforcement of a knowledge claim would be impossible is that the

inherently immune from propertization is misguided. Technological knowledge is a resource that exists in the material world in the form of both mental representations—the human mental acts or states of comprehending a fact—and extra-mental representations—the perceptible components of signs or symbols that are meaningful to a human mind.⁸ Mental and extra-mental representations are choke points that would allow newly created knowledge to be claimed by perceptive patent drafters if there were no legal doctrine that prevented them from doing so.⁹

Critically, the dichotomy does not view technology in an atemporal, static manner. It does not depend on a distinction between two ontologically distinct types of material things, one of which can be claimed and the other of which cannot. Rather, the dichotomy takes a dynamic view of progress and pays attention to the evolution of technology over time. It builds on a distinction between two types of advance, two forms of progress, or two kinds of distinction from the prior art. It therefore allows the exact same set of new resources to be patented if the resources result from one type of advance but not if they result from the other. To take a simple example, consider a claim to a book with two limitations: (a) the text represents propositional knowledge about a newly discovered correlation and (b) the binding uses a particular technology. Under the knowledge/embodiment dichotomy, the claimed resources are patent eligible if they are a novel embodiment of binding technology, but they are patent ineligible if it is only the extra-mental representation of knowledge that is new. Because it is the advance or progress that is critical, the knowledge/embodiment dichotomy keys in on what patent lingo commonly calls a claim's "point of novelty": a patent claim does not describe patent eligible subject matter if the only advance over the prior art (i.e., a claim's only point of novelty) lies in newly created

private costs of enforcement would be so high that no rational patent owner would opt to enforce (or, thinking ahead, seek from the PTO) such a claim. SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 129 (2004) ("Basic scientific knowledge . . . is generally not patentable, in recognition of the fact that the benefits would be hard to appropriate."); STEVEN SHAVELL, *FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW* 165 (2005) (arguing that "the definition and enforcement of property rights in basic research results [is] impractical").

⁸ See *infra* text accompanying notes 55–65.

⁹ Furthermore, there is nothing inherently natural about knowledge that would categorically prevent patents on knowledge-advances from issuing absent enforcement of the knowledge/embodiment dichotomy. Although technological facts may merely be discovered, technological knowledge is a man-made, novel resource. See *infra* text accompanying notes 48–52.

knowledge. This focus on the dynamic advance that makes a claim new means that the knowledge/embodiment dichotomy may be a unique type of limit on patent eligible subject matter as a doctrinal matter. Most exclusions from patent eligible subject matter have a static focus. They examine the stuff described by a patent claim in an atemporal fashion, cut off from the flow of technological progress; they query whether the stuff described by the claim is inherently the type of stuff that is eligible for patent protection. Because it takes a dynamic perspective that examines the nature of the advance at issue, the knowledge/embodiment dichotomy need not follow the same doctrinal rules that structure many other Section 101 exclusions from patent eligible subject matter.

The absence of the knowledge/embodiment dichotomy from patent doctrine and theory has first and foremost been a conceptual failure—perhaps precisely because its dynamic focus on the technological advance at issue does not fit the mold of the static focus on the claimed invention that structures other facets of the doctrine of patent eligibility. Contemporary patent discourse does not recognize that knowledge-advances and embodiment-advances are ontologically distinct categories of technological progress, so it lacks the concepts and vocabulary that are needed to formulate and apply the knowledge/embodiment dichotomy.¹⁰ Patent opinions do not expressly discuss the distinction between unpatentable knowledge-advances and patentable embodiment-advances, patent treatises do not expressly catalog it, and patent scholarship does not expressly analyze it. Nonetheless, despite this conceptual failure, there has been no accompanying, systemic failure in the on-the-ground reach of patent protection. That is, the knowledge/embodiment dichotomy already exists (albeit in a rough form) as a *de facto* limit on patent eligible subject matter even though it does not exist *de dicto* as patent doctrine or theory. More specifically, contemporary patent law achieves this *de facto* enforcement of the dichotomy through two distinct mechanisms.

First, a number of doctrines provide indirect, fragmentary enforcement of stretches of border that the knowledge/embodiment dichotomy draws around what can be patented. These doctrines are not conventionally considered to be acting in concert, and the rhetorics in which these doctrines are couched do not expressly recognize their role in preventing the patenting of knowledge-

¹⁰ References to both knowledge (and ideas and information) and embodiments are common in contemporary patent discourse, but they usually do more to teach away from the knowledge/embodiment dichotomy than they do to elucidate it. See *infra* Part III.

advances. Nonetheless, the limit on patentability that each doctrine is tasked with drawing provides effective enforcement of the dichotomy in a limited context. Because knowledge exists in the material world as both representational mental states and extra-mental representations that are intelligible to humans, the exclusion of mental processes from patent eligible subject matter and the printed matter doctrine unsurprisingly provide much of this indirect, fragmentary enforcement.

Second, in the gaps between these fragments of effective, indirect enforcement, the PTO and the courts improvise. They contort patent doctrine in whatever logic-defying manner is necessary to invalidate the claims that run afoul of the dichotomy. They fabricate factual distinctions that do not exist and twist patent doctrine into logical knots, allowing legal rules that appear on their rhetorical surfaces to be aimed at accomplishing one goal to, in fact, achieve the entirely different, unexpressed goal of enforcing the knowledge/embodiment dichotomy. Pragmatism about the patent ineligibility of knowledge-advances prevails, and doctrinal coherence suffers. Two recent developments in patent law exemplify these doctrinal contortions: the Supreme Court's refinement of the prohibition on the patenting of "laws of nature" in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*¹¹ and the PTO's distinction between functional and nonfunctional descriptive material in software-on-disk claims.¹² The sheer absurdity of the express reasoning in these doctrines demonstrates that something is going on underneath the surface of the doctrinal rhetoric and that the courts simply cannot be meaning what they say or saying what they mean. Much as a black hole can best be identified by its distortionary effects on the space that surrounds it, the doctrinal contortions are the best available evidence to support the descriptive thesis that the knowledge/embodiment dichotomy—including its point of novelty approach—already exists as a *de facto* limit on the reach of patent protection, even though it does not exist *de dicto* in patent opinions, treatises, or scholarship.

After explaining the dichotomy and demonstrating that it exists as a *de facto* limit on patentability, this Article argues that the PTO and the courts should acknowledge the knowledge/embodiment dichotomy as a *de dicto* component of patent law and openly use it as a doctrinal tool for limiting the reach of patent protection. The knowledge/embodiment dichotomy should not be mistaken for a universal theory

¹¹ 132 S. Ct. 1289 (2012).

¹² Examination Guidelines for Computer-Related Inventions, 61 Fed. Reg. 7478, 7481–82 (Feb. 28, 1996).

of patent eligibility that explains all historical and contemporary patent eligibility opinions; open acknowledgement of the knowledge/embodiment dichotomy would not resolve all or even most of the outstanding controversies concerning the optimal reach of patent eligible subject matter. Yet, open acknowledgement of the knowledge/embodiment dichotomy would yield two benefits. First, it would demonstrate the foundational nature of both the patent ineligibility of mental processes and the printed matter doctrine. These doctrines are today often treated as peripheral, inconsequential limits on the patent regime: they are ignored in patent law casebooks and hornbooks, and they are swept under the rug in non-precedential opinions on a regular basis.¹³ Open acknowledgement of the knowledge/embodiment dichotomy would transform these doctrines into fundamental limits that must be taken into account in order to understand how the contemporary patent regime operates. Second, open acknowledgement of the knowledge/embodiment dichotomy would eliminate the need for the PTO and the courts to engage in doctrinal contortion. It would enhance social welfare by making patent law more conceptually coherent and allowing courts to mean what they say and say what they mean when they invalidate patent claims.¹⁴

This Article proceeds in six substantive parts. Part I introduces two ontologically distinct types of technological progress: knowledge-advances and embodiment-advances. Part II presents and explains the knowledge/embodiment dichotomy as a legal rule that limits the reach of the patent regime. Part III demonstrates that the knowledge/embodiment dichotomy does not exist *de dicto* in the rhetoric of

¹³ See *infra* text accompanying notes 269–274.

¹⁴ This Article does not mount a ground-up defense of the knowledge/embodiment dichotomy on either normative or statutory grounds. The basic thrust of the normative argument is that claims to knowledge-advances are unusually costly and that the loss of incentives at the margin forgoes only a small social benefit. Kevin Emerson Collins, *An Economic Justification of Mayo? It's All in Your Head* 8–9 (February 21, 2014) [hereinafter *Economic Justification*] (unpublished manuscript) (on file with author) (justifying a mind-centered interpretation of the Section 101 exclusion of “laws of nature” in *Mayo* on social-welfare grounds). The statutory argument suggests that the knowledge/embodiment dichotomy follows from interpreting Section 101 in light of the structure of the Patent Act as a whole, and its disclosure provisions in particular, such that an inventor cannot opt out of his statutory disclosure obligation by claiming his knowledge-advances. Kevin Emerson Collins, *Semiotics 101: Taking the Printed Matter Doctrine Seriously*, 85 *IND. L.J.* 1379, 1427–30 (2010) [hereinafter *Semiotics 101*]; see Kevin Emerson Collins, *Claims to Information qua Information and a Structural Theory of Section 101*, 4 *I/S: J.L. & POL'Y FOR INFO. SOC'Y* 11, 22–26 (2008).

contemporary patent law. Although patent opinions and commentary are rife with discussions of unpatentable knowledge, ideas, and information on the one hand, and patentable embodiments on the other, these discussions do more to obfuscate the dichotomy than they do to clarify it. Part IV turns to patent theory. Although patent theory does not expressly recognize the dichotomy, it provides implicit support for the dichotomy by assuming that patent disclosures generate pre-expiration knowledge spillovers of patent rights. Part V addresses black-letter patent law. It illustrates the two mechanisms—indirect, fragmentary policing and doctrinal contortions—through which patent doctrine already enforces the knowledge/embodyment dichotomy as a *de facto* limit on patentability despite the *de dicto* absence of the dichotomy from patent rhetoric, theory, and doctrine. Part VI identifies benefits that would follow from express judicial recognition of the knowledge/embodyment dichotomy.

I. AN ONTOLOGY OF TECHNOLOGICAL PROGRESS

Technology is often treated as a black-box category in the social sciences.¹⁵ Economists reduce it to a production function characterized by inputs and outputs; philosophers of technology commonly examine the social consequences of a technology rather than the intrinsic nature of the technology itself.¹⁶ Opening the black box reveals that there are two ontologically distinct types of events that constitute technological progress: there is the creation of new bits of technological knowledge, and there is the creation of new embodiments of technologies. These two events are tightly interconnected both temporally and causally, but they remain distinct.

A. New Knowledge

As used herein, knowledge is a relatively narrow term of art. It is “propositional knowledge” which, in turn, is commonly defined as justified true belief.¹⁷ It is called propositional knowledge because any

¹⁵ Clive Lawson, *An Ontology of Technology: Artefacts, Relations, and Functions*, 12 *TECHNÉ* 48, 49 (2008).

¹⁶ *Id.*

¹⁷ CARL MITCHAM, *THINKING THROUGH TECHNOLOGY: THE PATH BETWEEN ENGINEERING AND PHILOSOPHY* 194 (1994); Jonathan Jenkins Ichikawa & Matthias Steup, *The Analysis of Knowledge* § 1, *STANFORD ENCYCLOPEDIA OF PHILOSOPHY* (Nov. 15, 2012), <http://plato.stanford.edu/archives/win2012/entries/knowledge-analysis/>. For an interesting use of a much broader definition of knowledge as a lens through which to view patent law, see generally Michael J. Madison, *Beyond Invention: Patent as Knowledge Law*, 15 *LEWIS & CLARK L. REV.* 71 (2011).

particular “bit” or “piece” of such knowledge can be described as a belief that a factual proposition or declarative statement about the world is true. One can have propositional knowledge that the earth is round, that mixing chemicals *A* and *B* together makes chemical *C*, and that certain hedging processes offset one’s risk position.

Propositional knowledge is distinct from another type of knowledge that is important in technological endeavors, namely “knowledge-how.” Knowledge-how cannot be reduced to declarative statements about the world.¹⁸ Abilities like knowledge of how to swim or ride a bicycle are classic examples of knowledge-how.¹⁹ “The sensorimotor skills of [swimming or riding a bicycle] are preconscious ‘knowhow’ . . . acquired by intuitive as well as trial and error learning or imitative apprenticeship to some master craftsman, and thus do not qualify as knowledge in the strict sense,” when knowledge is defined as justified true belief.²⁰ However, many types of knowledge that intuitively seem like they belong to a category entitled knowledge-how are in fact propositional knowledge about how tasks can be accomplished. Knowledge about how to do things is a subset of propositional knowledge insofar as the knowledge at issue is a set of communicable propositions that describe steps that, if undertaken, lead to something being done. Thus, Alice, who is a world-class swimmer but who has radically false, subjectively-held views about how to swim well, possesses knowledge-how about swimming that cannot be reduced to propositional knowledge. In contrast Bert, who is a world authority on swimming technique, but who cannot stay afloat for more than a few seconds, possesses only propositional knowledge about swimming.²¹

¹⁸ GILBERT RYLE, *THE CONCEPT OF MIND* 27–32 (1949). Knowledge-how is often defined in part by its juxtaposition to *knowledge-that*, the latter being a synonym for propositional knowledge. *Id.*

¹⁹ Ephraim Glick, *Two Methodologies for Evaluating Intellectualism*, 83 *PHIL. & PHENOMENOLOGICAL RES.* 398, 427 (2011).

²⁰ MITCHAM, *supra* note 17, at 193. Knowledge-how is a close conceptual cousin of tacit knowledge. See MICHAEL POLANYI, *THE TACIT DIMENSION* 1–26 (1967). However, tacit knowledge is often defined broadly to encompass both knowledge-how and propositional knowledge that in theory could be, but has not yet been, codified. Dan L. Burk, *The Role of Patent Law in Knowledge Codification*, 23 *BERKELEY TECH. L.J.* 1009, 1014–16 (2008). However, because “intellectualists” and “anti-intellectualists” debate whether all knowledge-how can be reduced to propositional knowledge, there may not be any slippage between tacit knowledge and knowledge-how. See Ephraim Glick, *Abilities and Know-How Attributions*, in *KNOWLEDGE ASCRIPTIONS* 120, 120 (Jessica Brown & Mikkel Gerken eds., 2012) [hereinafter *Abilities and Know-How Attributions*].

²¹ Glick, *Abilities and Know-How Attributions*, *supra* note 20, at 120, 121. Both knowledge-that and knowledge-how are distinct from a third type of knowledge:

There are many different types of propositional knowledge that are implicated in technological endeavors. Propositional knowledge encompasses both theoretical or general knowledge, on the one hand, and practical or applied knowledge, on the other. Knowledge that the second law of thermodynamics is true and knowledge that Einstein's theory of relativity is true are bits of general, theoretical knowledge. In contrast, knowledge that rubber in the rubber press in the corner of the particular factory where I work will usually reach its optimal cure in fifty-nine seconds is practical, applied knowledge. Both, however, are core instances of propositional knowledge.²² Walter Vincenti famously created a taxonomy of different types of engineering knowledge that roughly ranges from the general to the specific: fundamental design concepts (operational principles and normal configurations), design criteria and specifications, theoretical tools (mathematics, reasoning, laws of nature), quantitative data (descriptive and prescriptive), practical considerations, and design instrumentalities.²³ The knowledge disclosed in a patent specification is also a good place to look to understand the diverse array of different kinds of propositional knowledge that are implicated in technological endeavors. A specification reveals knowledge about the physical, structural characteristics of the claimed invention: knowledge that tab A is inserted into slot B or that the molecular structure of Molecule X is such-and-such.²⁴ It discloses knowledge of the steps required to make and use a claimed technology.²⁵ It may disclose knowledge that demonstrates why the claimed technology is better than prior-art

acquaintance knowledge. Acquaintance knowledge is the knowledge expressed in statements like "I know John" or "I know that hotel." Bertrand Russell, *Knowledge by Acquaintance and Knowledge by Description*, in 11 PROCEEDINGS OF THE ARISTOTELIAN SOCIETY 108, 108 (1911).

²² Some philosophers draw a distinction between scientific and technological knowledge. JOSEPH C. PITT, THINKING ABOUT TECHNOLOGY: FOUNDATIONS OF THE PHILOSOPHY OF TECHNOLOGY 25–32 (2000) (distinguishing scientific, technological, and engineering knowledge). Assuming that such a distinction exists, it is irrelevant to the knowledge/embodiment dichotomy because the dichotomy prevents the patenting of all knowledge-advances. See *infra* text accompanying note 44 (noting that the distinction between the technological and the non-technological is irrelevant to the knowledge/embodiment dichotomy).

²³ WALTER G. VINCENTI, WHAT ENGINEERS KNOW AND HOW THEY KNOW IT 207–25 (1990).

²⁴ The rules of means-plus-function claiming and the written description requirement both mandate disclosure of this knowledge. 35 U.S.C. § 112(a), (f) (2012); *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1349–50, 1352–53 (Fed. Cir. 2010) (en banc).

²⁵ The enablement requirement mandates this disclosure. 35 U.S.C. § 112(a).

technologies,²⁶ and it may disclose causal knowledge (i.e., knowledge that explains why a technology works for its intended purpose).²⁷

B. New Embodiments (Objects and Processes)

Regardless of how important and pervasive technological knowledge is to technological endeavors, technological progress is more than a growing body of knowledge. As one philosopher of technology has noted:

A country might have citizens who “know” how to put a satellite into earth orbit but might nevertheless not have the facilities or resources to accomplish this. If we define technology merely as a kind of knowledge, then we would have to say that that country possesses the technology of space flight even though it cannot actually put an object into space. We can avoid such awkwardness by recognizing that technology involves more than mere knowledge.²⁸

To compile a catalog of distinct types of technological advance, it is clearly necessary to account for technology in forms other than “mere” propositional knowledge.

One attempt to develop a taxonomy of the forms in which technology exists other than propositional knowledge is Yochai Benkler’s distinction between “information-embedded goods” and “information-embedded tools.”²⁹ (Benkler’s categories have alternatively been described as “knowledge-embedded” goods and tools.³⁰) These are goods and tools “that are not themselves information, but that are better, more plentiful, or cheaper because of some technological advance embedded in them or associated with their production.”³¹ Benkler distinguishes information-embedded goods and tools from “information” which is “raw data, scientific reports of the output of scientific discovery, news, and factual reports” and thus roughly what this Article refers to as knowledge.³²

²⁶ This knowledge may help to prove nonobviousness. *See id.* § 103.

²⁷ Patent law does not mandate this disclosure. *Newman v. Quigg*, 877 F.2d 1575, 1581–82 (Fed. Cir. 1989).

²⁸ MAURICE N. RICHTER, *TECHNOLOGY AND SOCIAL COMPLEXITY* 8 (1982).

²⁹ BENKLER, *supra* note 3, at 311–15.

³⁰ *See* Jack Balkin, *What Is Access to Knowledge?*, *BALKINIZATION* (Apr. 21, 2006, 7:05 PM), <http://balkin.blogspot.com/2006/04/what-is-access-to-knowledge.html>.

³¹ BENKLER, *supra* note 3, at 311.

³² *Id.* at 313. Benkler reserves the term “knowledge” for “the set of cultural practices and capacities necessary for processing the information into either new

Carl Mitcham's work on the philosophy of technology offers another attempt to classify different types of technological progress. Mitcham argues that technologies exist not only as "manifestations in the mind" or as "mental knowledge or cognition" but also as both "objects" and "processes."³³ Objects are material entities that exist in the physical world, such as tools, machines, and tangible consumer goods.³⁴ Of the three categories, Mitcham suggests that it is perhaps technological objects that come most readily to mind when the term "technology" is used in every-day conversation.³⁵ It is thus likely not difficult to conceive of technology as an object or, in most cases, to differentiate technology as object from technology as knowledge.³⁶ Yet, despite the semantic accessibility of technology as object, Mitcham also suggests that it is technology as process that is technology's primary manifestation.³⁷ "[M]anufacturing, working, operating, and maintaining are all processes in technology as activity."³⁸ Processes are

statements in the information exchange [or] for practical use of the information in appropriate ways to produce more desirable actions or outcomes from action." *Id.* The Access to Knowledge movement embraces Benkler's definition of knowledge as a capacity. Amy Kapczynski, *Access to Knowledge: A Conceptual Genealogy*, in *ACCESS TO KNOWLEDGE IN THE AGE OF INTELLECTUAL PROPERTY* 17, 45–47 (Gaelle Krikorian & Amy Kapczynski eds., 2010); Lea Bishop Shaver, *Defining and Measuring A2K: A Blueprint for an Index of Access to Knowledge*, 4 *I/S: J.L. & POL'Y FOR INFO. SOC'Y* 1, 20–21 (2008). Therefore, the rhetoric of Access to Knowledge does not map onto the rhetoric of the knowledge/embodiment dichotomy: much of the knowledge to which the movement seeks to create free access is in fact technology in the form of knowledge-embedded goods.

³³ MITCHAM, *supra* note 17, at 159, 209. Technically, Mitcham distinguishes between "technology as knowledge, technology as activity, and technology as object," *id.* at 159, and identifies processes as a sub-category of activities. *Id.* at 210. However, Mitcham's activities that are not processes are not relevant to patent eligible subject matter. See *infra* note 39. For similar tripartite distinctions among the ontologically distinct forms in which technology exists, see RICHTER, *supra* note 28, at 9 (distinguishing knowledge, tools, and practices); MICHAEL BRIAN SCHIFFER, *TECHNOLOGICAL PERSPECTIVES ON BEHAVIORAL CHANGE* 44 (1990) (distinguishing artifacts, behaviors, and knowledge).

³⁴ MITCHAM, *supra* note 17, at 161–91. For a more detailed taxonomy of technological objects, see LEWIS MUMFORD, *TECHNICS AND CIVILIZATION* 9–12 (1934).

³⁵ MITCHAM, *supra* note 17, at 161.

³⁶ Davis Baird, *The Thing-Y-Ness of Things: Materiality and Spectrochemical Instrumentation, 1937–1955*, in *THE EMPIRICAL TURN IN THE PHILOSOPHY OF TECHNOLOGY* 99, 99–117 (Peter Kroes & Anthonie Meijers eds., 2000) (contrasting the "thing-y-ness" of technological things to technological ideas). *But cf. infra* text accompanying notes 62–65 (arguing that extra-mental representations of knowledge have a material basis in worldly objects).

³⁷ Mitcham technically identifies activities as the most important. MITCHAM, *supra* note 17, at 209; *cf. infra* note 39 (discussing Mitcham's definition of activities).

³⁸ MITCHAM, *supra* note 17, at 210.

“repetitive” activities, not “creative or original ones”; they are about “putting [technology] into practice as opposed to bringing [technology] into existence.”³⁹

To simplify the terminology, this Article adopts the term “embodiment-advances” to refer to new knowledge-embedded goods and tools (in Benkler’s terminology) or new technological objects and processes (in Mitcham’s terminology).

C. The Advances Are Tightly Interconnected, yet Distinct, Events

Knowledge-advances and embodiment-advances are ontologically distinct events within technological progress.⁴⁰ To fully appreciate this distinction, however, it is useful to understand how they are tightly interconnected in practice. If one is to tease knowledge-advances apart from embodiment-advances and view them as distinct events within the stream of technological progress, it is critical to comprehend the interconnections that need to be undone to separate them. This section explores two dimensions of the interconnection.

First, any given “lump” of progress—that is, a quantum of technological progress that may intuitively be framed as a single invention—is most commonly composed of both a knowledge-advance and a distinct embodiment-advance. For example, consider the invention of the first spring-loaded mousetrap. This single invention consists of both a knowledge-advance and an embodiment-advance. The knowledge-advance is the justified true belief that a mousetrap that uses a spring in a particular manner provides an effective means of catching a mouse. The embodiment-advance is the material device that uses a spring to actually catch mice. These two types of advance are distinct resources: it is entirely possible to possess one but not the other. One may possess a spring-loaded object without any realization that it is an effective device for catching mice; one may possess knowledge that a spring-loaded object is an effective

³⁹ *Id.* at 231. Mitcham identifies *activities* as the third state in which technology exists in addition to knowledge and objects. *Id.* at 159. Processes are only a subcategory of activities. *See id.* at 209-10, 230-46. For Mitcham, activities also encompass *actions*, which are roughly the activities that generate innovation. “Crafting, inventing, and designing are all actions in technology as activity.” *Id.* at 210-30. Mitcham also identifies technology as *volition* or the human drive to create technology as a fourth state in which technology exists. *Id.* at 247-66. Actions and volition are not patent eligible subject matter. They are the processes through which technological progress occurs, not the new resources that technological progress produces.

⁴⁰ *See supra* Part I.A–B.

mousetrap without ownership of a mousetrap that can catch mice.⁴¹ Furthermore, there are also counterexamples in which a lump of progress consists entirely of either a knowledge-advance or an embodiment-advance. What is commonly referred to in patent parlance as a discovery (and usually is juxtaposed to an invention) is technological progress in which a knowledge-advance is generated without any accompanying embodiment-advance.⁴² Inversely, an accident in a laboratory may produce a new chemical entity about which its inventor knows absolutely nothing at all.

Second, many successive knowledge-advances and embodiment-advances are causally linked. Earlier knowledge-advances enable the knowledge-advances and embodiment-advances that make up a lump of later progress. The knowledge created by an earlier inventor that the use a spring in a particular manner provides an effective means of catching a mouse allows later inventors to create improved mousetraps. Inversely, earlier embodiment-advances routinely enable later knowledge-advances. Research tools—whether in the form of microscopes or screening assays—exemplify this causal link. Knowledge-advances thus beget embodiment-advances, and those embodiment-advances, in turn, beget further knowledge-advances. Technological progress is an iterative sociological process in which the human mind shapes its environment through the creation of new technological embodiments and the new environment in turn shapes the human mind through the creation of new knowledge.⁴³ Yet, despite their interdependence, it is important to recognize that knowledge-advances and embodiment-advances are distinct types of technological progress. They generate distinct resources; they are not manifest in the world in the same type of material stuff. One generates a group of new, justified and true beliefs; the other generates a set of things or processes that behave or function in useful ways.

⁴¹ The co-existence of distinct knowledge-advances and embodiment-advances within the same “lump” of progress makes Yochai Benker’s terminology a useful way of capturing the knowledge/embodiment dichotomy. The knowledge produced by any given invention exists as both knowledge itself and as a knowledge-embedded good. See *supra* text accompanying notes 29–32.

⁴² See PETER. D. ROSENBERG, *PATENT LAW FUNDAMENTALS* 12-14 (1975).

⁴³ In this sense, technology and the built environment are close parallels. See WINSTON S. CHURCHILL, *A Sense of Crowd and Urgency* (Oct. 28, 1943), in 7 WINSTON S. CHURCHILL: *HIS COMPLETE SPEECHES, 1897-1963*, at 6869, 6869 (Robert Rhodes James ed., 1974) (“We shape our buildings, and afterwards our buildings shape us.”); Thomas F. Gieryn, *What Buildings Do*, 31 *THEORY & SOC’Y* 35, 41 (2002) (“Plainly, a complete sociology of buildings . . . must respect the double reality of buildings, as structures structuring agency but never beyond the potential restructuring by human agents.”).

II. THE KNOWLEDGE/EMBODIMENT DICHOTOMY

Building on the ontology of technological progress discussed in Part I, the knowledge/embodiment dichotomy is a simple legal rule that limits the kind of progress that can be patented: the creation of new propositional knowledge is not an advance that generates a “new . . . process, machine, manufacture, or composition of matter” that is eligible for patent protection under Section 101 of the Patent Act.⁴⁴ That is, the dichotomy precludes patents on knowledge-advances, and it recognizes only embodiment-advances as patent eligible subject matter.

Simply put, the knowledge/embodiment dichotomy prevents a patent owner from procuring rights to exclude others from making, using, selling, offering to sell, or importing a newly created bit of knowledge, regardless of how novel, nonobvious, and useful that bit of knowledge may be.⁴⁵ Yet, of course, the knowledge/embodiment dichotomy does not give the public unfettered rights to use newly created knowledge in whatever manner it pleases. Without the permission of the patent owner, there is one particular use of that knowledge in which the public cannot engage: it cannot use that knowledge to make, use, or sell (or offer to sell or import) a claimed embodiment-advance.⁴⁶ In this limited sense, it remains true that “[t]he grant of a patent . . . does prevent full use by others of the

⁴⁴ See 35 U.S.C. § 101 (2012). Arguments that only the “technological arts” can be patented also rely on an ontology of technology to limit patent eligible subject matter. See, e.g., John R. Thomas, *The Patenting of the Liberal Professions*, 40 B.C. L. REV. 1139, 1163–75 (1999) (discussing the possible meanings of “technology”). The ontology underlying the knowledge/embodiment dichotomy slices in a different direction. Whatever stuff one chooses to include within the ambit of technology, there is always a distinction within that stuff between knowledge-advances and embodiment-advances. The dichotomy is therefore agnostic about whether patent protection is limited to the technological arts and, if it is, how one defines the technological arts. Cf. MITCHAM, *supra* note 17, at 161 (adopting an extremely expansive definition of technology that encompasses art); PITT, *supra* note 22, at 10 (noting that “expand[ing] our account beyond the more standard view of tool-as-mechanical-mechanism to tool-as-mechanism-in-general” would bring “governments, organizations, and hierarchies” within the ambit of the technological, just as “hammers and nails” already are).

⁴⁵ Of course, new embodiments are patentable only if they satisfy all of patent law’s statutory requirements for validity. Claims to new embodiments must pass muster under not only novelty, nonobviousness, utility, and sufficient disclosure, but also under the facets of the doctrine of patent eligible subject matter that are distinct from the knowledge/embodiment dichotomy, such as the abstract ideas and products of nature exclusions.

⁴⁶ Cf. 35 U.S.C. § 271(a) (2012) (defining direct infringement).

inventor's knowledge" even when the knowledge/embodiment dichotomy is fully enforced.⁴⁷

This Part examines the mechanics of the knowledge/embodiment dichotomy as a legal doctrine by asking and answering three questions. Section II.A asks: "Why bother?" It explains why the dichotomy is not self-enforcing and thus why there is a need to have the dichotomy as a legal doctrine that limits the reach of patent protection. Section II.B asks: "Why a point of novelty analysis?" It demonstrates that the dichotomy mandates a distinction between two types of progress, not two categories of objects or processes, and that the dynamic view of technological evolution provided by a point of novelty analysis is needed to mark that distinction. Section II.C asks: "Why not a conventional levels-of-abstraction analysis?" It contrasts the patent dichotomy with its copyright namesake, the idea/expression dichotomy, and it thereby demonstrates that the limit on patent protection created by the knowledge/embodiment dichotomy is orthogonal to the limit created by a levels-of-abstraction analysis.

A. *Why Bother? Knowledge Is a Propertizable Resource*

At first glance, the knowledge/embodiment dichotomy may appear superfluous. Knowledge *per se* might seem to be something that would be beyond the reach of patent protection even if there were no doctrine like the knowledge/embodiment dichotomy that provided a legal curb on patent eligibility. This intuition leads to the "Why bother?" question: Why jump through hoops to establish a legal doctrine to limit patent protection if the limit would exist even if there were no such doctrine? More specifically, this question comes in two different forms. Some might argue that knowledge is not new, and others might argue that, even if it is new, knowledge by its very nature is inherently immune from being patented. This section demonstrates that neither argument has merit.

If knowledge was never new, then claims to knowledge-advances would fail to satisfy patent law's novelty requirement, and the knowledge/embodiment dichotomy would be superfluous.⁴⁸ However, knowledge is a man-made entity. A piece of propositional knowledge is not the same thing as a fact. Facts are states of affairs in the world.⁴⁹ Many facts—especially those that are facts about possibility rather

⁴⁷ See *Eldred v. Ashcroft*, 537 U.S. 186, 216–17 (2003).

⁴⁸ See 35 U.S.C. § 102 (2012).

⁴⁹ Roger Crisp, *Fact/Value Distinction*, in 3 *ROUTLEDGE ENCYCLOPEDIA OF PHILOSOPHY* 537, 537–38 (Edward Craig ed., 1998).

than actuality—have always existed, so technological progress does not produce them but rather discovers them. Discoveries have long been contrasted with inventions in patent law, with only the latter being patent eligible.⁵⁰ Propositional knowledge is not discovered. It comes into existence only when a fact is discovered and thus known, understood, or comprehended by one or more individuals.⁵¹ Assume that an inventor invents a new method of taking a particular pill in a particular manner to treat a particular disease. This invention entails the discovery of the fact that taking the pill in the prescribed manner treats a disease. The inventor did not create this state of affairs; it existed long before the date of the invention. However, the inventor has created new propositional knowledge, namely the knowledge that the pill will treat the disease if it is taken in the prescribed manner. There now is a justified true belief after the inventor's invention where previously there was not. Novelty, therefore, cannot do the work of the knowledge/embodiment dichotomy.⁵² A discovery may not change anything outside of the mind, but the very definition of a discovery is the presence of a new mental state within the mind.

Alternatively, even if knowledge is recognized as a man-made resource, the knowledge/embodiment dichotomy may appear redundant because knowledge may seem by its very nature to be beyond the reach of property. That is, the free availability of knowledge may seem like an inevitable feature of patent law that does not need to be established by legal fiat. For example, couching his argument in terms of information rather than knowledge, Polk Wagner offers an argument in this vein when he asserts that: “[T]he ‘fencing’ of information is a remarkably futile proposition; the control we offer owners of intellectual property rights is simply not the control we offer land owners. It should not be, but more importantly, it *cannot* be. It turns out that information *does* ‘want to be free.’”⁵³ In other words, Wagner argues that the natural “architecture” of knowledge immunizes knowledge from the propertizing effects of all

⁵⁰ ROSENBERG, *supra* note 42, at 12-14.

⁵¹ Alex Oliver, *Facts*, in 3 ROUTLEDGE ENCYCLOPEDIA OF PHILOSOPHY, *supra* note 49, at 535, 536 (“Facts as worldly referents or truth-makers of true sentences are best conceived as . . . parts of the actual world, unlike true propositions [of knowledge] which belong to the abstract and other-worldly realm of sense.”).

⁵² Nor is the knowledge/embodiment dichotomy redundant in light of patent law's utility doctrine, which requires a patented invention to have a substantial and specific utility. *In re Fisher*, 421 F.3d 1365, 1369–78 (Fed. Cir. 2005). To the contrary, it is the extraordinary utility of most propositional knowledge that justifies excluding claims to knowledge-advances from the patent regime.

⁵³ Wagner, *supra* note 7, at 999.

possible patent regimes.⁵⁴ If the free availability of knowledge were an inevitable feature of our world, then the knowledge/embodiment dichotomy would be a self-enforcing principle, and there would be no need to reconceptualize the doctrine of patent eligible subject matter to recognize it. Perhaps we do not need the knowledge/embodiment dichotomy for the same reason we do not need a law to prohibit teleportation: why establish a legal doctrine to enforce a limit on patent protection that (in today's world, at least) is inevitable?

However, knowledge is not inherently immune from propertization.⁵⁵ Knowledge exists in the material world in two forms. Each is a bottleneck or choke point that allows patent drafters to describe, claim, and privatize knowledge. First, patent claims can describe a mental state in a human mind, and, second, they can describe the extra-mental components of a sign that, through a social convention, triggers a mental state in the mind of a human interpreter.⁵⁶

A piece of propositional knowledge is a justified true belief.⁵⁷ Given that a belief is in turn a mental phenomenon, cognitive scientists unsurprisingly describe propositional knowledge as an entity that is first and foremost present in human minds. More specifically, they posit that propositional knowledge resides in a particular type of mental state—a mental representation.⁵⁸ “[O]n a standard account, having knowledge is a matter of having mental representations with true contents—that is, representations that correctly represent” the

⁵⁴ “Architecture” is used here in the sense of a modality of regulation that follows from material possibility. Lawrence Lessig, *The New Chicago School*, 27 J. LEGAL STUD. 661, 663 (1998).

⁵⁵ The argument that the architecture of knowledge makes it inherently unpropertizable resonates with the argument made by early cyberlibertarians that the architecture of the internet makes it inherently unregulable. LAWRENCE LESSIG, *CODE AND OTHER LAWS OF CYBERSPACE* 24–25 (1999). The cyberlibertarian argument has not withstood the test of time.

⁵⁶ Knowledge is commonly described as intangible or immaterial. See, e.g., JAMES BOYLE, *THE PUBLIC DOMAIN: ENCLOSING THE COMMONS OF THE MIND* 45 (2008) (“While it sounds grandiloquent to call [increased intellectual property protection] ‘the enclosure of the intangible commons of the mind,’ in a very real sense that is just what it is.”); Charlotte Hess & Elinor Ostrom, *Introduction: An Overview of the Knowledge Commons*, in *UNDERSTANDING KNOWLEDGE AS A COMMONS* 1, 9 (Charlotte Hess & Elinor Ostrom eds., 2007) (discussing knowledge “in its intangible form”). However, knowledge must have a footprint in the material world. But for the existence of mental states and extra-mental representations, there would not be any knowledge.

⁵⁷ See *supra* text accompanying note 17.

⁵⁸ PAUL M. CHURCHLAND, *MATTER AND CONSCIOUSNESS* 63 (1988); JAEGWON KIM, *PHILOSOPHY OF MIND* 25 (2d ed. 2006).

world outside of the mind.⁵⁹ It is easy to draft a claim that describes a newly created mental representation. For example, in its most blunt form, a claim can describe the mental process of understanding that newly created molecule X has such-and-such a structure.

Even if it is technically possible to draft a patent claim that refers to, and thus propertizes, a mental representation, a more nuanced argument that the knowledge/embodiment dichotomy is superfluous is that patent owners cannot enforce claims to mental representations. Human thought is notoriously introverted in the sense that it is uniquely accessible to the person who has the thought.⁶⁰ How can a patent owner ever know what goes on inside the mind of an infringer? If a claim cannot be enforced, it is economically worthless, and creating patent doctrine to exclude it from the patent regime is perhaps not worth the effort. However, the enforcement difficulties created by the introverted nature of thought can easily be overcome through the use of circumstantial evidence. Just as one can prove infringement within a factory without ever having direct access to the factory floor, one can prove infringement within the mind without ever having performed brain scans. In both situations, inputs and outputs from a black box provide circumstantial evidence of what goes on inside the box.⁶¹ Patent owners may not be able to tax all infringers who make and use newly created mental representations, but perfect enforcement is an unattainable ideal for almost all patents. Researchers and inventors will have incentives to obtain and enforce claims to

⁵⁹ KIM, *supra* note 58, at 25. Mental representations are stock elements in the common “folk psychology” approach to cognitive science that adopts the commonsense mental entities and laws that laymen postulate to explain human thought and behavior. See JERRY A. FODOR, *A THEORY OF CONTENT AND OTHER ESSAYS* 4-5 (1990); KIM, *supra* note 58, at 270; STEPHEN P. STICH, *FROM FOLK PSYCHOLOGY TO COGNITIVE SCIENCE* 30-35 (1983).

⁶⁰ KIM, *supra* note 58, at 19.

⁶¹ There are a fair number of cases in which patent owners have successfully demonstrated infringement of claims with mental process limitations. See, e.g., *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289 (2012) (noting that plaintiffs successfully demonstrated infringement of a claim with a mental-process limitation, even though the Court ultimately found the patent invalid as it concerned unpatentable natural law); *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124 (2006) (addressing the validity of a claim with a mental-process limitation that the district court found to be infringed). These cases suggest that even purely mental claims could be enforced if they were to be issued. Direct infringement occurs only when each and every limitation of a claim is satisfied, so proving infringement of a claim with a mental process limitation among other limitations is by definition more difficult than proving infringement of a claim to the same mental process standing alone.

mental representations so long as they can tax enough infringers to offset their private costs of obtaining and enforcing the patent.

Propositional knowledge may have its primary locus in the human mind, but it can also be codified in the material world beyond the mind. Texts, diagrams, pictures, and the sound waves created by speech are all extra-mental objects or states of affairs that codify knowledge, and they can easily be the referents of patent claims. It is entirely possible for a claim to describe all texts or speech acts that convey any given piece of propositional knowledge from one mind to another. In its most blunt form, a claim could describe any tangible medium of expression that conveys knowledge of the structure of the newly created molecule X. However, it would be misleading to think that these extra-mental, material things that codify knowledge are independent of mental representations. These extra-mental things that codify knowledge are meaningful only because they are intelligible to human minds and function as components of signs.⁶² They represent facts to human minds because there are social conventions through which the mind attributes meaning to them.⁶³ A book has meaning not in its own right but because people—entities with minds and representational mental states—attribute meaning to the book. To the extent we say that the sentence “London is large” in a book represents a state of affairs in the world, we do so “only because language users use the word to refer to London.”⁶⁴ The ability of language to represent knowledge “depends on, and is derived from, the [representational capacities] of language users and their mental processes. It is the latter that have intrinsic [representational capacity] that is not derived from, or borrowed from, anything else.”⁶⁵

In sum, knowledge is not by its very nature inherently immune from propertization by patent law. To the extent that patent law does not allow knowledge-advances to constitute patent eligible subject matter, it is because there is patent doctrine that stands in the way.

⁶² Collins, *Semiotics 101*, *supra* note 14, at 1408–17 (defining a sign).

⁶³ *Id.* at 1413–17.

⁶⁴ KIM, *supra* note 58, at 25.

⁶⁵ *Id.* at 25–26. Philosophy of mind distinguishes between the *original* or *intrinsic* representational capacity of a human mental state and the *derived* representational capacity of worldly things such as books and diagrams. JOHN SEARLE, *INTENTIONALITY: AN ESSAY IN THE PHILOSOPHY OF MIND* 27 (1983); John Haugeland, *The Intentionality All-Stars*, in *HAVING THOUGHT: ESSAYS IN THE METAPHYSICS OF MIND* 129 (1998).

B. *Why Point of Novelty? It Is the Advance, Not the Claimed Stuff*

The knowledge/embodiment dichotomy employs what is commonly called a “point of novelty” analysis: a patent claim fails to describe patent eligible subject matter if the only advance over the prior art (i.e., a claim’s only point of novelty) lies in a limitation reciting newly created knowledge, whether in the form of a mental or extra-mental representation.⁶⁶ A point of novelty analysis mixes the analysis of distinction from the prior art that is conventionally performed under the Section 102 novelty requirement and the Section 103 nonobviousness requirement into the Section 101 determination of patent eligible subject matter. It works on a limitation-by-limitation basis, sorting a claim’s limitations into those that describe old and new features of the claimed technology and querying whether the distinction from the prior art that is needed for patentability resides solely in limitations that, examined in isolation, describe patent ineligible subject matter.⁶⁷

Patent opinions and commentary frequently critique the use of a point of novelty analysis to structure the Section 101 patent eligibility inquiry.⁶⁸ The disfavored point of novelty analysis is usually contrasted to a preferred “claim-as-a-whole” analysis in which courts simply ask whether the claimed objects or processes are or are not intrinsically the type of stuff that is eligible for patent protection. Under a claim-as-a-whole analysis, any given patent claim is either in

⁶⁶ The notion of an invention’s point or points of novelty was already in use in nineteenth century patent discourse. See, e.g., *Union Edge-Setter Co. v. Keith*, 139 U.S. 530, 533–36 (1891) (discussing the point of novelty of a burnishing tool).

⁶⁷ A novel combination of a set of pre-existing limitations can be a point of novelty. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1298 (2012) (considering the novelty of the steps as “an ordered combination”).

⁶⁸ The critique includes arguments grounded in consequentialist, precedential, and statutory reasoning. See *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1057 n.4 (Fed. Cir. 1992) (noting general agreement that *Diehr* superseded the point of novelty analysis in *Flook*); *In re Bergy*, 596 F.2d 952, 960-61 (C.C.P.A. 1979) (arguing that it is statutorily impermissible to mix the Section 102 novelty analysis into the Section 101 analysis of patent eligibility); Mark A. Lemley et al., *Life After Bilski*, 63 STAN. L. REV. 1315, 1335–36 (2011) (arguing that a point of novelty analysis leads to a normatively overbroad exclusion from patentability). But see Bernard Chao, *Moderating Mayo*, 107 NW. U. L. REV. 423, 436 (2012) [hereinafter *Moderating Mayo*] (arguing in favor of a point of novelty analysis in patent eligible subject matter). For a discussion of the many current and possible future roles that a point of novelty analysis can play outside of the doctrine of patent eligibility, see Bernard Chao, *Breaking Aro’s Commandment: Recognizing that Inventions Have Heart*, 20 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1183, 1220–28 (2010); Mark A. Lemley, *Point of Novelty*, 105 NW. U. L. REV. 1253, 1255 (2011) [hereinafter *Point of Novelty*].

or out of the patent regime, and the finer-grained analysis that focuses on the feature of the claimed stuff that renders that stuff distinct from the prior art is irrelevant.⁶⁹ This conventional belief that patent eligibility should employ a claim-as-a-whole analysis may well be correct in many situations. For example, the Section 101 exclusions of natural phenomena⁷⁰ and abstract ideas⁷¹ likely should not employ a point of novelty approach.⁷² However, the knowledge/embodiment dichotomy is different from other limits on patent eligibility: it requires a point of novelty analysis. Examiners and judges cannot draw the required line between patent ineligible knowledge-advances and patent eligible embodiment-advances without it.

The knowledge/embodiment dichotomy must employ a point of novelty analysis because it requires a dynamic view of technological progress that pays attention to the evolution of technology over time. It makes a distinction between two types of advance or progress: knowledge-advances are not patent eligible, but embodiment-advances are. Courts can only determine if patent claims encompass one or the other of these two types of progress if they can determine the reason why the claims are novel in relation to the prior art, and this is the very determination that a point of novelty analysis allows the courts to make. A claim-as-a-whole approach forces the courts to view a claim in a static manner—as a set of objects or processes cut out from the evolutionary stream of technological progress.

As a practical matter, the static claim-as-a-whole analysis cannot enforce the knowledge/embodiment dichotomy because patent eligibility does not hinge on the intrinsic properties of the claimed stuff.⁷³ Two different inventions or advances, one patent eligible and the other patent ineligible, can yield claims to the exact same stuff. The dichotomy allows this exact same stuff to be patent eligible if the novelty results from one type of advance but not if it results from the other type of advance.⁷⁴ To see this point in action, consider two

⁶⁹ *Diamond v. Diehr*, 450 U.S. 175, 188–89 (1981).

⁷⁰ *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2116 (2013).

⁷¹ *Bilski v. Kappos*, 130 S. Ct. 3218, 3225, 3229–31 (2010).

⁷² See *infra* note 81.

⁷³ For a definition of a thing's intrinsic and extrinsic properties, see 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, 521–27 (2008).

⁷⁴ The knowledge/embodiment dichotomy therefore mandates an “external” rather than a “claim-centered” definition of an invention. See Christopher Anthony Cotropia, *What Is the “Invention”?* 5 (Aug. 29, 2011), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1918841.

hypothetical claims, one addressing a mental representation and the other an extra-mental representation.

First, consider a two-step method claim: (a) using a diagnostic tool to measure the level of chemical X in a sample, and (b) understanding that the amount of chemical X in the sample is inversely proportional to the amount of chemical Y in the sample.⁷⁵ If the technological advance resides in a newly created diagnostic tool, then this claim describes a patent eligible embodiment-advance under the knowledge/embodiment dichotomy. The inventor could have obtained patent protection for step (a) standing alone as an embodiment-advance, so the two-step method claim does not give the inventor any rights to which he is not entitled.⁷⁶ However, if the point of novelty resides in the second step, then the claim describes a patent ineligible knowledge-advance under the knowledge/embodiment dichotomy. The inventor has only created a new mental representation, and the creation of new knowledge, standing alone, does not justify the issuance of a patent claim. A point of novelty analysis is required to differentiate the former, patent eligible invention from the latter, patent ineligible invention. A claim-as-a-whole approach cannot differentiate between these two different inventions or advances that give rise to claims to the same stuff. Because it decides patent eligibility only by looking at the type of stuff described by a claim, it would either invalidate or sanction claims to both inventions.⁷⁷

Second, consider a two-limitation claim to a book: (a) the binding uses a particular technology, and (b) the text represents specified propositional content. If the binding technology is novel, this claim is a patent eligible embodiment-advance. Again, it does not give an inventor any more protection than he deserves because the inventor is entitled to a broad claim to an embodiment-advance that encompasses all books in which the binding is performed using the specified

⁷⁵ Cf. *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124 (2006) (addressing a similar claim).

⁷⁶ As a practical matter, the inventor of the tool probably would not seek the narrower, two-step claim. However, the narrower claim demonstrates why a point of novelty approach is essential to enforce the knowledge/embodiment dichotomy.

⁷⁷ The claim-as-a-whole approach does allow some steps, such as “insignificant post-solution activity” or steps that simply limit patent ineligible subject matter to “a particular technological environment,” to be discounted when assessing the patent eligibility of the claimed subject matter. *Diamond v. Diehr*, 450 U.S. 175, 191–92 (1981). However, these claim-as-a-whole fudge factors cannot be used to consider whether any particular step is novel, and they therefore cannot distinguish between the two factual variants discussed in the text.

technology.⁷⁸ However, if it is only the content of the representation that distinguishes this claim from the prior art, the claim violates the knowledge/embodiment dichotomy. It impermissibly attempts to leverage newly created propositional knowledge into patent protection. Again, a claim-as-a-whole approach cannot distinguish between these different inventions or advances that give rise to a claim to the exact same stuff.⁷⁹ It only considers the intrinsic nature of the stuff described by a claim, which is identical in both situations.⁸⁰

In these two examples, the knowledge/embodiment dichotomy distinguishes between two kinds of technological advance. It therefore allows the exact same stuff to be patented if the stuff results from one type of advance but not if the stuff results from the other. The PTO and the courts can only draw this distinction if they employ a point of novelty analysis.

To be clear, courts could use a claim-as-a-whole analysis to invalidate a subset of the claims that run afoul of the knowledge/embodiment dichotomy. For example, a one-step process claim to understanding a newly discovered fact and a product claim to all textual representations of a newly discovered fact would likely be invalid because mental processes and free-floating extra-mental representations, respectively, are simply not the type of stuff that is commonly presumed to be patent eligible. However, courts could not use a claim-as-a-whole analysis to fully enforce the knowledge/embodiment dichotomy. They could not stop patent applicants from claiming newly discovered propositional knowledge in conjunction with conventional technology (e.g., texts in bound books, labels on bottles of conventional pills, methods of use printed on conventional machines, and mental representations together with conventional diagnostic tools). In claims like these, a claim-as-a-whole analysis allows a knowledge-advance to successfully masquerade as an embodiment-advance because the claim describes stuff that looks like an every-day embodiment of technology. To achieve the required demasking, the knowledge/embodiment dichotomy must pay attention to the point of novelty of the claim. It cannot simply draw a line

⁷⁸ See *supra* text accompanying note 76.

⁷⁹ See *supra* text accompanying note 77.

⁸⁰ The example need not involve a book. It could involve printed matter on any machine, manufacture, or composition of matter. For example, a scale with markings is patent eligible under the knowledge/embodiment dichotomy if the mechanics of the weighing mechanism are new but not if the markings represent newly created knowledge about what it means for an object to have a particular weight. Cf. *In re Lockert*, 65 F.2d 159 (C.C.P.A. 1933) (finding that the addition of a chart to a weighing device does not result in a patent eligible machine).

between two ontologically distinct kinds of stuff; it cannot be limited to a claim-as-a-whole approach to patent eligibility.⁸¹

C. *Why Not Levels-of-Abstraction? Distinguishing the Idea/Expression Dichotomy of Copyright Law*

This Article coins the name “knowledge/embodiment dichotomy” with the express intent of positioning the limit on patent eligibility as the patent law analog of the idea/expression dichotomy of copyright law.⁸² The idea/expression dichotomy is widely recognized as a foundational limit on what can be protected by copyright, and the semantic association between the dichotomies reinforces the notion that the knowledge/embodiment expression should enjoy the same status in patent law. However, the knowledge/embodiment dichotomy is not analogous to the idea/expression dichotomy in its mechanism of operation. The idea/expression dichotomy employs a levels-of-abstraction analysis, but the knowledge/embodiment dichotomy does not.

As Judge Learned Hand has famously noted, the idea/expression dichotomy in copyright law uses a levels-of-abstraction analysis to curb the permissible generality at which a copyright interest may be formulated:

⁸¹ The argument here is modest in one important respect: it is not an argument in favor of using a point of novelty analysis in all strains of the doctrine of patent eligibility. Putting the knowledge/embodiment dichotomy aside, a point of novelty analysis may not be a good way to administer strains of the doctrine of patent eligibility, including the infamous exclusions of “laws of nature, physical phenomena, and abstract ideas.” *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980). *But see infra* Part V.B.1 (arguing that a point of novelty analysis should be used to administer the “laws of nature” exclusion when that exclusion is, underneath the rhetoric of the opinion, a doctrinal contortion that enforces the knowledge/embodiment dichotomy). In fact, a consequentialist critique of point of novelty has considerable merit when the goal is preventing the patenting of the natural, not the mental. *See Collins, Economic Justification, supra* note 14, at 12–14. The dichotomy’s focus on the advance—and not the claimed stuff viewed in an atemporal manner, sliced out from the flow of technological progress—may make it uniquely amenable to a point of novelty analysis. Looking at the big picture, the doctrine of patent eligibility is called upon to address several distinct normative problems, so it should be expected that patent eligibility may require several distinct doctrinal solutions. *See Kevin Emerson Collins, Bilski and the Ambiguity of “An Unpatentable Abstract Idea,”* 15 LEWIS & CLARK L. REV. 37, 42–44 (2011) [hereinafter *Bilski and Ambiguity*].

⁸² The idea/expression dichotomy today has its statutory basis in 17 U.S.C. § 102(b) (2012). However, it was initially created by the courts, and the courts continue to feature prominently in its ongoing evolution. *See, e.g., Nichols v. Universal Pictures Corp.*, 45 F.2d 119 (2d Cir. 1930) (discussing similarity between works running along a continuum from a shared abstract idea to shared literal expression).

Upon any work . . . a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at times might consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his “ideas,” to which, apart from their expression, his property never extended.⁸³

There are several patent doctrines that employ a levels-of-abstraction analysis to invalidate patent claims that employ highly general or abstract language and that therefore sweepingly describe not only an inventor’s contribution to progress but much more technology as well.⁸⁴ However, the knowledge/embodiment dichotomy is not like these doctrines. It is not premised on a levels-of-abstraction analysis. Rather, it marks a true dichotomy. There are two ontologically distinct types of technological advances,⁸⁵ and the knowledge/embodiment dichotomy creates a *per se* prohibition on patents on knowledge-advances. Unlike copyright law’s idea/expression dichotomy, the knowledge/embodiment dichotomy is not concerned with the level of abstraction at which the propositional knowledge is formulated. The propositions at issue in newly created bits of knowledge can run the gamut from highly generalized to extremely specific,⁸⁶ but the generality of the proposition is irrelevant under the knowledge/embodiment dichotomy. The dichotomy holds that even a claim to newly created knowledge of the most narrow, particular, and targeted of empirically true facts is not patent eligible.⁸⁷

⁸³ *Id.* at 121.

⁸⁴ Language becomes more abstract as it disregards more differences between distinct things. D. ALAN CRUSE, MEANING IN LANGUAGE: AN INTRODUCTION TO SEMANTICS AND PRAGMATICS 50–51 (2000) (identifying greater generality in word meaning as “a more extensive area of quality space”). The commensurability analyses in the Section 112(a) disclosure doctrines employ a levels-of-abstraction analysis. See *Univ. of Cal. v. Eli Lilly & Co.*, 119 F.3d 1559, 1566–67 (Fed. Cir. 1997) (written description); *In re Fisher*, 427 F.2d 833, 839 (C.C.P.A. 1970) (enablement). The Section 101 exclusion of “abstract ideas” from patent eligibility also sometimes employs a levels-of-abstraction analysis. See *infra* text accompanying notes 110–113.

⁸⁵ See *supra* Part I.

⁸⁶ See *supra* text accompanying notes 22–27.

⁸⁷ For example, imagine a printed text representing the fact that an individual patient has a particular genetic mutation. Although it is highly specific and it might be extremely useful in developing a course of therapeutic treatment of the individual, this text is not patent eligible under the dichotomy.

Inversely, claims to embodiment-advances drafted in extremely abstract language are patent eligible under the knowledge/embodiment dichotomy.⁸⁸ Because the level of abstraction is irrelevant, the knowledge/embodiment dichotomy is in fact more closely related on a doctrinal level to the fact/expression dichotomy in copyright law than it is to the idea/expression dichotomy.⁸⁹

III. PATENT RHETORIC TEACHES AWAY FROM THE DICHOTOMY

Contemporary patent discourse is often couched in rhetoric that resonates with the concepts of knowledge and embodiments. More specifically, both talk of knowledge, ideas, and information as unpatentable entities and talk of embodiments as patentable entities permeate patent opinions and commentary. Yet, despite these semantic resonances, the knowledge/embodiment dichotomy does not exist *de dicto* in the contemporary discourse that conveys patent doctrine and theory. This Part demonstrates that contemporary patent discourse does not use the terms “knowledge,” “ideas,” “information,” and “embodiments” in a manner that accurately refers to the knowledge/embodiment dichotomy. To the contrary, the use of these terms in contemporary patent discourse does more to “teach away” from the dichotomy than to elucidate it.⁹⁰

A. Talk of Knowledge, Ideas, and Information

The Supreme Court’s modern patent cases often use the term “knowledge” to describe limits on what can be patented. In most of these cases, however, the Court’s statements only make sense if they are interpreted to refer to knowledge-embedded goods, not propositional knowledge.⁹¹

⁸⁸ For example, Morse’s infamously broad eighth claim to the telegraph is patent eligible under the knowledge/embodiment dichotomy. *See infra* text accompanying notes 110–113. Of course, Morse’s claim would not be valid at the end of the day because there are patent doctrines other than the knowledge/embodiment dichotomy that do police the permissible level of abstraction at which an embodiment claim can be drafted. *See supra* note 84.

⁸⁹ *See* Feist Publ’ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 344–45 (1991). The combination of the knowledge/embodiment and fact/expression dichotomies means that propositional knowledge cannot be protected under either patent or copyright law.

⁹⁰ The knowledge/embodiment dichotomy may therefore be nonobvious over prior patent commentary, despite all of the terms used to convey the dichotomy being present in that commentary. *See* United States v. Adams, 383 U.S. 39, 51–52 (1966) (discussing the import of teaching away in the doctrine of nonobviousness).

⁹¹ *See supra* text accompanying notes 29–32 (discussing this distinction). The use

For example, in *Funk Brothers Seed Co. v. Kalo Inoculant Co.*, the Court held that a claim to a new combination of naturally occurring bacteria was not patent eligible subject matter.⁹² The Court justified its conclusion in part with the statement that “[t]he qualities of these bacteria, like the heat of the sun, electricity, or the qualities of metals, are part of the storehouse of knowledge of all men.”⁹³ The Court’s turn of phrase “storehouse of knowledge” does not refer to a collection of bits of propositional knowledge: the Funk Brothers’ claims described embodiment-advances; they did not attempt to privatize propositional knowledge.⁹⁴ Rather, “the storehouse of knowledge” is a loose metaphor for the objects and processes that cannot be patented because they are embodiments of nature, not embodiments of man-made technology.⁹⁵

Similarly, the Court has repeatedly described Sections 102 and 103 as doctrines that prevent the patenting of “knowledge.” According to the Court, these provisions “exclude from consideration for patent protection knowledge that is already available to the public,”⁹⁶ and they “protect the public’s right to retain knowledge already in the public domain.”⁹⁷ However, courts employing Sections 102 and 103 are not preventing the privatization of newly created propositional knowledge.⁹⁸ Rather, they are enforcing patent law’s anti-backsliding

of the term “knowledge” to refer to patent eligible embodiment-advances is also common in academic literature on the patent regime. *See, e.g.*, James Bessen & Alessandro Nuvolari, *Knowledge Sharing Among Inventors: Some Historical Perspectives*, in *REVOLUTIONIZING INNOVATION: USERS, COMMUNITIES AND OPEN INNOVATION* (D. Harhoff & K. Lakhani eds., 2012) (using the notion of the free sharing “knowledge” to describe the free sharing of all new technology).

⁹² 333 U.S. 127, 130–31 (1948).

⁹³ *Id.* at 130.

⁹⁴ *See id.* at 128 n.1 (noting that the claims described combinations of bacteria).

⁹⁵ The Supreme Court’s loose usage of “knowledge” permeates lower court opinions on patent eligibility as well. *See, e.g.*, *Ass’n for Molecular Pathology v. U.S. Patent & Trademark Office*, 689 F.3d 1303, 1324 (Fed. Cir. 2012), *rev’d*, 133 S. Ct. 2107 (2013) (labeling products of nature as one part of the “storehouse of knowledge” that is freely available to all).

⁹⁶ *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 148 (1989).

⁹⁷ *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 65 (1998). The Court has also used knowledge rhetoric to note that distinction from the prior art is a constitutionally mandated validity requirement: “Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available.” *Graham v. John Deere Co.*, 383 U.S. 1, 6 (1966).

⁹⁸ *But see infra* note 176 (noting that the printed matter doctrine, which does enforce part of the knowledge/embodiment dichotomy, is sometimes lodged in Sections 102 and 103).

or baseline principle: they are protecting the public's right to use knowledge-embedded goods that are already available to the public.⁹⁹

In the same vein, the Court famously justified its invalidation of a claim for lack of statutory utility in *Brenner v. Manson* by reasoning that the claim would, if valid, grant its owner a "monopoly of knowledge."¹⁰⁰ Yet, this claim did not describe a knowledge-advance; it may not have had statutory utility, but it did not run afoul of the knowledge/embodiment dichotomy. To the contrary, it described a novel knowledge-embedded good: a process for making a steroid that was structurally distinct from prior-art steroids.¹⁰¹

Like the term "knowledge," the term "idea" is common in patent discourse. However, unlike knowledge-talk, idea-talk cuts both ways in discussions of patent protection: an idea is sometimes presented as precisely what can be patented,¹⁰² but it is also sometimes put forward as what absolutely cannot (or, at least, should not) be patented.¹⁰³ Neither form of idea-talk accurately captures the knowledge side of the knowledge/embodiment dichotomy.

It is commonplace to describe patent law as a form of intellectual property that protects and creates monopolies in new ideas.¹⁰⁴ In the same vein, even the notion that intellectual property protects "things that 'spring' from a person's mind" is an unremarkable assertion.¹⁰⁵ These characterizations of patent law should not be taken as implicit arguments that patents routinely protect knowledge-advances and

⁹⁹ *Atlas Powder Co. v. IRECO Inc.*, 190 F.3d 1342, 1346-48 (Fed. Cir. 1999) (discussing inherency).

¹⁰⁰ 383 U.S. 519, 534 (1966).

¹⁰¹ *Id.* at 520. There are, of course, exceptions to the rule: the Supreme Court has occasionally used the term "knowledge" in a way that reflects its usage in the knowledge/embodiment dichotomy. See *MacKay Radio & Tel. Co. v. Radio Corp. Am.*, 306 U.S. 86, 94 (1939) ("While [knowledge of] a scientific truth, or the mathematical expression of it, is not [a] patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be."); *supra* text accompanying note 47 (quoting *Eldred v. Ashcroft*, 537 U.S. 186, 216-17 (2003)).

¹⁰² *Gill v. United States*, 160 U.S. 426, 434 (1896) ("In every case, the idea conceived is the invention.").

¹⁰³ *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. 498, 507 (1874) ("An idea of itself is not patentable . . .").

¹⁰⁴ See, e.g., Tun-Jen Chiang, *The Levels of Abstraction Problem in Patent Law*, 105 *Nw. U. L. REV.* 1097, 1097-98 (2011) (describing a patent as right to exclude from an inventor's idea); Michael Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 *Q.J. ECON.* 1137, 1137 (1998) (describing patents as providing inventors with rights to exclude from ideas).

¹⁰⁵ See Andrew Beckerman-Rodau, *Patent Law—Balancing Profit Maximization and Public Access to Technology*, 4 *COLUM. SCI. & TECH. L. REV.* 1, 1 (2002).

violate the knowledge/embodiment dichotomy. Rather, idea-talk in these instances is a kind of shorthand. Patents use mental ideas or concepts to determine permissible claim scope (i.e., the size of the set of new embodiments to which an inventor is entitled).¹⁰⁶ When the notion of patents protecting ideas is used as shorthand for what patents do on a day-to-day basis, “[a] claim to ‘a flying machine’ is really a claim to the idea of artificial flight” not in the sense that it allows a patentee to prevent others from thinking about a flying machine but rather in the sense that “it will cover every flying machine.”¹⁰⁷

Inversely, it is also commonplace in contemporary patent discourse to identify “abstract ideas” or “abstract intellectual concepts” as what does or should lie beyond the reach of patent protection.¹⁰⁸ This variant of idea-talk has semantic resonance with the knowledge/embodiment dichotomy and might appear at first glance to accurately capture the dichotomy. To the extent that an idea is defined as a mental phenomenon and can include a mental representation, new ideas are precisely what cannot be patented under the knowledge/embodiment dichotomy. Yet, even here, idea-talk in contemporary patent discourse fails to capture the knowledge/embodiment dichotomy. Flushing out this failure is complicated by the fact that the word “idea” in this type of idea-talk is ambiguous: the exclusion of “abstract ideas” from patent protection means different things in different contexts.¹⁰⁹ In none of these contexts, however, does it map onto the knowledge/embodiment dichotomy.

In some contexts, the exclusion of “abstract ideas” from patent eligibility employs a levels-of-abstraction analysis and invalidates claims to embodiment-advances that are drafted with excessively abstract language. For example, consider the Supreme Court’s

¹⁰⁶ Kevin Emerson Collins, *Getting into the “Spirit” of Innovative Things: Looking to Complementary and Substitute Properties to Shape Patent Protection for Improvements*, 26 BERKELEY TECH. L.J. 1217, 1273–79 (2011) (offering a normative justification for linking up an inventor’s ideas with permissible claim scope).

¹⁰⁷ Tun-Jen Chiang, *Defining Patent Scope by the Novelty of the Idea*, 89 WASH. U. L. REV. 1211, 1215 (2012) [hereinafter *Defining Patent Scope*]. This type of idea-talk is accurate when its full meaning has been decoded. However, to the extent that we routinely use shorthand and talk about ideas as the resource being protected by patent law, we have less semantic space to convey the knowledge/embodiment dichotomy and its prohibition on patents covering knowledge-advances.

¹⁰⁸ See *Bilski v. Kappos*, 130 S. Ct. 3218, 3229–32 (2010); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972).

¹⁰⁹ Cf. Collins, *Bilski and Ambiguity*, *supra* note 81, at 44 (discussing the multiple ambiguities of an “abstract idea”).

conclusion that Samuel Morse's infamous eighth claim to the telegraph was an impermissible claim to an abstract idea.¹¹⁰ Having invented the first working telegraph machine, Samuel Morse attempted to sweepingly claim all means of using electromagnetism to communicate intelligible characters at a distance.¹¹¹ The Supreme Court held that Morse's claim was drafted with language that was too general or abstract and that it was therefore a claim to a patent ineligible abstract idea.¹¹² In this guise, the exclusion of abstract ideas from patent eligibility does not enforce the knowledge/embodiment dichotomy because the dichotomy is not premised on a levels-of-abstraction analysis.¹¹³

In other contexts, a prohibition on patents on "ideas" or even "naked ideas" is in fact a prohibition on the patenting of inventions that are still "embryonic" or in an early stage of development.¹¹⁴ To this end, patent law's disclosure and utility doctrines "prevent[] mere ideas from being patented," but the meaning of this statement is that "the mere germ of an idea does not constitute enabling disclosure" and that "vague intimations of general ideas that may or may not be workable" cannot justify the issuance of patent.¹¹⁵ This prohibition on the patenting of naked or mere ideas does not enforce the knowledge/embodiment dichotomy, either. A patent on an early-stage, embryonic technology is likely expansive in that it encompasses many later-developing embodiment-advances that have not yet been

¹¹⁰ *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 112–20 (1853). *O'Reilly* does not use the term "abstract idea," but later cases routinely characterize the *O'Reilly* case as a case dealing with a claim to an abstract idea. *CLS Bank Int'l v. Alice Corp.*, 717 F.3d 1269, 1298–99 (Fed. Cir. 2013) (en banc).

¹¹¹ *O'Reilly*, 56 U.S. at 112.

¹¹² *Id.* at 112–17. Similarly, the Supreme Court's recent opinion in *Bilski v. Kappos*, 130 S. Ct. 3218, may also have used the exclusion of "abstract ideas" from patent eligible subject matter to perform a variant of a levels of generality analysis. Lemley et al., *supra* note 68, at 1336.

¹¹³ See *supra* Part II.C.

¹¹⁴ See Oren Bar-Gill & Gideon Parchomovsky, *A Marketplace for Ideas?*, 84 TEX. L. REV. 395, 396–97 (2005); Suzanne Scotchmer, *Ideas and Innovations: Which Should Be Subsidized?* 2 (Jan. 11, 2011), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1755091 ("The 'idea' is an investment opportunity The idea becomes an innovation if a firm invests in implementing it."). John Duffy argues that a claim to an abstract idea is prohibited because a claim to an invention that is so nascent or ill-formed cannot be described with precision. John F. Duffy, *Rules and Standards on the Forefront of Patentability*, 51 WM. & MARY L. REV. 609, 644–46 (2009).

¹¹⁵ *Janssen Pharmaceutica N.V. v. Teva Pharms. USA Inc.*, 583 F.3d 1317, 1324 (Fed. Cir. 2009) (quoting in part *Genentech, Inc. v. NovoNordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997)).

invented as of the date of filing, but it need not encompass any knowledge-advances at all.¹¹⁶

Like idea-talk, information-talk cuts both ways in contemporary patent discourse. Information is sometimes used as the label for the resource that is routinely claimed and privatized by all patents. For example, suits alleging infringement of run-of-the-mill patents are described as actions against those “who deliberately or inadvertently used patented information.”¹¹⁷ Here, “information” must be understood as shorthand for information-embedded goods.¹¹⁸ Inversely, the term “information” is also often used to designate what cannot be patented, and it is perhaps in discussions using information in this manner that contemporary patent discourse comes closest to express recognition of the knowledge/embodiment dichotomy.¹¹⁹ For an example of information-talk in this vein, consider the following: “patentable subject matter is limited by statute to any new and useful process, machine, manufacture, or composition of matter [which are] all generally understood to be distinct from data or information.”¹²⁰

Yet, even when the term “information” refers to what cannot be patented rather than what can be patented, it is a problematic term to use to mark the knowledge/embodiment dichotomy. The problem lies in the fact that some products intuitively seem to be nothing more than newly discovered information, but are nonetheless patent eligible embodiment-advances, not patent ineligible knowledge-advances. For example, one can readily think of an isolated DNA molecule as nothing more than information recorded in a tangible storage medium: it is the information required to produce a protein recorded in a sequence of nucleotides that can be deciphered using the genetic

¹¹⁶ A third meaning for a claim to an “abstract idea” is a claim to a mental process. *Cybersource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1371 (Fed. Cir. 2011) (reasoning that “an unpatentable mental process” is “a subcategory of unpatentable abstract ideas”). This branch of the abstract ideas exclusion does provide indirect *de facto* enforcement of a significant fragment of the knowledge/embodiment dichotomy. See *infra* Part V.A.2.

¹¹⁷ See Arti K. Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 NW. U. L. REV. 77, 134 (1999); see also WARD BOWMAN, JR., *PATENT AND ANTITRUST LAW: A LEGAL AND ECONOMIC APPRAISAL* 17 (1973) (positing that information is the subject matter of patent law).

¹¹⁸ See *supra* text accompanying notes 29–32.

¹¹⁹ In fact, the printed matter doctrine uses information-talk to provide indirect, *de facto* enforcement of a significant fragment of the knowledge/embodiment dichotomy. See *infra* Part V.A.3.

¹²⁰ Rebecca S. Eisenberg & Arti K. Rai, *Harnessing and Sharing the Benefits of State-Sponsored Research: Intellectual Property Rights and Data Sharing in California's Stem Cell Initiative*, 21 BERKELEY TECH. L.J. 1187, 1193 n.29 (2006).

code.¹²¹ Yet, DNA molecules are not extra-mental representations of newly discovered knowledge: they are embodiment-advances, not simply knowledge-advances.¹²² They are today patent eligible subject matter, and they should remain patent eligible under the knowledge/embodiment dichotomy.¹²³

Viewed through the lens of information theory, the term “information” is a problematic term to mark the knowledge/embodiment dichotomy because things can embody information in two distinct ways: some things *carry* information and other things *represent* that same information.¹²⁴ DNA carries information within biological systems and triggers behaviors through deterministic processes, just as many embodiments of inventions carry information to mechanical and electronic devices and trigger behaviors through deterministic processes.¹²⁵ There need not be a mind in the picture for DNA to have utility or “meaning” to an interpreting ribosome, so DNA encoding newly discovered information is an embodiment-advance. In contrast, extra-mental things that convey knowledge because they function as components of signs do not carry information. They represent information to an interpreting mind. A bit of knowledge is a

¹²¹ Rebecca S. Eisenberg, *Re-Examining the Role of Patents in Appropriating the Value of DNA Sequences*, 49 EMORY L.J. 783, 787–89 (2000); Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827, 836 (1999). The problem with information-talk as a way of describing the knowledge/embodiment dichotomy goes deeper than DNA. Some strains of information theory characterize all new embodiments of technology as nothing but information. Dan L. Burk, *The Problem of Process in Biotechnology*, 43 HOUS. L. REV. 561, 582–88 (2006) (outlining why the argument against patenting information may prove too much).

¹²² More accurately, DNA molecules are not *solely* extra-mental representations of knowledge. See Collins, *Semiotics 101*, *supra* note 14, at 1392, 1421–22 (discussing the both-and problem that exists when something both carries and represents information).

¹²³ As a descriptive matter, the patentability of DNA is not today undermined by its informational nature. Genomic DNA is patent ineligible because it is a product of nature, but complementary DNA is patent eligible despite its informational nature. *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2116–19 (2013).

¹²⁴ Jerry Fodor, *Information and Representation*, in INFORMATION, LANGUAGE, AND COGNITION 176–78 (Phillip P. Hanson ed., 1990). The distinction is robust: many scholars have relied on it, although they have used different terms to mark the distinction. Paul Grice has discussed the same distinction using the terms “natural” and “non-natural” meanings. H.P. Grice, *Meaning*, 66 PHIL. REV. 377, 377–78 (1957). Luciano Floridi marks the same distinction with the concepts of “environmental” and “semantic” information. Luciano Floridi, *Is Semantic Information Meaningful Data?*, 70 PHIL. & PHENOMENOLOGICAL RES. 351, 352–59 (2005).

¹²⁵ Collins, *Semiotics 101*, *supra* note 14, at 1391, 1421–22.

justified true belief—an entity that is difficult to fathom absent a mind and a human interpreter. Extra-mental representations of knowledge are meaningful only to the extent that a mind knows the social conventions which decode the meaning.¹²⁶ In sum, information-talk is a problematic rhetoric in which to couch the knowledge/embodiment dichotomy, unless one routinely notes the importance of the cumbersome distinction between those patent eligible things that carry new information and those patent ineligible things that represent information.

B. *Talk of Embodiments*

On the other side of the dichotomy, contemporary patent discourse routinely employs the term “embodiments” in a manner that reinforces the dichotomy: embodiments are the individual objects and processes that patent claims describe, that patent specifications disclose, and that infringers make, use, or sell.¹²⁷ However, the conventional usage of the term “embodiment” differs from its usage as a term of art in the knowledge/embodiment dichotomy in two significant ways.

First, in the conventional usage, there is no substantive limitation on the stuff that can be an embodiment. An embodiment is a semantically empty term that refers to any technology disclosed in a patent specification, described by a patent claim, or used by an infringer. Thus, a claim to a mental process of understanding a newly discovered fact would encompass embodiments in contemporary patent discourse. In contrast, under the knowledge/embodiment dichotomy, the whole point of discussing embodiment-advances is to highlight that knowledge-advances are not a class of embodiment-advances and that patent eligible subject matter excludes knowledge-advances. For example, a claim to understanding a newly discovered fact describes a new state of affairs in the world that has been created by an inventor, but it does not describe a new embodiment of a technology.

¹²⁶ For an in-depth discussion of the distinction between knowledge and information viewed through the lens of semiotics, see *id.* at 1417–27.

¹²⁷ See, e.g., *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) (en banc) (“[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments.”). Talk of both objects and processes as distinct types of embodiments is also well established. *E.g.*, 1 DONALD S. CHISUM, CHISUM ON PATENTS §§ 1.02, 1.03 (2012). This rhetoric maps directly onto Mitcham’s ontology of embodiments. See *supra* text accompanying notes 33–39.

Second, the term “embodiment” is today used in a static sense to refer to an instance of the stuff described by a patent claim. However, the critical concept in the knowledge/embodiment dichotomy is the dynamic concept of an embodiment-advance: any disclosed, claimed, or used technology that is novel in relation to the prior art solely because it represents newly created knowledge is not a new embodiment of a technology.¹²⁸ Under the knowledge/embodiment dichotomy, whether a claim describes an embodiment-advance is not an intrinsic property of the claimed stuff: one cannot determine whether a claim describes an embodiment-advance or a knowledge-advance until one understands the nature of the progress in relation to the prior art that is at issue. For example, a claim to a bottle of pills with a label that represents knowledge may or may not be a claim to an embodiment-advance. It depends on whether it is the chemical structure of the pills or the represented knowledge that is new in relation to the prior art.

IV. THE DICHOTOMY AND THE QUID PRO QUO OF DISCLOSURE THEORY

The knowledge/embodiment dichotomy does not exist *de dicto* in contemporary patent theory.¹²⁹ However, the limit on patent protection that it enforces is already baked into many judges’ and commentators’ descriptions of how the patent regime works in practice. The knowledge/embodiment dichotomy is an implicit assumption of the branch of disclosure theory that focuses on patent law’s quid pro quo and touts the social benefits of pre-expiration knowledge spillovers.

The Patent Act creates a “duality of claiming and disclosing.”¹³⁰ It not only grants inventors rights to exclude others from using claimed technologies, it also forces inventors to disclose knowledge about those claimed technologies to the public. Disclosure theory posits that disclosures are part of a quid pro quo between an inventor and the public.¹³¹ The inventor gets exclusive rights for a limited period of

¹²⁸ See *supra* Part II.B (discussing why the knowledge/embodiment dichotomy requires a point of novelty analysis).

¹²⁹ See *supra* Part III.

¹³⁰ Dinwoodie & Dreyfuss, *supra* note 5, at 193 n.4.

¹³¹ J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc., 534 U.S. 124, 142 (2001). Other strains of disclosure theory highlight three types of benefits of patent disclosures that are distinct from the public’s benefit under the quid pro quo. First, in addition to benefiting the non-patenting public, disclosures create private benefits for the patentee: they advertise the patentee’s invention, Roberto Mazzoleni & Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. ECON. ISSUES

time, and, in return, the public gets the benefit of access to the knowledge about the invention disclosed in the patent specification—knowledge that, absent the patent disclosure, might have remained secret.¹³² More specifically, the public gets two distinct types of benefits from patent disclosures. First, the disclosed knowledge leads to post-expiration enablement: it enables the public to make and use the claimed embodiments of the patented technology after the patent has expired.¹³³ Second, it benefits the public even during the patent's term: by making the disclosed knowledge immediately free for all to use *qua* knowledge, it generates pre-expiration “knowledge spillovers” of the patentee's exclusive rights.¹³⁴

Pre-expiration knowledge spillovers exist because, although the public is prohibited from using the disclosed knowledge in a particular

1031, 1039 (1998), and they offer a low-cost means for a firm to send credible signals to capital markets, Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 637, 643–55 (2002). Second, when they are considered in conjunction with the exclusive rights of a patent, disclosures create social benefits that are distinct from the public's benefit under the *quid pro quo*. They provide a solution to Arrow's information paradox, Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1489–90 (2005), and they facilitate the contractual exchange of technological knowledge, *id.* at 1489–504. Relatedly, they facilitate the coordinated, non-wasteful exploitation of patent “prospects” after a patent disclosure has been published. Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 275–80, 285–86 (1977). Third, disclosures also play an important role in the administration of patent claims: they improve public notice of claim scope and help courts to assess claim validity. *See Universal Oil Prods. Co. v. Globe Oil & Ref. Co.*, 322 U.S. 471, 484 (1944) (public notice); *see also* 35 U.S.C. § 112(a) (2012) (codifying the enablement and written description doctrines that curtail permissible claim scope).

¹³² Although courts routinely emphasize the value of patent disclosures to the public, whether patents actually disclose useful information and whether the value of the disclosure can, standing alone, justify patent rights are highly contested questions. Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 555–62 (2012) (summarizing these distinct debates over the social value of patent disclosures).

¹³³ *Grant v. Raymond*, 31 U.S. (6 Pet.) 218, 246–48 (1832).

¹³⁴ *See* Zvi Griliches, *The Search for R&D Spillovers*, 94 SCANDINAVIAN J. ECON. 29, 36 (1992). In the economic literature on innovation, the term “knowledge spillover” is often used broadly to discuss spillovers from research and development. Thus, the most important factors impacting research and development spillovers often “include industry practice with respect to job mobility of researchers and technical personnel (with their inside information), formal or informal communication between researchers, and technical espionage.” Vincenzo Denicolò & Luigi Alberto Franzoni, *Weak Intellectual Property Rights, Research Spillovers, and the Incentive to Innovate*, 14 AM. L. & ECON. REV. 111, 113 (2012). This Article uses the term “knowledge spillover” more narrowly to refer only to the spillovers of patent rights that are attributable to patent disclosures.

manner during the patent's term (that is, to make, use, sell, offer to sell, or import the claimed embodiments¹³⁵), patent law does not prevent the public from using the disclosed knowledge in any other way that it pleases, even if those uses are detrimental to the patentee's interests.¹³⁶ The free availability of the disclosed knowledge is a theme that resounds through patent commentary. From the moment a patent application is published, "the patent holder may not thereafter monitor or control access to" the knowledge represented in a patent specification.¹³⁷ "By requiring public disclosure of information about an invention while limiting the exclusive rights to the inventions defined in claims, patent law not only fails to protect information but actually pushes it into the public domain as a spillover."¹³⁸

The historical pedigree of the disclosure theory that focuses on post-expiration enablement is concededly more impressive than the historical pedigree of the disclosure theory that focuses on pre-expiration spillovers.¹³⁹ Nonetheless, pre-expiration knowledge spillovers today lie at the core of many unquestioned assumptions about how the patent regime works. The timing of the patentee's obligation to disclose knowledge—that is, the free accessibility of the disclosure from the moment of publication and during the patent

¹³⁵ 35 U.S.C. § 271(a) (2012).

¹³⁶ The only possible exception to this rule under contemporary patent law is secondary liability for inducement. See *infra* note 159.

¹³⁷ Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1022 (1989) [hereinafter *Patents and the Progress of Science*]; see also Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 101 ("[T]he disclosure requirements are intended to benefit the public interest in faster-paced follow-on innovation by privileging the [public] 'use' of a patented inventive idea . . . during the patent term. No license or authorization is required for this activity.").

¹³⁸ Eisenberg & Rai, *supra* note 120, at 1194–95.

¹³⁹ The value of post-expiration enablement was already recognized in *Liardet v. Johnson*, an eighteenth century English opinion that is widely credited with creating patent law's quid pro quo and the modern enablement doctrine. Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 3)*, 77 J. PAT. & TRADEMARK OFF. SOC'Y 771, 796–97 (1995). Patent theory addressing pre-expiration knowledge spillovers dates back at least to the mid-twentieth century. See John C. Stedman, *Invention and Public Policy*, 12 LAW & CONTEMP. PROBS. 649, 666 (1947); SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS OF THE S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 25 n.135 (Comm. Print 1958) (prepared by Fritz Machlup). Hints at the value of pre-expiration spillovers date back to at least the late nineteenth century. 1 WILLIAM C. ROBINSON, LAW OF PATENTS FOR USEFUL INVENTIONS 52 (Boston, Little, Brown, & Co. 1890) (noting that a patent "secures to the public an immediate knowledge of the character and scope of the invention").

term—supports the assumption that the patent applicant must tolerate pre-expiration knowledge spillovers.¹⁴⁰ But for pre-expiration knowledge spillovers, disclosures would not generate “additions to the general store of knowledge [that] stimulate ideas and the eventual development of further significant advances in the art” before the expiration of a patent.¹⁴¹ Pre-expiration knowledge spillovers are the sole reason why “on issuance . . . the patent [disclosure] immediately increases the storehouse of public information available for further research and innovation”¹⁴² They are the reason why “the patent disclosure alone may sometimes benefit subsequent researchers even if they are unable to use the [patented] invention” and why “the disclosure of a patented invention might suggest to a subsequent researcher an experiment that could be performed without infringing the patent claims.”¹⁴³ But for the existence of pre-expiration knowledge spillovers, the incentive for the public to undertake the innovative activity required to design around patent claims that courts often cite as a social benefit of patent protection would not exist.¹⁴⁴ Competitors can design around patent claims only because they can use the knowledge created by the patentee and represented in the patent disclosure during the term of the patent. They can design around only because the disclosure “provides all of the patentee’s competitors with an opportunity to study the new invention” and “be educated” so that they can “take up the challenge of finding the next breakthrough invention.”¹⁴⁵ Similarly, they can improve upon a

¹⁴⁰ Eisenberg, *Patents and the Progress of Science*, *supra* note 137, at 1022 (“If the public had absolutely no right to use the disclosure without the patent holder’s consent until after the patent expired, it would make little sense to require that the disclosure be made freely available to the public at the outset of the patent term.”).

¹⁴¹ See *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 481 (1974). *But cf. supra* text accompanying notes 91–101 (noting that the Supreme Court uses the term “knowledge” in an imprecise manner in its patent opinions).

¹⁴² 3 CHISUM, *supra* note 127, § 7.01; see also Timothy R. Holbrook, *Possession in Patent Law*, 125 SMU L. REV. 123, 133 (2006) (“[T]he disclosure in the patent is . . . designed . . . to enrich the state of the art contemporaneously with the invention.”).

¹⁴³ Eisenberg, *Patents and the Progress of Science*, *supra* note 137, at 1071 & n.219; see also Eisenberg & Rai, *supra* note 120, at 1195 (“A reader . . . who uses the disclosed information to problem-solve and devise a new spring-loaded device falling outside the scope of the mousetrap patent claims would not be liable, though the patent disclosure may have been invaluable to the reader in solving his problem.”).

¹⁴⁴ *Intel Corp. v. VIA Techs., Inc.*, 319 F.3d 1357, 1367 (Fed. Cir. 2003); WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW* 295 (2003); Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 805.

¹⁴⁵ William A. Drennan, *Changing Invention Economics by Encouraging Corporate Inventors to Sell Patents*, 58 U. MIAMI L. REV. 1045, 1074 n.115 (2004). In other words,

patented technology during the patent's term, and obtain a blocking improvement patent, only if they can use the knowledge disclosed in a patent in the process.¹⁴⁶ In sum, it is because of pre-expiration knowledge spillovers that disclosures “stimulate others to design around the invention or conceive of new inventions—either by improving upon the invention or by being inspired by it—even during the patent term.”¹⁴⁷

Given the choice, patentees would opt to plug up pre-expiration knowledge spillovers. Knowledge spillovers bestow a positive externality on a patentee's competitors that the patentee would prefer not to provide.¹⁴⁸ This positive externality explains why disclosures are not in an inventor's self-interest. It explains why they are a “price” that “is *exacted from*” patentees in return for patent protection—a price that patentees would prefer not to pay, if they had the choice.¹⁴⁹ Inversely, “[t]he requirement of public disclosure creates a situation of *incomplete appropriability* by the patent holder” when the patent holder would prefer complete appropriability.¹⁵⁰ The best way for an enterprising patent applicant to plug up pre-expiration knowledge spillovers would be to draft claims to knowledge-advances that read on the propositional knowledge disclosed by the disclosure.¹⁵¹ The bulk of the value of a disclosure to the public lies in the propositional knowledge that it conveys.¹⁵² If an inventor could violate the knowledge/embodiment dichotomy and claim mental and extra-mental representations of newly discovered facts,¹⁵³ he could claw back exclusive rights to the very resource that his disclosure

pre-expiration knowledge spillovers explain why the disclosure provides a “roadmap for inventing around.” Beckerman-Rodau, *supra* note 105, at 20–21.

¹⁴⁶ See Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1008–10 (1997).

¹⁴⁷ Jeanne C. Frommer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548–49 (2009). In the same vein, pre-expiration knowledge spillovers enable patents to “accelerate the process of cumulative innovations because they . . . allow[] everyone in the field to build upon one another's work continually.” Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2010 (2005).

¹⁴⁸ See Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 267 (1994); Suzanne Scotchmer & Jerry Green, *Novelty and Disclosure in Patent Law*, 21 RAND J. ECON. 131, 132 (1990).

¹⁴⁹ *Eldred v. Ashcroft*, 537 U.S. 186, 216 (2003).

¹⁵⁰ LANDES & POSNER, *supra* note 144, at 298–99.

¹⁵¹ Patent law already expressly forbids any copyright that exists in patent disclosures from affecting the dissemination of the patent document itself. 37 C.F.R. § 1.71(e) (2013).

¹⁵² See *supra* text accompanying notes 24–27.

¹⁵³ See *supra* text accompanying notes 55–65.

obligation in theory requires him to make available for public use even during the term of the patent. In other words, the knowledge/embodiment dichotomy is simply the negative corollary of the patentee's disclosure obligations. But for the knowledge/embodiment dichotomy, the patentee could shirk his disclosure obligation and plug up the pre-expiration knowledge spillovers of his claims. He could opt out of his disclosure obligation and privatize the very resource that disclosure theory presumes he will publicize.

In his well-known patent treatise, Peter Rosenberg set up patent law's duality of disclosures and claims in the following manner:

In the case of a patent, the specification, upon the issuance of the letters patent, becomes a matter of public record. Immediately thereafter anyone is free to think and to write about what is covered by the patent without trespassing upon the exclusive right of the patentee. However, none but the patentee or his licensees may lawfully embody what is covered by that patent, as by constructing the claimed device or by carrying out the steps of the claimed process.¹⁵⁴

Rosenberg assumes that the public's right to "think and write about what is covered by the patent" can coexist with the patentee's right to exclude others from "what is covered in the patent."¹⁵⁵ However, the only way that these two rights can exist side by side without conflict is if courts enforce the knowledge/embodiment dichotomy. There must be a legal doctrine that prevents patent applicants from drafting claims that recite thinking and writing about what is covered by the patent at their points of novelty.¹⁵⁶

¹⁵⁴ ROSENBERG, *supra* note 42, at 10.

¹⁵⁵ *See id.*

¹⁵⁶ This Article does not mount a normative defense of the knowledge/embodiment dichotomy or of using it to mandate the existence of pre-expiration knowledge spillovers. *See supra* note 14. Nonetheless, it is important to point out that in most situations, pre-expiration knowledge spillovers are just that—spillovers. They reduce inventors' incentives to innovate, but they do not eliminate them. They are a widely acknowledged and uncontroversial feature of the contemporary patent regime. Inventors continue to have incentives to produce new knowledge because that knowledge production frequently makes their patentable embodiments technologically viable or economically more valuable.

V. DE FACTO DOCTRINAL ENFORCEMENT OF THE DICHOTOMY

The knowledge/embodiment dichotomy does not exist *de dicto* in patent doctrine or theory,¹⁵⁷ but it does exist in a rough form as a *de facto* limit on what can today be patented. Setting aside short-term deviations, the PTO and the courts regularly invalidate claims to knowledge-advances.¹⁵⁸ This Part identifies the two mechanisms through which the PTO and the courts use invalidity doctrines to enforce a limitation on the reach of patent protection that is not openly acknowledged in patent doctrine: fragmentary, indirect policing and doctrinal contortions.¹⁵⁹

A. Fragmentary, Indirect Policing

Several extant patent doctrines police isolated fragments of the border between what can and cannot be patented under the

¹⁵⁷ See *supra* Part III.

¹⁵⁸ “Short-term” is obviously a fudge factor. For example, the PTO had routinely issued claims to medical diagnostics that ran afoul of the knowledge/embodiment dichotomy in the years immediately prior to the Supreme Court’s opinion in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 132 S. Ct. 1289 (2012).

¹⁵⁹ One possible exception to the descriptive argument that the contemporary patent regime already provides effective, *de facto* enforcement of the knowledge/embodiment dichotomy may be the law of active inducement. Active inducement occurs if “the inducer ‘cause[s], urge[s], encourage[s], or aid[s]’ the infringing conduct and . . . the induced conduct is carried out.” *Akamai Techs., Inc. v. Limelight Networks, Inc.*, 692 F.3d 1301, 1308 (Fed. Cir. 2012) (en banc) (quoting *Arris Grp., Inc. v. British Telecomms. PLC*, 639 F.3d 1368, 1379 n.13 (Fed. Cir. 2011)). Active inducement requires “an affirmative act of some kind,” and cannot be performed through inaction. *Tegal Corp. v. Tokyo Electron Co.*, 248 F.3d 1376, 1378–79 (Fed. Cir. 2001). One line of inducement cases holds that the dissemination of knowledge about a patented product or method standing alone cannot be an affirmative act that supports inducement, even when the publisher receives a financial benefit from the dissemination. 5 CHISUM, *supra* note 127, § 17.04[g] (“Publication of information about a patented product or method does not constitute active inducement unless accompanied by other activity, such as sale of material capable of an infringing use.”). These cases suggest that inducement respects the knowledge/embodiment dichotomy and that patent owners cannot use inducement to leverage claims to embodiment-advances into rights against individuals who only use their knowledge-advances. However, older inducement cases suggest that one can induce infringement merely by providing instructions or plans about how to infringe. See, e.g., *Toppan v. Tiffany Refrigerator Car Co.*, 39 F. 420, 421 (C.C.N.D. Ill. 1889) (finding that a company induced infringement when it provided instructions on how to recreate a firm’s patented rail car design). Instructions and plans are nothing but extra-mental representations of knowledge, so these cases suggest that patent owners can sometimes use inducement to leverage claims to embodiment-advances into rights against individuals who only use knowledge-advances.

knowledge/embodiment dichotomy. These doctrines are not conventionally considered as a family of related doctrines. Rather, they are usually addressed within distinct analytical and statutory silos. Nor do their black-letter formulations purport to play any role in enforcing the knowledge/embodiment dichotomy. Yet, this is exactly what they do, albeit in an indirect manner. Because knowledge-advances can take the form of both new mental representations and new extramental representations,¹⁶⁰ it should not be surprising that extant doctrinal restrictions on claims to both mental processes and extramental texts that are intelligible to the human mind do the bulk of the indirect policing.

1. Inherency

The inherency doctrine limits the patent protection that an inventor can obtain upon the discovery of a previously unknown fact about the world and thus upon the creation of new knowledge. More specifically, claims lack novelty even if they employ newly created knowledge to describe pre-existing stuff in a new way.¹⁶¹ For example, when a researcher discovers that an already-known metal alloy is unusually resistant to corrosion, he has created new knowledge. He may use that knowledge to attempt to claim the alloy by reciting its constituent metals and adding the limitation “said alloy being characterized by good corrosion resistance.”¹⁶² In a parallel example, assume that a researcher discovers that the consumption of a known medicine that is already sometimes taken with food has a surprisingly significant increase in bioavailability when it is consumed with food. The researcher may attempt to claim a method for increasing “the rate and extent of absorption” of the drug that consists of “administering [the drug] to the patient . . . with food.”¹⁶³ In both examples, the researcher has discovered a previously unknown fact and generated

¹⁶⁰ See *supra* Part II.B.

¹⁶¹ See *Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1375–76 (Fed. Cir. 2005) (“[A] prior art reference without express reference to a claim limitation may nonetheless anticipate by inherency.”); *Atlas Powder Co. v. IRECO Inc.*, 190 F.3d 1342, 1348 (Fed. Cir. 1999) (“The public remains free to make, use, or sell prior art compositions or processes, regardless of whether or not they understand their complete makeup or the underlying scientific principles which allow them to operate.”).

¹⁶² Cf. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 776–77 (Fed. Cir. 1985) (detailing an attempt to patent an alloy based on the discovery of a new property of the alloy).

¹⁶³ Cf. *King Pharm., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1270–71 (Fed. Cir. 2010) (describing an attempt to patent the process of taking a known drug with food).

new propositional knowledge. In neither example, however, has the researcher claimed new stuff. The inherency doctrine therefore invalidates the claims for lack of novelty: the newly discovered properties are recognized as being inherently present in the prior art even if humankind had no knowledge of those properties until the inventor created that knowledge.

However, there is an easy way for a patent applicant who has discovered new knowledge to circumvent the inherency doctrine: she can recite the new knowledge as a limitation on claim scope. The discovery of a pre-existing fact creates new knowledge, so a claim reciting that knowledge as a limitation is novel in light of the prior art.¹⁶⁴ Continuing the hypotheticals above, claims with limitations such as “understanding that the alloy has good corrosion resistance,” “telling a patient that consuming a drug with food increases bioavailability,” or “a text representing to a human reader that consuming a drug with food increases bioavailability” do not describe pre-existing stuff, and the inherency doctrine does not invalidate them. When claims recite knowledge limitations, there are two other patent doctrines that, working in concert, provide imperfect *de facto* enforcement of the knowledge/embodiment dichotomy: the exclusion of mental processes from patent eligible matter and the printed matter doctrine.¹⁶⁵ The following two sections address each of these two limitations on patent validity, in turn.

2. The Mental Process Exclusion

The Supreme Court has held that mental processes are not patent eligible subject matter under Section 101.¹⁶⁶ The mental process exclusion is an essential component in the contemporary patent regime’s fragmentary, *de facto* enforcement of the knowledge/embodiment dichotomy. Mental representations are clearly mental processes (or mental states), so the prohibition on mental process

¹⁶⁴ See *supra* text accompanying notes 48–52.

¹⁶⁵ It is the gaps in between these two doctrines that require the PTO and the courts to engage in doctrinal contortions in order to enforce the knowledge/embodiment dichotomy. See *infra* Part V.B.

¹⁶⁶ See *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1293 (2012); *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124, 127, 134 (2006) (Breyer, J., dissenting from the dismissal of certiorari as improvidently granted); *Parker v. Flook*, 437 U.S. 584, 589 (1978); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972). In some cases, courts assume that the mental process exclusion is subsumed within the abstract ideas exclusion. *In re Comiskey*, 554 F.3d 967, 978–80 (Fed. Cir. 2009).

patents invalidates some of the most direct claims to knowledge-advances.¹⁶⁷ For example, a patent applicant cannot simply claim a knowledge-advance in the form of a method claim to “understanding that a previously known alloy has good corrosion resistance” because the claim describes a mental process.

However, the contemporary mental process exclusion does not weed all claims to newly created mental representations out of the patent regime. It is under-exclusive: it sanctions some claims that violate the knowledge/embodiment dichotomy.¹⁶⁸ The Supreme Court has never expressly discussed the conditions under which a claim that recites a mental process limitation is ineligible for patent protection, so the Federal Circuit has, to date, been responsible for sculpting the contours of the mental process exclusion. According to the Federal Circuit, the mental process exclusion employs a strict claim-as-a-whole analysis, not a point of novelty analysis, so it only invalidates

¹⁶⁷ See *supra* text accompanying notes 57–61 (noting that claims to knowledge-advances may describe newly created mental representations). Mental representation claims resemble software claims in that they can easily be drafted as either process claims (describing the understanding of a fact as a process) or object claims (describing a mental representation as a state of affairs in the mind of a thinker). The mental process exclusion presumptively applies with equal force to both mental processes and mental states.

¹⁶⁸ Although it is not directly relevant to the thesis at hand—namely that contemporary patent doctrine provides indirect *de facto* enforcement of fragments of the knowledge/embodiment dichotomy—the mental process exclusion is also over-exclusive in at least two respects when compared to the exclusion needed to enforce the knowledge/embodiment dichotomy.

First, the knowledge/embodiment dichotomy focuses narrowly on preventing newly created mental representations at a claim’s point of novelty. There are many mental processes that are novel for reasons other than their inclusion of a novel mental representation. For example, a mental process claim might describe a more efficient algorithm for performing a mental calculation. There may be a sound normative justification for excluding this type of mental process claim from the patent regime, but the knowledge/embodiment dichotomy does not mandate its exclusion.

Second, the Federal Circuit sometimes sweeps processes that in fact cannot be performed entirely by the mind into the mental process category. For example, in *In re Comiskey*, it held that the step of “enrolling a person . . . in a mandatory arbitration system” was a purely mental process. 554 F.3d at 970 n.1, 980. Absent paranormal abilities, this is not a process that can be performed by the mind alone. Similarly, the Federal Circuit has invalidated some software claims because the claimed computer-executed processes are analogous to mental processes that occur in human minds. *Cybersource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1371–73 (Fed. Cir. 2011) (labeling a process claim to be performed over the internet as a claim to an unpatentable mental process). In both cases, the Federal Circuit was less than literal about what constitutes a mental process in order to shoehorn claims that it found to be objectionable into the well-established mental process exclusion.

claims that are performed entirely within the mind.¹⁶⁹ The knowledge/embodiment dichotomy makes patent eligibility contingent on the nature of the advance over the prior art at issue,¹⁷⁰ so the absence of a point of novelty analysis in the mental process exclusion leaves a gap in the exclusion's ability to police the knowledge/embodiment dichotomy.¹⁷¹

The mental process exclusion was not always under-exclusive; it has not always left this gap. Throughout the 1950s and 1960s, the court that was the Federal Circuit's predecessor in hearing appeals from the PTO used the mental steps doctrine to invalidate any claim in which the point of novelty resided in a mental process.¹⁷² However, the mental steps doctrine was overruled forty years ago in dicta in a series of opinions that paved the way for the patentability of computer software.¹⁷³ The Federal Circuit has shown no interest in reviving the mental steps doctrine, and the Supreme Court has not been asked to do so.

3. The Printed Matter Doctrine

The mental process exclusion cannot stand in the way of any claim that violates the knowledge/embodiment dichotomy because it has a limitation reciting knowledge in the form of an extra-mental representation.¹⁷⁴ For *de facto* enforcement of the knowledge/embodiment with respect to such claim, contemporary patent law calls

¹⁶⁹ *In re Bilski*, 545 F.3d 943, 958, 961 n.26 (Fed. Cir. 2008) (en banc), *aff'd on other grounds*, *Bilski v. Kappos*, 130 S. Ct. 3218 (2010); see *Ass'n for Mol. Pathology v. Myriad Genetics, Inc.*, 689 F.3d 1303, 1333–37 (Fed. Cir. 2012), *rev'd on other grounds*, 133 S. Ct. 2107 (2013). *But cf. supra* note 77 (addressing fudge factors that can be used to invalidate some claims that recite both mental and extra-mental conduct under a claim-as-a-whole approach to the mental process exclusion).

¹⁷⁰ See *supra* Part II.B.

¹⁷¹ This is the gap that the Supreme Court filled with its doctrinal contortion in *Mayo*. See *infra* Part V.B.1.

¹⁷² See *In re Abrams*, 188 F.2d 165, 166–70 (C.C.P.A. 1951); Katharine P. Ambrose, *The Mental Steps Doctrine*, 48 TENN. L. REV. 903, 903, 908–13 (1981); Warren T. Jessup, *Patentability of Mental Processes*, 40 J. PAT. OFF. SOC'Y 482, 482 (1958).

¹⁷³ See Kevin Emerson Collins, *Prometheus Laboratories, Mental Steps, and Printed Matter*, 50 HOUS. L. REV. 391, 411–20 (2012) [hereinafter *Mental Steps & Printed Matter*]; Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1032–48 (1990).

¹⁷⁴ *Cf. supra* text accompanying notes 62–65 (noting that some claims to knowledge-advances describe extra-mental, rather than mental, representations).

on the printed matter doctrine.¹⁷⁵ The contemporary printed matter doctrine holds that “information recorded in any substrate or medium” cannot be patented when it is the “content” of the information that differentiates the claim from the prior art.¹⁷⁶ The printed matter doctrine is well-tailored to the job of enforcing the knowledge/embodiment dichotomy for four reasons. First, it focuses solely on information that is intelligible to a human interpreter. Second, it employs a point of novelty analysis. Third, courts have not hesitated to expand the doctrine to deal with human-intelligible information in a wide array of different manifestations. And, fourth, the printed matter doctrine has a cooperative-relation exception that prevents it from creating an exclusion from patent eligibility that is radically over-exclusive with respect to the exclusion required by the knowledge/embodiment dichotomy.¹⁷⁷

The Federal Circuit has held that the printed matter doctrine only governs the patentability of information that is “useful and intelligible only to the human mind.”¹⁷⁸ The focus on human-intelligible information tailors the printed matter doctrine to the knowledge/embodiment dichotomy. Using information-talk in the doctrine that enforces the dichotomy is not ideal because only signs

¹⁷⁵ The printed matter doctrine is often described as a doctrine that serves a channeling function. It channels expressive subject matter that should be protected (or not) by copyright out of the patent regime and into the copyright regime to avoid creating a mutant species of copyright law. See *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”). When the excluded subject matter is artistic expression like a song or a novel, the printed matter doctrine does serve a channeling function. However, when the excluded subject matter is a text that represents newly created factual knowledge, it does not. Newly discovered facts and newly created knowledge are subject matters that are not protected by either copyright law or patent law. See *supra* text accompanying note 89. The point is not to channel them into another regime with doctrines that are better suited for addressing their patentability but rather to categorically deny them any type of protection.

¹⁷⁶ 1 CHISUM, *supra* note 127, § 1.02[4]. The printed matter doctrine is today viewed as a facet of both the Section 101 doctrine of patent eligibility and the Section 102 and 103 doctrines that require distinction from the prior art, but the substance of the doctrine is identical regardless of the doctrine’s statutory locus. Collins, *Semiotics 101*, *supra* note 14, at 1402–03.

¹⁷⁷ However, the printed matter doctrine does not provide complete enforcement of the knowledge/embodiment dichotomy when claims recite extra-mental representations as limitations. The PTO has had to creatively distort the printed matter doctrine to enforce the dichotomy in the context of *Beauregard* or software-on-disk claims. See *infra* Part V.B.2.

¹⁷⁸ *In re Lowry*, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re Bernhart*, 417 F.2d 1395, 1399 (C.C.P.A. 1969)).

that represent information, not objects that carry information, are problematic under the dichotomy.¹⁷⁹ The focus on human-intelligible information offers a rough-cut resolution of this problem because it limits the patent-invalidating effect of the printed matter doctrine to situations in which the human mind—and thus signs—are present.¹⁸⁰

The printed matter doctrine has a long and convoluted history that spans the entire twentieth century,¹⁸¹ but it had already adopted the point of novelty analysis by the early-to-mid-1900s: it invalidated a printed-matter claim only if “the substance or language of that which is printed” was the locus of the advance over the prior art.¹⁸² Furthermore, unlike the mental process exclusion that shed its point of novelty analysis in the 1960s and 1970s,¹⁸³ the contemporary printed matter doctrine continues to use a point of novelty analysis today. For example, in *In re Ngai*, an inventor discovered a new use for an existing set of chemicals, and he sought a kit claim to the old chemicals in combination with written instructions on how to use the chemicals in the new manner.¹⁸⁴ The Federal Circuit relied on the printed matter doctrine to invalidate the claim for lack of novelty: only the content of the printed matter distinguished the claim from the prior art, and any advance in that content could not be considered in assessing whether the claim was novel.¹⁸⁵ This point of novelty analysis allows courts to pay attention to the nature of the

¹⁷⁹ See *supra* text accompanying notes 124–126.

¹⁸⁰ The notion that the printed matter doctrine focuses exclusively on information that is intelligible *only* to the human mind is under-inclusive. The printed matter doctrine also applies to information that is initially “intelligible” only to a machine but that causes the machine to produce information that is intelligible to a human mind. See Collins, *Semiotics 101*, *supra* note 14, at 1423–24. Under limited circumstances, it may also apply to information that is meaningful to both machines and humans. *Id.* at 1422 n.233.

¹⁸¹ There is no single, coherent narrative arc to describe the doctrine’s historical evolution. See generally 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. *Bilski v. Kappos*, 130 S. Ct. 3218, 3228–29 (2010).

¹⁸² *In re Sterling*, 70 F.2d 910, 912 (C.C.P.A. 1934).

¹⁸³ See *supra* text accompanying note 173.

¹⁸⁴ *In re Ngai*, 367 F.3d 1336, 1337–38 (Fed. Cir. 2004).

¹⁸⁵ *Id.*; see also *King Pharm., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1279–80 (Fed. Cir. 2010) (invalidating a claim to a known drug with a new printed label); *AstraZeneca LP v. Apotex, Inc.*, 623 F. Supp. 2d 579, 588–92 (D.N.J. 2009) (invalidating kit claims to a known chemical with new printed instructions), *aff’d*, 633 F.3d 1042 (Fed. Cir. 2010).

technological advance at issue and adopt the dynamic view of technological progress that is required to police the knowledge/embodiment dichotomy.¹⁸⁶

The printed matter doctrine also provides effective *de facto* enforcement of the knowledge/embodiment dichotomy in the sense that it is technologically neutral. It originated as a doctrine that dealt with a particular type of technology for conveying extra-mental representations, namely printing. As technology progressed through the late twentieth century, however, courts generalized the printed matter doctrine into a technology-neutral rule under which claims to “information recorded in any substrate or medium” cannot be patented when it is the “content” of the information that differentiates the claim from the prior art.¹⁸⁷ This broadening of the printed matter doctrine recognized that, for example, a recording of a book on a magnetic tape is no different in principle than the same book in the form of stack of printed paper.¹⁸⁸ Yet more recently, the Federal Circuit extended the printed matter doctrine to spoken matter, implicitly treating sound waves (i.e., the varying density of air molecules) as a medium in which the information can be conveyed.¹⁸⁹ This technological neutrality in theory allows the courts to enforce the knowledge/embodiment dichotomy regardless of the medium in which an extra-mental representation is crafted.

Finally, the long-standing cooperative-relation exception to the printed matter doctrine ensures that the doctrine is not radically over-exclusive with respect to the knowledge/embodiment dichotomy. This exception holds that the content of printed matter can be considered to determine whether a claimed technology embodies a patent eligible advance over the prior art if the printed matter has a cooperative relationship with the underlying substrate. Older cases focused on a “cooperative relationship between the printed indicia and the structural features” of the substrate like the relationship between a paper ticket that will be torn in certain directions and the position of the writing on the ticket.¹⁹⁰ The new spatial arrangements of the printed matter on these paper tickets enabled the tickets to be torn or

¹⁸⁶ See *supra* Part II.B.

¹⁸⁷ 1 CHISUM, *supra* note 127, § 1.02[4].

¹⁸⁸ Cf. *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).

¹⁸⁹ See *King Pharm.*, 616 F.3d at 1277–79; see also *In re Huai-Hung Kao*, 639 F.3d 1057, 1064, 1072–74 (Fed. Cir. 2011) (affirming the PTO’s rejection of a claim to informing a patient before treating him with medicine).

¹⁹⁰ *Flood v. Coe*, 31 F. Supp. 348, 349 (D.D.C. 1940).

punched in ways that were not previously possible, allowing ticket-takers to divide up or obliterate the bits of printed matter on the tickets more easily than was possible in the prior art.¹⁹¹ In more recent cases, the cooperative-relation exception has morphed into a functional-relation exception: the content of printed matter can be considered when identifying a patent eligible advance over the prior art if the content of the printed matter has a functional relationship to the underlying substrate.¹⁹² For example, a claim to a circular band with a series of printed numbers that had no beginning or end could rely on the content of the printed matter to demonstrate a distinction from the prior art because the looping nature of the substrate (the band) and the looping content of the printed matter (the numbers) displayed a functional relationship.¹⁹³ The patent claims in which there is a cooperative relationship between the content of the printed matter and the substrate do not run afoul of the knowledge/embodiment dichotomy. They describe new ways of conveying known knowledge, so they are patentable embodiment-advances, not unpatentable knowledge-advances.

B. Doctrinal Contortions

Inherency, the mental process exclusion, and the printed matter doctrine provide indirect, *de facto* enforcement of fragments of the knowledge/embodiment dichotomy.¹⁹⁴ However, there are gaps in between the fragments. To enforce the knowledge/embodiment dichotomy in these gaps without *de dicto* recognition of the dichotomy, the PTO and the courts resort to more creative measures. They take the resources that they have at hand—namely patent doctrines that are usually used to perform other tasks—and they distort them in whatever logic-defying manner is necessary to invalidate patent ineligible claims to knowledge-advances.¹⁹⁵ This

¹⁹¹ For an overview of these ticket-tearing cases, see Collins, *Semiotics 101*, *supra* note 14, at 1393–94.

¹⁹² *Id.* at 1394–95.

¹⁹³ *In re Gulack*, 703 F.2d 1381, 1386–87 (Fed. Cir. 1983); *see also In re Miller*, 418 F.2d 1392, 1393–95 (C.C.P.A. 1969) (upholding claims for measuring spoons with false textual indications of the spoons' sizes that facilitated reducing or enlarging recipes).

¹⁹⁴ *See supra* Part V.A.

¹⁹⁵ With respect to judicial motivation, the argument is not that judges act strategically or that they intentionally engage in subterfuge to enforce the dichotomy as a *de facto* matter without recognizing it *de dicto*. Rather, the more plausible argument is that judges do the best they can in the circumstances in which they find themselves. Perhaps the knowledge/embodiment dichotomy is so fundamental to the

section identifies two of these doctrinal contortions. Section V.B.1 examines the Supreme Court's recent opinion in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*¹⁹⁶ Here, the Court takes a doctrine that conventionally prevents the patent regime from intruding into the realm of nature and twists it into a logical knot in order to invalidate a claim to a knowledge-advance. Section V.B.2 considers the PTO's distinction between functional and nonfunctional descriptive material in software-on-disk claims.¹⁹⁷ Here, the PTO fabricates a factual distinction that does not actually exist in order to use the cooperative-relation exception to printed matter doctrine to uphold claims to embodiment-advances and invalidate claims to knowledge-advances.

Because the knowledge/embodiment dichotomy does not exist *de dicto* in patent opinions, treatises, or scholarship, it is difficult to prove the descriptive thesis that the dichotomy already exists as a *de facto* limit on what can be patented. One cannot just point to the language of patent discourse and say "There it is!" The doctrinal contortions, therefore, provide perhaps the strongest support possible for this descriptive thesis. The absurdity of the express reasoning in these doctrinal-contortion cases demonstrates that courts are not being transparent in their reasoning. They are not simply meaning what they say or saying what they mean. Much as the best evidence of the existence of a black hole lies in the distortionary effects that the black hole has on the space that surrounds it,¹⁹⁸ some of the best evidence of the *de facto* existence of the knowledge/embodiment dichotomy in contemporary patent law lies in doctrinal distortions that plug the gaps in between the doctrines that enforce the dichotomy in a fragmentary, indirect manner.

1. *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*

On its rhetorical surface, the Supreme Court's opinion in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.* addresses the exclusion of "natural laws" or "laws of nature" from patent eligible

contemporary patent regime that judges intuit the need to enforce it. Absent a vocabulary and conceptual framework for articulating the dichotomy, judges simply do the best that they can with the tools at hand: they contort patent doctrine that is usually tasked with serving other goals to enforce the dichotomy.

¹⁹⁶ 132 S. Ct. 1289 (2012).

¹⁹⁷ See Examination Guidelines for Computer-Related Inventions, 61 Fed. Reg. 7478, 7481-82 (Feb. 28, 1996).

¹⁹⁸ See Letter from John Michell to Henry Cavendish (May 26, 1783), reprinted in 74 PHIL. TRANS. ROYAL SOC. LONDON 35, 50 (1784).

subject matter.¹⁹⁹ If it were to be taken at face value and interpreted so as to prevent the patent regime from intruding too far into the realm of the natural, *Mayo* would lead to absurd results. It would invalidate vast swaths of patent protection in the life sciences and beyond that are neither descriptively nor normatively controversial.²⁰⁰ However, once reconceptualized as a case that invalidates a claim to a knowledge-advance and that protects the mind, not nature, from the privatizing incursion of a patent claim, *Mayo* makes perfect sense. Underneath its “natural laws” rhetoric, *Mayo* is a textbook application of the knowledge/embodiment dichotomy. *Mayo* distorts the doctrine that excludes “natural laws” from patent eligibility in order to fill a gap in patent law’s indirect, *de facto* enforcement of the knowledge/embodiment dichotomy.²⁰¹

The *Mayo* claims describe a medical diagnostic method that is enabled by the discovery of previously unknown correlations.²⁰² The method allows a doctor to determine whether and how to adjust the dosage of thiopurine drugs taken by patients who have an autoimmune disease. Upon ingestion of a thiopurine drug, a patient’s body breaks the drug down into metabolites. The patent arose from research that quantified the correlation between a patient’s metabolite levels and her likely clinical outcome: a metabolite level below a newly discovered lower threshold leads to concerns that the drug will be ineffective and a level above a newly discovered upper threshold leads to concerns about toxicity and adverse side effects. Based on this discovery, the researchers applied for, and received, a patent containing the following representative claim:

A method of optimizing therapeutic efficacy for treatment of an [autoimmune] disorder, comprising:

(a) administering a [thiopurine] drug . . . to a subject having said . . . disorder; and

¹⁹⁹ The Supreme Court’s gloss on Section 101 that expressly carves out “laws of nature” from patent eligible subject matter is well established. See *Bilski v. Kappos*, 130 S. Ct. 3218, 3225 (2010); *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980). “Laws of nature” and “natural laws” appear in quotes in this Article because they are patent law terms of art and the author is unsure of what they mean beyond the context of *Mayo*.

²⁰⁰ See *infra* text accompanying notes 222–232.

²⁰¹ The Federal Circuit created the gap that *Mayo* fills by abandoning the mental steps doctrine and its point of novelty analysis as a means of enforcing the Section 101 mental process exclusion. See *supra* notes 172–173.

²⁰² The facts in this paragraph are pulled from *Mayo Collaborative Services, v. Prometheus Laboratories, Inc.*, 132 S. Ct. 1289, 1294–95 (2012).

(b) determining the level of [a particular metabolite] in said subject . . .

wherein the level of [the metabolite] less than [a lower threshold] indicates a need to increase the amount of said drug subsequently administered to said subject and

wherein the level of [the metabolite] greater than [an upper threshold] indicates a need to decrease the amount of said drug subsequently administered to said subject.²⁰³

The Court parsed the claim into three steps or limitations that a doctor must perform to infringe the patent: the doctor must administer the drug, determine the metabolite level, and infer a need to adjust the drug dosage if the metabolite level is above or below the optimal treatment window.²⁰⁴ No post-inference action on the part of the doctor, such as an adjustment to the amount of the drug actually prescribed or administered to the patient, is necessary to infringe the claim.²⁰⁵ The final wherein clauses describe mental steps; they are infringed simply “if the doctor *believes*” that a dosage adjustment “is the proper procedure.”²⁰⁶

When the patent owner sued for infringement, the defendant raised patent invalidity as a defense. A well-established judicial gloss on Section 101 of the Patent Act prohibits patents on “laws of nature” or “natural laws” in the abstract while allowing patents on applications of those same laws.²⁰⁷ From early in the district court proceedings, the *Mayo* litigation focused on the “laws of nature” exclusion, as the defendant argued that the correlations between metabolite levels and likely clinical outcomes were “laws of nature” and that the diagnostic claims encompassed them in an impermissibly abstract manner.²⁰⁸ In a

²⁰³ *Id.* at 1295.

²⁰⁴ *Id.* at 1297–98.

²⁰⁵ *Id.* at 1296.

²⁰⁶ *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, No. 04cv1200-JAH (RBB), slip op. at 17–18 (S.D. Cal. Nov. 22, 2005) (emphasis added) (claim construction order). Interestingly, the Federal Circuit opinion saw the mental nature of the wherein step as the primary obstacle that had to be surmounted to demonstrate the patent eligibility of the *Mayo* claims. *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, 628 F.3d 1347, 1358–59 (Fed. Cir. 2010). However, the Supreme Court does not expressly note the mental nature of the wherein step.

²⁰⁷ *Mayo Collaborative Servs.*, 132 S. Ct. at 1294.

²⁰⁸ See *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, No. 04cv1200-JAH (RBB), 2008 WL 878910, at *3–13 (S.D. Cal. Mar. 28, 2008).

unanimous opinion penned by Justice Breyer, the Supreme Court agreed with the defendant on both issues and invalidated the claims.²⁰⁹

The Court's conclusion that the correlations are "natural laws" creates a sweepingly broad, albeit implicit, definition of "natural laws" for three reasons: the correlations are not truly natural, they are not very law-like, and they are quite factually contingent. The Court reasoned that the correlations are sufficiently natural to qualify as "laws of nature" because the body uses "entirely natural processes" to metabolize thiopurine drugs and the correlations "exist[] in principle apart from any human action," despite the fact that thiopurine drugs are administered to patients through human action.²¹⁰ The Court did not note that thiopurine drugs are man-made compounds and that the correlations did not exist as an empirical matter in some mythic state of nature that pre-dates human innovation.²¹¹ Nor did the Court address the fact that the correlations are not very law-like. The correlations are not necessary, universal relationships like the prototypical "laws of nature" such as the laws of thermodynamics: they are statistical generalizations with both false positives and negatives because there are individual patients for whom the patented treatment window is not the optimal window.²¹² Furthermore, the correlations are social constructs: what constitutes a medically acceptable level of risk of inefficacy or toxicity is an artifact of our culture, not nature.²¹³

One of the patent owner's principal arguments was that "laws of nature" are limited to broadly applicable, highly generalized relationships, whereas the correlations between metabolites and likely clinical outcomes are narrow, targeted, and factually contingent relationships.²¹⁴ The correlations are tied to particular drugs (thiopurine drugs) and to the use of those particular drugs to treat a particular disease (an autoimmune disease). They are also tied to particular metabolites of those thiopurine drugs. Therefore, the patent

²⁰⁹ *Mayo Collaborative Servs.*, 132 S. Ct. at 1297.

²¹⁰ *Id.* at 1296–97.

²¹¹ The district court did consider and reject the argument that the man-made nature of thiopurine drugs prevented the correlations from being "laws of nature." *Prometheus Labs., Inc.*, 2008 WL 878910, at *6–9.

²¹² See *Mayo Collaborative Servs.*, 132 S. Ct. at 1295 (noting that the correlation indicates that the dosage is "likely" too high or low).

²¹³ Cf. Nicholas Bakalar, *In Medicine, Acceptable Risk in the Eye of the Beholder*, N.Y. TIMES, June 20, 2006 (noting individuals do not make medical decisions based on mathematical models).

²¹⁴ See *Mayo Collaborative Servs.*, 132 S. Ct. at 1303; Brief for Respondent at 42–46, *Mayo Collaborative Servs.*, 132 S. Ct. 1289 (No.10-1150).

owner argued, the economic justification of the exclusion of “laws of nature” from patent eligible subject matter was not implicated: the claims did not privatize any “basic tools of scientific and technological work” or impose significant dynamic costs in the form of slower innovation in the future.²¹⁵ The Supreme Court rejected this argument. Conceding that “[t]he laws of nature at issue here are narrow laws that may have limited applications” and that claims are therefore less likely to “interfere significantly with innovation in other fields now or in the future,” the Court defended its refusal to examine the generality of the “law of nature” at issue by noting that exclusions from patent eligible subject matter are administrable, and sometimes over-exclusive, proxies for prohibitions on claims with unusually high dynamic costs:

[O]ur cases have not distinguished among different laws of nature according to whether or not the principles they embody are sufficiently narrow. And this is understandable. Courts and judges are not institutionally well suited to making the kinds of judgments needed to distinguish among different laws of nature. And so the cases have endorsed a bright-line prohibition against patenting laws of nature, mathematical formulas and the like, which serves as a somewhat more easily administered proxy for the underlying “building-block” concern.²¹⁶

Shifting to the issue of whether the *Mayo* claims crossed the line between patent ineligible, abstract “laws of nature” and patent eligible applications of “laws of nature,” the Court employed a point of novelty analysis to conclude that the claims are impermissibly abstract.²¹⁷ According to the Court, the *Mayo* claims are patent

²¹⁵ See *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972).

²¹⁶ *Mayo Collaborative Servs.*, 132 S. Ct. at 1302, 1303.

²¹⁷ *Id.* at 1297–98. The *Mayo* opinion does not use the term “point of novelty,” but other commentators have also recognized it as a point of novelty analysis. Chao, *Moderating Mayo*, *supra* note 68, at 425; Ted Sichelman, *Funk Forward*, in *INTELLECTUAL PROPERTY AT THE EDGE: THE CONTESTED CONTOURS OF IP* (Rochelle Dreyfuss, Jane Ginsburg & Carol Rose eds.) (forthcoming 2014) (manuscript at 7-8), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2035027.

The doctrinal framework for drawing this line had not been definitively established prior to *Mayo*. In fact, each of the three courts that ruled on the “laws of nature” argument in *Mayo* used a different methodology to identify impermissibly abstract claims. The district court focused on preemption. *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, No. 04cv1200-JAH (RBB), 2008 WL 878910, at *10–12 (S.D. Cal. Mar. 28, 2008). The Federal Circuit relied most heavily on the machine-or-transformation test. *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, 628 F.3d 1347, 1355–59 (Fed. Cir. 2010).

ineligible because “the steps in the claimed processes (apart from the laws of nature themselves) involve well-understood, routine, conventional activity previously engaged in by researchers in the field.”²¹⁸ Inversely, the sole point of novelty of the claimed invention resides in the newly discovered “laws of nature” that underpin the final wherein clauses.²¹⁹ Had the claims counterfactually recited “other elements or a combination of elements, sometimes referred to as an ‘inventive concept,’ sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the law of nature itself,” the court implied that the claims would likely have described patentable applications of “laws of nature.”²²⁰ In sum, the mental inference step was concededly new, but the Court attributed its novelty entirely to the newly discovered “laws of nature”—it is nothing more than “a suggestion that [a doctor] should take those laws into account when treating his patient.”²²¹

The Supreme Court’s opinion in *Mayo* has been roundly criticized in patent commentary.²²² These *Mayo* critics mount a persuasive argument that the Court’s methodology for defining the exclusion of “law of nature” from patent eligible subject matter would, if taken at face value, not result in anything that approaches a reasonable proxy for an exclusion of claims that are likely to generate significant dynamic costs.²²³ The combination of the sweepingly expansive definition of a “law of nature” and the point of novelty analysis would trigger a radical shift in the status quo of what can be patented and invalidate a large set of claims for which there are no unusual dynamic cost concerns.

For example, consider a claim to a new use of a known, man-made chemical.²²⁴ The functional property that makes the chemical effective

²¹⁸ *Mayo Collaborative Servs.*, 132 S. Ct. at 1294. Importantly, the steps apart from the “law of nature” were conventional even as a combination. *See id.* at 1297–98.

²¹⁹ *See id.* at 1297–98.

²²⁰ *See id.* at 1294.

²²¹ *See id.* at 1297.

²²² *See, e.g.,* Chao, *Moderating Mayo*, *supra* note 68, at 427–33 (discussing the problems the *Mayo* decision created); Jeffrey L. Fox, *Industry Reels as Prometheus Falls and Myriad Faces Further Reviews*, 30 NATURE BIOTECHNOLOGY 373, 373 (2012) (discussing patent attorneys’ negative opinions concerning the ruling); Sichelman, *supra* note 217, (manuscript at 13-14) (criticizing *Mayo* as being capable of invalidating “scores of patents”). For rapid-fire critiques of *Mayo* in the blogosphere, see Chao, *Moderating Mayo*, *supra* note 68, at 424–25 nn.2–3.

²²³ The opinion has also been criticized on doctrinal grounds because it privileges the point of novelty methodology articulated in *Parker v. Flook* over the apparent rejection of that methodology in *Diamond v. Diehr*. *See* Collins, *Mental Steps & Printed Matter*, *supra* note 173, at 416–20.

²²⁴ *Cf.* Brief for Amici Curiae of 20 Law and Business Professors in Support of

for its new use is presumptively a “law of nature”; it has always been in the nature of that compound to have this functional property, even if the property is newly discovered by man.²²⁵ Once this functional property is removed from consideration, there would not seem to be anything other than the conventional compound, suggesting the worrisome result that the point of novelty analysis would label all new-use claims as patent ineligible subject matter. It is difficult to fathom why new-use claims are unusually likely to generate dynamic costs. If anything, they are far less likely to generate dynamic costs than object claims to the chemicals are, given that the latter claims encompass all possible uses of the chemicals.

Alternatively, consider the fate of a claim to a mercury thermometer under the point of novelty analysis articulated in *Mayo*.²²⁶ It is a “law of nature” that mercury, when confined within a narrow-diameter glass tube with a large reservoir at one end, rises and falls over a distance that is visible to the human eye in response to relatively small shifts in temperature. Once this “law of nature” is bracketed away, there does not appear to be an “inventive concept” in what remains of the claimed mercury thermometer. Velcro, too, is at risk of being labeled as an unpatentable claim to a “law of nature.” Velcro is made up of a set of tiny hooks on one side and eyes on the other. When the two sides are brought together, the hooks and eyes latch together in a way that requires considerable force to separate them. The fact that hooks and eyes have this property of adhesion is presumptively a “law of nature” that was simply discovered by man. Once this “law of nature” is excised from the claim, what “inventive concept” is there in the remains of a claim to Velcro?

One way to avoid the absurd result of invalidating patents on new uses, thermometers, and Velcro for lack of patent eligibility is to limit the definition of what constitutes a “law of nature” to highly general laws and turn the “laws of nature” exclusion into another variant of a levels-of-generality analysis.²²⁷ The “law of nature” in the thermometer claim could be the temperature-responsive expansion of the element mercury, and the use of this law in the context of a mercury thermometer could be viewed as containing an “inventive concept.” Similarly, the law of friction could be the relevant “law of nature,” and

Neither Party at 21, *Bilski v. Kappos*, 130 S. Ct. 3218 (2010) (No. 08-964) (discussing Rogaine).

²²⁵ The fact that the chemical is man-made does not preclude the functional property of the chemical from “law of nature” status. See *supra* notes 210–211.

²²⁶ See Lemley, *Point of Novelty*, *supra* note 68, at 1279 (using this example).

²²⁷ See *supra* text accompanying notes 214–215.

the use of this law in the context of Velcro could be framed as an “inventive concept.”²²⁸ However, the Supreme Court in *Mayo* expressly forbade any consideration of the level of generality when identifying “laws of nature,” cutting off this route out of the *Mayo* conundrum.²²⁹

In sum, the point of novelty analysis in *Mayo* is an absurd methodology for identifying impermissible claims to “laws of nature” broadly writ. In the words of one patent attorney, “Under Breyer’s analysis, potentially every patent in biotechnology is not valid because most use ‘natural processes.’”²³⁰ Many *Mayo* critics argue that the best way to fix *Mayo* is to sweep it under the rug and ignore it.²³¹

However, another way to fix *Mayo* that does not require its complete erasure is to reframe it as a case in which the Supreme Court employs a doctrinal contortion to enforce the knowledge/embodiment dichotomy. The “laws of nature” exclusion is conventionally viewed as a doctrine that prevents the patenting of nature, but the Court’s use of that exclusion in *Mayo* is different. Although the opinion’s rhetoric does not focus on the patentability of human knowledge or mental processes, *Mayo* can easily be read as a case that is tasked with preventing patents from expanding into the mind, not preventing them from reaching into nature. All that needs to be done is to construe the case narrowly to address only patentability of propositional knowledge of “laws of nature,” not the patentability of

²²⁸ This is the approach that the Supreme Court took in *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U.S. 45 (1923). A patent claimed a paper-making machine that used gravity to feed paper slurry through the machine. *Id.* at 49–51. If the Court had framed the relevant “law of nature” narrowly—for example, as the ability of gravity to pull paper slurry through the patented machine—then the claim would have described patent ineligible subject matter. However, the Court must have implicitly defined the “law of nature” at a higher level of generality—for example, as the law of gravity itself—because it upheld the patent as valid. *Id.* at 45.

²²⁹ See *supra* text accompanying note 216.

²³⁰ Fox, *supra* note 222, at 373. If anything, this apocalyptic vision understates the problem because a literal interpretation of *Mayo* threatens the patent eligibility of inventions in all arts. See *supra* text accompanying note 226.

²³¹ A point of novelty analysis for administering the “laws of nature” exclusion had been repeatedly criticized even before the Court’s *Mayo* opinion. See, e.g., *In re Bergy*, 596 F.2d 952, 959–66 (C.C.P.A. 1979) (Rich, J.) (criticizing conflation of Section 101’s statutory-categories requirement with Section 102’s novelty requirement); Lemley et al., *supra* note 68, at 1335–36 (describing *Flook*’s reliance on point of novelty analysis as “problematic”); Lemley, *Point of Novelty*, *supra* note 68, at 1277–79 (criticizing the Court’s approach in *Flook*). But cf. Chao, *Moderating Mayo*, *supra* note 68 (arguing in favor of a clarified point of novelty approach for determining the patent eligibility of “laws of nature”).

“laws of nature” broadly writ.²³² When interpreted in this manner, *Mayo* is a textbook application of the knowledge/embodiment dichotomy: it invalidates a claim to a knowledge-advance.

To see *Mayo* as a case that enforces the knowledge/embodiment dichotomy, it is initially important to understand that the *Mayo* claims are not like most claims that are wound up with “laws of nature.” Run-of-the-mill patent claims that implicate “laws of nature” describe, and thus propertize, subject matter whose behavior is actually governed by the law. “Laws of nature” are what make claimed drugs treat diseases, claimed thermometers have mercury that expands or contracts, and claimed surfaces stick together.²³³ The final, inference limitations of the *Mayo* claims, however, implicate “laws of nature” in a very different way: they recite newly created propositional knowledge of “laws of nature.” More specifically, they describe logical inferences that occur in the minds of infringing doctors and that employ knowledge of the “laws of nature” as factual premises.²³⁴ They require a doctor to possess two mental representations that are the premises and derive a third mental representation that is the conclusion drawn from them:

- Premise 1: My particular patient has a metabolite level above the specified upper threshold.
- Premise 2: In general, patients with metabolite levels above the specified upper threshold are more likely to suffer from the toxicity of the drug.
(a “law of nature”)

²³² For an argument that a narrow, mind-centered interpretation of *Mayo* is a reasonable interpretation based on the text of the *Mayo* opinion, see Collins, Economic Justification, *supra* note 14, at 19–22. Landmark Supreme Court opinions often accrete meanings that are not self-evident on their rhetorical surfaces. For example, in *Baker v. Selden*, 101 U.S. 99 (1879), the Supreme Court case that many copyright casebooks present as the foundation of the idea/expression dichotomy, says little in express terms to suggest the doctrine for which it now stands.

²³³ Cf. *supra* text accompanying notes 224–226 (considering examples of “laws of nature”).

²³⁴ Reasoning processes are sequences of mental representations. “To infer a proposition *q* from the propositions *p* and *if p then q* is (*inter alia*) to have a sequence of thoughts [i.e., mental representations] of the form *p, if p then q, q*.” David Pitt, *Mental Representation* § 1, STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Dec. 11, 2012), <http://plato.stanford.edu/entries/mental-representation>.

Conclusion: My particular patient is more likely to suffer from the toxicity of the drug.²³⁵

Critically, Premise 2 is the mental representation that constitutes knowledge of the newly discovered “law of nature”—knowledge that a doctor can learn from reading either the patent specification or, more likely, the *New England Journal of Medicine*. In gross, the *Mayo* claims describe a process through which a doctor gains utility from understanding a piece of propositional knowledge that must be disclosed, and thus publicized, in the patent specification and using it in a simple act of logical reasoning.²³⁶

Once the *Mayo* claim is recognized as a claim with a limitation that recites a (newly created) mental representation of a (newly discovered) “law of nature,” the two highly controversial features of the *Mayo* opinion—namely its point of novelty analysis and its expansive definition of a “law of nature”—can be viewed in a different light. They craft precisely the doctrine that is needed to effectively enforce the knowledge/embodiment dichotomy.

²³⁵ For an in-depth analysis of the logical structure of an inferring step in a similar diagnostic claim, see Kevin Emerson Collins, *Propertizing Thought*, 60 SMU L. REV. 317 (2007).

²³⁶ In theory, one could interpret the knowledge/embodiment dichotomy to create only a small exclusion from patent eligibility that would not invalidate the *Mayo* claims. One could do this by drawing a line between a mental representation standing alone and an act of syllogistic logic that employs the mental representation. A claim with a limitation simply reciting the mental state of understanding the “law of nature” (Premise 2 above) standing alone would be an impermissible claim to a knowledge-advance under any interpretation of the knowledge/embodiment dichotomy. However, a claim reciting an act of syllogistic logic that employs the “law of nature” as a factual premise could be treated differently. It could be labeled as a permissible claim to an application of a mental representation. In other words, inverting Justice Breyer’s intended meaning, the process of following “an instruction to read some numbers in light of [new] medical knowledge” could be patent eligible even though the process of understanding the new medical knowledge *per se* would be patent ineligible. See *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124, 137 (2006) (Breyer, J., dissenting from the dismissal of certiorari as improvidently granted). This narrow interpretation of the knowledge/embodiment dichotomy would render the *Mayo* claims patent eligible. However, any attempt to draw this line would require the courts to develop a taxonomy of new mental steps, some of which would be more likely to be patent eligible than others. See Kevin Emerson Collins, *An Initial Comment on King Pharmaceuticals: The Printed Matter Doctrine as a Structural Doctrine and Its Implications for Prometheus Laboratories*, 2010 PATENTLY-O PAT. L.J. 111, 118–19 (noting the possibility of such a line).

Mayo's point of novelty analysis maps perfectly onto the dichotomy's point of novelty analysis. The Supreme Court said that the point of novelty could not reside in the "laws of nature" recited in the wherein clauses,²³⁷ and these wherein clauses are limitations that describe mental representations of the "laws of nature."²³⁸ Given the *Mayo* claims, saying that newly discovered correlations cannot be a claim's point of novelty boils down to the exact same thing as saying that newly created mental representations of those correlations cannot be a claim's point of novelty.²³⁹

Although it may be puzzling when viewed as part of a doctrine that curtails the patentability of nature, *Mayo's* expansive, implicit definition of a "law of nature" is exactly what is needed to distort the "law of nature" exclusion into effective, *de facto* enforcement of the knowledge/embodiment dichotomy. The knowledge/embodiment dichotomy prevents knowledge-advances of any kind from being patent eligible subject matter, so it would make no sense to limit *Mayo* to a particular type of knowledge. Propositional knowledge includes justified true beliefs about any empirically true facts.²⁴⁰ It includes knowledge of both natural and artificial systems, so *Mayo's* "laws of nature" should not be limited to relationships in naturally occurring systems. Propositional knowledge includes knowledge of both statistical generalizations and universal truths, so *Mayo's* "laws of nature" should not be limited to relationships that are universal, necessary truths. Propositional knowledge ranges from the general to the specific,²⁴¹ so *Mayo's* "laws of nature" should encompass both factually contingent and broadly applicable "laws of nature." *Mayo* uses "law of nature" as a term of art that is specific to cases in which claims recite human-knowledge limitations. *Mayo* suggests that a "law

²³⁷ See *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1297–98 (2012).

²³⁸ See *supra* text accompanying notes 233–236.

²³⁹ A narrow interpretation of *Mayo* in which its point of novelty analysis only governs the patent eligibility of claims with limitations reciting knowledge of "laws of nature" also helps to explain the Supreme Court's yet more recent case on patent eligibility in *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107 (2013). In *Myriad*, the Court applied the Section 101 exclusion of naturally occurring products to patents claiming DNA molecules, but it did not employ the point of novelty analysis that it had adopted only a year earlier in *Mayo*. *Id.* at 2116–19. If *Mayo* is interpreted as a case that uses a doctrinal contortion to enforce the knowledge/embodiment dichotomy, the failure to adopt a point of novelty analysis in *Myriad* makes perfect sense because the claims did not have limitations reciting knowledge of a naturally occurring product.

²⁴⁰ See *supra* Part I.A.

²⁴¹ See *supra* text accompanying note 22.

of nature” in such cases is so expansive that it is nothing short of an empirically true fact.²⁴²

2. Functional and Nonfunctional Descriptive Material

One common technique for claiming computer software inventions is a software-on-disk or *Beauregard* claim that describes a program encoded on a computer-readable storage medium.²⁴³ Applying the printed matter doctrine and its functional-relation exception, the PTO sorts these software-on-disk claims into two categories: there are patent eligible claims to “functional descriptive material” and patent ineligible claims to “nonfunctional descriptive material.”²⁴⁴ The problem with this factual distinction is that it does not exist: it is “simply a misstatement of fact.”²⁴⁵ Yet, the sorting that the PTO achieves with its functional/nonfunctional distinction is the exact sorting that must be accomplished to bring the knowledge/embodiment dichotomy to bear on software-on-disk claims. Underneath its rhetoric, the PTO uses the functional/nonfunctional distinction to invalidate software-on-disk claims if and only if the distinction from the prior art resides in a knowledge-advance. That is,

²⁴² The litmus test for determining whether a “law of nature” is about relationships that are natural in any meaningful way is how *Mayo* would impact the patentability of claims reciting knowledge of newly discovered correlations that are clearly social or cultural constructs. For example, assume an enterprising marketing firm discovers that consumers who use Apple iPhones are more likely than consumers who use Android phones to make high-end purchases. Cf. Dana Mattioli, *On Orbitz, Mac Users Steered to Pricier Hotels*, WALL ST. J., June 26, 2012 (noting a correlation between Mac users and people who are more likely than average to purchase more expensive hotel bookings). This marketing firm could attempt to patent the two-step diagnostic method of (a) determining whether a customer who walks into a retail store is using an Apple or Android phone and (b) understanding a need to pitch more high-end products to the customer if the customer is using an Apple phone. If *Mayo* is really about preventing the patenting of nature, then this claim should be patent eligible. However, if *Mayo* uses doctrinal contortion to enforce the knowledge/embodiment dichotomy, then this claim should be patent ineligible.

²⁴³ *In re Beauregard*, 53 F.3d 1583, 1584 (Fed. Cir. 1995).

²⁴⁴ Examination Guidelines for Computer-Related Inventions, 61 Fed. Reg. 7478, 7481-82 (Feb. 28, 1996); see *Ex Parte Srivatsan D.*, No. 2009-013829, 2012 WL 527390, at *2 (B.P.A.I. Feb. 16, 2012).

²⁴⁵ 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) [hereinafter *Of Text, Technique, and the Tangible*]; see also Lee A. Hollar, *Justice Douglas Was Right: The Need for Congressional Action on Software Patents*, 24 AIPLA Q.J. 283, 294 (1996) (asserting that the “distinction [is] not anchored in computer science”).

the PTO uses a doctrinal contortion to fill a gap in the indirect, *de facto* enforcement of the knowledge/embodiment dichotomy.²⁴⁶

Long after the courts had been upholding apparatus and method claims to software as patent eligible subject matter, the PTO still cited the printed matter doctrine to reject software-on-disk claims as patent ineligible subject matter in the early 1990s.²⁴⁷ The PTO viewed the claimed subject matter as nothing but information recorded on a tangible substrate, and it correctly noted that the content of the information was the sole point of novelty.²⁴⁸ The PTO also reasoned that the functional-relation exception to the printed matter doctrine did not apply because there was no functional relationship between the recorded information (the software program) and the substrate (the storage medium).²⁴⁹

In *In re Lowry*, the Federal Circuit reversed the PTO's position on software-on-disk claims.²⁵⁰ The *Lowry* claims described an arrangement of computer-readable data of a disk that allowed increased computing efficiency.²⁵¹ The Federal Circuit reasoned that the functional-relation exception to the printed matter doctrine did apply because the claimed information "define[d] the functional characteristics of the memory."²⁵² Yet, *Lowry* also cautioned against allowing all software-on-disk claims to qualify as patent eligible subject matter. If a claim sought "to patent the content of information resident in a database" recorded on a computer-readable storage medium, *Lowry* suggested that the claim should not be patent eligible.²⁵³

Lowry left the PTO with the unenviable task of shoehorning the distinction between patentable and unpatentable software-on-disk

²⁴⁶ The gap was in large part created by the difficulty of distinguishing between knowledge-advances and embodiment-advances when using the information-talk in which the printed matter doctrine is couched. See *supra* text accompanying notes 124–126.

²⁴⁷ See *supra* text accompanying notes 182–193.

²⁴⁸ See *In re Lowry*, 32 F.3d 1579, 1582 (Fed. Cir. 1994).

²⁴⁹ See *id.*; *supra* text accompanying notes 190–193 (discussing the functional-relation exception).

²⁵⁰ *In re Lowry*, 32 F.3d at 1582–85.

²⁵¹ More accurately, *Lowry* addressed claims to an arrangement of computer-readable data in a computer's memory. *Id.* at 1580. *Lowry*'s reasoning, however, applies in full to software-on-disk claims, and the PTO changed its position on software-on-disk claims after *Lowry*. See *In re Beauregard*, 53 F.3d 1583, 1584 (Fed. Cir. 1995).

²⁵² *In re Lowry*, 32 F.3d at 1583. However, even after *Lowry*, a claim that encompasses software in the form of transitory signals is not patent eligible subject matter. *In re Nuijten*, 500 F.3d 1346, 1357 (Fed. Cir. 2007).

²⁵³ See *In re Lowry*, 32 F.3d at 1583.

claims into the functional-relation exception to the printed matter doctrine. To draw the needed line, the PTO wrote guidelines for its examiners outlining how the printed matter doctrine should be brought to bear on software-on-disk claims.²⁵⁴ The guidelines defined two categories of descriptive material that could be encoded on a computer-readable medium. First, there is “functional descriptive material” that, following *Lowry*, is “structurally and functionally interrelated to the medium” and thus patent eligible subject matter in most cases.²⁵⁵ “Computer programs” are functional descriptive material: “a claimed computer-readable medium encoded with a computer program defines structural and functional interrelationships between the computer program and the medium which permit the computer program’s functionality to be realized, and is thus statutory.”²⁵⁶ Second, there is “nonfunctional descriptive material” that is “not structurally and functionally interrelated to the medium but is merely carried by the medium.”²⁵⁷ “[C]ompilations of facts or data” are nonfunctional descriptive material: they “are merely stored so as to be read or outputted by a computer without creating any functional interrelationship, either as part of the stored data or as part of the computing processes performed by the computer.”²⁵⁸

One problem with the PTO’s distinction between functional and nonfunctional descriptive material is that it is fabricated out of thin air. It has no basis in computer science. As John Thomas has noted:

Whether users value the encoded data for use as a word processor or musical composition, no difference exists between the manner in which the media records the information. Indeed, the computer software that audibilizes encoded musical compositions could likely play data that was intended to be a spreadsheet program, although the generated sounds may not suit the tastes of many individuals. Stating

²⁵⁴ Examination Guidelines for Computer-Related Inventions, 61 Fed. Reg. 7478, 7481-82 (Feb. 28, 1996).

²⁵⁵ *Id.* at 7481.

²⁵⁶ *Id.* at 7482.

²⁵⁷ *Id.* at 7481.

²⁵⁸ *Id.* at 7482. Nonfunctional descriptive material also includes “music, literature, art, photographs” and the like, too. *Id.* For this reason, the exclusion of nonfunctional descriptive material from patent eligibility is often seen as a doctrine that channels certain subject matter out of the patent regime and into the copyright regime. *See id.* at 7481. However, when the excluded subject matter is a text that represents newly discovered technological knowledge, the printed matter doctrine does not serve a channeling function because facts are not protected by copyright, either. *See supra* note 175.

that one set of data is merely recorded on a medium, while the other bears a functional relationship towards that medium is simply a misstatement of fact.²⁵⁹

There is no difference in the functional relationship between factual data and a storage medium, on the one hand, and a computer program and a storage medium, on the other hand. The Federal Circuit and the PTO have fabricated a factual distinction in order to use the pre-existing functional-relation exception to the printed matter doctrine to sanction the patentability of some software-on-disk claims while undermining the patentability of ebook-on-disk claims.

Yet, the sorting that the PTO accomplishes with its fictitious distinction is precisely the sorting that is required to enforce the knowledge/embodiment dichotomy. When the software-on-disk cases are reconceptualized and viewed through the lens of the knowledge/embodiment dichotomy, a valid factual distinction on which the PTO could have relied comes into focus. The relevant factual distinction is a distinction between two types of technological progress. It is the very distinction between things that *represent* new information and things that *carry* new information that can be easily overlooked when one uses the information-talk in which the printed matter doctrine is couched to administer the knowledge/embodiment dichotomy.²⁶⁰

The PTO's distinction is therefore a doctrinal contortion that provides *de facto* enforcement of the knowledge/embodiment dichotomy in the limited context of software-on-disk claims. Claims to nonfunctional descriptive material describe a knowledge-advance: the encoded data causes a computer to represent new information to the interpreting mind of the person who uses the computer. The data instruct a computer to do something, but that something is only nonobvious in relation to the prior art because it creates new mental representations in the mind of a human computer user. The advance over the prior art that is needed for patentability therefore resides in an extra-mental representation of knowledge. In fact, a claim to factual data on a disk is no different from a claim to factual data on a magnetic tape encoding audio sounds and played by cassette player: both require machines to transform the data into a form that is intelligible to the human mind.²⁶¹ Even the PTO recognized the importance of the human mind in drawing the needed line in a

²⁵⁹ Thomas, *Of Text, Technique, and the Tangible*, *supra* note 245, at 260.

²⁶⁰ See *supra* text accompanying notes 124–126.

²⁶¹ See *supra* text accompanying note 188 (noting that claims to factual data on magnetic audio tape are not patentable under the printed matter doctrine).

footnote in its guidelines: “Data consists of facts, which become information [(i.e., knowledge)] when they are seen in context and convey meaning to people. Computers process data without any understanding of what that data represents.”²⁶² In contrast, claims to functional descriptive material describe an embodiment-advance: the encoded data carries information that is interpreted by the computer, making the computer do something new (other than representing information to a human user). When viewed in terms of the information that is involved, software-on-disk claims to new computer programs that do not simply represent information to a human user are no different from routinely patentable claims to DNA: both have “meaning” because they deterministically cause systems, whether electronic or biological, to behave in a particular manner.²⁶³ There is no interpreting mind in the picture, and this is not the type of claim to information that is problematic under the knowledge/embodiment dichotomy.²⁶⁴

Again, it is the nature of the advance at issue that is dispositive, so a point of novelty analysis is required to draw a distinction between the two types of advances that the PTO refers to as the distinction between functional and nonfunctional descriptive material.²⁶⁵ A claim-as-a-whole approach cannot make the needed distinction. A claim to the self-same stuff may be either patent eligible or patent ineligible depending upon the advance over the prior art at issue. For example, a claim may describe a storage medium with two types of data recorded thereon: (a) an ebook reader and (b) an ebook. The claim is a patent eligible embodiment-advance if the ebook reader is new, but it is a patent ineligible knowledge-advance if only the ebook is new.²⁶⁶

²⁶² Examination Guidelines, 61 Fed. Reg. 7478, 7482 n.31 (quoting COMPUTER DICTIONARY 210 (2d ed. 1994)).

²⁶³ See Collins, *Semiotics 101*, *supra* note 14, at 1391-92, 1421-22.

²⁶⁴ There is always a mind in the picture when computer software is at issue because computer software both carries information to a computer and represents information to the mind of a programmer who can understand code. (What is important to observe, however, is that a computer and a programmer “read” code in very different ways.) Things that labor under the “both-and” problem—that is, things that both carry information to a mechanistic/biological interpreter and represent information to a human mind—are usually patent eligible under the knowledge/embodiment dichotomy because human knowledge is not the sole point of novelty. *Cf. id.* at 1421–22 (discussing the both-and problem and its resolution under a mind-centered, semiotic interpretation of the printed matter doctrine).

²⁶⁵ See *supra* Part II.B.

²⁶⁶ More broadly, a point of novelty analysis is needed to draw the distinction between knowledge-advances and embodiment-advances in all software claims, regardless of whether the claims are apparatus, method, or software-on-disk claims.

VI. THE ARGUMENT FOR *DE DICTO* RECOGNITION OF THE DICHOTOMY

The courts should give open, *de dicto* recognition to the knowledge/embodiment dichotomy as a Section 101 limit on patent eligibility. This goal could be accomplished by recognizing the dichotomy as a free-standing doctrine or, more modestly, by building on the exclusion of mental processes from patent eligibility (to deal with claims to mental representations) and the printed matter doctrine (to deal with claims to extra-mental representations).²⁶⁷ If it is the later route that is chosen, these two doctrines must be recognized as fundamental limits on patent protection and modified to fill the gaps that the courts currently fill through doctrinal contortions.

Both the mental process exclusion and the printed matter doctrine are today treated, at best, as peripheral exclusions from the patent regime that merit little attention and, at worst, as historical appendices that should be surgically excised from contemporary patent law. The Supreme Court expressly listed the mental process exclusion in its trilogy of patent eligibility exclusions in *Gottschalk v. Benson*²⁶⁸ but not in its later opinions in *Diamond v. Chakrabarty*²⁶⁹ or *Diamond v. Diehr*.²⁷⁰ As a consequence, the mental process exclusion was overlooked for several decades at the end of the twentieth century and the beginning of the twenty first century.²⁷¹ The printed matter doctrine fares yet worse in terms of its public visibility. It is not

Just as one cannot claim a new e-book that represents technological facts, one should not be able to claim either a computer programmed to display newly discovered knowledge to a user or a method of executing software on a computer that displays newly discovered knowledge to a user. Viewing the printed matter doctrine as the sole enforcer of the knowledge/embodiment dichotomy artificially hives off one small facet of the much larger problem, forcing courts to address it in isolation rather than allowing them to see the big picture. The big picture demonstrates that a point of novelty analysis is needed to enforce the knowledge/embodiment dichotomy for all software claims.

²⁶⁷ See *supra* Parts V.A–B.

²⁶⁸ 409 U.S. 63, 67 (1972) (“Phenomena of nature, . . . mental processes, and abstract intellectual concepts are not patentable . . .”).

²⁶⁹ 447 U.S. 303, 309 (1980) (listing “laws of nature, physical phenomena, and abstract ideas”).

²⁷⁰ 450 U.S. 175, 185 (1981) (listing “laws of nature, natural phenomena, and abstract ideas”).

²⁷¹ See, e.g., *State St. Bank & Trust Co. v. Signature Fin. Grp., Inc.*, 149 F.3d 1368, 1373 (Fed. Cir. 1998) (“The Supreme Court has identified three categories of subject matter that are unpatentable, namely ‘laws of nature, natural phenomena, and abstract ideas.’” (quoting *Diehr*, 450 U.S. at 185)), *abrogated by In re Bilski*, 545 F.3d 943, 951 (Fed. Cir. 2008) (en banc). A more recent Supreme Court case has at least recited the mental process exclusion. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1293 (2012) (quoting *Benson*, 409 U.S. at 67).

mentioned at all in many patent law casebooks that are used to educate the next generation of patent lawyers,²⁷² and the Federal Circuit has openly questioned its very existence as a limitation on patent protection.²⁷³ When addressing both the mental process exclusion and the printed matter doctrine, the Federal Circuit and the PTO frequently label their printed matter opinions “unpublished” and “nonprecedential,” respectively.²⁷⁴ Their goal here is likely to sweep these doctrines under the rug whenever possible and avoid drawing public attention to what they perceive to be their unimportant or even embarrassing cases. Overt recognition of the knowledge/embodiment dichotomy would take these two doctrines out of the shadows and put them front and center in the spotlight; it would require judicial recognition of the fundamental role that they play in curtailing the reach of patent protection as we know it.

Overt recognition of the knowledge/embodiment dichotomy would also require modifying contemporary patent doctrine to fill the gaps that courts currently fill through doctrinal contortions. The courts should add a point of novelty analysis to the Section 101 mental process exclusion, obviating the need to distort the “laws of nature” doctrine to invalidate claims to knowledge-advances.²⁷⁵ They should

²⁷² See generally F. SCOTT KIEFF ET AL., PRINCIPLES OF PATENT LAW: CASES AND MATERIALS (4th ed. 2008) (containing no mention of the printed matter doctrine). Another 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).

²⁷³ The Federal Circuit has repeatedly warned that “[a] ‘printed matter rejection’ . . . stands on questionable legal and logical footing.” *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)).

²⁷⁴ For a mental process case, see generally *PerkinElmer, Inc. v. Intema Ltd.*, 496 Fed. App’x 65 (Fed. Cir. 2012). For printed matter cases, see generally *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).

²⁷⁵ See *supra* Part V.B.1. This could be accomplished by reviving and refining the historical mental steps doctrine. See *supra* notes 172–173. For an argument that *Mayo* has already revitalized the mental steps doctrine and its point of novelty analysis, see Collins, *Mental Steps & Printed Matter*, *supra* note 173, at 411–20. However, the Federal Circuit’s post-*Mayo* cases appear to be moving in the opposite direction: they make the rather implausible assumption that *Mayo* does not employ a point of novelty analysis. For example, in its second opinion in *Myriad* after its first opinion had been vacated in light of *Mayo*, the Federal Circuit refused to use a point of novelty analysis when assessing the patent eligibility of diagnostic claims that recited mental representations as claim limitations. *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 689 F.3d 1303, 1333–37 (Fed. Cir. 2012), *rev’d on other grounds*, 133 S. Ct. 2107 (2013).

also recognize that the distinction between things that represent and carry information should not be shoehorned into the functional-relation exception to the printed matter doctrine.²⁷⁶ The courts should recognize that the printed matter doctrine invalidates any claim that recites an extra-mental representation of newly created knowledge at its point of novelty.²⁷⁷

Whether it gives rise to a new, stand-alone doctrine or whether it results from the retooling of the mental process exclusion and the printed matter doctrine, *de dicto* recognition of the knowledge/embodiment dichotomy would create social benefits because it would eliminate two types of costs from the contemporary patent regime.²⁷⁸

First, *de dicto* recognition may prevent the doctrinal distortions of both yesterday and tomorrow from either sanctioning claims to knowledge-advances or invalidating claims to embodiment-advances in the future. For example, if the “laws of nature” rhetoric in the *Mayo* opinion were to be taken at face value, *Mayo* would undermine the patentability of a wide swath of embodiment-advances in the biosciences and beyond that likely should be patentable as a normative matter.²⁷⁹ Conceptually bankrupt distinctions also might make patent judges, scholars, and practitioners abandon the printed matter doctrine as a limit on what can be patented: without overt recognition of the knowledge/embodiment dichotomy, the dichotomy’s indirect, *de facto* protection that already exists today might be gone tomorrow.²⁸⁰

Second, conceptual coherence and doctrinal transparency—that is, having the PTO and the courts mean what they say and say what they mean—create social value even if no claim to a knowledge-advance is ever sanctioned.²⁸¹ The costs of litigating and prosecuting patents increase if parties must grapple with distinctions that do not mean

²⁷⁶ See *supra* Part V.B.2.

²⁷⁷ For a similar proposal, see generally Collins, *Semiotics 101*, *supra* note 14 (flushing out a mind-centered, semiotic interpretation of the printed matter doctrine).

²⁷⁸ These benefits arise from the shift from the contemporary patent regime in which the dichotomy is enforced through doctrinal contortions to a future patent regime in which there is black-letter patent doctrine that overtly enforces the dichotomy. This Article does not mount a normative justification for the patent ineligibility of claims to knowledge-advances. For the author’s articulation of such a normative justification, see generally Collins, *Economic Justification*, *supra* note 14.

²⁷⁹ See *supra* text accompanying notes 222–232.

²⁸⁰ See Thomas, *Of Text, Technique, and the Tangible*, *supra* note 245, at 260 (“This sort of conclusory reasoning [about the distinction between functional and nonfunctional descriptive material] hardly inspires confidence . . .”); *supra* text accompanying note 273.

²⁸¹ See Chiang, *Defining Patent Scope*, *supra* note 107, at 1235–36.

what they purport to mean. The lack of doctrinal coherency may also create fear today that a patent will be invalidated tomorrow, even if no patents are ever invalidated. In turn, this fear creates social costs today because it creates greater uncertainty about the validity of patent rights and thereby decreases the private sector's willingness to invest in innovation. Finally, the doctrinal contortions also decrease the willingness of the different players who are responsible for clarifying patent law to defer to each other when appropriate. For example, the Federal Circuit has exhibited a simmering disdain for the Supreme Court's patent jurisprudence, and *Mayo* has only added fuel to the fire.²⁸² These costs are real, and they can be mitigated simply by changing patent rhetoric to match what courts are already doing.

CONCLUSION

Surprisingly, patent doctrine and theory have failed to recognize one of the most fundamental and intuitive limits on the reach of patent eligible matter: the knowledge/embodiment dichotomy. The knowledge/embodiment dichotomy distinguishes between claims to knowledge-advances and claims to embodiment-advances. It invalidates the latter and thereby prevents newly created knowledge from being rewarded with a patent.

To date, the failure of courts and scholars to give *de dicto* recognition to the knowledge/embodiment dichotomy has not led to the *de facto* wide-spread patentability of newly created knowledge. The extant exclusion of mental processes from patent eligibility and the printed matter doctrine effectively police fragmentary stretches of the dichotomy in an indirect manner. However, without access to the conceptual framework, vocabulary, and doctrine that is needed to enforce the dichotomy in a transparent, mean-what-you-say-and-say-what-you-mean fashion, the PTO and the courts distort patent doctrines that are usually tasked with achieving completely different goals in order to fill the gaps between fragments. The Supreme Court's opinion in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.* on the patenting of "laws of nature" and the PTO's distinction between functional and nonfunctional descriptive material in software-on-disk claims both exemplify these doctrinal contortions that in practice, if not in name, invalidate claims that run afoul of the dichotomy.

²⁸² Ryan Davis, *Rader Calls Out High Court's "Activism" in IP Law*, LAW 360 (Jan. 22, 2013), www.law360.com/ip/articles/408846/rader-calls-out-high-court-s-activism-in-ip-law.

While this ends-justify-the-means approach to enforcing the knowledge/embodiment dichotomy may lead to the correct result in individual cases, the distorted doctrine has its own costs. Overt recognition of the knowledge/embodiment dichotomy as a limit on the reach of patent eligible matter would eliminate those costs.