

THE ONTOLOGICAL FUNCTION OF THE PATENT DOCUMENT

Andrew Chin*

ABSTRACT

With the passage and implementation of the “first-to-file” provisions of the America Invents Act of 2011, the U.S. patent system must rely more than ever before on patent documents for its own ontological commitments concerning the existence of claimed kinds of useful objects and processes. This Article provides a comprehensive description of the previously unrecognized function of the patent document in incurring and securing warrants to these ontological commitments, and the respective roles of legal doctrines and practices in the patent system’s ontological project. Among other contributions, the resulting metaphysical account serves to reconcile competing interpretations of the written description requirement that have emerged from the Federal Circuit’s recent jurisprudence, and to explain why the patent system is willing and able to examine, grant and enforce claims reciting theoretical entities. While this Article is entirely descriptive, it concludes by identifying promising normative and prescriptive implications of this work, including the formulation of an appropriate test for the patent-eligibility of software-implemented inventions in the post-*Bilski* era.

* Associate Professor, University of North Carolina School of Law. The author wishes to thank Adam Candeub, David Chalmers, Kevin Collins, John Conley, Michael Corrado, Tim Holbrook, David Lange, Marc Lange, Mark Lemley, Adam Mossoff, Daniel Nazer, Kristen Osenga, Arti Rai, and Kathy Strandburg for helpful comments and suggestions at different stages of this project.

Table of Contents

I. Introduction265

II. The Patent System’s Ontology of “Useful Arts”273

 A. The Ontological Status of Claims273

 1. Claims as Kinds.....273

 2. Claim Language and Essential Sortals280

 B. The Ontological Status of Embodiments286

 1. The Causal Powers of Embodiments.....287

 2. Scientific Essentialism289

 3. Scientific Realism and Unobserved Embodiments.....295

III. The Ontological Role of the Written Description Requirement299

 A. Written Description as a Definitional Requirement.....299

 B. Ontological Commitments in Patent Discourse305

 C. Written Description as a Doctrine of Ontological Possession.....310

IV. The Ontological Role of the Enablement Requirement.....314

V. Toward an Essential Causation Requirement for Patent-Eligibility323

VI. Conclusion.....329

I. INTRODUCTION

According to skeptics at least, self-proclaimed psychics feign familiarity with their clients' personalities and problems by feeding back observed and volunteered information as revelation, using a process known as "cold reading."¹ It is easy to unmask the technique, if the client is willing to lie to get at the truth. For example, a single, unemployed woman may state that "two weeks ago I got a new job at the same company where my husband works," diverting the psychic into an earnest discussion of the woman's nonexistent marital relationship, colleagues, and boss in which the psychic simply takes her word for it that these entities exist.²

In the parlance of metaphysics, this so-called "psychic baiting" ploy roots out cold reading³ by exposing weaknesses in the foundations of the psychic's ontology—what the psychic takes to exist in the world.⁴ The practice of cold reading demands that the psychic take on whatever ontological commitments—commitments to the existence of things⁵—are expressed by the client in the course of their conversation, even when those commitments are not warranted in fact. The revelation of such a permissive and incoherent criterion of ontological commitment

¹ See, e.g., Ray Hyman, *Cold Reading: How to Convince Strangers That You Know All About Them*, 1 THE ZETETIC 18 (1976); Clare Wilson, *Spellbound: What gives mediums their seemingly uncanny ability to read our minds, asks Clare Wilson*, NEW SCIENTIST, July 30, 2005, at 32.

² See IAN ROWLAND, THE FULL FACTS BOOK OF COLD READING 182–84 (2002) (presenting an example of a tarot reading in which the client lies); see also *id.* at 115–16 (explaining that a cold-reading psychic may proceed to discuss or avoid discussion of a dog depending on whether or not the client represents that she used to own a dog); Hyman, *supra* note 1, at 22 ("The [cold] reader, after a suitable interval, will usually feed back the information that the client has given him in such a way that the client will be further amazed at how much the reader 'knows' about him. Invariably the client leaves the reader without realizing that everything he has been told is simply what he himself has unwittingly revealed to the reader.").

³ ROWLAND, *supra* note 2, at 182 ("In essence, psychic baiting is the only sure way to demonstrate that someone giving readings is using cold reading, not genuine psychic ability.").

⁴ See, e.g., WILLIAM BECHTEL, PHILOSOPHY OF MIND: AN OVERVIEW FOR COGNITIVE SCIENCE 2 (1988) (describing scientific and philosophical approaches to ontology as views on "what we take to exist . . .").

⁵ See, e.g., RINKE HOEKSTRA, ONTOLOGY REPRESENTATION: DESIGN PATTERNS AND ONTOLOGIES THAT MAKE SENSE 70 n.1 (2009) ("[A]n ontological *commitment* is a commitment to the existence of something . . .").

puts the lie to the psychic's claim of special knowledge regarding the true state of the world.⁶

The American patent system reposes an extraordinary trust in patent applicants that they are not similarly "baiting" the Patent Office, the courts, and the public with untenable statements about what they have invented. While the doctrine of inequitable conduct aims to deter applicants from making misrepresentations in the first place,⁷ readers of the patent document describing the invention generally must take the applicant's word for it.⁸ Under the longstanding doctrine of constructive reduction to practice,⁹ there is no requirement that a patent applicant actually have made or practiced what she claims to have invented; adequate disclosure in a filed patent application suffices.¹⁰ Accordingly, the Patent Office long ago dispensed with requiring the applicant to produce a working model of the invention.¹¹ With the passage and impending implementation of the "first-to-file"

⁶ See ROWLAND, *supra* note 2, at 8 (describing client testimonials to psychic ability); *id.* at 184 (noting that the psychic-baiting client's lie does not excuse the psychic's claim to have seen a nonexistent husband).

⁷ See *Aventis Pharma S.A. v. Amphastar Pharm.*, 525 F.3d 1334, 1349 (Fed. Cir. 2008) (Rader, J., dissenting) ("Without doubt, candor and truthful cooperation are essential to an ex parte examination system The threat of inequitable conduct, with its 'atomic bomb' remedy of unenforceability, ensures that candor and truthfulness."); *but cf.* Thomas F. Cotter, *An Economic Analysis of Patent Law's Inequitable Conduct Doctrine*, 53 ARIZ. L. REV. 735 (2011) (surveying recent debate over whether inequitable conduct doctrine actually reduces fraud and suggesting reforms).

⁸ The applicant is the author of the patent document because the patent application, authored by the applicant, "ripens into" the patent document upon issuance. See, e.g., *Bayer AG v. Schein Pharm.*, 301 F.3d 1306, 1325 (Fed. Cir. 2002) (Rader, J., concurring).

⁹ See Warren H. Willner, *Origin and Development of the Doctrine of Constructive Reduction to Practice*, 36 J. PAT. OFF. SOC'Y 618, 619–20, 622–23 (1954) (tracing the doctrine to *Wheeler v. Clipper Mower, etc., Co.*, 29 F. Cas. 881 (C.C.N.Y. 1872) and *Dolbear v. Am. Bell Tel. Co.*, 126 U.S. 1 (1888)).

¹⁰ See *Bigham v. Godtfredsen*, 857 F.2d 1415, 1417 (Fed. Cir. 1988) (holding that the constructive requirement to practice requires adequate disclosure under 35 U.S.C. § 112, first paragraph); J. THOMAS MCCARTHY, ROGER E. SCHECHTER & DAVID J. FRANKLYN, MCCARTHY'S DESK ENCYCLOPEDIA OF INTELLECTUAL PROPERTY 504 (3d ed. 2004) ("A constructive reduction to practice is the filing of a patent application with the [PTO] . . . that adequately discloses the invention.").

¹¹ See Kendall J. Dood, *Patent Models and the Patent Law: 1790–1880 (Part II-Conclusion)*, 65 J. PAT. OFF. SOC'Y 234, 271 (1983) ("In 1880 the general model requirement was finally dropped from the rules of the Patent Office."); *but see infra* text accompanying notes 193–95 (describing rare situations where examiners may require a working model).

provisions of the America Invents Act of 2011,¹² only acts of public disclosure, through the filing of a patent application or otherwise—not those of making or practicing the invention, will count toward establishing the priority of an inventor’s patent claims.¹³ Now more than ever, the patent system must rely on applicants’ representations for its own ontological commitments concerning the existence of categories of “useful Arts”,¹⁴ i.e., kinds of objects and processes capable of producing beneficial effects in the world.¹⁵

Fortunately, the patent system need not practice cold reading in its dealings with patent applicants, and its criteria of ontological commitment in reading patent documents are much less permissive and more coherent than those of a psychic. As this Article will explain, this is because the adequate disclosure requirements of § 112 of the Patent Act serve to regulate the patent document’s role in informing the patent system’s ontological commitments. Specifically, the written description and enablement requirements enforce the conditions under which the patent system incurs ontological commitments to patent claims and takes such commitments to be warranted, respectively. More fundamentally, this Article will serve to identify and describe the previously unrecognized, but increasingly salient, ontological function of the patent document.

This Article departs methodologically from previous legal scholarship in its focused search for, and reliance on, the patent system’s metaphysical commitments. Scholars who have previously attributed particular metaphysical stances to the patent system have generally done so in order to reject those stances, thereby clearing the way for proposed policy or doctrinal reforms.¹⁶ A common

¹² Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011). Section 3 of the Act, which contains the “first-to-file” provisions, goes into effect eighteen months from the date of enactment, on March 16, 2013. *Id.*

¹³ The America Invents Act does not require strict priority of filing dates, as section § 102(b) excludes from prior art certain pre-filing disclosures by or derived from the inventor. *See* 35 U.S.C. § 102(b) (2012); *see also* William Ahmann & Tenaya Rodewald, *Patent Reform: The Impact on Start-Ups*, 24 INTELL. PROP. & TECH. L.J. 3 (Jan. 2012) (describing the new law as creating a “First-(Inventor)-to-Disclose System”).

¹⁴ U.S. CONST. art. I, § 8, cl. 8 (authorizing Congress “[t]o promote the Progress of . . . useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their respective . . . Discoveries.”).

¹⁵ *Diamond v. Diehr*, 450 U.S. 175, 183 n.7 (1981) (“It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted. . . .” (quoting *Corning v. Burden*, 56 U.S. 252, 268 (1853))).

¹⁶ *See, e.g.*, Dan L. Burk, *Feminism and Dualism in Intellectual Property*, 15 AM. U. J. GENDER SOC. POL’Y & L. 183, 186 (2007) (arguing that the conception-focused inventorship doctrine exemplifies a

characteristic of this literature is that modern philosophy supplies much of the artillery against the accused stances but few fortifications in support of the proposed changes; thus, potentially powerful metaphysical insights ultimately serve only as adjuncts to normative appeals for reform. In contrast, this Article aims to demonstrate that an explicit recognition of, and reliance on, the patent system's core metaphysical commitments would be not only jurisprudentially defensible, but also instrumental in illuminating the form and nature of the project of "promot[ing] the Progress of . . . useful Arts"¹⁷ and in aligning patent laws and institutions with that constitutional purpose. The advantage of such an approach is that any resulting doctrinal proposals can find warrant not only on policy grounds but also importantly as metaphysically necessary consequences of settled legal principles.

Even though the Supreme Court long ago recognized patent law as the "most metaphysical branch of modern law,"¹⁸ the bench, bar, and academy to date have shown remarkably little interest in articulating, stabilizing, and building on the essential metaphysical foundations of the patent system.¹⁹ Courts in patent cases tend instead to attach the term "metaphysical" pejoratively to considerations deemed too theoretical to guide practical jurisprudence.²⁰ Practitioners, scholars,

"striking pattern of dualism" in the patent system that is subject to critique); Ariel Simon, *Reinventing Discovery: Patent Law's Characterizations of and Interventions Upon Science*, 157 U. PA. L. REV. 2175, 2192–97 (arguing that modern metaphysics has undermined patent law's characterization of laws of nature as fundamental truths).

¹⁷ U.S. CONST. art. I, § 8, cl. 8.

¹⁸ Hogg v. Emerson, 47 U.S. 437, 485–86 (1848); see also Rohm & Haas Co. v. Dawson Chem. Co., 599 F.2d 685, 706 (5th Cir. 1979) (citing Judge Rich's comment that "patent law is 'the metaphysics' of the law"); Folsom v. Marsh, 9 F. Cas. 342, 344 (C.C. Mass. 1841) (No. 4901) (Story, J.) ("Patents and copyrights approach, nearer than any other class of cases belonging to forensic discussions, to what may be called the metaphysics of the law, where the distinctions are, or at least may be, very [subtle] and refined, and, sometimes, almost evanescent."); Giles S. Rich, *The Relation Between Patent Practices and the Anti-Monopoly Laws*, 14 FED. CIR. B.J. 87, 92 (2004) (describing patent law as a "metaphysical branch of the law" and "the invisible, intangible, incorporeal patent right" as "one of the most elusive of all legal concepts . . ."); cf. Simon, *supra* note 16, at 2197 (noting that "the metaphysics of patent law" is "foundational to doctrines of patentable subject matter" but suggesting that "abstract questions of reality otherwise play little to no role in patent law.").

¹⁹ Cf. Darren Hudson Hick, *Making Sense of the Copyrightability of Plots: A Case Study in the Ontology of Art*, 67 J. AESTHETICS & ART CRITICISM 399, 399 (2009) ("[W]hile copyright law assumes some metaphysical basis to its objects, this basis tends to go largely uninvestigated.").

²⁰ See, e.g., *In re Nuijten*, 500 F.3d 1346, 1367 (Fed. Cir. 2007) (en banc) (Linn, J., concurring-in-part and dissenting-in-part) ("[T]he outer limits of statutory subject matter should not depend on metaphysical distinctions such as those between hardware and software or matter and energy, but rather with the requirements of the patent statute. . . ."); *Sarkisian v. Winn-Proof Corp.*, 697 F.2d 1313, 1325

and other commentators have generally followed suit: criticizing metaphysical approaches to patent doctrine as exceeding the competence of the Patent Office and the judiciary,²¹ clashing with scientific methods and teachings,²² and ignoring normative economic considerations.²³

(9th Cir. 1983) (contrasting the courts' earlier "metaphysical and semantic" approach to double patenting with the "specific, workable criteria" used in the current test); *Kalamazoo Loose Leaf Binder Co. v. Wilson Jones Loose Leaf Co.*, 286 F. 715, 720 (S.D.N.Y. 1920) (Hand, J.) (dismissing "the metaphysical question whether [a binder and rack] form a 'combination' or an 'aggregation.'"); *Wilson v. Singer*, 30 F. Cas. 217, 220 (C.C.D.C. 1860) (rejecting alternative interpretation of joint inventorship law as "too refined and metaphysical for the practical business of life."); see also *Earle v. Sawyer*, 8 F. Cas. 254 (C.C. Mass. 1825) (Story, J.) ("It did not appear to me at the trial, and does not appear to me now, that this mode of reasoning upon the metaphysical nature, or the abstract definition of an invention, can justly be applied to cases under the patent act. That act proceeds upon the language of common sense and common life, and has nothing mysterious or equivocal in it."); Neil A. Smith, *Remembrances and Memorial: Judge Giles Sutherland Rich, 1904-1999*, 9 FED. CIR. B.J. 87, 92 (1999) (noting that one of Judge Rich's stated intentions in drafting § 103 of the Patent Act was "to release the courts from all the metaphysical law of the cases about this concept of 'invention' and to make it clear that not all inventions, only unobvious inventions, are patentable."); cf. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 134-35 (1948) (Frankfurter, J., concurring) (arguing that majority's exclusion of "manifestations of laws of nature" from patentable subject matter relies on "vague and malleable terms infected with too much ambiguity and equivocation."); *Rohm & Haas Co.*, 599 F.2d at 706 (noting "the difficulty of the subject matter" of 35 U.S.C. § 271, which Judge Rich referred to as "the metaphysics of patent law"); *Jamesbury Corp. v. U.S.*, 518 F.2d 1384, 1396 (Ct. Cl. 1975) (quoting *Mueller Brass Co. v. Reading Indus.*, 352 F. Supp. 1357, 1372 (E.D. Pa. 1972)) (describing joint inventorship as "one of the muddiest concepts in the muddy metaphysics of the patent law.").

²¹ See, e.g., William Michael Schuster, *Predictability and Patentable Processes: The Federal Circuit's In re Bilski Decision and Its Effect on the Incentive to Invent*, 11 COLUM. SCI. & TECH. L. REV. 1 (2009) ("[I]nherently difficult metaphysical questions such as 'What is an abstract idea?' or 'What is the claimed invention?' are not the expertise of judges or patent examiners but rather philosophers."); John R. Thomas, *Formalism at the Federal Circuit*, 52 AM. U. L. REV. 771, 804 (2003) (noting that *State Street Bank's* relatively simple test for patent-eligibility held the promise of "decreas[ing] Patent Office workload by allowing examiners to avoid the metaphysical inquires that sometimes accompanied" previous tests, though increased filings have swamped any such effect); Todd R. Geremia, *Protecting the Right to Copy: Trade Dress Claims for Configurations in Expired Utility Patents*, 92 NW. U. L. REV. 779, 814-15 (1998) ("[T]o ask courts to make the metaphysical determination of exactly what constitutes the 'true,' 'essential,' or 'significant' inventive components of a formerly patented invention is to invite chaos and unpredictability."); Dennis S. Karjala, *The Relative Roles of Patent and Copyright in the Protection of Computer Programs*, 17 J. MARSHALL J. COMPUTER & INFO. L. 41, 43 (1998) (criticizing "some 20 years of § 101 subject matter metaphysics" during which judges and the Patent Office "had great difficulty extricating themselves from the form in which [software] technology appeared . . ."); John A. Kidwell, *Software and Semiconductors: Why Are We Confused?*, 70 MINN. L. REV. 533, 566 (1985) ("The norms of patent law generally create problems in their administration because patent law is notorious for asking judges to apply criteria that are almost metaphysical in character."); cf. Douglas A. Applegate, *Patenting Improvements: The Costs of Making Patents Easily Available*, 8 SANTA CLARA COMPUTER & HIGH TECH. L.J. 429, 442 (1992) (suggesting that the Supreme Court's approach to combination patents in the wake of *Graham v. John Deere Co.*, 383 U.S. 1 (1966) unhelpfully "wreaked confusion in the patent bar, and rekindled judicial inquiries into the

These concerns should of course be taken seriously. It would indeed be foolish to expect the Patent Office or the courts to resolve long-contested metaphysical questions in the course of administering, enforcing, applying, and developing the patent laws. It would be equally unwise for patent law and policy to abandon sound science and economics for the sake of mere metaphysical line-drawing.

At the same time, the patent system's metaphysical commitments also need to be taken seriously. As Steven Smith persuasively argues in *Law's Quandary*,²⁴ metaphysical commitments "pervade and inform the ways that lawyers talk and argue and predict and that judges decide and justify."²⁵ Legal scholars have long recognized the involvement of the metaphysics of causation in accounts of legal

metaphysics of patentable invention."). *But see* Craig Allen Nard, *Legal Forms and the Common Law of Patents*, 90 BOSTON U. L. REV. 51, 57–58 (2010) (citing *Jamesbury*) ("[M]ore than two centuries of experience has taught us that the common law has handled its responsibility relatively well when engaging 'the muddy metaphysics of the patent law.'"); *but cf.* John R. Thomas, *Of Text, Technique, and the Tangible: Drafting Patent Claims Around Patent Rules*, 17 J. MARSHALL J. COMPUTER & INFO. L. 219, 266–67 (1998) (arguing that "jurists, PTO officials, and commentators concerned with the patent system have not been particularly articulate in describing [the] ontological task" of identifying the invention that is the subject of an artfully drafted patent claim, but proposing that the courts and the PTO employ "the philosophical discipline of phenomenology.").

²² *See, e.g.*, Simon, *supra* note 16, at 2192 ("[P]atentable-subject-matter jurisprudence is filled with metaphysical curiosities that bear little resemblance to how historians of science, philosophers, or even scientists think about science."); Andrew W. Torrance, *Metaphysics and Patenting Life*, 76 UMKC L. REV. 363, 395 (2007) (criticizing the Canadian Supreme Court's appeal to "[m]etaphysical phenomena, such as souls and spirits," in delineating the patentability of life forms, as being "outside the analytical reach of the scientific method . . ."); *cf.* DAVID R. KOEPESELL, *THE ONTOLOGY OF CYBERSPACE: LAW, PHILOSOPHY AND THE FUTURE OF INTELLECTUAL PROPERTY* 102–04, 111 & 121–24 (2000) (arguing that the current "legal ontology" of information technology draws distinctions among media of expression that computer science shows to be false, and advocating legal reform based on "correct ontologies," including the abolition of software patents).

²³ *See, e.g.*, Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 554–57 (2008) (arguing that metaphysical approaches to after-arising technologies will lead courts "to dole out identical treatment for pairings of patentees and alleged infringers who are distinct from a normative perspective."); A. Samuel Oddi, *Contributory Infringement/Patent Misuse: Metaphysics and Metamorphosis*, 44 U. PITT. L. REV. 73, 127–30 (1982) (arguing that the Supreme Court's metaphysical approach in *Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176 (1980), led to a result that creates uneven incentives for inventive activity).

²⁴ STEVEN DOUGLAS SMITH, *LAW'S QUANDARY* (2004).

²⁵ Steven D. Smith, *Metaphysical Perplexity?*, 55 CATH. U. L. REV. 639, 644–45 (2006) (summarizing a central thesis of *LAW'S QUANDARY* for a symposium on the book).

responsibility, particularly in the areas of criminal and tort law.²⁶ In the patent system, inventors, examiners, lawyers, and judges are tasked with drafting and reviewing statements about the capacities of objects and processes to cause beneficial effects in the world.²⁷ Patent claims, the patent system's stock in trade,²⁸ are essentially ad hoc ontological categories²⁹—the metaphysician's stock in trade.³⁰ It is not hard to imagine that ontological commitments might attach to legal

²⁶ See, e.g., MICHAEL S. MOORE, CAUSATION & RESPONSIBILITY (2009); H.L.A. HART & TONY HONORÉ, CAUSATION IN THE LAW (2d ed. 1985); Marcelo Ferrante, *Causation in Criminal Responsibility*, 11 NEW CRIM. L. REV. 470 (2008); Michael Moore, *For What Must We Pay? Causation and Counterfactual Baselines*, 40 SAN DIEGO L. REV. 1181 (2003); Michael S. Moore, *The Metaphysics of Causal Intervention*, 88 CAL. L. REV. 827 (2000); Stephen J. Morse, *The Moral Metaphysics of Causation and Results*, 88 CAL. L. REV. 879 (2000); Jane Stapleton, *Choosing What We Mean by "Causation" in the Law*, 73 MO. L. REV. 433 (2008); Richard W. Wright, *Causation in Tort Law*, 73 CAL. L. REV. 1735 (1985).

²⁷ See 35 U.S.C. § 101 ("Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."); *Diamond v. Diehr*, 450 U.S. 175, 183 n.7 (1981) ("It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted. . . ." (quoting *Corning v. Burden*, 56 U.S. 252, 268 (1853))).

²⁸ See, e.g., Giles S. Rich, *Extent of Protection and Interpretation of Claims: American Perspectives*, 21 INT'L REV. INDUS. PROP. & COPYRIGHT L. 497, 499 (1990) ("To coin a phrase, the name of the game is the claim.").

²⁹ See Jeffrey A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1168 (2008) (noting "the ontological nature of patent claims . . .").

³⁰ See Jan Westerhoff, *The Construction of Ontological Categories*, 82 AUSTRALASIAN J. PHIL. 595, 595 (2004) ("[T]he notion of an ontological category . . . is central to ontology and metaphysics (it is, after all, what these disciplines are about)."). It should be noted that Westerhoff's highly abstract notion of an ontological category excludes "categories as specific as kni[v]es and forks, tables and chairs, or chairs and palaces," and presumably would also exclude typical patent claims. *Id.* at 596. Neither do patent claims appear to provide a general ontological account of the relation between artifacts as "higher-order objects and their material basis." Wybo Houkes & Anthonie Meijers, *The Ontology of Artefacts: The Hard Problem*, 37 STUD. HIST. PHIL. SCI. 118, 119 (2006) (concluding that describing such a relation is "a hard problem in metaphysics"). Patent claim drafting's ad hoc approach is more closely related to the recent use of ontological categories in information science and biomedicine to organize domain-specific knowledge. See Katherine Munn, *What is Ontology For?*, in APPLIED ONTOLOGY: AN INTRODUCTION 7, 10–12 (Katherine Munn & Barry Smith eds., 2009) (discussing the need for an information system to "have a categorical structure readymade for slotting each piece of information programmed into it under the appropriate heading" and to organize domain-specific human knowledge about reality); THE OPEN BIOLOGICAL AND BIOMEDICAL ONTOLOGIES, <http://www.obofoundry.org> (last visited Mar. 23, 2013) (providing open-source ontologies for further research and development in various fields of biology and biomedical research).

While longstanding patent doctrine entitles inventor-applicants to devise their own ontologies within the scope of the prosecution history, see, e.g., *Process Control Corp. v. HydReclaim Corp.*, 190

accounts of patent acquisition, validity, and infringement, even if only tacitly, giving rise to a rich ontology of “useful Arts.” Part II of this Article develops the first descriptive account of such an ontology, deriving formal characterizations of the ontological status of claims and their embodiments from linguistics and the philosophy of science.

Given the long-settled principle of patent claim interpretation that claims are to be read in light of the specification,³¹ it is not surprising that the specification informs the patent system’s ontology. Parts III and IV address the role of the specification in incurring and warranting ontological commitments to claims and their embodiments. Part III offers an interpretation of the written description requirement as a doctrine of ontological possession. This interpretation reconciles the Federal Circuit’s affirmation in its recent *Ariad* en banc opinion³² that adequate written description requires the applicant to demonstrate “possession of the invention”³³ with Jeffrey Lefstin’s equally defensible reading of the requirement as a demand for adequate “definitional information” concerning the scope of patent claims.³⁴ Part IV exhibits the enablement requirement’s role in ensuring that the patent system’s ontological commitments are warranted. The legal literature has not previously explained the fact that the patent system routinely is willing and able to examine, grant, and enforce claims that recite unobserved theoretical entities, therefore effectively taking the word of scientists that subatomic particles and the like exist.³⁵ Using the Federal Circuit’s decision in *Centricut v. Esab Group*³⁶ as a

F.3d 1350 (Fed. Cir. 1999) (“[W]e have held many times that a patentee can act as his own lexicographer to specifically define terms of a claim contrary to their ordinary meaning”), at least one information science researcher questions the necessity of this ad hoc approach. Jeffrey Gower, a graduate student at University at Buffalo-SUNY, has embarked on a massive computer-driven effort to unify the ontology of patent claims around “a structured and controlled vocabulary.” *Towards an Ontology of Patent Claims*, 3TU CENTER FOR ETHICS AND TECHNOLOGY, http://www.ethicsandtechnology.eu/news/comments/towards_an_ontology_of_patent_claims/ (last visited Mar. 23, 2013) (abstract for Gower’s Apr. 29, 2010 presentation).

³¹ See, e.g., *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) (en banc) (quoting *In re Fout*, 675 F.2d 297, 300 (C.C.P.A. 1982)); *Nash Engineering Co. v. Cashin*, 13 F.2d 718, 721 (1st Cir. 1926).

³² *Ariad Pharm. v. Eli Lilly & Co.*, 598 F.3d 1336 (Fed. Cir. 2010) (en banc).

³³ See *id.* at 1351.

³⁴ Lefstin, *supra* note 29, at 1217.

³⁵ The search query “clm(electron) & da(2011)” to Westlaw’s US-PAT database finds 2,726 patents issued in 2011 containing the word “electron” in at least one claim.

³⁶ *Centricut, LLC v. Esab Group, Inc.*, 390 F.3d 1361 (Fed. Cir. 2004).

case study, Part IV explains how the patent system's epistemological commitment to scientific realism informs the court's analysis of claims involving the causal powers of electrons.

If this account of the ontological function of the patent document is reasonably accurate, it will illuminate not only the form and nature of the patent system's project of "promoting . . . Progress," but the coherence of proposed reforms within that project.³⁷ Thus, even though this Article is descriptive, it has extensive normative and prescriptive implications that warrant further investigation. Part V summarizes this Article's descriptive analysis and previews its prescriptive sequel. Responding to the Federal Circuit's split decision in *In re Nuijten*,³⁸ Part V explains how an "essential causation requirement" that reflects the patent system's metaphysical commitments might put patentable subject matter doctrine on firm footing.³⁹ Part V defers a fuller discussion of recommended reforms to a future article.

II. THE PATENT SYSTEM'S ONTOLOGY OF "USEFUL ARTS"

A. *The Ontological Status of Claims*

1. Claims as Kinds

In the modern patent system, patent claims "stand alone to define the invention."⁴⁰ Any study of the patent system's ontological commitments must therefore begin with a precise metaphysical and linguistic characterization of the valid⁴¹ patent claims that are the subject of those commitments.

A widespread misconception about patent claims is that they are merely sets of embodiments, so that certain doctrines about claim scope are reducible to set-theoretic propositions.⁴² This is a useful intuition for introducing the notion of

³⁷ U.S. CONST. art. 1, § 8, cl. 8.

³⁸ *In re Nuijten*, 500 F.3d 1346 (Fed. Cir. 2007).

³⁹ See Andrew Chin, *Patentable Causation* (working title, forthcoming).

⁴⁰ *Ex parte Fressola*, 27 U.S.P.Q.2d 1608, 1609 (B.P.A.I. 1993).

⁴¹ It is implicit throughout Part III.A that any discussion of the linguistic structure of claims is referring to *valid* claims. It is, of course, possible to file a linguistically nonsensical or deviant claim, but such a claim would not be held valid. See 35 U.S.C. § 112(b) (2006 & Supp. V 2011) ("The specification shall conclude with one or more claims pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.").

⁴² See, e.g., Thomas D. Brainard, *Patent Claim Construction: A Graphic Look*, 82 J. PAT. & TRADEMARK OFF. SOC'Y 670 *passim* (2000) (using Venn diagrams to illustrate "[t]he patent concepts of

claim scope and the distinction between claims and embodiments. However, it is an imprecise and inadequate ontological description because while the definition of a set necessarily determines a patent claim's elements,⁴³ the language of a claim does not determine which, if any, of its embodiments exist. Conversely, the number of existing patent claim embodiments has no effect on the claim's scope.⁴⁴ All empty sets are identical,⁴⁵ yet there are many distinct patent claims with no existing embodiments.⁴⁶

For purposes of metaphysical and linguistic ontology, it is more accurate to describe patent claims and their embodiments in terms of the distinction between "types" and "tokens." In metaphysics, the type-token distinction conceptually separates a category—an abstract type—from its members—a concrete token,

validity, infringement, prior art, the doctrine of equivalents, file history estoppel and principles of claim differentiation."); Raj S. Davé, *A Mathematical Approach to Claim Elements and the Doctrine of Equivalents*, 16 HARV. J. L. & TECH. 507, 518–25 (2003) (using Venn diagrams to illustrate doctrine of equivalents and prosecution history estoppel); Jeanne C. Fromer, *Claiming Intellectual Property*, 76 U. CHI. L. REV. 719, 772 (2009) ("[O]ne point of consensus . . . is . . . to ensure that patent claims should enable a properly sized set of embodiments—not too big, not too small—to be protected."); Charles L. Gholz, *A Critique of Recent Opinions in Patent Interferences*, 86 J. PAT. & TRADEMARK OFF. SOC'Y 464, 476–83 (2004) (using Venn diagram to illustrate blocking situation resulting from interference decision); Michael J. Meurer & Craig Allen Nard, *Invention, Refinement and Patent Claim Scope: A New Perspective on the Doctrine of Equivalents*, 93 GEO. L.J. 1947, 1984 (2005) (describing the "refinement" of patent claims during prosecution as the "process of identifying and claiming the broadest patentable set of embodiments enabled by the disclosure in the patent specification."); Samson Vermont, *A New Way to Determine Obviousness: Applying the Pioneer Doctrine to 35 U.S.C. § 103(a)*, 29 AIPLA Q.J. 375, 418–24 (2001) (describing anticipation and obviousness in terms of Venn diagrams). *But cf.* Lefstin, *supra* note 29, at 1159–67 (finding that "[n]early all of the doctrines of patent law . . . may be posed almost as mathematical set-functions whose truth value is described in terms of the claimed subject matter," but concluding that "patent law [is] not reducible to a simple set-theoretic system" insofar as it is impossible "to formulate a doctrine of enablement as a simple function of exclusion or inclusion.").

⁴³ See Nicholas Wolterstorff, *Toward an Ontology of Art Works*, 9 NOUS 115, 121 (1975) (noting that "whatever members a set has it has necessarily."). It should be noted that the truth of this statement assumes the axiom of extensionality, which is widely accepted in set theory. See, e.g., AZRIEL LÉVY, *BASIC SET THEORY* 5 (1979) (stating the axiom as "if [sets] y and z have the same members they are equal.").

⁴⁴ See Collins, *supra* note 23, at 503 (noting that the exclusionary scope of a widget patent claim "is unaffected by a patentee's decision to manufacture ten or ten thousand widgets.").

⁴⁵ See Wolterstorff, *supra* note 43 ("That there is but one null set is clear enough.").

⁴⁶ To be valid, a patent claim need not be actually reduced to practice. See *supra* text accompanying note 10.

which exemplifies the type.⁴⁷ In linguistics, the term “kind” is often used synonymously with “type”,⁴⁸ thus, a noun phrase may refer to a kind rather than a particular object, as in “The Irish economy became dependent upon *the potato*.”⁴⁹ In both of these contexts, a patent claim is accurately understood as a “type” or “kind” whose embodiments are its “tokens” or “examples.”⁵⁰

The metaphysics literature provides strong support for the view that patent claims are kinds of embodiments. In an influential⁵¹ 1975 article, philosopher Nicholas Wolterstorff set out to determine the ontological status of various creative works.⁵² He took pains to distinguish between works and their examples, in much the same way that the 1976 Copyright Act dissected the bundle of uses of an underlying copyrighted work.⁵³ Despite the clear relevance of Wolterstorff’s work for copyright law, he did not mention copyright, and his analysis does not appear to have engaged the attention of legal scholars.⁵⁴ Wolterstorff squarely rejected “the view that performance-works and object-works are *sets* of their examples,”⁵⁵ reasoning that the existence of a creative work is independent of the existence of performances and artifacts, which exemplify that work:

⁴⁷ See THE CAMBRIDGE DICTIONARY OF PHILOSOPHY 936–37 (Robert Audi ed., 1999) (defining “type-token distinction”).

⁴⁸ See, e.g., WAYNE A. DAVIS, MEANING EXPRESSION, AND THOUGHT 316 (2003) (“I can see no metaphysical reason not to use ‘type’ and ‘kind’ interchangeably, and thus to describe words and thoughts as kinds of things.”).

⁴⁹ Manfred Krifka et al., *Genericity: An Introduction*, in THE GENERIC BOOK 1, 2 (Gregory N. Carlson & Francis Jeffry Pelletier eds., 1995) (noting that “the potato” in this sentence does not refer to “some particular potato or group of potatoes, but rather the kind Potato (*Solanum tuberosum*) itself.”).

⁵⁰ See Collins, *supra* note 23, at 503 (“Except in the calculation of damages, references to ‘things’ or ‘sets of things’ in patent law invoke types, not tokens.”); cf. Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621, 626 n.23 (2010) (“An ‘embodiment’ is a concrete form of an invention (like a chemical compound or a widget) described in a patent application or patent.”).

⁵¹ See Charles Nussbaum, *Kinds, Types, and Musical Ontology*, 61 J. AESTHETICS & ART CRITICISM 273, 273 (2003) (describing Wolterstorff’s article as “influential”).

⁵² See Wolterstorff, *supra* note 43, at 115 (“What sort of entity is a symphony? A drama? A dance? A graphic art print? A sculpture? A poem? A film? A painting? Are works of art all fundamentally alike in their ontological status?”).

⁵³ See 17 U.S.C. § 106 (2006).

⁵⁴ No citation to Wolterstorff’s article appears in Westlaw’s TP-ALL database. Subsequent philosophers, however, have recently begun to examine the ontological status of objects of copyright law. See, e.g., Hick, *supra* note 19.

⁵⁵ Wolterstorff, *supra* note 43, at 121.

Just as an art work might have had different and more or fewer performances and objects than it does have, so too the kind Man, for example, might have had different and more or fewer examples than it does have. If Napoleon had not existed, it would not then have been the case that Man did not exist. Rather, Man would then have lacked one of the examples which in fact it had. And secondly, just as there may be two distinct unperformed symphonies, so too may there be two distinct unexampled kinds—e.g., the Unicorn and the Hippogriff.⁵⁶

Wolterstorff wrote that these observations “tend[] at once to confirm us in the suggestion that art works are kinds whose examples are the examples of those works.”⁵⁷ More specifically, “[a] performance-work is a certain kind of performance; an object-work is a certain kind of object.”⁵⁸

Wolterstorff’s analysis of creative works applies with equal force to patent claims. Like a symphony composition that exists and is the subject of copyright regardless of how often it has been performed, a patent claim exists and defines the same scope of patent rights regardless of which, if any, embodiments of the claim exist. Patent claims also exist as unexampled kinds because an inventor may obtain a patent without actually reducing the invention to practice. Under the doctrine of constructive reduction to practice, the filing of a patent application that satisfies the written description, enablement, and best mode requirements of § 112⁵⁹ has the same legal effect as conception and actual reduction to practice through the creation of an operative embodiment.⁶⁰ These observations support the conclusion that a patent claim is a kind whose examples are its embodiments.⁶¹

⁵⁶ *Id.* at 126–27.

⁵⁷ *Id.* at 126.

⁵⁸ *Id.*

⁵⁹ 35 U.S.C. § 112 (2006 & Supp. V 2011).

⁶⁰ Compare *Hyatt v. Boone*, 146 F.3d 1348, 1352 (Fed. Cir. 1998) (“The filing of a patent application serves as conception and constructive reduction to practice of the subject matter described in the application.”), and *Yasuko Kawai v. Metlesics*, 480 F.2d 880, 885 (C.C.P.A. 1973) (“[T]he act of filing the United States application has the legal effect of being, constructively at least, a simultaneous conception and reduction to practice of the invention.”), with *Slip Track Systems, Inc. v. Metal-Lite, Inc.*, 304 F.3d 1256, 1265 (Fed. Cir. 2002) (“In order to establish actual reduction to practice, the inventor must prove that he constructed an embodiment or performed a process that met all the limitations of the claim, and that he determined that the invention would work for its intended purpose.”).

⁶¹ In contrast with copyrighted works and patent claims, the subject matter protected by trademark law appears to defy ontological classification. See *Qualitex Co. v. Jacobson Products Co., Inc.*, 514 U.S.

A close linguistic analysis of patent claim language also leads to the conclusion that patent claims are kinds of embodiments. Interestingly, linguists have singled out the verb “invent” as a stock example of a kind-level predicate—an expression that can be true of a kind but not of individual members or of quantified sets of members of the kind.⁶² As a group of leading scholars in the field explains:

There are some predicates with argument places that can be filled only with kind-referring NPs [noun phrases]. Examples are the subject argument of *die out* or *be extinct* and the object argument of *invent* or *exterminate*. The reason is, of course, that only kinds (not objects) can die out or be invented.⁶³

Linguists therefore justifiably regard a kind-level predicate as strongly indicative of an accompanying reference to a kind.⁶⁴

As with Wolterstorff’s dissection of creative works, this linguistic analysis neither references nor is referenced by the legal literature.⁶⁵ Yet the ongoing examination of “invent” as a linguistic predicate offers a significant insight into the grammar of patent claims.

159, 164 (1995) (“It is the source-distinguishing ability of a mark—not its ontological status as color, shape, fragrance, word, or sign—that permits it to serve these basic purposes.”).

⁶² See GREGORY N. CARLSON, REFERENCES TO KINDS IN ENGLISH 47 (1980) (identifying a class of predicates “which cannot meaningfully be said of any particular individuals, nor can they meaningfully be said of any of the quantified NP’s of the language” and referring to them as “special predicates”); see also *Predicate (grammar)*, WIKIPEDIA, [http://en.wikipedia.org/wiki/Predicate_\(grammar\)#Kind-level_predicates](http://en.wikipedia.org/wiki/Predicate_(grammar)#Kind-level_predicates) (last visited Mar. 11, 2013) (defining a kind-level predicate as a predicate that “is true of a kind of thing, but cannot be applied to individual members of the kind”). The characterization of kind-level predicates is credited to Carlson. See, e.g., THEODORE B. FERNALD, PREDICATES AND TEMPORAL ARGUMENTS 37 (2000) (describing kind-level predicates as a “type-theoretic distinction” drawn by Carlson).

⁶³ Krifka, *supra* note 49, at 10. See Berit Brogaard, *Sharvy’s Theory of Definite Descriptions Revisited*, 88 PAC. PHIL. Q. 160, 177 n.12 (2007) (“‘Babbage invented the computer,’ for example, does not seem to be making a claim about the sum of the world’s computers. Rather, it seems to be making a claim about the concept *computer*.”); Friederike Moltmann, *Properties and Kinds of Tropes: New Linguistic Facts and Old Philosophical Insights*, 113 MIND 1, 33 n.23 (2004) (citing examples of “kind-specific predicates”); Roberto Zamparelli, *Definite and Bare Kind-Denoting Noun Phrases*, in ROMANTIC LANGUAGES AND LINGUISTIC THEORY 2000, at 305, 311–12 (Claire Beyssade et al. eds., 2002) (providing “invented” as an example of a kind-level predicate operating on “Edison” and “light-bulbs”).

⁶⁴ See Zamparelli, *supra* note 63, at 309 (“Probably the best case for the linguistic relevance of kinds comes from predicates which cannot usually apply to ordinary individuals . . .”).

⁶⁵ The terms “kind-level predicate,” “kind-specific predicate” and “kind predicate” do not appear in Westlaw’s TP-ALL database.

Indefinite singular noun phrases—singular nouns preceded by the indefinite article “a” or “an”—have been regarded as incompatible with kind-level predicates.⁶⁶ For example, it is valid to say “Bell invented *the telephone*” or “*Honeybees* are dying out” but unacceptable to say “*A lion* will become extinct soon.”⁶⁷ Bart Geurts and Veneeta Dayal have pointed out, however, that an indefinite singular noun phrase is acceptable “provided it names a novel kind.”⁶⁸ For example, the sentence, “This morning Fred invented a pumpkin-crusher,” is a valid sentence in which the noun phrase “a pumpkin-crusher” denotes a novel kind.⁶⁹ As Olav Mueller-Reichau explains,

Dayal’s point of departure was the widespread assumption that the use of an indefinite article is connected to a certain pragmatic novelty condition. This condition brings it about that any individual designated by an indefinite noun phrase must be understood as being newly introduced into the discourse. What is (more or less) common wisdom as far as interpretations at the object-level are concerned, is supposed to be true also at the kind-level: indefinite NPs are used to introduce kinds when they have the status of novel discourse referents.⁷⁰

Read as a whole, the grammar of a patent claim is consistent with that of one or more novel kinds serving as object arguments for the predicate “invented.” While boilerplate such as “I claim”; “We claim”; “The invention claimed is”; or “What is claimed is”; is more common,⁷¹ implicit in the language preceding every set of patent claims is the assertion that the applicant invented the subject matter of the claims.⁷² Thus, for example, in the following claim, “8. A golf ball having a cover and a core wherein the cover comprises a thermoset cationic polyurethane

⁶⁶ See Krifka, *supra* note 49, at 10.

⁶⁷ *Id.*

⁶⁸ Veneeta Dayal, *Number Marking and (In)Definiteness in Kind Terms*, 27 LINGUISTICS & PHIL. 393, 396 (2004) (citing Bart Geurts, *Genericity, Anaphora and Scope*, Paper presented at the Workshop on Genericity at University of Cologne (2001)).

⁶⁹ *Id.*

⁷⁰ See OLAV MUELLER-REICHAU, SORTING THE WORLD: ON THE RELEVANCE OF THE TYPE/TOKEN-DISTINCTION TO REFERENTIAL SEMANTICS 66 (2011) (citation omitted).

⁷¹ See FABER ON MECHANICS OF PATENT CLAIM DRAFTING § 2:2, at 2-2 (6th ed. 2009) (citing M.P.E.P. § 608.01(m)).

⁷² See 35 U.S.C. § 102(f) (providing that “[a] person shall be entitled to a patent unless . . . he did not himself invent the subject matter sought to be patented.”).

ionomer,”⁷³ “a golf ball,” “a cover,” “a core,” and “a thermoset cationic polyurethane ionomer” are all indefinite singular noun phrases. The sentence that begins with “We invented” and concludes with the text of claim 8 is a valid sentence in which “invented” is a kind-level predicate and each indefinite noun phrase introduces a novel kind into the discourse of the claim.

More generally, the prohibition on “inferential claiming,”⁷⁴ a technical rule of claim drafting, strictly regulates the use of definite and indefinite articles preceding claim elements. Patent attorneys are instructed:

It is important that a new item mentioned for the first time in the claim not be first mentioned as an element operated upon or cooperated with by a previous element described in the same clause

A new element or step is introduced with an indefinite article “a” or “an.” (Some plural items have no introductory article “a” and are introduced by the plural noun itself. But, from the context, the silent introductory indefinite article can be inferred.) On the other hand, when a previously identified element or step is repeated, it is introduced by a definite article “the” or “said.”⁷⁵

In linguistic terms, each indefinite noun phrase in the body of the claim introduces a novel kind—a new element or step—into the discourse of the claims. As for the preamble of the claim, each indefinite noun phrase appearing therein introduces the claim as a whole, which itself refers to a novel kind, provided that the claim is valid.⁷⁶ In the product claim example above, each of the indefinite singular noun phrases represents a novel kind. In process claims, steps typically take the form of gerunds,⁷⁷ which have the external characteristics of a noun phrase⁷⁸ and therefore also represent novel kinds when they lack antecedent basis. Claim drafting thus conforms to the linguistic practice of using indefinite noun phrases “to introduce kinds when they have the status of novel discourse

⁷³ U.S. Patent No. 5,692,974 col.8 ll.34–35 (issued Dec. 2, 1997).

⁷⁴ See FABER, *supra* note 71, § 10:7.4, at 10-43.

⁷⁵ *Id.*

⁷⁶ See 35 U.S.C. § 102(a), (e), (f) & (g) (requiring the applicant to be the first inventor of the claimed invention).

⁷⁷ See, e.g., Lock See Yu-Jahnes, *An Introduction to Claim Drafting*, 906 PLI/Pat 143, 151 (2007).

⁷⁸ See Richard Hudson, *Gerunds Without Phrase Structure*, 21 NAT. LANGUAGE & LINGUISTIC THEORY 579, 579 (2003).

referents”;⁷⁹ i.e., when there is no antecedent basis in the claims that serves as a referent for the newly mentioned element or step. Simply put: claims are written as novel kinds are written.

As we have seen, recent scholarship in metaphysical and linguistic ontology provides strong analytical support for the characterization of patent claims as kinds, rather than sets, of embodiments. This may have been a distinction without a difference in the previous patent literature,⁸⁰ but the significance of patent claims’ kindhood is immediately evident when we undertake to examine the nature of the patent system’s ontological commitments.⁸¹

2. Claim Language and Essential Sortals

Claims are kinds, but they are not *natural kinds*: their boundaries are fixed a posteriori by patent attorneys, not a priori by nature.⁸² At least according to Aristotelian metaphysics, only natural kinds can be said to have essential properties;⁸³ i.e., properties that it is metaphysically necessary for a thing of the kind to have.⁸⁴ Evidently, however, the patent system’s worldview is not Aristotle’s worldview because a claim is a kind of kind that has essential properties.⁸⁵ Specifically, the language of a claim facilitates picking out individuals of the claimed kind and identifying properties of those individuals that are essential to their kind.⁸⁶

⁷⁹ MULLER-REICHAU, *supra* note 70.

⁸⁰ The search term “kind of embodiment” does not appear in Westlaw’s TP-ALL database.

⁸¹ See *infra* Part III.C.

⁸² See BRIAN ELLIS, SCIENTIFIC ESSENTIALISM 19 (2001) (“[M]embership of a natural kind is decided by nature, not by us. . . . [T]he identity of a natural kind can never be dependent only on our interests, psychologies, perceptual apparatus, languages, practices, or choices. For if the identity of a kind depended on any of these things, then it might well be a kind of our own making, not one that exists in the world prior to our knowledge, perception, or description of it.”).

⁸³ See Collins, *supra* note 23, at 525–26 (citing Michael R. Ayers, *Locke Versus Aristotle on Natural Kinds*, 78 J. PHIL. 247, 250–53 (1981) (discussing natural kinds)).

⁸⁴ See Teresa Robertson, *Essential vs. Accidental Properties*, STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Apr. 29, 2008), <http://plato.stanford.edu/entries/essential-accidental> (characterizing essential properties modally in terms of metaphysical necessity and possibility).

⁸⁵ Cf. Collins, *supra* note 23, at 526 (suggesting that courts are influenced by “a different and more modern type of essentialism” that is “scientific, physical and structural.”).

⁸⁶ This essentialist approach to kinds is most commonly associated with the causal account of reference developed by linguistic philosophers Saul Kripke and Hilary Putnam. See SAUL KRIPKE, NAMING AND

In metaphysical terms, the language of each claim corresponds to an essential sortal. While the definition of a sortal varies,⁸⁷ a sortal is commonly understood to provide a criterion of identity for items of a kind.⁸⁸ Examples of terms that would widely be recognized as sortals include “person,” “man,” “brick,” “tomato,” “flamingo,”⁸⁹ “cat,” “dog,” “mountain,” “star,” and “table.”⁹⁰ In contrast, philosopher E.J. Lowe explains, “red thing” is not considered a sortal because whether or not one red thing is identical with another does not depend on a single condition applicable to all red things but “depends at least in part on what sort or kind of red things they are—and then the relevant criterion of identity will be that supplied by the relevant sortal term, be it say, ‘cat,’ ‘apple,’ or ‘star.’”⁹¹ As philosopher Penelope Mackie explains more generally:

NECESSITY (1980); Hilary Putnam, *The Meaning of Meaning*, in 2 MIND, LANGUAGE AND REALITY: PHILOSOPHICAL PAPERS 215 (1975). An anti-essentialist, descriptivist theory of reference also has a distinguished pedigree. See, e.g., Bertrand Russell, *On Denoting*, 14 MIND 479 (1905).

In a fascinating forthcoming article, Daniel Nazer finds both theories implicitly at play in patent doctrine. See Daniel Nazer, *Solving Rader’s Paradox: Patent Law’s Quest for a Theory of Reference* (Feb. 6, 2012) (unpublished manuscript), available at http://www.law.uh.edu/wipip2012/Abstracts/NazerPaper_WIPIP2012.pdf. While Nazer finds that descriptivism tends to be dominant, he declines to find either theory to be the sole “correct” one, and argues for the necessity of keeping the essentialist approach available to inform patent doctrine (e.g., in applying the written description requirement to biotechnology patent claims when reference-fixing descriptions are impracticable). See *id.*

Nazer’s analysis highlights the point that while claim language facilitates identifying the properties of individuals (i.e., embodiments) that are essential to their kind, the practice of reading a claim on an alleged embodiment, see *infra* text accompanying notes 95–97, does not necessarily follow such an approach, nor should it necessarily do so. I do not argue here to the contrary. My more modest contention is that the language of a claim always makes an essentialist approach possible, whether or not the applicable doctrine leads the patent system to take it.

⁸⁷ See Richard E. Grandy, *Sortals*, STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Apr. 17, 2007), <http://plato.stanford.edu/entries/sortals> (surveying characterizations of sortals).

⁸⁸ See *id.*; E.J. Lowe, *Individuation*, in A COMPANION TO METAPHYSICS 28 (Jaegwon Kim et al. eds., 2009) (“It is commonly said that the key distinction between sortal and adjectival terms is that while both possess criteria of *application*, only the former possess criteria of *identity*.”) (citation omitted); Penelope Mackie, *Sortal Concepts and Essential Properties*, 44 PHIL. Q. 311, 312–13 (1994) (“Although [the notion of a sortal] has been employed in slightly different ways, a common thread is provided by the idea that sortal concepts have a special role in *individuation*: they are concepts that provide *criteria of identity or principles of individuation* for the things that fall under them . . .”).

⁸⁹ See Mackie, *supra* note 88, at 311–13.

⁹⁰ See Lowe, *supra* note 88, at 30.

⁹¹ See *id.* at 28.

[I]f ‘C’ is not a sortal term, then the attempt to single something out as ‘this C,’ ‘that C,’ etc., will fail to determine what counts as the same individual as the one picked out, unless some sortal term is implicitly being invoked, in which case it is the sortal term, and not ‘C,’ that is really doing the work.⁹²

Mackie defines essential sortals as follows: “A sortal concept *S* is an *essential sortal* if and only if the things that fall under *S* could not have existed without falling under *S*.”⁹³

Using terms to individuate things of an artificial kind is not necessarily straightforward. The term “clock” does not help to explain when a particular clock loses its original identity in the course of having all of its parts successively repaired and replaced.⁹⁴ The patent system, however, does not concern itself with the persistence of the identity of embodiments over time. In each of the contexts in which it is necessary for the patent system to identify individual products or processes to which claim terms apply, i.e., to determine whether a claim literally “reads on” a given product or process, there is a single temporal focus. In the interference context, the relevant time for the “reads on” inquiry is when a party purports to have actually reduced the claimed invention to practice.⁹⁵ In an anticipation analysis, it is the effective date of the prior art reference that allegedly anticipates the claim.⁹⁶ And in a proceeding against literal infringement, it is the date of the challenged conduct involving the accused device.⁹⁷ In each of these

⁹² See Mackie, *supra* note 88, at 313.

⁹³ See *id.*

⁹⁴ See DAVID WIGGINS, SAMENESS AND SUBSTANCE RENEWED 92 (2001) (“Nor is there one piece of clock—the spring, the regulator, the escapement, the face, the case . . . which the concept *clock* could suggest that we should revere as the ‘focus’ or ‘nucleus’ of a clock, and which can help us past this difficulty.”).

⁹⁵ See, e.g., *Eaton v. Evans*, 204 F.3d 1094, 1097 (Fed. Cir. 2000) (“In an interference proceeding, a party seeking to establish an actual reduction to practice must [have] . . . constructed an embodiment or performed a process that met every element of the interference count . . .”).

⁹⁶ See, e.g., *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1322–23 (Fed. Cir. 2011) (“[T]he proper framework for challenging the validity of a patent is . . . to show that every element of the patent claims reads on a single prior art reference.”).

⁹⁷ See, e.g., *Jeneric/Pentron, Inc. v. Dillon Co.*, 205 F.3d 1377, 1382 (Fed. Cir. 2000) (“[A]n accused product literally infringes if every limitation recited in the claim appears in the accused product, i.e., the properly construed claim reads on the accused product exactly.”); Mark A. Lemley, *The Changing Meaning of Patent Claim Terms*, 104 MICH. L. REV. 101, 108 (2005) (“Whether an accused device infringes is tested as of the time of the alleged infringement . . .”).

contexts, the patent system's inquiry into the identity of an embodiment is confined to the properties the embodiment possesses at the relevant time, regardless of any prior or subsequent changes.

The boundless ability of humans to define and name parts of things can also complicate the use of sortals to count items of a kind. Consider an ancient puzzle posed by the Stoic philosopher Chrysippus:

Dion, a whole-bodied man, has a proper part, Theon, which consists of all of Dion except Dion's left foot. This morning Dion's left foot was amputated. If Dion and Theon both survive there are two material objects coincident in space and time, and made of the same matter! Which has ceased to exist? Not Dion—a man can survive the loss of a foot. Not Theon, which has had no part chopped off.⁹⁸

The apparent conclusion that such coincident material objects survive as numerically distinct entities is unacceptable to many philosophers.⁹⁹ To avoid this result, Michael Burke offers the following premises as an “essentialist solution” to Chrysippus's puzzle: (1) “the concept of a person is maximal, that is, that proper parts of persons are not themselves persons”; (2) “persons are essentially persons and thus . . . nonpersons are essentially nonpersons”; (3) the separation from Theon of Dion's left foot was a change that would have made Theon a person if Theon survived.¹⁰⁰ According to these premises, Theon was essentially a nonperson, i.e., a proper part of Dion, and therefore could not have survived the separation from Dion's foot that would have changed him into a person.¹⁰¹

Burke's argument is debatable as a solution to Chrysippus's puzzle,¹⁰² but it does provide a coherent account¹⁰³ that fits the patent system's treatment of a

⁹⁸ Jim Stone, *Why Sortal Essentialism Cannot Solve Chrysippus's Puzzle*, 62 ANALYSIS 216, 216 (2002).

⁹⁹ *See id.*

¹⁰⁰ *See* Michael Burke, *Dion and Theon: An Essentialist Solution to an Ancient Puzzle*, 90 J. PHIL. 129, 134 (1994).

¹⁰¹ *See id.* at 135.

¹⁰² *See* Stone, *supra* note 98, at 216; *but see* Marta Ujvari, *Cambridge Change and Sortal Essentialism*, 5 METAPHYSICA 25 (2004) (defending a reconstructed version of Burke's argument).

¹⁰³ *See* Stone, *supra* note 98, at 216–17 (explaining that his response to Burke “may discourage philosophers who hope to deploy essentialism against Chrysippus, but it will encourage those who believe in the viability of sortal essentialism or wish to better understand it”).

claim's embodiments. As a general matter, the patent system treats the concept of an embodiment as maximal. Given the claim, "A thing comprising elements *A* and *B*," a thing *T* consisting solely of extensions of terms *A*, *B*, *C* and *D* counts as one embodiment ($A+B+C+D$), not four embodiments ($A+B$, $A+B+C$, $A+B+D$, $A+B+C+D$).¹⁰⁴ Only the whole thing *T* falls under the sortal *S* corresponding to the claim language, which picks out embodiments and only embodiments of the claim.

Assuming for the moment that *S* is an essential sortal, it is straightforward to identify the essential properties of *T* within this account, namely *T*'s possession of extensions of terms *A* and *B* and the lack of another, larger, thing comprising extensions of terms *A* and *B*, of which *T* is a proper part. This is just another way of saying that *T* is a complete thing that falls within the literal scope of the claim. Patent law's notion of essentiality for elements and limitations that determine the scope of a claim thus maps naturally onto the metaphysical notion of essentiality for properties of things that fall under the corresponding sortal, i.e., embodiments of the claim. As Part II.B explains, such essential properties may include causal powers and other dispositional properties.

The patent system is deeply committed to the view that the language of a claim corresponds to an essential sortal. The patent system does not entertain the ontological possibility of worlds in which an embodiment of a claimed invention exists, yet lacks an element of the claim.¹⁰⁵ As far as the patent system is concerned, the embodiments of a claim could not have existed without falling under the sortal corresponding to the claim language. A worldview in which it is metaphysically possible for an embodiment of a claim to come into existence when, and only when, all elements of the claim are present, might seem strange to many philosophers,¹⁰⁶ but this worldview follows concomitantly from the ontological reading of the predicate "make" that suffuses patent doctrine.¹⁰⁷

¹⁰⁴ See FABER, *supra* note 71, § 2:5, at 2-15 (discussing interpretation of "comprising").

¹⁰⁵ See, e.g., *Peeler v. Miller*, 535 F.2d 647, 651 (C.C.P.A. 1976) ("[W]ithout an actual reduction to practice there is no invention in existence . . ."). *But cf.* *Pfaff v. Wells Electronics, Inc.*, 124 F.3d 1429, 1433 (Fed. Cir. 1997) ("[R]eduction to practice is not necessarily a prerequisite to application of the on-sale bar.").

¹⁰⁶ See generally DAVID K. LEWIS, COUNTERFACTUALS (2001) (illustrating the wide range of metaphysical possibility).

¹⁰⁷ See, e.g., *Bayer AG v. Housey Pharm.*, 340 F.3d 1367, 1372 nn.5-6 (Fed. Cir. 2003) (citing RANDOM HOUSE WEBSTER'S UNABRIDGED DICTIONARY 1172 (2d ed. 1998) definitions of "make" as "to bring into existence" and "cause to exist or happen"); *Radio Corp. of America v. Andrea*, 79 F.2d 626, 628 (2d Cir. 1935) (Swan, J.) ("No wrong is done the patentee until the combination is formed. His

In characterizing claim language in this way, no distinction is drawn between product and process claims, and none is necessary. While the discussion thus far has exclusively cited material objects as examples of things that can fall under a sortal, the language of a process claim, which recites a series of steps, can also be recognized as corresponding to an essential sortal. The items that fall under such a sortal are series of events covered by the corresponding process claim, where each such event is the performance of one of the recited steps. The patent system regards these events as concrete individual things¹⁰⁸ that exist in time and space.¹⁰⁹ Events can thus be accorded the same ontological status as material objects, at least in their capacity of exemplifying claim elements.

The treatment of events as particulars coheres with the ontological worldview of philosopher Donald Davidson.¹¹⁰ According to Davidson, events have a causal principle of individuation: “[E]vents are identical if and only if they have exactly the same causes and effects.”¹¹¹ Despite the apparent strictness of this principle, any form of causal evidence, including “logic alone, or logic plus physics, or almost anything else . . . depending on the descriptions provided,” can establish the identity of an individual event.¹¹² When this causal evidence is available, Davidson concludes it is reasonable to describe events as things falling under a sortal,¹¹³ inasmuch as “the individuation of events poses no problems worse in principle than the problems posed by individuation of material objects.”¹¹⁴ As we will see in the

monopoly does not cover the manufacture or sale of separate elements capable of being, but never *actually*, associated to form the invention.”) (emphasis added); *accord* *Deepsouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 529 (1972) (quoting *Radio Corp.* with approval as “the leading case” on the construction of “make” in § 271 of the Patent Act).

¹⁰⁸ *Cf.* Collins, *supra* note 23, at 501 n.18 (2008) (using the term “things” to encompass both objects (products) and events (processes) described by patent claims).

¹⁰⁹ *See, e.g.*, *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282 (Fed. Cir. 2005). In *NTP*, a patentee asserted method claims that each recited a step that had been performed, if at all, only in Canada. *Id.* at 1318. Holding that “a process cannot be used ‘within’ the United States as required by section 271(a) unless each of the steps is performed within this country,” the court found the claims not infringed as a matter of law. *Id.*

¹¹⁰ DONALD DAVIDSON, *ESSAYS ON ACTIONS AND EVENTS* 105–203 (2001) (presenting and defending the position that events are particulars).

¹¹¹ *Id.* at 179.

¹¹² *Id.* at 179–80.

¹¹³ *Id.* (“Individuation at its best requires sorts or kinds that give a principle for counting. But here again, events come out well enough. . .”).

¹¹⁴ *Id.* at 180.

next section, the patent system's ontology of "useful Arts" demands such causal evidence of the embodiments of every claim.¹¹⁵ Process claims therefore do not raise special ontological problems, provided that Davidson's treatment of events is consistent with the patent system's other commitments.

B. *The Ontological Status of Embodiments*

The conclusion that embodiments exemplify claims immediately implies that embodiments hold the ontological status of particulars, i.e., "something (not necessarily an object) that instantiates but is not itself instantiated."¹¹⁶ But the patent system's ontology of "useful Arts" requires that embodiments be capable of more than instantiation. For an invention to have operative utility, an invention must be "capable of being used to effect the object proposed."¹¹⁷ To have beneficial utility, it must be "capable of providing some identifiable benefit."¹¹⁸ Thus, to be included among the "useful Arts," an invention must have the capability, or power, to cause "a beneficial result or effect" when it is used.¹¹⁹ Since to use a claimed invention is just to use one of its embodiments,¹²⁰ the utility of a claimed invention is grounded in the causal powers of the claim's embodiments. Our characterization

¹¹⁵ See *infra* text accompanying notes 126–34.

¹¹⁶ E.J. Lowe, *The Metaphysics of Abstract Objects*, 92 J. PHIL. 509, 518 (1995); see also Nari Lee, *Patent Eligible Subject Matter Reconfiguration and the Emergence of Proprietary Norms: The Patent Eligibility of Business Methods*, 45 IDEA 321, 325 (2005) ("What patent law gives is property-like protection on the instantiation of ideas."); Jerome T. Tao, Comment, *Theories of Computer Program Patentability*, 7 SANTA CLARA COMPUTER & HIGH TECH. L.J. 291, 300 (1991) (restating Pamela Samuelson's view that "[i]nstantiation" is defined as the embodiment of the inventive concept.).

¹¹⁷ *Stiftung v. Renishaw PLC*, 945 F.2d 1173, 1180 (Fed. Cir. 1991) (citation omitted).

¹¹⁸ *Juicy Whip, Inc. v. Orange Bang, Inc.*, 185 F.3d 1364, 1366 (Fed. Cir. 1999) ("An invention is 'useful' under section 101 if it is capable of providing some identifiable benefit.").

¹¹⁹ See *Diamond v. Diehr*, 450 U.S. 175, 183 n.7 (1981) (citing *Corning v. Burden*, 56 U.S. 252, 268 (1854) ("It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted . . .")); *Stiftung*, 945 F.2d at 1180 (noting the constitutional dimension of the utility requirement).

¹²⁰ See, e.g., *Zenith Elec. Corp. v. PDI Commc'ns Sys., Inc.*, 522 F.3d 1348 (Fed. Cir. 2008) (citation omitted) (explaining that § 102(b) public use bar turns on "whether the public use related to a device that embodied the invention."); Timothy R. Holbrook, *Liability for the "Threat of a Sale": Assessing Patent Infringement for Offering to Sell an Invention and Implications for the On-Sale Patentability Bar and Other Forms of Infringement*, 43 SANTA CLARA L. REV. 751, 813–14 (2003) (reasoning that under a plain meaning interpretation of § 271(a), an infringing use requires "a physical embodiment of the patented invention").

of the ontological status of embodiments therefore focuses on the patent system's metaphysical commitments regarding the nature and role of their causal powers.

1. The Causal Powers of Embodiments

The term *causal power* is not in the vocabulary of patent law,¹²¹ but the concept is familiar to patent doctrine. A causal power is simply a disposition to engage in a process that relates a cause and an effect.¹²² That a claim's embodiments have causal powers follows from the patent system's attribution of "a beneficial result or effect" to the use of an embodiment of the claimed invention, i.e., as a "practicable method or means of producing" the beneficial effect.¹²³

As a preliminary matter, it is necessary to note that the causal powers of a claim's embodiments may vary, at least to the extent that the use of certain embodiments, under some or all conditions, might not achieve the intended purpose of the claimed invention.¹²⁴ The presence of such inoperative embodiments within the claim scope need not negate enablement however as long as their number does not "in effect force[] one of ordinary skill in the art to experiment unduly in order to practice the claimed invention."¹²⁵

An enabling patent disclosure explains how to employ the causal powers of embodiments by "teach[ing] those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation."¹²⁶ Given that every claim has infinitely many embodiments,¹²⁷ it is neither necessary nor possible for the disclosure to provide a specific teaching for every embodiment within the

¹²¹ A search on Westlaw's Federal Circuit decision (CTAF) database finds no occurrences of the phrase "causal power."

¹²² See BRIAN ELLIS, *THE PHILOSOPHY OF NATURE* 48 (2002).

¹²³ *Diamond*, 450 U.S. at 183; cf. 1 CHISUM ON PATENTS § 1.03[2] (2012) ("In its primary significance, the exclusion of principles and abstract ideas merely emphasizes the fundamental concept that patents are issued only for new *means* to achieve useful results.").

¹²⁴ See *In re Dinh-Nguyen*, 492 F.2d 856, 858–59 (C.C.P.A. 1974) ("It is not a function of the claims to specifically exclude . . . possible inoperative substances . . .").

¹²⁵ *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750 F.2d 1569, 1576–77 (Fed. Cir. 1984).

¹²⁶ *Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1378 (Fed. Cir. 2009) (citing *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993)).

¹²⁷ See Tun-Jen Chiang, *The Rules and Standards of Patentable Subject Matter*, 2010 WIS. L. REV. 1353, 1391 (2010); Lefstin, *supra* note 29 at 1168–74.

scope of the claim.¹²⁸ Patent applicants therefore employ generic disclosures to teach those skilled in the art how to employ the causal powers of a claim's embodiments. Such disclosures are considered sufficient as long as undue experimentation is not required to achieve operability.¹²⁹ Each embodiment within the scope of a generic disclosure possesses certain causal powers that are employed in using the claim's embodiments as taught by the disclosure, even though sometimes those causal powers may prove insufficient for operability in actual use circumstances. Such causal powers may be said to be essential to the embodiment, because the embodiment necessarily possesses them in virtue of being an example of the kind defined by the claim.¹³⁰

Even without an explicit description of the cause and effect in question, a disclosure may be found sufficient to teach one or more of the causal powers employed in practicing an invention, through a theory of inherent disclosure.¹³¹ To show inherency, the effect in question "must inevitably happen."¹³² For this purpose, it is sufficient for the disclosure that the effect in question is "the natural result flowing from the operation as taught."¹³³ Causal powers of embodiments that manifest natural dispositions therefore exist necessarily, insofar as entities possessing such dispositions are involved in "the operation as taught" and the

¹²⁸ There is no requirement that an enabling patent disclosure provide information pertaining to the enablement of specific embodiments (i.e., "working examples"). See *In re Long*, 368 F.2d 892, 895 (C.C.P.A. 1966) ("If by 'specific embodiment' is meant a working example, then the same is not required where sufficient working procedure has been set forth showing that one skilled in the art may prepare the claimed article without undue experimentation.").

¹²⁹ As the Federal Circuit has explained, despite the lack of specific enabling information regarding "every possible variant of the claimed invention, . . . the artisan's knowledge of the prior art and routine experimentation can often fill gaps, interpolate between embodiments, and perhaps even extrapolate beyond the disclosed embodiments, depending upon the predictability of the art." *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1244 (Fed. Cir. 2003); see also *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988) (listing factors, including predictability of the art, to be considered in determining whether a disclosure would require undue experimentation).

¹³⁰ See *ELLIS*, *supra* note 122, at 12 (defining "the kind essence of a thing" as "the set of its properties in virtue of which it is a thing of the kind it is" and subsequently using the term "essential properties" to refer to "kind essences").

¹³¹ See *Pingree v. Hull*, 518 F.2d 624, 627–28 (C.C.P.A. 1975) (applying inherency doctrine in interference context to find enablement by junior party). The inherency doctrine is more commonly applied in the context of finding teachings in prior art references. See, e.g., *Cont'l Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991).

¹³² *Pingree*, 518 F.2d at 627.

¹³³ *Id.* at 628 (citing *Hansgirk v. Kemmer*, 102 F.2d 212, 214 (C.C.P.A. 1939)).

effects of such causal powers “must inevitably happen.” Thus the causal laws of nature are necessary in the metaphysical sense: to say an effect is a natural result necessarily entails that it is also an inevitable result.¹³⁴

2. Scientific Essentialism

The patent system’s recognition of essential causal powers in embodiments and the necessity of laws of nature contrasts with the “regularity account” attributed to David Hume, which informs most modern theories of causation.¹³⁵ This so-called Humean¹³⁶ worldview holds that objects have no essential dispositional properties, the behavior of objects are completely determined by the laws of nature, laws of nature are contingent on regularities in the ways objects behave, and causal relationships are nothing more than connections between logically independent events.¹³⁷ Philosopher Brian David Ellis describes the Humean worldview as “still-dominant” and refers to it as “passivism,” in that it is

¹³⁴ See *Newman v. Quigg*, 877 F.2d 1575, 1580 (Fed. Cir. 1989) (“This court . . . believes that the laws of thermodynamics do not brook contradiction.”); cf. ELLIS, *supra* note 122, at 59 (“Essentialists believe that . . . the laws of nature are metaphysically necessary, because anything that belongs to a natural kind is logically required (or is necessarily disposed) to behave as its essential properties dictate.”).

The metaphysical necessity of the natural dispositions of naturally occurring substances is also implicit in the “purification” doctrine relating to the exclusion of products of nature from patentable subject matter. An artificially purified form of a naturally occurring substance will not be found patentable unless it differs “in kind” (and not merely “in degree”) from the impure form found in nature, see *Parke-Davis & Co. v. H.K. Mulford & Co.*, 189 F. 95, 103 (S.D.N.Y. 1911), *aff’d*, 196 F. 496 (2d Cir. 1912), and such a difference in kind “will normally be found only if the new pure compound has an entirely new utility from the old one.” 1 CHISUM ON PATENTS § 1.02[9] (2012). Thus, where purification alters the essential causal powers of a natural substance (at least to the extent that it can be used to produce a beneficial result or effect not manifested in nature), patent doctrine recognizes the existence of a new, non-natural kind, of which the new pure substance is an example and the old impure substance is not.

¹³⁵ DANIEL M. HAUSMAN, CAUSAL ASYMMETRIES 36 (1998) (“Hume’s theory is the starting point for most modern treatments of causation, and the problems his theory must surmount are problems for all theories of causation . . .”).

¹³⁶ Compare Alexander Rosenberg, *Hume and the Philosophy of Science*, in THE CAMBRIDGE COMPANION TO HUME 64, 73–78 (David Fate Norton ed., 1993) (describing Hume’s views that “notions of efficacy or causal power or causal necessity in the objects are without the requisite pedigree in experience to be meaningful” and that “laws are the instantiation of contingent regularities whose evidential strength . . . sustains an attribution of some sort of necessity to the connections they report”), with TOM L. BEAUCHAMP & ALEXANDER ROSENBERG, HUME AND THE PROBLEM OF CAUSATION 32–37 (1981) (arguing that Hume himself did not hold these views).

¹³⁷ ELLIS, *supra* note 122, at 59–60.

“[t]he view that things in nature are essentially passive, and obedient to nature’s laws.”¹³⁸ According to Ellis,

To be a passivist, one must believe that inanimate things are capable of acting only as directed—depending, for example, on how they are pushed or pulled around by God, or by the forces of nature (or, in Hume’s case, by what the laws of nature happen to be). A passivist therefore believes that the tendencies of things to behave as they do can never be inherent in the things themselves. They must always be imposed on them from the outside. The forces of nature, for example, are always seen as being external to the objects on which they act. They act on them, or between them, but the things themselves are never the source of any activity.¹³⁹

Since passivism attributes the behavior of embodiments entirely to the laws of nature, a passivist views every invention as nothing more than the manifestation of a newly discovered aspect of a law of nature. This perspective is deeply incompatible with longstanding patentable subject matter doctrine, which holds that “[p]henomena of nature, though just discovered . . . are not patentable, as they are the basic tools of scientific and technological work”¹⁴⁰ and regards “manifestations of laws of nature” as “free to all men and reserved exclusively to none.”¹⁴¹ While patentable inventions may arise “from the application of [a] law of nature to a new and useful end,”¹⁴² the notion of an embodiment capable of applying a law of nature to a new and useful end is foreign to passivism. Equally foreign is the idea that the use of an embodiment of a patentable invention represents “a practical method or means of producing a beneficial result or effect.”¹⁴³ If the previous section’s account of the causal powers of embodiments is more or less accurate, then there is no place for passivism in the patent system.

The patent system’s worldview also differs from that of classical Aristotelian essentialism, in which everything that exists by nature has an essential *telos*, or

¹³⁸ See *id.* at 2.

¹³⁹ *Id.* at 2–3.

¹⁴⁰ See *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972).

¹⁴¹ See *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948).

¹⁴² See *Diamond v. Diehr*, 450 U.S. 175, 188 n.11 (1981).

¹⁴³ See *id.* at 183 n.7 (citing *Corning v. Burden*, 56 U.S. 252, 268 (1854)).

purpose, i.e., “that for the sake of which a thing . . . exists.”¹⁴⁴ Patent doctrine contemplates the existence of objects without essential purposes; it does not “conceive of the world as a grand teleological system in which the parts exist for the sake of a whole.”¹⁴⁵ In granting patents for the “new use of a known . . . machine, manufacture, composition of matter, or material,”¹⁴⁶ the patent system acknowledges that the causal powers of objects may be made to serve a new purpose. In so doing, the patent system generally declines to treat the new purpose as an essential property that can, by itself, distinguish the claimed invention over the prior art;¹⁴⁷ the claimed method of using the old object must also recite a new manipulative step.¹⁴⁸

A patent claim may state “a purpose or intended use” for the invention in its preamble, but such a stated purpose generally has no independent status as an essential property of an embodiment of the claim.¹⁴⁹ Preambular language is considered “essential,” and therefore held to affect claim scope, only to the extent that it may be found to state “essential structure or steps” of the claimed invention or to give “life, meaning, and vitality” to a claim that would otherwise fail to meaningfully define essential structure or steps.¹⁵⁰ Accordingly, infringement

¹⁴⁴ See ELLIS, *supra* note 122, at 11–12 (citation omitted).

¹⁴⁵ See *id.* at 13.

¹⁴⁶ See 35 U.S.C. § 100(b).

¹⁴⁷ See David A. Kelly, *What Constitutes a “New Use” of a Known Composition and Should a Patentee’s Purported Objective Make Any Difference?*, 21 SANTA CLARA COMPUTER & HIGH TECH. L.J. 319, 322–32 (2005) (discussing cases supporting the principle that “when the claim recites using an old composition and the ‘use’ is directed to a result or property of that composition, then the claim is inherently anticipated.”).

¹⁴⁸ See *id.* at 336 & n.77 (citing *Integra Life Sciences I, Ltd. v. Merck KGaA*, 50 U.S.P.Q.2d 1846, 1850–51 (S.D. Cal. 1999), *aff’d in relevant part*, 331 F.3d 860 (Fed. Cir. 2003), *vacated on other grounds*, 545 U.S. 193 (2005)); *but see* *Jansen v. Rexall Sundown, Inc.*, 342 F.3d 1329, 1333 (Fed. Cir. 2003) (construing a preambular “statement of the intentional purpose for which the method must be performed” as a claim limitation).

¹⁴⁹ See *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997) (“[W]here a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention, the preamble is not a claim limitation.”); *see also* *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 809 (Fed. Cir. 2002) (“[T]he patentability of apparatus or composition claims depends on the claimed structure, not on the use or purpose of that structure.”).

¹⁵⁰ See, e.g., *Vizio, Inc. v. Int’l Trade Comm’n*, 605 F.3d 1330, 1340–41 (Fed. Cir. 2010) (citation omitted) (finding that claims “would have little meaning without the intended objective” recited in the preamble and that preambular language “does not ‘only add[] an intended use,’ but rather, states an essential limitation to the claims”); *Griffin v. Bertina*, 285 F.3d 1029, 1033 (Fed. Cir. 2002) (finding that “diagnosis is . . . the essence of this invention” because “its appearance in the count gives ‘life and

doctrine does not treat a preambular purpose as an essential property of a patent claim, because “[i]ntent is not an element of infringement.”¹⁵¹

By recognizing causal powers but not purposes as essential properties of embodiments, the patent system appears to be committed to a third metaphysical worldview, known as *scientific essentialism*. In the words of Ellis, who jointly coined the term,¹⁵² scientific essentialism holds that “there are genuine causal powers, capacities, and propensities that . . . exist in nature as universals, and are therefore the same in all possible worlds.”¹⁵³ For example, gravitational mass and charge are properties of an object that determine its causal role in generating gravitational and electromagnetic fields, respectively, and hence the effects it has on other objects present in these fields.¹⁵⁴

Scientific essentialism holds that there are *natural kinds*,¹⁵⁵ i.e., kinds that are “independent of human interests, language and epistemic considerations, and thereby reflect true divisions of the world.”¹⁵⁶ Paradigmatic examples of natural kinds include “water,” “electron,” and “planet,” because these kinds “are out there in the natural world, not just in our way of thinking about the world.”¹⁵⁷ Scientific essentialism holds that scientific explanations are based at least in part on “postulates concerning the essential natures of the fundamental natural kinds of

meaning’ to the manipulative steps”); see also *Catalina*, 289 F.3d at 808 (“[C]lear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.”).

¹⁵¹ *Hilton Davis Chem. Co. v. Warner-Jenkinson Co.*, 62 F.3d 1512, 1519 (Fed. Cir. 1995), *rev’d on other grounds*, 520 U.S. 17 (1997); see also *Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank*, 527 U.S. 627, 645 (1999) (“Actions predicated on direct patent infringement, however, do not require any showing of intent to infringe; instead, knowledge and intent are considered only with respect to damages.”); *Warner-Jenkinson v. Hilton Davis Chem. Co.*, 520 U.S. 17, 35 (1997) (“Application of the doctrine of equivalents, therefore, is akin to determining literal infringement, and neither requires proof of intent.”); Kelly, *supra* note 147, at 333–34 (discussing cases).

¹⁵² See ELLIS, *supra* note 82, at 57 n.16.

¹⁵³ *Id.* at 48.

¹⁵⁴ See *id.* at 6.

¹⁵⁵ See *id.* at 19 (explaining that “[n]atural kinds clearly have a central place” in the ontology underlying scientific essentialism).

¹⁵⁶ RICHARD A. RICHARDS, *THE SPECIES PROBLEM: A PHILOSOPHICAL ANALYSIS* 149 (2010).

¹⁵⁷ *Id.* at 150.

objects and processes occurring in the world.”¹⁵⁸ On this view, the task of science “is to discover what makes a thing the kind of thing it is and hence to explain why it behaves or has the properties it has.”¹⁵⁹ For example, science has discovered that an electron “has a certain mass and a certain charge essentially,” and must therefore “generate [certain gravitational and electromagnetic] fields in any world in which it might exist, and have precisely the same effects on things of just the same kinds.”¹⁶⁰ Because a disposition to generate these fields is essential to the electron, “[i]f a particle lacked this causal power, essentialists say, then, whatever else it might be, it would not be an electron.”¹⁶¹

Consistent with the patent system’s worldview,¹⁶² scientific essentialism holds that “[t]he laws of nature are not contingent, but metaphysically necessary.”¹⁶³ This is because laws of nature are simply “descriptions of natural kinds of processes arising from the intrinsic properties of things belonging to natural kinds.”¹⁶⁴ Thus, “[i]f the laws of nature were different, the things existing in the world would have to be different,”¹⁶⁵ because, *inter alia*, their causal powers, capacities and propensities would be different.¹⁶⁶ Electrons would not exist, because nothing would have an electron’s essential causal powers.¹⁶⁷

This is not to say that causal powers cannot vary among different things of the same kind. While the causal powers and other dispositional properties of “the “most elementary things” of a natural kind are “fixed by their essential natures,” scientific essentialism contemplates variability in the causal powers of “more complicated things.”¹⁶⁸ “One cannot . . . teach a copper atom or a proton any new

¹⁵⁸ See ELLIS, *supra* note 82, at 57 n.16.

¹⁵⁹ *Id.* at 55.

¹⁶⁰ *Id.* at 6.

¹⁶¹ ELLIS, *supra* note 122, at 13.

¹⁶² See *supra* text accompanying note 134.

¹⁶³ See ELLIS, *supra* note 82, at 7.

¹⁶⁴ *Id.*

¹⁶⁵ *Id.*

¹⁶⁶ See *supra* text accompanying note 153.

¹⁶⁷ See *supra* text accompanying notes 159–60.

¹⁶⁸ See ELLIS, *supra* note 122, at 142.

tricks,”¹⁶⁹ but the causal powers of a more complex object may change because of its history or circumstances. For example, an iron object may become fatigued, and therefore brittle, or magnetized, and therefore capable of attracting other pieces of iron.¹⁷⁰ Furthermore, even when an object, such as a mousetrap spring, actually possesses a given causal power, the history or circumstances surrounding the object’s use may affect whether the causal power is manifested as an intended effect, as Ellis describes:

If the mousetrap is not set off by the taking of the cheese, then presumably the disturbance was not enough to release the causal power latent in the spring. Unless there are extraordinary defeating circumstances, there can be no question of the catch being released and the mousetrap not snapping shut.¹⁷¹

Scientific essentialism can therefore account for the potentially wide variations among the causal powers of embodiments of a given patent claim and the manifestations of those causal powers as effects.¹⁷² Patent claims are non-natural kinds of relatively complex objects and processes, and the making of an embodiment may entail introducing changes to the causal powers of many constituent elements.¹⁷³ Thus the causal powers of different embodiments of the same claim may vary, depending on the ways the causal powers of natural kinds are brought into play and the circumstances in which each embodiment is made. Because of this variation in causal powers, some embodiments of a claimed invention may even be inoperable within the range of circumstances of the invention’s intended use. Some mousetraps may fail to snap shut when they should—but it is always possible to build a better one.¹⁷⁴

¹⁶⁹ ELLIS, *supra* note 82, at 21.

¹⁷⁰ See ELLIS, *supra* note 122, at 142.

¹⁷¹ See *id.*

¹⁷² See *supra* text accompanying note 124.

¹⁷³ See, e.g., *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722, 728–29 (2002) (describing claim limitation requiring that “the outer shell of the device, the sleeve, be made of a magnetizable material” and noting that the commercial embodiment of the claim uses a “magnetized alloy”).

¹⁷⁴ *But see* *Graham v. John Deere Co.*, 383 U.S. 1, 19 (1966) (noting that due to advances in the field, “[h]e who seeks to build a better mousetrap today has a long path to tread before reaching the Patent Office.”).

While the causal powers of embodiments may vary widely due to complexity and circumstances, scientific essentialism does imply that all embodiments, along with other objects and processes of non-natural kinds, are ontologically grounded in the fundamental properties that exist in our world:

All objects and processes that do not belong to natural kinds depend ontologically on objects and processes that do, since those very same objects and processes could not exist, or occur, in any world in which any of the natural kinds of things of which it is constituted did not exist. Therefore the kinds of objects and processes that actually exist or occur could not exist or occur in any possible world except one with the same fundamental property universals and the same spatio-temporal-energy structural possibilities as ours.¹⁷⁵

According to scientific essentialism, the fundamental dispositional properties of things in our world and spatio-temporal structure of our world are manifested in “instances of the most fundamental natural kinds of processes.”¹⁷⁶ By leaving to science the task of identifying and explaining the natural kinds of processes that actually exist,¹⁷⁷ scientific essentialism entails an epistemological commitment to *scientific realism*,¹⁷⁸ as discussed in the next section.

3. Scientific Realism and Unobserved Embodiments

Scientific realism is “the view that our best scientific theories give approximately true descriptions of both observable and unobservable aspects of a mind-independent world”¹⁷⁹ or, in other words, “the doctrine that scientific theories are to be taken seriously, in particular with respect to ontological commitment.”¹⁸⁰ As an epistemological thesis, scientific realism holds that “[t]he things our best

¹⁷⁵ See ELLIS, *supra* note 82, at 252.

¹⁷⁶ See *id.* at 217–18.

¹⁷⁷ See *supra* text accompanying note 159.

¹⁷⁸ See ELLIS, *supra* note 82, at 145–46 (explaining that scientific essentialism entails a form of scientific realism that may appropriately be called “essentialist realism”).

¹⁷⁹ ANJAN CHAKRAVARTTY, A METAPHYSICS FOR SCIENTIFIC REALISM: KNOWING THE UNOBSERVABLE 212 (2007).

¹⁸⁰ Richard Creath, *Taking Theories Seriously*, 62 SYNTHESIS 317, 317 (1985).

scientific theories tell us about entities and processes are decent descriptions of the way the world really is.”¹⁸¹

Scientific essentialism’s epistemological commitment to scientific realism justifies its taking the causal powers of the electron to be real essences of a natural kind.¹⁸² Implicit in scientific essentialism’s view that “[u]nit charge, unit mass, and spin 1/2 are essential properties of electrons, and electrons are by their very nature bound to act and interact as these properties determine,”¹⁸³ is scientific realism’s view that electrons exist. While no one has ever directly observed an electron,¹⁸⁴ scientific realists reason that “[i]f the world behaves as if things like atoms and electrons exist, then the best explanation of this fact is that they really do exist.”¹⁸⁵ This appeal to scientific theory¹⁸⁶ is often described as the “argument from the best explanation”¹⁸⁷ or “inference to the best explanation.”¹⁸⁸ According to Ellis, the argument from the best explanation is the “main argument” for scientific realism.¹⁸⁹

Patent doctrine evidences a strong commitment to scientific realism. As long as an assertion of a claimed invention’s utility is not “incredible in light of the knowledge of the art, or factually misleading,” the Patent Office and the courts do not need to observe an embodiment to satisfy themselves that embodiments of the

¹⁸¹ CHAKRAVARTY, *supra* note 179, at 9; *see also* THE PHILOSOPHY OF SCIENCE: AN ENCYCLOPEDIA 686 (Sahotra Sarkar & Jessica Pfeifer eds. 2006) (“[Scientific r]ealism takes the explanatory and predictive success of theories to warrant an ontological commitment to the existence of the entities they posit.”).

¹⁸² *See* ELLIS, *supra* note 82, at 54–55.

¹⁸³ *See id.* at 48–49; *see also supra* text accompanying note 161.

¹⁸⁴ *See generally* THEODORE ARABATZIS, REPRESENTING ELECTRONS: A BIOGRAPHICAL APPROACH TO THEORETICAL ENTITIES (2006) (providing a history of theoretical representations of the electron as an unobservable entity).

¹⁸⁵ *See* ELLIS, *supra* note 82, at 146.

¹⁸⁶ *See supra* text accompanying note 181; Creath, *supra* note 180, at 317 (“If the theories we adopt say that there are protons or pi-mesons, then we are ontologically committed to things of these sorts every bit as much as we are ontologically committed to peanuts and pachyderms by our views at the observational level.”).

¹⁸⁷ *See* BRIAN ELLIS, THE METAPHYSICS OF SCIENTIFIC REALISM 24 (2009).

¹⁸⁸ *See* PETER LIPTON, INFERENCE TO THE BEST EXPLANATION I (1991) (describing inference to the best explanation as the practice whereby “[b]eginning with the evidence available to us, we infer what would, if true, provide the best explanation of that evidence.”).

¹⁸⁹ *See* ELLIS, *supra* note 187, at 24, 30.

claim can exist and be capable of causing the asserted beneficial effect.¹⁹⁰ Accordingly, the Patent Office advises examiners:

With the exception of cases involving perpetual motion, a model is not ordinarily required by the Office to demonstrate the operability of a device. If operability of a device is questioned, the applicant must establish it to the satisfaction of the examiner, but he or she may choose his or her own way of so doing.¹⁹¹

In advising the public, however, the Patent Office reserves its right to require a working model:

A working model, or other physical exhibit, may be required by the Office if deemed necessary. This is not done very often. A working model may be requested in the case of applications for patent for alleged perpetual motion devices.¹⁹²

¹⁹⁰ See *In re Isaacs*, 347 F.2d 887, 890 (C.C.P.A. 1965) (citing *In re Citron*, 325 F.2d 248, 253 (C.C.P.A. 1963)); Sean B. Seymore, *Patently Impossible*, 64 VAND. L. REV. 1491, 1500–07 (2011) (describing the Patent Office’s examination rubric for the operability requirement).

Realism about unobserved embodiments has not been a permanent fixture in the patent system, which required applicants to furnish working models of their inventions, where possible, between 1836 and 1880. See Kendall J. Dood, *Patent Models and the Patent Law: 1790–1880 (Part I)*, 65 J. PAT. OFF. SOC’Y 187, 187 (1983). A few years before dispensing with the requirement, Patent Office Commissioner Ellis Spear noted:

It will be necessary only that provision be made for requiring models in cases where the *capability of the machine to operate is called into question*, or where the Examiner is in doubt as to the sufficiency of the drawings, or where models may be necessary for ready illustration on appeal, or interference cases.

Dood, *supra* note 11, at 271 (emphasis added).

Many issued patent claims expressly recite theoretical entities that would be unobservable even in a completed embodiment. For example, a search of the Patent Office’s PatFT database shows that the word “electron” appears in the claims of 49,181 patents, <http://patft.uspto.gov/netahtml/PTO/searchbool.html> (last visited Mar. 25, 2013).

¹⁹¹ U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 608.03 (July 2010) [hereinafter MPEP].

¹⁹² *General Information Concerning Patents*, U.S. PATENT & TRADEMARK OFFICE (2011), http://www.uspto.gov/patents/resources/general_info_concerning_patents.pdf.

Consistent with scientific realism's epistemological grounding in "the best explanation" informed by "our best scientific theories," the patent system may require proof of utility where there are "factual reasons which would lead one skilled in the art to question the objective truth of the statement of operability."¹⁹³ For example, the "highly unusual nature" of an invention¹⁹⁴ or "considerable doubt" within the scientific community¹⁹⁵ may justify a requirement that the applicant provide proof of utility. Except in the case of alleged perpetual motion machines,¹⁹⁶ such proof does not necessarily require the demonstration of a working model¹⁹⁷ or a correct account of the invention's theory of operation,¹⁹⁸ but must convince one skilled in the art of the asserted utility.¹⁹⁹ If an applicant does rely on scientific theories to show operability, the theories must be part of the "knowledge of the art,"²⁰⁰ and one of skill in the art must be able to recognize that the theories are applicable to the claimed invention.²⁰¹

¹⁹³ *In re Gaubert*, 524 F.2d 1222, 1224 (C.C.P.A. 1975).

¹⁹⁴ *See In re Houghton*, 433 F.2d 820, 821 (C.C.P.A. 1970).

¹⁹⁵ *See In re Dash*, 118 Fed. Appx. 488 (Fed. Cir. 2004), *cert. denied*, 126 S. Ct. 346 (2005) (unpublished opinion); *cf. In re Marzocchi*, 439 F.2d 220, 223 (C.C.P.A. 1971) (dicta) (stating that unpredictability of chemical reactions may create reasonable doubt as to enablement where a broad representation "is, on its face, contrary to generally accepted scientific principles.").

¹⁹⁶ *See supra* text accompanying notes 191–92.

¹⁹⁷ *See supra* note 191 and accompanying text; *see also In re Houghton*, 433 F.2d at 821 (noting that Patent Office did not require working model as proof of utility).

¹⁹⁸ *See Newman v. Quigg*, 877 F.2d 1575, 1581–82 (Fed. Cir. 1989).

¹⁹⁹ *See In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995).

²⁰⁰ *See supra* text accompanying note 190; *see also BlackLight Power, Inc. v. Rogan*, 295 F.3d 1269, 1271 (Fed. Cir. 2002) (holding that Patent Office's withdrawal of patent from issuance was not unreasonable in light of examining group director's determination that "the applicant was claiming the electron going to a lower orbital in a fashion that I knew was contrary to the known laws of physics and chemistry."); *In re Houghton*, 433 F.2d at 821 n.1 (finding applicant's reliance on published articles purporting to provide theoretical support for invention "not persuasive" where "most of these articles were authored by appellant, and none of them appear in the record.").

²⁰¹ *See In re Houghton*, 433 F.2d at 821 (finding claimed hovercraft inoperable where applicant "presented no evidence from any skilled persons other than himself to show that such persons would be convinced for the practical applicability of the [disclosed aerodynamic] equations to a flying machine"); *cf. In re Gazave*, 379 F.2d 973, 978 (C.C.P.A. 1967) (citation omitted) (where a claimed device is of "such a nature that it could not be tested by any known scientific principles . . . it is incumbent on the applicant to demonstrate the workability and utility of the device and make clear the principles on which it operates.").

My description of the patent system's ontology thus far has characterized the ontological status of claims and their embodiments under settled patent doctrine. Claims are non-natural kinds with corresponding essential sortals; embodiments are particulars that have essential causal powers in virtue of being examples of those kinds and falling under those sortals. Operative embodiments have utility in virtue of their essential causal powers. Other embodiments of the same claim also have these essential causal powers, but may be inoperative due to wide variations in causal powers and in the history or circumstances of reduction to practice and use. When a claim is filed, typically none of the embodiments described by the claim is observable to the patent system. Nevertheless, the patent system is committed to scientific essentialism and scientific realism, and therefore accepts that operative embodiments of a claim can exist, without knowledge or observation of the actual existence of any such entities, based on an argument from the best explanation.

As an indispensable guide to the interpretation of claim language,²⁰² and as a statement of facts about the potential and actual existence of embodiments and kinds of embodiments, the specification of a filed patent application plays a vital role in incurring and warranting ontological commitments to claims and their embodiments. In the next Part, I undertake to show how the patent specification's ontological role serves in part to explain the complexity of the demands put upon it by patent law's adequate disclosure doctrines.

III. THE ONTOLOGICAL ROLE OF THE WRITTEN DESCRIPTION REQUIREMENT

A. *Written Description as a Definitional Requirement*

The complexity of the patent system's demand for adequate disclosure is apparent from the fact that a simple set-theoretic inquiry as to whether all embodiments within the claim are enabled will not suffice.²⁰³ This is not only

At least one leading patent scholar has recently criticized the Patent Office's operability inquiry as too subjective and tending to lag behind rapidly developing scientific fields. See Seymore, *supra* note 190, at 1507–23.

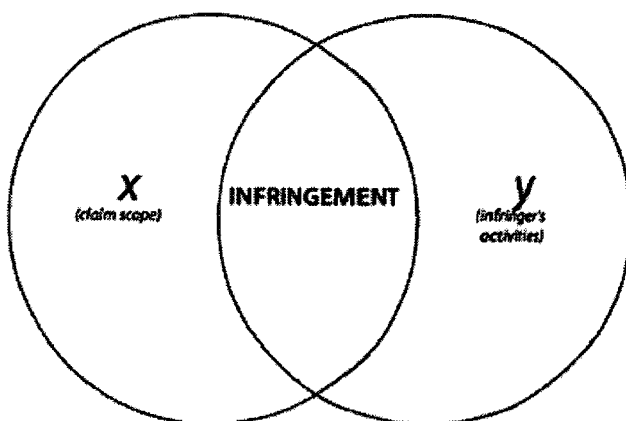
²⁰² See *supra* text accompanying note 31.

²⁰³ See Lefstin, *supra* note 29, at 1159–67 (contrasting enablement doctrine with other patent doctrines that he says are amenable to a set-theoretic characterization). For example, if we “[t]ake a claim reciting particular properties, and call the set of all possible things or events characterized by those properties as x ,” and “[l]et y be the set of all things the accused infringer has made, used, sold, or offered for sale within the United States,” then “[t]he claim is infringed if and only if x and y intersect” as shown in the figure below.

because every claim contains some non-enabled subject matter,²⁰⁴ but also because a claim's embodiments may be adequately enabled even though its scope bears no relation to what the inventor actually invented.²⁰⁵

In his 2008 article *The Formal Structure of Patent Law and the Limits of Enablement*,²⁰⁶ Jeffrey Lefstin persuasively shows that the written description requirement brings needed coherence to the adequate disclosure inquiry by providing a legal test directed to “the scope of the claim itself” rather than “a particular embodiment or collection of embodiments.”²⁰⁷ Specifically, Lefstin interprets the written description requirement as a demand that the disclosure provide adequate “definitional information” concerning the scope of the claim.²⁰⁸

According to Lefstin, the Federal Circuit provided guidance regarding the written description's definitional function in its 1997 *Lilly* decision.²⁰⁹ Prior to



Id. at 1159–60.

²⁰⁴ See *id.* at 1175 (“Due to the infinite scope of patent claims, a patentee certainly need not, and in most cases cannot, enable every embodiment falling within the ‘full scope’ of the claims.”); see *supra* text accompanying notes 124–25.

²⁰⁵ See *id.* at 1194 (emphasis omitted). For example, Lefstin points out that the following claim would be enabled: “All material objects which are enabled by the prior art, excluding those which are known or obvious in light of the prior art.” *Id.* at 1182–85.

²⁰⁶ See Lefstin, *supra* note 29.

²⁰⁷ See *id.* at 1168.

²⁰⁸ See *id.* at 1217.

²⁰⁹ *Regents of the Univ. of Cal. v. Eli Lilly & Co.*, 119 F.3d 1559 (Fed. Cir. 1997).

Lilly, it was widely believed that originally-filed patent claims adequately described their own subject matter, so that the written description requirement served solely to prohibit the later claiming of new matter added during prosecution.²¹⁰ In *Lilly*, however, the Federal Circuit held invalid an originally filed claim directed to a microorganism modified to contain human insulin-encoding cDNA.²¹¹ The specification disclosed “a process for obtaining human insulin-encoding cDNA” and “the amino acid sequence of the human insulin A and B chains,” but gave “no further information . . . pertaining to that cDNA’s relevant structural or physical characteristics.”²¹² The court found that the disclosure did not provide a written description of the cDNA, and went on to explain what an adequate description would “usually” entail:

[A] cDNA is not defined or described by the mere name “cDNA,” even if accompanied by the name of the protein that it encodes, but requires a kind of specificity usually achieved by means of the recitation of the sequence of nucleotides that make up the cDNA. A description of a genus of cDNAs may be achieved by means of a recitation of a representative number of cDNAs, defined by nucleotide sequence, falling within the scope of the genus or of a recitation of structural features common to the members of the genus, which features constitute a substantial portion of the genus.²¹³

Departing from the majority of *Lilly*’s commentators who “have focused on the Federal Circuit’s demand for structure or sequence information,”²¹⁴ Lefstin

²¹⁰ See Christopher M. Holman, *Is Lilly Written Description a Paper Tiger? A Comprehensive Assessment of the Impact of Eli Lilly and Its Progeny in the Courts and PTO*, 17 ALB. L.J. SCI. & TECH. 1, 6 (2007); but see Lefstin, *supra* note 29, at 1200–02 (citing WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 484 (1890)) (noting that Robinson’s “monumental and influential 1890 treatise” recognized a written description requirement separate from the enablement requirement for original claims); Zhibin Ren, Note, *Confusing Reasoning, Right Result: The Written Description Requirement and Regents of the University of California v. Eli Lilly & Company*, 1999 WIS. L. REV. 1297, 1312 (1999) (“Although prior to *Lilly* the written description requirement had been used exclusively to prevent later-claims from obtaining an earlier priority date, the court never expressly closed the door on applying the written description requirement to originally filed claims.”).

²¹¹ *Eli Lilly*, 119 F.3d at 1567.

²¹² *Id.*

²¹³ *Id.* at 1568–69 (citation omitted).

²¹⁴ See Lefstin, *supra* note 29, at 1205 (citing Holman, *supra* note 210, at 19 n.89 (collecting structural criticisms)); Dan L. Burk & Mark A. Lemley, *Biotechnology’s Uncertainty Principle*, 54 CASE W. RES. L. REV. 691, 697–98 (2004)).

interprets the court's language as a call for definitional information about the claimed genus.²¹⁵ He notes that the two descriptive approaches suggested by the court "correspond perfectly to the two modes of definition" presented in Peter Coffey's classic text *The Science of Logic*;²¹⁶ i.e., *definition by intension* and *definition by type*.²¹⁷ Definition by intension involves "specifying the proximate genus to which it belongs, and those properties which differentiate it from other members of the genus."²¹⁸ As Coffey writes, differentiating properties "are intended as much to be diagnostic—i.e., features by which a species may be identified—as to declare the essential nature of the species."²¹⁹ Definition by type "proceeds by designating some individual or group of individuals as central or typical members of the genus and determining membership in the genus by degree of resemblance."²²⁰ According to Coffey, the "perfect" definition by type of a class of things consists of an "exemplification" of the class by a smaller group of individuals²²¹ such that "the class exemplified does possess in common those attributes, those only, possessed in common by the smaller group."²²²

Lefstin argues that by requiring a claimed genus to be defined by one of these approaches, *Lilly*'s written description requirement "anchor[s] claim scope within the hierarchy of definitional genera."²²³ For example, *Lilly* itself is concerned with locating claims amidst a hierarchy of successfully narrower genera consisting of "DNA," "vertebrate DNA," "vertebrate insulin DNA," "mammalian insulin DNA," "rat insulin DNA," and some "particular variant of rat insulin DNA."²²⁴ According to Lefstin, an inventor who discovers and discloses only rat insulin DNA may claim "rat insulin DNA" but not "vertebrate insulin DNA," because the inventor's disclosure defines the broader genus "neither by properties that distinguish it from

²¹⁵ See Lefstin, *supra* note 29, at 1205.

²¹⁶ P. COFFEY, *THE SCIENCE OF LOGIC* (1912).

²¹⁷ See Lefstin, *supra* note 29, at 1205.

²¹⁸ See *id.* at 1205–06 & n.200 (citing COFFEY, *supra* note 216, at 94).

²¹⁹ COFFEY, *supra* note 216, at 94.

²²⁰ See Lefstin, *supra* note 29, at 1206 & n.201 (citing COFFEY, *supra* note 216, at 98).

²²¹ See COFFEY, *supra* note 216, at 94.

²²² See *id.* at 103 n.1.

²²³ See Lefstin, *supra* note 29, at 1212.

²²⁴ See *id.* at 1211.

other genera, nor by a set of types by which the genus can be recognized by degrees of resemblance.”²²⁵ Thus conceived as an “anchor[]” of claim scope, the written description requirement performs at least two needed functions: “more precisely defin[ing] the boundaries of the patent,”²²⁶ and providing a way for “the disclosure of the invention [to] become a more significant source of definitional information” in keeping with its increasingly vital role in claim construction.²²⁷

In the course of proposing his definitional account of the written description requirement, Lefstin rejects the Federal Circuit’s explanation of the requirement as a rule that the applicant must demonstrate “possession of the invention” as of the filing date.²²⁸ Lefstin essentially accuses the court of a category error,²²⁹ reasoning that “[i]t is not syntactically sensible to ask whether an inventor ‘invented’ or ‘possessed’ an abstract bundle of properties defining a legally cognizable right.”²³⁰ As I argue below,²³¹ however, the Federal Circuit’s “possession” jurisprudence, which the court pointedly reaffirmed in *Ariad Pharmaceuticals* (2010),²³² is neither metaphysically erroneous nor incompatible with Lefstin’s definitional account. I am inclined to accept that the written description requirement serves both functions.

I find Lefstin’s other arguments convincing and his ontological perspectives on claim scope insightful, though ultimately incomplete. Lefstin persuasively demonstrates that the enablement requirement cannot alone define the scope of patent claims, and that the written description requirement serves in part to provide this definitional function. But Lefstin does not explore how the patent system confers ontological status upon inventions and embodiments under the doctrine of constructive reduction to practice. The issue of ontological commitment does not arise in Lefstin’s analysis, because nothing in his incomplete account of patent

²²⁵ See *id.*

²²⁶ See *id.* at 1219.

²²⁷ See *id.* at 1220–21.

²²⁸ See *id.* at 1197–1200 (citing *Vas-Kath v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991)).

²²⁹ See THE CAMBRIDGE DICTIONARY OF PHILOSOPHY, *supra* note 47, at 123 (defining “category mistake” as “the placing of an entity in the wrong category” or “the attribution to an entity of a property which that entity cannot have”).

²³⁰ Lefstin, *supra* note 29, at 1199.

²³¹ See *infra* Part III.C.2.

²³² *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc).

doctrine entails that claims and embodiments have any particular status in the patent system's ontology.

Lefstin is careful in his ontological description of patent claims, as far as he goes. He notes that many of patent law's doctrines, including infringement, anticipation, nonobviousness and utility, can be described using the set-theoretic concepts of intersection and containment,²³³ but finds that the enablement standard cannot be so characterized, because the nature of the patent claim "makes patent law not reducible to a simple set-theoretic system."²³⁴ He accurately concludes that the "ontological nature of patent claims" is that they are classes having infinite scope.²³⁵ But Lefstin's analysis does not entail that the patent system be ontologically committed to the existence of claims as either set-entities or class-entities. The intersection and containment relationships he employs can be adequately expressed without ontological commitment to sets or classes, by characterizing claims as *mereological sums* or *fusions* of their embodiments (and embodiments as *parts* of claims).²³⁶ For example, without using set-intersection language, we can simply say that making a collection of things *y* infringes claim *x* if there is an embodiment *z* that is both a part of *x* and a part of *y*; in other words, there is an *overlap* between *x* and *y*,²³⁷ or *x shares parts with y*.²³⁸ On this reading, an adequate written description performs its definitional function by picking out the embodiments whose fusion *is* the claim, thereby determining the claim's (infinite)

²³³ See Lefstin, *supra* note 29, at 1161–64.

²³⁴ See *id.* at 1167.

²³⁵ See *id.* at 1168.

²³⁶ See ROUTLEDGE ENCYCLOPEDIA OF PHILOSOPHY 318 (Edward Craig ed., 1998) (defining mereology as "the theory of the part-whole relation" that "tak[es] the part-whole relation as primitive"); ROBERT CASATI & ACHILLE C. VARZI, PARTS AND PLACES: THE STRUCTURES OF SPATIAL REPRESENTATION 11 (1999) ("Mereologically, for every whole there is a set of parts, and to every set of parts (that is, every arbitrary collection of objects) there may in principle correspond a complete whole, viz. their mereological sum or fusion.").

This is not to say that patent claims can accurately be characterized as mereological sums or fusions of their embodiments, as such a characterization incorrectly ties claim scope to the embodiments that make up the claim. See *supra* text accompanying note 44 ("[T]he number of existing patent claim embodiments has no effect on the claim's scope."). There is nothing in Lefstin's incomplete account of patent doctrine, however, that is inconsistent with a mereological account of claims and embodiments.

²³⁷ See CASATI & VARZI, *supra* note 236, at 36.

²³⁸ See *id.* at 33; cf. *supra* note 203 (describing Lefstin's set-theoretic description of infringement doctrine).

scope.²³⁹ Such a mereological account need not be taken to entail any ontological commitment to claims beyond that already provided to their embodiments.²⁴⁰

Lefstin's account of patent doctrine is sufficient, and indeed well suited, to support his central thesis that the written description requirement has a necessary function in limiting claim scope; however, it misses the adequate disclosure requirements' more fundamental roles in connection with incurring and warranting ontological commitments to claims and embodiments. In the two sections that follow, I will explain how these roles not only subsume both the definitional and "possession" conceptions of the written description requirement, but also critically illuminate the patent system's ontology of "useful Arts."

B. *Ontological Commitments in Patent Discourse*

In the metaphysics literature, a theorist is said to incur an *ontological commitment* if she is committed to acknowledging an entity's existence in virtue of her acceptance of the truth of a given theory.²⁴¹ The theorist's *warrant* for this commitment is the set of facts she takes to justify such an assertion of the entity's existence.²⁴²

²³⁹ See Lefstin, *supra* note 29, at 1211 ("Once we recognize written description as a method of logical definition, then its function in determining claim scope becomes clear.")

²⁴⁰ See DAVID LEWIS, PARTS OF CLASSES 81 (1991) (describing mereology as "ontologically innocent"). Lewis gives the following example:

Given a prior commitment to cats, say, a commitment to cat-fusions is not a *further* commitment. The fusion is nothing over and above the cats that compose it. It just *is* them. They just *are* it. Take them together or take them separately, the cats are the same portion of Reality either way.

Id.; see also 2 D.M. ARMSTRONG, A THEORY OF UNIVERSALS: UNIVERSALS AND SCIENTIFIC REALISM 36–38 (1978); Donald L.M. Baxter, *Identity in the Loose and Popular Sense*, 97 MIND 575 (1988). Lewis's view on this matter is not undisputed. See, e.g., Peter Forrest, *How Innocent Is Mereology?*, 56 ANALYSIS 127 (1996) (arguing against mereological innocence); Verity Harte, *Plato's Problem of Composition*, in PROC. BOSTON AREA COLLOQUIUM IN ANCIENT PHILOSOPHY v. 17, at 5–6 (John J. Cleary & Gary M. Gurtler eds. 2001) (same); Byeong-uk Yi, *Is Mereology Ontologically Innocent?*, 93 PHIL. STUDIES 141 (1999) (same). The point here, however, is that Lefstin's logic is valid even on a mereological reading, so it was not necessary for Lefstin's analysis to explore the issue of ontological commitment for it to be complete on its own terms.

²⁴¹ See E.J. LOWE, A SURVEY OF METAPHYSICS 215 (2002) (defining criterion of ontological commitment as "a principle which will reliably tell us what kinds of entities a theorist is committed to acknowledging as existent, in virtue of his acceptance of the truth of a given theory . . .").

²⁴² Such warrants are often implicit. See Alexander Bird, *Laws and Criteria*, 32 CAN. J. PHIL. 511, 515–16 (2002) (explaining that for a thinker who is not "consciously or reflectively aware" of her propositional attitudes, "[w]hat facts she 'takes to warrant' what other facts will be shown in the

An ontological commitment may be *de dicto* or *de re*. A *de dicto* commitment is to be understood as a proposition about a state of affairs, while a *de re* commitment is understood to refer to a specific entity.²⁴³ As Michael Jubien explains, a *de dicto* commitment to a particular holds that the truth of a theory implies the existence of some unique entity, but does not per se restrict the identity of this entity to a “*particular particular*.”²⁴⁴ For example, the truth of a theorem that “there is a unique president at a given moment in 1972” incurs a commitment to the existence of exactly one president at that moment in time, but does not by its terms incur a commitment to the existence of Richard Nixon at that time.²⁴⁵ In contrast, a *de re* commitment to a particular implies the existence of a specific entity. A theorem stating that “there is an x such that $x=c$,” where c is a constant interpreted as referring to Richard Nixon, would incur such a commitment.²⁴⁶

Analogously, a *de dicto* commitment to a kind takes the form “The theory is committed to the existence of (possible) objects of a given kind,” in contrast to a *de re* commitment, which essentially states “There are certain (possible) objects of a given kind to which the theory is committed.”²⁴⁷ As Jubien notes, a *de re* commitment to a kind is equivalent to a *de re* commitment to certain particulars of the kind.²⁴⁸

The decisions and actions of legal institutions, including the Patent Office and the courts, are premised on facts and theories that such institutions take to be true in law, whether or not known to be true in fact.²⁴⁹ Accordingly, the patent system may be said to incur ontological commitments to claims and embodiments whenever it

inferences she is disposed to make, what beliefs she forms given certain information and so forth, and need *not* be manifested by assertions equivalent to ‘I take p to provide me with warrant for asserting q .’”).

²⁴³ See Justin Brookes, *Belief De Re and De Dicto*, 36 PHIL. Q. 374, 374 (1986) (“Belief *de dicto* is belief that a certain *dictum* (or proposition) is true, whereas belief *de re* is belief about a particular *res* (or thing) that it has a certain property.”).

²⁴⁴ See Michael Jubien, *Ontological Commitment to Particulars*, 28 SYNTHÈSE 513, 513 (1974).

²⁴⁵ See *id.*

²⁴⁶ See *id.*

²⁴⁷ See Michael Jubien, *Ontological Commitment to Kinds*, 31 SYNTHÈSE 85, 86 (1975).

²⁴⁸ See *id.*

²⁴⁹ See Harold J. Berman & Charles J. Reid, Jr., *The Transformation of English Legal Science: From Hale to Blackstone*, 45 EMORY L.J. 437, 458 (1996) (“Like a literary work of fiction, a legal fiction is not meant to be taken as true *in fact*. It is, however, true in another sense—it is true *in law*.”).

engages in legally operative discourse predicated on the existence of such entities. Such discourse reveals the patent system's *criteria of ontological commitment*. A criterion of ontological commitment is "a principle for determining just what objects or entities a theory says there are (or what entities must exist in order for a theory to be true)."²⁵⁰ The warrants for the patent system's ontological commitments are the facts taken by the patent system to be legally sufficient to justify its decisions and actions arising from the discourse in question. By this account, the patent system appears to incur ontological commitments to patent claims and embodiments in at least three situations.

First, under the doctrine of constructive reduction to practice, the disclosure of an invention in a filed patent application is given the same legal effect as a finding that the patent specification is a true description of existing kinds of entities with essential causal properties; i.e., the claim exists as a kind whose examples include (possible) embodiments,²⁵¹ and any specifically disclosed embodiments exist as particulars.²⁵² The patent system thereby incurs a *de dicto* ontological commitment to the claim as a kind,²⁵³ *de re* ontological commitments to any specifically disclosed actual embodiments as particulars, and *de dicto* ontological commitments to any specifically disclosed prophetic embodiments as particulars.²⁵⁴

²⁵⁰ CYNTHIA MACDONALD, *VARIETIES OF THINGS: FOUNDATIONS OF CONTEMPORARY METAPHYSICS* 25 (2005).

²⁵¹ See, e.g., *Hoffman-LaRoche, Inc. v. Promega Corp.*, 323 F.3d 1354, 1377 (Fed. Cir. 2003) ("The patent law authorizes that an invention may be constructively reduced to practice by filing a patent application, whether the embodiments were actually made or are constructed in the patent application.").

²⁵² A priority determination in the interference context may be predicated on the constructive reduction to practice of a specifically disclosed embodiment. See, e.g., *Hunt v. Treppschuh*, 523 F.2d 1386, 1387 (C.C.P.A. 1975) (explaining that support of a count requires "disclosure of an embodiment within the count that meets the requirements of the first paragraph of 35 U.S.C. § 112.").

²⁵³ See *supra* note 128 (explaining that support for a claim need not include support for actual embodiments); cf. Jubien, *supra* note 247, at 88–89 (for a kind that is a natural kind or species, suggesting approach of using "a species-term" to refer to "the (possible) species it would correctly pick out if the relevant parts of the story were true reports of the accurate observations of a naturalist (if such a species exists)").

²⁵⁴ A prophetic (or paper) example "describe[s] the manner and process of making an embodiment of the invention which has not actually been conducted." MPEP, *supra* note 191, at § 608.01(p). Under the doctrine of constructive reduction to practice, a prophetic example is given same the legal effect as a finding of the existence of a specific embodiment enabled by the example, even though no *particular* embodiment of that sort can be identified. See *Hoffman-LaRoche, Inc. v. Promega Corp.*, 323 F.3d 1354, 1377 (Fed. Cir. 2003) (Newman, J., dissenting) ("To fulfill their legal purpose, [prophetic] examples must be enabling of specific embodiments. . . . The patent law authorizes that an invention may be constructively reduced to practice by filing a patent application, whether the embodiments were actually made or are constructed in the patent application.").

Each of these commitments is warranted by the adequacy of the filed disclosure under the first paragraph of § 112 with respect to the claim or embodiment in question.²⁵⁵

Second, when a claim is found anticipated by use²⁵⁶ or prior reduction to practice under § 102(a),²⁵⁷ or barred by public use or on-sale activity under § 102(b),²⁵⁸ it is because the patent system has affirmed the existence of a specific embodiment of the claim prior to the invention or the critical date (or its constructive equivalent, either in another inventor's patent application²⁵⁹ or in the commercial offer for sale of an invention at the "ready for patenting" stage²⁶⁰). The patent system incurs a *de re* ontological commitment to the prior art embodiment referred to in the evidentiary finding (as in "x was in public use more than a year before the filing date"), which is warranted by clear and convincing evidence of direct experience of a particular that is an example of the claim.²⁶¹

²⁵⁵ See 3A CHISUM ON PATENTS § 10.05[5], at 10-162 ("In order to constitute constructive reduction to practice as of its filing date, the application must comply with the requirements of the first paragraph of Section 112.").

²⁵⁶ See 35 U.S.C. § 102(a) (denying patentability where the claimed "invention was . . . used by others in this country . . . before the invention thereof by the applicant for patent . . .").

²⁵⁷ See 35 U.S.C. § 102(g)(2) (denying patentability if the claimed invention was made earlier by the other party in an interference, or made earlier in the United States by another inventor, and not abandoned, suppressed or concealed). An applicant who is first to reduce to practice may also lose priority to another inventor who is first to conceive and diligent in reducing to practice. *See id.* In such a case, no ontological commitment to a prior embodiment of the claim is incurred.

²⁵⁸ See 35 U.S.C. § 102(b) (denying patentability where the claimed "invention was . . . in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States . . .").

²⁵⁹ See *Frazer v. Schlegel*, 498 F.3d 1283, 1287 (Fed. Cir. 2007) (citations omitted) ("When interference priority is at issue, constructive reduction to practice of a count may be established by disclosure of an embodiment within the count.").

²⁶⁰ See *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 67-68 (1998); *see also* Timothy R. Holbrook, *The More Things Change, The More They Stay the Same: Implications of Pfaff v. Wells Electronics, Inc. and the Quest for Predictability in the On-Sale Bar*, 15 BERKELEY TECH. L.J. 933, 952-55 (2000) (relating Pfaff's "ready for patenting" standard to the doctrine of constructive reduction to practice).

²⁶¹ See *Orion IP, LLC v. Hyundai Motor America*, 605 F.3d 967, 975 (Fed. Cir. 2010) (citation omitted) ("[T]he party asserting invalidity due to anticipation must prove anticipation, a question of fact, by clear and convincing evidence."); *Netscape Commc'ns Corp. v. Konrad*, 295 F.3d 1315, 1320 (Fed. Cir. 2002) (citation omitted) ("A conclusion that a section 102(b) bar invalidates a patent must be based on clear and convincing evidence.").

Finally, when a claim is found infringed under § 271(a), it is because the patent system has affirmed the existence of a specific embodiment of the claim that was made, used, offered for sale, sold or imported by the defendant.²⁶² The patent system incurs a *de re* ontological commitment to the infringing embodiment, which is warranted by the preponderance of evidence of past or present direct experience of a particular that is an example of the claim.

If the above inventory is basically correct, then the patent system's ontological commitments to claims and embodiments are grounded in either (1) adequate disclosure in a filed patent application or (2) a proven report of past or present direct experience. Moreover, given that proven reports of direct experience would be acceptable ontological warrants even in a minimal legal epistemology,²⁶³ it is patent law's doctrines of adequate disclosure that determine the overall extent of the patent system's ontological commitments to claims and embodiments.

It is costly for the patent system to incur ontological commitments to claims and embodiments.²⁶⁴ The filing of a claim in a patent application is a demand that

²⁶² Cf. *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors*, 617 F.3d 1296, 1310–11 (Fed. Cir. 2010) (concluding that schematics accompanying a sales contract could support a finding of infringement even when the product had not yet been built and the accused infringer retained the right to alter the design to make it non-infringing); *Waymark Corp. v. Porta Sys. Corp.*, 245 F.3d 1364, 1368 (Fed. Cir. 2001) (noting that “infringement without a completed infringing embodiment is not the norm in patent law” but is contemplated by statutory provisions beyond the scope of § 271(a)).

²⁶³ See, e.g., FED. R. EVID. 602 advisory committee's note (citation omitted) (“[T]he rule requiring that a witness who testifies to a fact which can be perceived by the senses must have had an opportunity to observe, and must have actually observed the fact” is a ‘most pervasive manifestation’ of the common law insistence upon ‘the most reliable sources of information.’”); Joseph Boyle, *Free Choice, Incommensurable Goods and the Self-Refutation of Determinism*, 50 AM. J. JURIS. 139, 157 (2005) (“[I]t may be possible to stand back epistemologically from one’s assent, but seeing an event, or remembering a recent event, you just believe the proposition describing it, and reasonably so. There seems to be no choice in the matter.”).

Of course, the patent system does not accept all reports of direct experience as *proof* of existence. See, e.g., *Woodland Trust v. Flowertree Nursery, Inc.*, 148 F.3d 1368 (Fed. Cir. 1998) (rejecting “uncorroborated oral testimony . . . of interested persons recalling long-past events” regarding prior use of patented method). In admitting reports of direct experience as *evidence* of existence, however, the patent system rejects a posture of *universal* skepticism toward sensory experience and memory, such as that expressed in René Descartes’s *Meditations on First Philosophy*. Compare FED. R. EVID. 602 (“Evidence to prove personal knowledge may . . . consist of the witness’ own testimony.”), with RENÉ DESCARTES, *MEDITATIONS ON FIRST PHILOSOPHY* 51 (Donald A. Cress ed., 1996) (“[E]verything I ever thought I sensed while awake I could believe I also sometimes sensed while asleep”).

²⁶⁴ See generally JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* 38–45 (2008) (describing costs of defining new property rights).

the patent system not only admit a new kind into its ontology of “useful Arts,” but regulate the creation, use and sale of all entities within its jurisdiction that are examples of the kind.²⁶⁵ As I will now argue, patent law’s written description doctrine serves in part to provide limiting criteria for the patent system’s ontological commitments to claims.

C. *Written Description as a Doctrine of Ontological Possession*

A comprehensive analysis of the patent system’s criteria of ontological commitment to claims as kinds is beyond the scope of this Article.²⁶⁶ It is sufficient here to argue as a more general matter that any kind that is the subject of ontological commitment must pick out a definite (possibly empty) class of examples. As philosopher Michael Jubien describes this proposition,²⁶⁷ this is “a very modest and natural assumption about kinds—one that I think would be met by any plausible philosophical doctrine on the nature of kinds.”²⁶⁸ Jubien himself relies on this assumption in formulating a criterion of *de dicto* ontological commitment to kinds²⁶⁹ suitable for theories in which kinds may stand in definitional hierarchies.²⁷⁰

By this account, the patent system’s criteria of ontological commitment subsume Lefstin’s definitional account of the written description requirement. According to Lefstin, the standard for the written description’s definitional function is to be found in the Federal Circuit’s *Lilly* decision, which characterizes “a fully described genus” as one that allows “one skilled in the art . . . [to] visualize or

²⁶⁵ See 35 U.S.C. § 154(a) (granting the patentee “the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States or importing the invention into the United States” during the patent term).

²⁶⁶ Cf. Jubien, *supra* note 247, at 85 (noting that his explanation of ontological commitment to kinds is “not self-contained,” but relies on “technical notions introduced” in a previous article).

²⁶⁷ See *id.* (stating the assumption more formally as “for any kind \mathcal{K} , there exists in every world a definite (possibly empty) class of objects of that kind” and denoting the class of objects of kind \mathcal{K} in world H by $\{x \mid \mathcal{K}_x\}_H$).

²⁶⁸ *Id.*

²⁶⁹ More formally, Jubien states the criterion as follows: $\langle T, I \rangle$ is committed to objects of kind \mathcal{K} if for every $I_u(H)$ -model M , $D(M) \cap \{x \mid \mathcal{K}_x\}_H \neq \emptyset$ for every H in which $\langle T_u, I_u \rangle$ is true. See *id.* at 87.

²⁷⁰ See *id.* at 86 (“The criterion we seek should satisfy the condition that if a theory is committed to objects of kind \mathcal{K} , and if objects of kind \mathcal{K} are necessarily also of kind \mathcal{K}' , then the theory is committed to objects of kind \mathcal{K}' as well.”).

recognize the identity of the members of the genus.”²⁷¹ A claim that is “fully described” according to this standard is one that can be the subject of ontological commitment, as one skilled in the art can recognize (and therefore pick out) the embodiments of the claim, which form a definite class of examples.

This reinterpretation of Lefstin’s account also plausibly explains the Federal Circuit’s characterization of the written description requirement as an obligation that the applicant show “that, as of the filing date sought, he or she was in possession of the invention.”²⁷² To Lefstin, the Federal Circuit’s “possession” jurisprudence makes no sense, because “‘the invention’ is a bundle of properties recited by the claims, defining the perimeter of the patentee’s legal right to exclude”: it may be meaningful to ask whether an inventor possessed certain “ideas and things,” but not “abstract legal entities or infinite sets of subject matter.”²⁷³ Since *Lilly*, however, the court has continued to frame the written description requirement as a possession inquiry,²⁷⁴ including in its recent en banc decision in *Ariad*.²⁷⁵

In the written description case law leading up to *Ariad*, Lefstin sees a missed opportunity to follow *Lilly*’s lead in clarifying that the “true role of the written description doctrine” was in requiring definitional information rather than a showing of possession.²⁷⁶ But *Lilly* need not be read as a departure from the Federal Circuit’s “possession” jurisprudence. In *Lilly*, the court refers to its opinion four months earlier in *Lockwood v. American Airlines*²⁷⁷ for what it takes to be the

²⁷¹ Lefstin, *supra* note 29, at 1206 (citing *Regents of the Univ. of Cal. v. Eli Lilly & Co.*, 119 F.3d 1559, 1568 (Fed. Cir. 1997)).

²⁷² See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991). For other commentary challenging this characterization, see, for example, Mark D. Janis, *On Courts Herding Cats: Contending with the “Written Description” Requirement (and Other Unruly Patent Disclosure Doctrines)*, 2 WASH. U. J.L. & POL’Y 55, 62 (2000) (arguing that the written description requirement is “an essentially standardless disclosure doctrine that can be deployed arbitrarily”); Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 161–63 (2006) (arguing that the written description requirement should not be used to ensure possession, as that function is better performed by the enablement requirement).

²⁷³ See Lefstin, *supra* note 29, at 1199.

²⁷⁴ See *id.* at 1210 & n.220 (citing cases).

²⁷⁵ See *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (“[T]he test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.”).

²⁷⁶ See Lefstin, *supra* note 29, at 1207–10.

²⁷⁷ *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565 (Fed. Cir. 1997).

definitive statement of the written description requirement: “To fulfill the written description requirement, a patent specification must describe an invention and do so in sufficient detail that one skilled in the art can clearly conclude that ‘the inventor invented the claimed invention.’”²⁷⁸ The *Lockwood* court, in turn, finds that it is “accurate[.]” to say that the requirement is met by a “show[ing] that one is ‘in possession’ of the invention,”²⁷⁹ and goes on to explain what such a showing entails:

One shows that one is “in possession” of the invention by describing the invention, with all its claimed limitations, not that which makes it obvious. (“[T]he applicant must also convey to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention. The invention is, for purposes of the ‘written description’ inquiry, *whatever is now claimed.*”) One does that by such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention.²⁸⁰

The effect of this explanation is to read into the language preceding the patent claims (e.g., “I claim”²⁸¹) a further predicate of the form “I am now in possession of.” Under a standard interpretation, the speaker of such a predicate (i.e., the patent applicant) incurs an ontological commitment to each entity that is an object of the predicate: one can possess only what exists. By our account above, the written description requirement serves to ensure that the claims are kinds that pick out well-defined classes,²⁸² as is necessary to satisfy the patent system’s criteria of ontological commitment.

On this interpretation, to “possess” a claimed invention is to possess the claim as a kind in one’s ontology, having incurred a *de dicto*²⁸³ ontological commitment

²⁷⁸ *Regents of the Univ. of Cal. v. Eli Lilly & Co.*, 119 F.3d 1559, 1566 (Fed. Cir. 1997) (citing *Lockwood*, 107 F.3d at 1572).

²⁷⁹ See *Lockwood*, 107 F.3d at 1572 (citing *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991) (“*Lockwood* argues that all that is necessary to satisfy the description requirement is to show that one is ‘in possession’ of the invention. *Lockwood* accurately states the test. . . .”).

²⁸⁰ *Id.* (citation omitted).

²⁸¹ See *supra* text accompanying note 71.

²⁸² See *supra* text accompanying note 271.

²⁸³ In this case, the entities are kinds to which the patent system incurs only a *de dicto* and not a *de re* ontological commitment. See *supra* text accompanying note 253. Since the language of the patent

to the claim according to the patent system's criteria for such commitment. The filing of a patent application that meets the written description requirement serves to "convey" this ontological commitment "to those skilled in the art" who read the application, insofar as a reader's acceptance of the truth of the patent specification (including the applicant's representations of possession) implies the existence of the claims as kinds whose examples include (possible) working embodiments.

Whatever the *inventor's* criteria of ontological commitment may be, the written description requirement ensures that the patent disclosure convey ontological commitment to a reader according to the *patent system's* criteria for such commitment. Every such reader is entitled to "possess" the invention in this ontological sense.²⁸⁴ By demonstrating ontological possession of the claimed and described invention at the time of filing, however, the inventor is uniquely entitled to establish priority for the filed claims. The written description requirement's role in securing ontological commitment thus also subsumes the requirement's traditional role in policing against the addition of new matter.²⁸⁵ Upon securing priority in this way and meeting the other requirements for patentability, the inventor is awarded an entitlement to regulate the ontological possession of future *de re* commitments to the claim and its embodiments; i.e., by excluding others from bringing into existence any embodiments that might be the subject of such commitments. On this reading, then, the patent right does not include an exclusive right to "possess" the claimed invention, but does include the most important of the "sticks" in the property rights "bundle": the right to exclude others.²⁸⁶

application need convey no more than a *de dicto* commitment to these kinds, the applicant need incur only a *de dicto* commitment in making the application.

²⁸⁴ Cf. *In re Borst*, 345 F.2d 851, 855 (C.C.P.A. 1965) (holding that for the teachings of a prior art patent to anticipate a claimed invention, "the [prior art] disclosure must be such as will give possession of the invention to the person of ordinary skill."). Since such ontological possession includes knowledge of claim scope, this account also recognizes the notice function of the written description requirement. Cf. Lefstin, *supra* note 29, at 1219 (arguing that by demanding definitional information, the written description requirement improves notice of patent scope).

²⁸⁵ See, e.g., *In re Curtis*, 354 F.3d 1347, 1351 (Fed. Cir. 2004) (explaining that later-filed claims can claim the priority date of an earlier application only if the earlier application's disclosure "reasonably convey[s] to one of ordinary skill in the art that the inventors possessed the later-claimed subject matter when they filed the earlier application.").

²⁸⁶ Cf. *College Sav. Bank v. Florida Prepaid Postsecondary Educ. Expense Bd.*, 527 U.S. 666, 673 (1999) (citation omitted) ("The hallmark of a protected property interest is the right to exclude others. That is 'one of the most essential sticks in the bundle of rights that are commonly characterized as property.'"); Aleksandar Nikolic, *Securitization of Patents and Its Continued Viability in Light of the Current Economic Conditions*, 19 ALB. L.J. SCI. & TECH. 393, 395-96 (2009) ("While a patent is

In summary, I have provided an ontological account of the written description requirement that both incorporates Lefstin's definitional account and supports the Federal Circuit's "possession" jurisprudence. In this account, the written description requirement serves to ensure that one who reads the applicant's claims in light of the specification thereby incurs *de dicto* ontological commitments to those claims according to the patent system's criteria for such commitments. I will now turn to an account of the enablement requirement as providing the complementary function of ensuring that any ontological commitments so incurred are warranted according to the patent system's epistemology.

IV. THE ONTOLOGICAL ROLE OF THE ENABLEMENT REQUIREMENT

To complete our account of the patent system's ontological commitments, it remains to show how the enablement requirement secures warrants to *de dicto* ontological commitments to claims as kinds; i.e., how an enabling disclosure serves to justify (according to the patent system's epistemology) the belief that entities of the claimed kind, having certain essential causal properties, may exist in this world. To understand what an enabling disclosure needs to do to fulfill this justificatory role, it is necessary first to examine the epistemological burdens such a belief places on the patent system. In particular, the enforceability of a patent claim requires that the patent system have available sufficient epistemological machinery to make factual determinations as to whether a given accused entity exists and is of the claimed kind.

These determinations may involve extensive appeals to scientific realism, as *Centricut v. Esab Group*²⁸⁷ illustrates. In that case, Esab Group ("Esab") asserted two patent claims directed to an improved electrode for a plasma arc torch.²⁸⁸ Centricut sought a declaratory judgment of invalidity and noninfringement against Esab, and Esab filed infringement counterclaims.²⁸⁹ After a bench trial,²⁹⁰ the district court held one of Esab's claims infringed.²⁹¹ The Federal Circuit reversed

considered property, an owner is not granted the full 'bundle of sticks' of property rights in an invention but merely 'the [negative] right to exclude others.'").

²⁸⁷ *Centricut, LLC v. Esab Group, Inc.*, 390 F.3d 1361 (Fed. Cir. 2004).

²⁸⁸ *See id.* at 1363.

²⁸⁹ *See id.*

²⁹⁰ *See id.* at 1365.

²⁹¹ *See id.* at 1366–67.

the trial court's finding of infringement, relying heavily on the testimony of Centricut's expert that Esab had not conducted testing sufficient to show that the accused electrode fell within the scope of the claim.²⁹² In giving weight to this expert testimony, the appeals court discounted the rebuttal testimony of Esab's inventor and other witnesses, none of whom were qualified as experts.²⁹³

The Federal Circuit based its decision on the following facts. Plasma arc torches use electrical arcs—essentially, artificial lightning bolts²⁹⁴—to superheat a stream of gas to a plasma state at temperatures of around 30,000 degrees Kelvin, hot enough to cut metal.²⁹⁵ Torches that use oxygen gas are particularly suitable for cutting carbon steel.²⁹⁶ Most conventional torch electrodes consist of a metal emissive insert embedded in a holder made of a different metal.²⁹⁷

According to Esab's patent disclosure, the emissive insert is composed of a metal that has a low "work function"; i.e., the amount of energy required to "permit[] thermionic emission of [an electron from] a metal at a given temperature."²⁹⁸ This low work function makes the insert "capable of readily emitting electrons when an electric potential is applied thereto," so that in the torch's normal operation the arc is supported by the insert.²⁹⁹ In conventional torches, however, the use of oxygen gas can cause the metal holder to oxidize.³⁰⁰ If the holder is made of a metal such as copper whose work function falls when it is oxidized, the arc may begin to emanate from the holder in preference to the insert, causing the holder to melt and the electrode to fail.³⁰¹ Esab's invention provides a sleeve positioned between the insert and the holder that has a high work function

²⁹² See *id.* at 1367–68.

²⁹³ See *id.* at 1368–69.

²⁹⁴ See, e.g., ENVIRONMENTAL MANAGEMENT IN HEALTHCARE FACILITIES 34 (Kathryn D. Wagner ed., 1998) ("Plasma Arc reactors generate intense heat . . . through discharge of a powerful electrical arc (artificial lightning).").

²⁹⁵ See *Centricut*, 390 F.3d at 1363.

²⁹⁶ See *id.*

²⁹⁷ See *id.*

²⁹⁸ U.S. Patent No. 5,023,425 col.1 (filed Mar. 6, 1990).

²⁹⁹ *Id.*

³⁰⁰ See *id.*

³⁰¹ See *id.*

relative to the emissive insert.³⁰² The addition of the sleeve keeps the arc on the emissive insert even when the holder becomes oxidized, thereby prolonging the electrode's life.³⁰³

Claim 1, the broader of Esab's claims recited, *inter alia*, "an emissive insert composed of a metallic material having a relatively low work function, and a sleeve surrounding said emissive insert . . . composed of a metallic material having a work function which is greater than that of the material of said emissive insert."³⁰⁴ Esab's other claim, claim 8, further specified, *inter alia*, that the sleeve's work function was greater than that of the holder and that the insert's "relatively low work function" adapted it "to readily emit electrons upon an electric potential being applied thereto."³⁰⁵

In the district court, Centricut moved for summary judgment of invalidity for indefiniteness, arguing that the work function of a metallic material is dependent on too many variables (e.g., surface treatment and crystalline structure) for one of skill in the art to determine whether either claim read on a particular combination of holder, sleeve and insert materials.³⁰⁶ The court rejected this argument, finding the claims' work function limitation to be definite:

It may well be, as Centricut claims, that some silver sleeves could be within the claims while others silver sleeves fall outside the claims, depending upon the physical characteristics of the particular sample of silver used and the identity of the metal used for the emissive insert, but that is not due to any indefiniteness in the claim. Rather, it is due to the nature of work function as an electro-chemical characteristic that is dependent upon a variety of variables [A]ll one must do to make a silver [sleeve] that avoids the work-function limitation . . . is to use silver with the necessary physical characteristics (surface treatment, crystalline structure, etc.) to give it a work function equal to or lower than the work function of the material selected for the emissive insert³⁰⁷

³⁰² See *Centricut*, 390 F.3d at 1363–64.

³⁰³ See *id.* at 1364.

³⁰⁴ *Id.*

³⁰⁵ *Id.* at 1364 n.1.

³⁰⁶ *Centricut, LLC v. Esab Group, Inc.*, No. 99-039-M, 2002 WL 220057, at *4 (D.N.H. Feb. 7, 2002).

³⁰⁷ *Id.* at *5.

In Centricut's accused electrode, the holder was made of copper, the sleeve was made of silver, and the insert was made of hafnium.³⁰⁸ At trial, Centricut's expert had submitted tables providing work function values for various element samples, including one that reported values ranging from 3.08 to 4.81 electron-volts for silver and a single value of 3.53 electron-volts for hafnium.³⁰⁹ The district court inferred from these tables that "silver commonly has a higher work function than hafnium [sic]."³¹⁰ Noting that "[n]othing in the record suggests that Centricut made its silver sleeves from one of the relatively few low-work-function forms of silver," the court concluded that it was more likely than not that Centricut's electrode infringed claim 1.³¹¹ In contrast, the court found "too great an overlap in relative work-function values for silver and copper to give rise to a reliable inference" as to whether the electrode infringed claim 8.³¹²

Centricut did not appeal the district court's ruling on indefiniteness,³¹³ but raised the issue of the variability of work functions again in appealing the district court's judgment of infringement.³¹⁴ As Centricut noted, there was no evidence in the record "of either the *actual* work-function values or the *actual* relative work-function rankings in the accused Centricut electrode."³¹⁵ According to Centricut, the district court erred in relying on work function tables as evidence of the actual values applicable to the accused electrode.³¹⁶ Such tables "do not show values for materials in bulk," because the work function of each specimen varies according to

³⁰⁸ See *Centricut*, 390 F.3d at 1366; *Centricut, LLC v. Esab Group, Inc.*, No. 99-CV-39, 2003 WL 21558348, at *2 (D.N.H. July 9, 2003).

³⁰⁹ See *Centricut*, 390 F.3d at 1366 & n.3.

³¹⁰ *Id.* at 1366 (citing *Centricut*, 2003 WL 21558348, at *3).

³¹¹ *Id.*

³¹² *Id.* (citing *Centricut*, 2003 WL 21558348, at *3).

³¹³ See *id.* at 1367 n.4.

³¹⁴ Brief of Appellants at 7–26, *Centricut, LLC v. Esab Group, Inc.*, 390 F.3d 1361 (Fed. Cir. 2004) (No. 03-1574).

³¹⁵ *Id.* at 7; see also *Centricut*, 390 F.3d at 1365 ("[N]either party introduced any evidence of tests conducted to directly measure the work function of the materials used in the accused device. Indeed, neither party introduced evidence of tests or other evidence concerning the exact materials used in the accused device.").

³¹⁶ See Brief of Appellants, *supra* note 314, at 11.

its own surface and atomic arrangements and the conditions under which the emission is measured.³¹⁷

The Federal Circuit agreed with this argument, crediting the testimony of Centricut's expert to the effect that "work function is not an intrinsic property of a metal, but is rather a property of specific surfaces under specific conditions."³¹⁸ The appeals court found that this testimony "directly contradicted" the district court's conclusion that the tables showed that the accused electrode met the work function limitation by a preponderance of the evidence.³¹⁹ The Federal Circuit also credited Centricut's expert testimony that the observed durability of Centricut's accused electrode "could be attributed to a number of different factors, including temperature, the geometry of the electrode, the thermal and electrical conductivity of the sleeve, or the sleeve's resistance to oxidation, and that it was not reasonable to conclude that longer useful life was attributable to work function."³²⁰ Noting the district court's finding that "the field of technology from which [the invention] sprang is so poorly understood that it qualifies as a 'black art,'" the appeals court deemed the case to be one in which expert testimony was necessary to prove infringement:

We do not state a per se rule that expert testimony is required to prove infringement when the art is complex. Suffice it to say that in a case involving complex technology, where the accused infringer offers expert testimony negating infringement, the patentee cannot satisfy its burden of proof by relying only on testimony from those who are admittedly not expert in the field.³²¹

Since Esab had not presented any expert witnesses on the issue of work function, the court concluded that Esab had failed to satisfy its burden of proof on infringement.³²²

³¹⁷ See *id.* at 11–14.

³¹⁸ *Centricut*, 390 F.3d at 1365.

³¹⁹ See *id.* at 1367.

³²⁰ *Id.* at 1368.

³²¹ *Id.* at 1370.

³²² See *id.*

Identifying the patent system's ontological commitments in connection with the *Centricut* case reveals at least three illustrative examples of the patent system's reliance on scientific essentialism and scientific realism.

First, the issuance of claim 8 required the patent system to incur a *de dicto* ontological commitment to a kind of device with essential causal powers that include "readily emit[ting] electrons upon an electric potential being applied thereto."³²³ While the electron is a paradigmatic unobservable entity,³²⁴ "our best scientific theories" tell us that thermionic emission is an observable manifestation of a real entity of the natural kind known to science as the electron.³²⁵ The patent system's commitments to scientific essentialism and to scientific realism serve to warrant its acceptance that devices capable of emitting electrons according to claim 8 can exist.³²⁶

Second, the Patent Office's issuance of claims 1 and 8 and the district court's judgment of validity entail a finding that well-defined classes of particulars can be picked out, each particular having, *inter alia*, a sleeve characterized by a relatively high work function.³²⁷ The work function of a material is a causal power, insofar as it describes the disposition of the material to engage in a causal process (i.e., thermionic emission).³²⁸ The patent system's commitment to scientific essentialism

³²³ See *supra* text accompanying note 305.

³²⁴ See *supra* text accompanying notes 183–85.

³²⁵ In a recent book exploring the historicity of scientific realism in the case of the electron, Theodore Arabatzis describes the emergence of this scientific consensus:

Lorentz, Larmor, and even Thomson eventually adopted a single name, "electron," for the theoretical entities they had put forward. Apparently, they must have thought that those theoretical entities were representations of the same unobservable entity. A prominent reason for their thinking so was that the charge-to-mass ratio of ions, electrons, and corpuscles turned out to be approximately the same. As a result of the stability of that quantity across different experimental contexts, several experimental situations (the Zeeman effect, cathode rays, *thermionic emission*, the photoelectric effect, beta-rays, etc.) came to be considered observable manifestations of the same entity, the electron.

ARABATZIS, *supra* note 184, at 107–08. (citations omitted) (emphasis added).

³²⁶ See *supra* text accompanying note 182.

³²⁷ See *supra* text accompanying notes 304–07.

³²⁸ See *supra* text accompanying note 298. The parties agreed to construe the term "work function" as it was defined in Esab's patent. *Centricut, LLC v. Esab Group, Inc.*, 390 F.3d 1361, 1364 (Fed. Cir. 2004).

warrants the district court's treatment of the sleeve's work function as an essential property of each embodiment of the claims,³²⁹ even though work function may vary widely among different specimens of the same metallic element and under different conditions of use.³³⁰ As the court explained in its ruling on indefiniteness, any embodiments with silver sleeves that fall within the scope of Esab's claims do so in virtue of the sleeves' work functions rather than their silver composition.³³¹

Finally and most crucially, the Federal Circuit's judgment of noninfringement illustrates that the warrants provided by scientific essentialism and scientific realism to the patent system's ontological commitments are limited in scope by their epistemological reliance on the argument from the best explanation.³³² The district court's findings regarding the elemental composition of Centricut's accused electrode³³³ did not warrant a *de re* ontological commitment to the electrode as an embodiment of the claim, because such a commitment could not be grounded in the best available scientific theories.³³⁴ In the absence of other record evidence regarding the scientific theories pertaining to work function, the Federal Circuit credited the testimony of the only expert in the case qualified on the subject.³³⁵ Given the expert's testimony to the effect that the unobserved³³⁶ work function of the accused electrode's sleeve was neither an intrinsic property of the elemental silver observed in the sleeve's composition³³⁷ nor an adequate explanation for the electrode's observed durability,³³⁸ the argument from the best explanation could not justify a reasonable belief that the accused electrode was an example of the claim.³³⁹

³²⁹ See *supra* text accompanying note 152.

³³⁰ See *supra* text accompanying notes 168–71.

³³¹ See *supra* text accompanying note 307.

³³² See *supra* text accompanying notes 186–89.

³³³ See *supra* text accompanying note 308.

³³⁴ See *supra* text accompanying note 181.

³³⁵ See *supra* text accompanying notes 321–22.

³³⁶ See *supra* text accompanying note 315.

³³⁷ See *supra* text accompanying note 318.

³³⁸ See *supra* text accompanying note 320.

³³⁹ See *supra* text accompanying notes 321–22; *cf. supra* text accompanying notes 182–85 (explaining argument from the best explanation as the main justification for scientific essentialism's ontological commitment to electrons as a natural kind).

The above examination of the *Centricut* case illustrates the critical role of enablement doctrine in warranting the patent system's ontological commitments to claims as kinds whose examples are (possible) embodiments with essential causal powers. Given that claims are novel kinds, most of whose examples are unobservable entities,³⁴⁰ such warrants rely heavily on scientific realism and are justified in doing so by the argument from the best explanation. The warranting role of an enabling disclosure, then, is to furnish any theoretical or factual support that may be required in addition to the support provided by information known in the art, in order to satisfy the patent system that such reliance on the argument from the best explanation is justified.

The enablement requirement is met if one of skill in the art "could make or use the invention from disclosures in the patent coupled with information known in the art without undue experimentation."³⁴¹ The ability of a reader of the patent disclosure to "make . . . the invention . . . without undue experimentation" logically implies the possible existence of embodiments as entities. What remains to be warranted by the ability to "use the invention . . . without undue experimentation" is the ontological status of the claim as a kind whose examples are embodiments with essential causal powers.³⁴² This task is effectively performed by patent law's operable utility doctrine,³⁴³ which requires that the claimed invention "be 'capable of being used to effect the object proposed.'"³⁴⁴

Under the operable utility doctrine, the patent system is normally inclined to admit a claim into its ontology of "useful Arts" on the basis of a filed patent application's representation that embodiments of the claim can be used for the described purpose.³⁴⁵ Where there are "factual reasons which would lead one

³⁴⁰ See *supra* Part III.B.3.

³⁴¹ *United States v. Teletronics, Inc.*, 857 F.2d 778, 785 (Fed. Cir. 1988).

³⁴² See *supra* text accompanying notes 126–30; see generally *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750 F.2d 1569 (Fed. Cir. 1984).

³⁴³ Enablement entails operable utility. See, e.g., *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350 (Fed. Cir. 1999) ("If a patent claim fails to meet the utility requirement because it is not useful or operative, then it also fails to meet the how-to-use aspect of the enablement requirement.").

³⁴⁴ *Mitchell v. Tilghman*, 86 U.S. 287, 396 (1873) (citation omitted) ("To meet the utility requirement, the Supreme Court has held that a new product or process must be shown to be 'operable'—that is, it must be 'capable of being used to effect the object proposed.'").

³⁴⁵ See *In re Swartz*, 232 F.3d 862, 864 (Fed. Cir. 2000) (citations omitted) ("The PTO has the initial burden of challenging a patent applicant's presumptively correct assertion of utility."); see also *Ex parte Dash*, 27 U.S.P.Q.2d 1481, 1484 (B.P.A.I. 1993), *aff'd*, 118 Fed. Appx. 488 (Fed. Cir. 2004) (unpublished opinion), *cert. denied*, 126 S. Ct. 346 (2005) ("A disclosure of a utility satisfies the utility

skilled in the art to question the objective truth of the statement of operability,³⁴⁶ however, the patent system cannot accept such a representation as an ontological warrant, and therefore requires proof of utility sufficient to convince one skilled in the art.³⁴⁷ Furthermore, patent law recognizes no scientific theories capable of supporting a belief in the existence and causal powers of a perpetual motion device,³⁴⁸ and the patent system in such a case can find warrant for a *de dicto* ontological commitment to this kind of device only in a direct observation of an embodiment that can also warrant *de re* ontological commitments to both the claim and the embodiment.³⁴⁹

The patent system's commitment to scientific realism³⁵⁰ thus manifests itself doctrinally as a rather liberal approach to epistemological justification, at least when it comes to *de dicto* commitment to a claim. Absent factual or theoretical inconsistencies with the argument from the best explanation, the patent system may

requirement of section 101 unless there are reasons for the artisan to question the truth of such disclosure.”); *In re Gazave*, 379 F.2d 973 (C.C.P.A. 1967) (“[I]n the usual case where the mode of operation alleged can be readily understood and conforms to the known laws of physics and chemistry, operativeness is not questioned, and no further evidence is required.”).

³⁴⁶ *In re Gaubert*, 524 F.2d at 1224–25.

³⁴⁷ See *supra* text accompanying notes 193–95.

³⁴⁸ See *supra* notes 196–201 and accompanying text; see also *In re Gazave*, 379 F.2d at 978 (“[I]f the alleged operation seems clearly to conflict with a recognized scientific principle as, for example, where an applicant purports to have discovered a machine producing perpetual motion, the presumption of inoperativeness is so strong that very clear evidence is required to overcome it.”).

³⁴⁹ See *supra* text accompanying note 192. The distinction between *de re* and *de dicto* ontological commitments to embodiments may be material to patentability, e.g., where an examiner relies on the applicant's experimental results. See *Hoffmann-La Roche, Inc. v. Promega Corp.*, 323 F.3d 1354, 1367–68 (Fed. Cir. 2003).

To maintain this distinction, the patent system has adopted the linguistic practice of referring to a disclosed embodiment in the past tense only where *de re* ontological commitment is warranted. See *id.* at 1363–64 (“Example VI is written in the past tense . . . From the language used, a reader of the patent would conclude that the protocol was performed and that the following results were actually achieved.”); MPEP, *supra* note 191, at § 608.01(p) (“No results should be represented as actual results unless they have actually been achieved. Paper examples should not be described using the past tense.”).

To the extent that warrants for *de re* ontological commitment entail evidence of actual existence, the patent system may find that a disclosure provides a warrant for *de dicto* but not *de re* commitment. For example, prophetic examples can provide support for a claim if enabling. See *Atlas Powder Co. v. E.I. du Pont DeNemours & Co.*, 750 F.2d 1569 (Fed. Cir. 1984) (accepting trial court's finding that prophetic examples “would be helpful in enabling someone to make the invention.”).

³⁵⁰ See *supra* Part III.B.3.

find an acceptable warrant for such a commitment in the bare assertion that a kind of (possible) entity with certain essential causal powers exists in *this* (mind-independent) world, and not merely the (mind-dependent) world of the inventor's conception.

V. TOWARD AN ESSENTIAL CAUSATION REQUIREMENT FOR PATENT-ELIGIBILITY

This Article has presented a descriptive account of the ontology of “useful Arts” as revealed by the patent system’s legal doctrines and practices. In this ontology, claims are novel kinds of embodiments;³⁵¹ and embodiments are entities whose properties include essential causal powers,³⁵² and whose possible existence is therefore warranted by scientific essentialism and scientific realism.³⁵³ Many of the most fundamental and well-established doctrines of patent law commit the patent system to this ontology, including (1) the patentable subject matter requirement, which confines patentability to kinds of entities having causal powers;³⁵⁴ (2) doctrines pertaining to generic disclosure,³⁵⁵ inherent disclosure,³⁵⁶ and operable utility,³⁵⁷ which presuppose that the possible embodiments of a claim possess certain (variable) causal powers in virtue of being examples of the kind defined by the claim; (3) the doctrines of constructive reduction to practice, anticipation and infringement, which entail commitments to claims and embodiments in this ontology;³⁵⁸ (4) the written description requirement, which serves in part to satisfy the patent system’s criteria for incurring such commitments,³⁵⁹ and (5) the enablement requirement, which serves in part to warrant such commitments.³⁶⁰ Several other well-known features of the patent system are also consistent with this ontological picture, including the infinite scope

³⁵¹ See *supra* Part III.A.

³⁵² See *supra* Parts II.B.1–2.

³⁵³ See *supra* Parts II.B.2–3.

³⁵⁴ See *supra* text accompanying note 123.

³⁵⁵ See *supra* text accompanying notes 129–30.

³⁵⁶ See *supra* text accompanying notes 131–34.

³⁵⁷ See *supra* text accompanying notes 190–92.

³⁵⁸ See *supra* text accompanying notes 251–62.

³⁵⁹ See *supra* text accompanying Part III.C.

³⁶⁰ See *supra* text accompanying Part IV.

of patent claims,³⁶¹ the prohibition on inferential claiming,³⁶² the construction of preambular language in claims,³⁶³ and the near elimination of the Patent Office's working model requirement.³⁶⁴

If this theory correctly describes the patent system's implicit ontology, then it also provides a precise criterion for distinguishing between a patent-ineligible abstract idea and a patent-eligible "practical method or means of producing a beneficial result or effect."³⁶⁵ The latter characterization is applicable only where the utility of the claimed invention is amenable to explanation by a single causal account that reasonably specifies, *inter alia*, the resources necessarily brought into play by the invention's use (even though such an account need not be known to or submitted by the patent applicant).³⁶⁶ Here I use "resources" broadly to refer to any quantities that have a well-defined causal role generally accepted by practitioners, including physical quantities such as mass, energy, charge, and momentum, and real-time computational resources such as CPU cycles, network bandwidth, memory, disk space, and battery life. Generally accepted explanatory principles governing the involvement of such resources in the essential causal powers of the claim's embodiments may range from the conservation laws of physics to the scheduling disciplines implemented in operating systems.³⁶⁷ In future work, I plan to argue that this *essential causation requirement*, grounded in real-world resource considerations, can be readily satisfied by any *practical* method or means of achieving a useful effect, but not by any abstract idea.³⁶⁸

The essential causation requirement holds considerable promise for stabilizing and clarifying patentable subject matter doctrine, as illustrated by the Federal Circuit's analytical efforts in *In re Nuijten*.³⁶⁹ In *Nuijten*, a three-judge panel

³⁶¹ See *supra* text accompanying note 127.

³⁶² See *supra* text accompanying note 74.

³⁶³ See *supra* text accompanying notes 149–51.

³⁶⁴ See *supra* text accompanying notes 190–92.

³⁶⁵ See *supra* note 119 and accompanying text.

³⁶⁶ See *supra* text accompanying note 198.

³⁶⁷ Consistent with this requirement, embodiments of an invention may vary with respect to non-essential causal powers. See *supra* text accompanying notes 124–25.

³⁶⁸ See Chin, *supra* note 39.

³⁶⁹ *In re Nuijten*, 500 F.3d 1346 (Fed. Cir. 2007).

reviewed the Patent Office's rejection of a claim for "a signal with embedded supplemental data"³⁷⁰ as directed to unpatentable subject matter.³⁷¹ Construing the claim, Judge Arthur Gajarsa's opinion, joined by Judge Kimberly Moore, found:

The text of the claim[] is not limited by any specified physical medium . . . [It] can of course be embodied by conventional, known means, such as electrical signals, modulated electromagnetic waves, and pulses in fiber optic cable. So long as some object or transmission carries the information specified by Nuijten's claim, it falls within that claim's scope regardless of its physical form.³⁷²

Judge Richard Linn concurred with this finding,³⁷³ and further noted that the claim could cover a signal derived from "a pulse of energy or a stone tablet."³⁷⁴ The court divided, however, on the legal question of whether "[a] transient electric or electromagnetic transmission" is a "manufacture" within the meaning of § 101 of the Patent Act.³⁷⁵ The majority focused on the transmission's transience and intangibility as disqualifying characteristics.³⁷⁶ The dissent, however, noted the materiality of the transmission's physical carrier, which is given form and therefore manufactured by human action or a machine,³⁷⁷ and called for a broad interpretation of the statutory categories to include "anything under the sun that is made by man."³⁷⁸

³⁷⁰ *Id.* at 1351. Claim 14 of Petrus Nuijten's application read in full: "A *signal* with embedded supplemental data, the signal being encoded in accordance with a given encoding process and selected samples of the signal representing the supplemental data, and at least one of the samples preceding the selected samples is different from the sample corresponding to the given encoding process." *Id.*

³⁷¹ *See id.* at 1351–52.

³⁷² *Id.* at 1353.

³⁷³ *See id.* at 1358 (Linn, J., dissenting).

³⁷⁴ *Id.*

³⁷⁵ *Id.* at 1356–57; *id.* at 1359 (Linn, J., dissenting).

³⁷⁶ *See id.* at 1356–57.

³⁷⁷ *Id.* at 1358 (Linn, J., dissenting).

³⁷⁸ *See id.* at 1362–63 (quoting *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980)).

While *Nuijten* is still good law,³⁷⁹ Judge Gajarsa's reasoning has been subject to well-founded criticism. To the extent that the majority's legal conclusion is based on the claimed signal's transience, it is incompatible with a 1980 Court of Customs and Patent Appeals decision that held "transitory, unstable, and non-isolatable" chemical intermediates to be patentable.³⁸⁰ To the extent that the conclusion relies on the reasoning that "[a] transient electric or electromagnetic transmission"³⁸¹ is intangible, it denies the prevailing scientific view that electrons and photons are particles that exert pressure on objects.³⁸² The majority's stated holding, that physical but transitory electric or electromagnetic forms of signal transmission are not patent-eligible subject matter,³⁸³ is therefore controversial at best.³⁸⁴

By recognizing the patent system's metaphysical commitment to the essential causation requirement, the *Nuijten* court could have invalidated the claim on less contested grounds. The objectionable aspect of *Nuijten*'s claim to "a signal" was not the transitory or intangible nature of the signal, but the disparate causal powers that the various embodiments of the claimed invention purported to employ. All three of the judges construed *Nuijten*'s claim so broadly as to encompass every physical medium capable of carrying data. Presumably, all would also agree that a pulse of electromagnetic energy and a stone tablet employ different causal powers, and bring very different kinds of resources into play, in conveying information.

³⁷⁹ In particular, *Nuijten*'s holding survives *Bilski v. Kappos*, 130 S. Ct. 3218 (2010), which addressed the scope of the judicially created abstract-idea exclusion from patentable subject matter for process claims. 130 S. Ct. at 3229–31. The claim at issue in *Nuijten* was not a process claim. See 500 F.3d at 1354–55. Also, since the *Nuijten* holding is based solely on a determination that the claim does not fall within any of the statutory categories of patentable subject matter, see *id.* at 1353–54, the majority's analysis does not reach any of the judicially created exceptions.

³⁸⁰ See *Nuijten*, 500 F.3d at 1359 (Linn, J., dissenting) (citing *In re Breslow*, 616 F.2d 516, 519, 521–22 (C.C.P.A. 1980)); *In re Nuijten*, 515 F.3d 1361, 1362 (Fed. Cir. 2008) (Linn, J., dissenting from denial of petition for rehearing en banc) (same).

³⁸¹ See *Nuijten*, 500 F.3d at 1356–57.

³⁸² See Dolly Y. Wu & Steven M. Geiszler, *Patentable Subject Matter: What Is the Matter with Matter?*, 15 VA. J.L. & TECH. 101, 128–32 (2010).

³⁸³ See *Nuijten*, 500 F.3d at 1353.

³⁸⁴ See Mark A. Lemley et al., *Life After Bilski*, 63 STAN. L. REV. 1315, 1328 n.68 (2011) (citation omitted) (describing the *Nuijten* holding as "questionable as a matter of physics and statutory interpretation"); see also Scott Bloebaum, Comment, *From Telegraphs to Content Protection: The Evolution of Signals as Patentable Subject Matter Under 35 U.S.C. § 101*, 9 N.C. J.L. & TECH. 243, 265–75 (2008) (criticizing *Nuijten*).

Nuijten's claim would therefore present an easy case for the essential causation test. It does not limit its embodiments to any essential causal power, and is therefore simply too abstract to be compatible with the ontological commitments and warrants that make up the patent system's ontology of "useful Arts."

Judge Linn proceeded in his dissent to opine that "the outer limits of statutory subject matter should not depend on metaphysical distinctions such as those between hardware and software or matter and energy."³⁸⁵ The hardware/software and matter/energy distinctions indeed rest on unstable theoretical foundations,³⁸⁶ but the essential causation requirement does not necessitate such potentially fine line-drawing, and Judge Linn would have had no difficulty in applying the requirement to Nuijten's claim. Of course, Judge Linn's comment also gives voice to the patent system's apparent discomfort with metaphysical distinctions as a source of legal rules.³⁸⁷ But as this Article has demonstrated and the Supreme Court acknowledged more than 160 years ago,³⁸⁸ the patent system's involvement with metaphysics is ubiquitous and profound. If the patent system is to take its *existing* metaphysical commitments seriously, the kind of "signal" described by Nuijten's abstract claim language cannot be admitted into the patent system's ontology.

Judge Randall Rader's dissenting opinion in *In re Bilski*³⁸⁹ described the problems such an ontological mismatch could cause for the patent system in examining an abstract claim:

When considering the eligibility of "processes," this court should focus on the potential for an abstract claim. Such an abstract claim would appear in a form that is not even susceptible to examination against prior art under the traditional

³⁸⁵ See *Nuijten*, 500 F.3d at 1367 (Linn, J., dissenting).

³⁸⁶ See Albert Einstein, *Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?*, 18 ANNALEN DER PHYSIK 639 (1905) (proposing mass-energy equivalence); Alan Turing, *On Computable Numbers, with an Application to the Entscheidungsproblem*, 42 PROC. LONDON MATH. SOC'Y (SERIES 2) 230 (1937) (describing the Turing machine model of computation, which can be implemented either as hardware or software).

³⁸⁷ See *supra* notes 19–23 and accompanying text.

³⁸⁸ See *Hogg v. Emerson*, 47 U.S. 437, 485–86 (1848).

³⁸⁹ *In re Bilski*, 545 F.3d 945, 1011–15 (Fed. Cir. 2008) (Rader, J., dissenting).

tests for patentability. Thus this court would wish to ensure that the claim supplied some concrete, tangible technology for examination.³⁹⁰

Judge Rader's dissent, the only Federal Circuit opinion cited with approval by the Supreme Court majority in *Bilski v. Kappos*,³⁹¹ describes an essentially metaphysical approach to the abstract-ideas exclusion. Judge Rader would hold that abstract claims are "not even susceptible to examination against prior art" because to perform such an examination would entail the category error³⁹² of treating an abstract idea as if it were "concrete, tangible technology." The ontological mismatch between an abstract claim and the "useful Arts"³⁹³ would reveal itself in the patent system's practice of examining the claim against prior art.³⁹⁴

The descriptive ontological account in this Article, therefore, may have considerable prescriptive relevance as the Federal Circuit takes up the *Bilski* Court's invitation to "develop[] other limiting criteria that further the purposes of the Patent Act and are not inconsistent with its text."³⁹⁵ As this Article has demonstrated, among the purposes of the Patent Act is the regulation of the patent document's role in informing the patent system's ontological commitments. The essential causation requirement furthers that purpose, coheres with the patent system's statutes, doctrines and practices, and draws meaningful patent-eligibility distinctions without "pos[ing] questions of such intricacy and refinement that they risk obscuring" the patent system's larger goals.³⁹⁶ In a forthcoming article,³⁹⁷ I

³⁹⁰ *Id.* at 1013.

³⁹¹ See *Bilski v. Kappos*, 130 S. Ct. 3218, 3227, 3231 (2010).

³⁹² See THE CAMBRIDGE DICTIONARY OF PHILOSOPHY, *supra* note 47 (defining category mistake).

³⁹³ See *Diamond v. Chakrabarty*, 447 U.S. 303, 315 (1980) (explaining that the Patent Act's subject matter provisions "have been cast in broad terms to fulfill the constitutional and statutory goal of promoting 'the Progress of Science and the useful Arts'"); *In re Comiskey*, 554 F.3d 967, 977 (Fed. Cir. 2009) (explaining that in enacting statutory limitations on patentable subject matter, "Congress [] responded to the bidding of the Constitution" to promote the progress of "useful Arts" (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 6 (1966))).

³⁹⁴ Cf. David S. Oderberg, *Hylemorphic Dualism*, 22 SOC. PHIL. & POL'Y 70, 89 (2005) ("[T]here is an essential ontological mismatch between the proper objects of intellectual activity . . . and any kind of potential physical embodiment of them. . . . Concepts, propositions, and arguments are abstract; potential material loci for these items are concrete.").

³⁹⁵ *Bilski v. Kappos*, 130 S.Ct. at 3231.

³⁹⁶ *Id.* at 3227 (citing *In re Bilski*, 545 F.3d at 1015 (Rader, J., dissenting)).

³⁹⁷ See Chin, *supra* note 39.

will demonstrate the application of the essential causation requirement to several legally significant information technology patents. My tentative conclusion is that the “machine-or-transformation” inquiry, though downgraded by the *Bilski* Court from a “test” to a “useful and important clue,”³⁹⁸ can appropriately be adopted as a strict requirement for the patent-eligibility of software-implemented inventions.³⁹⁹

VI. CONCLUSION

This Article has not come close to conducting an exhaustive inventory of the patent system’s metaphysical commitments. In another future article, I plan to explore the patent system’s orientation to mental causation and the so-called mind-body problem, which are perhaps the most enduring controversies in all of metaphysics.⁴⁰⁰ The standard causal account of how the patent system “promote[s] the Progress of . . . useful Arts” seems unproblematically to traverse the boundary between mental and physical properties without engaging in any of these metaphysical debates: (1) the patent system hastens inventions and disclosures by offering patents as economic *incentives*⁴⁰¹ to (2) *inventors* who conceive,⁴⁰² reduce

³⁹⁸ *Bilski v. Kappos*, 130 S. Ct. at 3227.

³⁹⁹ To justify this conclusion, I will have to address doubts raised by the *Bilski* majority and numerous amici concerning the applicability and practicability of the “machine-or-transformation” inquiry in the “Information Age.” See *id.* at 3227 (citing amicus briefs from the Business Software Alliance, Biotechnology Industry Organization et al., the Boston Patent Law Association, the Houston Intellectual Property Law Association, and Dolby Labs., Inc.).

⁴⁰⁰ For a description of the philosophical controversies surrounding the mind-body problem, see, for example, THE OXFORD COMPANION TO PHILOSOPHY 608 (Ted Honderich ed., 2d ed. 2005) (describing the modern “mind-body debate” as focused on “the status of mental states, processes, and properties *vis-à-vis* physical states, processes, and properties.”). The problem dates back to René Descartes in 1641. See generally RENÉ DESCARTES, DISCOURSE ON METHOD AND MEDITATIONS ON FIRST PHILOSOPHY (Donald A. Cress trans., 3d ed. 1993).

⁴⁰¹ See, e.g., Arnold Plant, *The Economic Theory Concerning Patents for Inventions*, 1 ECONOMICA 30, 32 (1934) (“[T]he purpose of patents for inventions is, by giving an inventor the control for a definite period over the disposal of his invention, to make it easier for him to derive an income from it. . . . [T]he ultimate aim is to encourage inventing.”).

⁴⁰² *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986) (defining conception as the “formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention”) (quoting 1 ROBINSON ON PATENTS 532 (1890)).

to practice,⁴⁰³ and disclose their (3) *inventions*, which others can learn (at will) and use (as authorized by the patentee) to produce beneficial effects.⁴⁰⁴

It might be suggested that to foreground the implicit mind-body metaphysics within this account is to risk taking sides in a dispute the patent system lacks the time and expertise to adjudicate rigorously. For example, the doctrine conferring inventorship on one who conceives of an invention but relies on another to reduce it to practice⁴⁰⁵ may appear to commit the patent system to mind-body dualism⁴⁰⁶ (the view that the mind is not part of the physical world⁴⁰⁷), a stance that is under heavy siege from contemporary neuroscience⁴⁰⁸ and has long fallen out of fashion among analytic philosophers.⁴⁰⁹ More fundamentally, the interactions of minds,

⁴⁰³ Reduction to practice, whether constructive (filing a patent application) or actual (producing an embodiment of the invention in “physical or tangible form”), entails a physical act. *See Wetmore v. Quick*, 536 F.2d 937, 941 (C.C.P.A. 1976).

⁴⁰⁴ *See, e.g., Diamond v. Diehr*, 450 U.S. 175, 183 n.7 (1981) (quoting *Corning v. Burden*, 56 U.S. 252, 268 (1853)) (“‘It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted’ . . .”).

⁴⁰⁵ *See Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227–29 (Fed. Cir. 1994) (stating that to be recognized as a joint inventor, each collaborator “must contribute to the joint arrival at a definite and permanent idea of the invention as it will be used in practice”; i.e., the conception of the invention). Constructive reduction to practice is typically completed by patent attorneys and agents, who do not thereby become co-inventors. *See generally Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1382 (Fed. Cir. 2000) (rejecting the argument that patent attorney had become a joint inventor in the course of “defining [the client’s] invention to obtain, if possible, a valid patent with maximum coverage”).

The determination of *priority* of inventorship is a distinct issue, and is not based solely on first conception. *See* 35 U.S.C. § 102(g)(2) (providing that priority determination shall consider conception, reduction to practice, and diligence); *see also Price v. Symsek*, 988 F.2d 1187, 1190 (Fed. Cir. 1993) (“Although derivation and priority of invention are akin in that both focus on inventorship . . . they are distinct concepts.”).

⁴⁰⁶ *See Burk, supra* note 16, at 1986 (arguing that the conception-focused inventorship doctrine exemplifies a “striking pattern of dualism” in the patent system).

⁴⁰⁷ ANTHONY DARDIS, *MENTAL CAUSATION* 17 (2008).

⁴⁰⁸ *See, e.g., W.W. Meissner, The Mind-Brain Relation and Neuroscientific Foundations: I. The Problem and Neuroscientific Approaches*, 70 BULL. MENNINGER CLINIC 87, 89 (2006) (“For all practical purposes, modern neuroscientists are virtually unanimous in rejecting frank dualism.”).

⁴⁰⁹ *See* Howard Robinson, *Dualism*, STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Nov. 3, 2011), <http://plato.stanford.edu/entries/dualism/> (describing dualism as “out of fashion” in philosophy since the publication of Gilbert Ryle’s monograph *The Concept of Mind* in 1949); *but see, e.g., DAVID J. CHALMERS, THE CONSCIOUS MIND: IN SEARCH OF A FUNDAMENTAL THEORY* (1996) (offering a modern analytical defense of dualism, at least as to the non-physicality of mental properties).

bodies and money in innovative processes are too complex and varied to be metaphysically subsumed under a single causal account of how the patent laws hasten innovation.⁴¹⁰

Closer study of these metaphysical accounts of causation could also illuminate the law-of-nature exclusion from patentable subject matter. A potential doctrinal difficulty arises from the fact that our knowledge of the physical laws that govern causality in the world is contingent and incomplete. For example, the Supreme Court in *Parker v. Flook*⁴¹¹ cites Newton's law of universal gravitation as an unpatentable "scientific principle" that "reveals a relationship that has always existed."⁴¹² But the relationship $F = Gmm'/r^2$ "exists" between two bodies, if at all, only where there are no forces other than gravitational forces at work.⁴¹³ Moreover, its status as a "fundamental truth" is subject to falsification by future contrary observations,⁴¹⁴ which will remain possible as long as physics is unable to provide a complete account of all phenomena.⁴¹⁵ If the Court's language in *Le Roy* and *Flook* is read as a permanent ontological commitment to Newton's law (and other laws of today's physics) as true descriptions of the natural world, then those precedents are untenable as a basis for a metaphysical characterization of the "laws of nature" exception.⁴¹⁶

My current view is that both of the above difficulties are the avoidable result of reading problematic metaphysical commitments into patent doctrine where none need be found. The inventorship doctrine's account of mental causation does not entail mind-body dualism. The structure and function of the patent incentive are

⁴¹⁰ See generally Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1595–1630 (2003) (surveying "widely disparate explanations for the role of patents" in promoting innovation in general and in specific industries).

⁴¹¹ *Parker v. Flook*, 437 U.S. 584 (1978).

⁴¹² *Id.* at 593 n.15 (citing PETER D. ROSENBERG, PATENT LAW FUNDAMENTALS § 4, at 13 (1975)).

⁴¹³ NANCY CARTWRIGHT, HOW THE LAWS OF PHYSICS LIE 57–58 (1983).

⁴¹⁴ See generally KARL R. POPPER, THE LOGIC OF SCIENTIFIC DISCOVERY 78–92 (1959) (introducing falsifiability as a scientific criterion).

⁴¹⁵ Cf. Alyssa Ney, *Physicalism as an Attitude*, 138 PHIL. STUD. 1, 2 (2008) ("If physicalism is taken to be the view that the world is the way *current* physics says it is, then it is false since current physics is incomplete and at this time is probably not in a position to give us a complete explanation of all that exists.").

⁴¹⁶ See Simon, *supra* note 16, at 2191 ("That laws of nature are Truths to be uncovered and mastered by reason is a notion that continues to hold deep intuitive sway. There is no way to disprove this conjecture. But that is a far cry from saying that it is a reasonable cornerstone of modern patent law.").

essentially teleological, not causal. Patent-eligibility determinations can be grounded in today's best scientific theories without committing the patent system to accept their truth should they eventually be falsified. While I claim no special knowledge regarding the future,⁴¹⁷ I trust that this Article has demonstrated the potential value of further inquiries into the patent system's metaphysical commitments, regardless of their ultimate outcomes.

⁴¹⁷ *Cf.* text accompanying note 6.