Enabling After-Arising Technology

Kevin Emerson Collins

Indiana University Maurer School of Law

Follow this and additional works at: https://www.repository.law.indiana.edu/facpub

Part of the Intellectual Property Law Commons, and the Science and Technology Law Commons

Recommended Citation
Collins, Kevin Emerson, "Enabling After-Arising Technology" (2009). Articles by Maurer Faculty. 1753.
https://www.repository.law.indiana.edu/facpub/1753
I. INTRODUCTION

Much has been written on the nonobviousness standard of patent law, which establishes how different a new technology must be from the prior art in order to merit patent protection. In comparison, relatively little has been written about the reach of literal claim scope into after-arising technology (AAT): How far beyond the technology disclosed in a patent application and into future technologies should patent rights be...
permitted to reach? Both issues are critical to the creation of a well-tuned patent regime that offers efficient incentives, but work on the latter languishes in the shadow of efforts to address the former.

This Article offers a preliminary step in the sorely needed systematic exploration of the reach of patent rights into AAT, focusing exclusively on the role of the enablement doctrine in shaping the reach of literal claim scope into AAT. The enablement doctrine restricts the scope of an inventor’s claim so that it remains commensurate with the contribution to technological progress that the inventor has disclosed in her specification. When the Federal Circuit Court of Appeals (Federal Circuit) brings enablement to bear on claims that encompass AAT, the resulting doctrine is chaotic. Distinct lines of cases recite different doctrines, and the choice among the doctrines determines whether claims encompassing AAT are enabled. This Article searches for order in the chaos. It proposes that there are three rules that, taken together, explain what the Federal Circuit does when it grapples with the enablement of AAT: the foreseeability rule, the identity rule, and the complementarity rule. Courts and commentators have discussed the first two of these rules, but their effects are poorly understood and their policy justifications have not been clearly explained. The third, the complementarity rule, represents an original contribution to scholarly literature on enablement. In addition, this Article examines the most plausible normative justification for each of the rules. Where the complementarity rule makes claims more commensurate with contributions to technological contributions, the foreseeability and identity rules are “second best” rules that can undermine commensurability in order to achieve other goals.

This Article also makes a contrarian argument about the role that the predictability of a claimed technology plays in the enablement analysis. Conventional wisdom holds

---

2. The reach into AAT permitted by the doctrine of equivalents has attracted judicial and academic attention. See infra notes 49–52 and accompanying text. Scholarship addressing the reach of literal claim scope into AAT, however, is less common. For notable recent examples, see Christopher A. Cotropia, “After-Arising” Technologies and Tailoring Patent Scope, 61 N.Y.U. ANN. SURV. AM. L. 151 (2005) (arguing that claims cannot literally encompass AAT); Robin C. Feldman, Rethinking Rights in Biospace, 79 S. CAL. L. REV. 1 (2005) (arguing that the “footprint” of claims to “bioscience” inventions should not encompass AAT); Mark A. Lemley, The Changing Meaning of Patent Claim Terms, 104 MICH. L. REV. 101 (2005) [hereinafter Lemley, Changing Meaning] (arguing that literal claim scope should be fixed on the date of filing and therefore not encompass AAT); Robert P. Merges & Richard R. Nelson, On the Complex Economics of Patent Scope, 90 COLUM. L. REV. 839 (1990) (proposing that control over follow-on invention should be contingent on the pattern of development that characterizes the particular technological art at issue). The reach of patent rights into AAT and the nonobviousness standard are both implicated in blocking patents which arise when an initial inventor’s rights reach into AAT that is nonobvious in relation to the initial inventor’s disclosure. See Mark A. Lemley, The Economics of Improvement in Intellectual Property Law, 75 TEX. L. REV. 989, 1042–72 (1996) [hereinafter Lemley, Improvement] (defending a regime of blocking rights and divided entitlements in intellectual property to foster improvement).

3. This Article is preliminary because what is ultimately needed is not a splintered, doctrine-by-doctrine approach but rather a big-picture, comprehensive approach in which the effects of many traditionally distinct doctrines are considered simultaneously. Cf. infra Part II.C (discussing how doctrines other than enablement affect the reach of patent rights into AAT).

4. See infra notes 16–27 and accompanying text.

5. Complementary AAT is not the same thing as a complementary patent on a later-developed invention. See infra Part III.D.3 (distinguishing the two concepts).

that predictability influences how far enabled claims can reach into AAT, but predictability should be relevant only in the threshold determinations of whether a claim encompasses AAT and how much AAT it encompasses.

More broadly, the multi-rule approach proposed in this Article offers a new conceptual framework for enablement. The contemporary enablement doctrine is chaotic in part because different cases involve different categories of AAT that merit different treatment, but the Federal Circuit has not recognized the salience of the differences that mark the categories. The multi-rule approach highlights the heterogeneity of AAT. It establishes a taxonomy of AAT that allows courts to identify the categories of AAT that do—and likely should—receive different treatment under different rules.7

Part II provides background. It reviews the contradictory judicial pronouncements on the ability of an enabled claim to reach into AAT and the normative goal that enablement seeks to achieve through its tailoring of claim scope. Part III formulates the three rules that offer the most coherent and justifiable explanation of what courts actually do when deciding whether a claim that encompasses AAT is invalid for lack of enablement. It also reframes the importance of predictability. Part IV considers the collective impact of the three rules on the reach of enabled claims into AAT and the commensurability of claims and disclosures. Part V concludes.

II. ENABLEMENT, COMMENSURABILITY AND AAT

This Part presents the contemporary doctrine on enablement and AAT, and it explains the normative goal of commensurability that enablement promotes through its tailoring of the reach of literal claim scope into AAT. Reviewing the other patent doctrines that also restrain the reach of a patentee’s rights into AAT, it also highlights the limits of an inquiry into enablement in isolation.

A. The Doctrinal Chaos

To provide reasonable notice of claim scope to the public, the contemporary patent regime requires patent applicants to stake out claims marking the set of technologies that are presumptively under the inventor’s control.8 More specifically, it requires patent applicants to draft “peripheral” claims: texts that describe the full set of technologies that will be under the inventor’s control, right out to the set’s “outer boundaries.”9 Inventors must include their preliminary claims in the applications that they file with the Patent and Trademark Office (PTO).10

7. The multi-rule approach also reveals that the enablement doctrine gives courts more than one “policy lever” to shape the reach of literal claim scope into AAT. See Dan L. Burk & Mark A. Lemley, Policy Levers in Patent Law, 89 VA. L. REV. 1575 (2003) (arguing that courts can apply technology-neutral patent statutes to generate technology-specific incentive structures); infra notes 72, 120, 143, 182 (explaining distinct mechanisms through which courts can extend or curtail the reach of literal claim scope into AAT).
10. Post-filing modification of claim language is permitted through a variety of mechanisms. Cf. Ten-Jun Chiang, Fixing Patent Boundaries, MICH. L. REV. (forthcoming) (addressing the mechanisms through which
Inventors cannot simply include language describing any technology that they can 
imagine, file the language as a patent claim, and thereby obtain a right to exclude others 
making the technology. The invalidity doctrines restrict the permissible scope of a claim. 
Most invalidity doctrines fall into one of two different families. One set of doctrines—
including novelty\(^ 11 \) and nonobviousness\(^ 12 \)—operates retrospectively, preventing 
 inventors from claiming technology that does not embody a sufficient advance in relation 
to the status quo. Another set—including the disclosure doctrines of enablement and 
written description\(^ 13 \)—operates prospectively, restricting the reach of patent claims 
technologies that are nonobvious in relation to the prior art.

To achieve this end of restricting the reach of claim scope into nonobvious 
technologies, the disclosure doctrines bring the patent specification into the spotlight. 
Patent applications are not simply lists of an inventor's desired claims. They also contain 
a specification or a detailed disclosure of information about the invention. The 
enablement doctrine forces the inventor to disclose information in the specification that 
teaches the person having ordinary skill in the art (the PHOSITA) how to make and use 
the claimed invention without undue experimentation at the time the claim is filed.\(^ 14 \)
More specifically, enablement employs the concept of commensurability to restrict claim 
scope: it mandates that the set of the technologies described by a claim remain 
commensurate with the set of technologies enabled by the disclosure.\(^ 15 \)

Literal claim scope is not limited to the technologies that are already in existence at 
the time a claim is filed. It routinely encompasses technology that is beyond the 
competence of the PHOSITA of ordinary creativity to make and/or use at the time a 
claim is filed and that can be realized only after a post-filing technological advance has 
occurred. This type of technology is called after-arising technology (AAT) because it 
arises only after the claim has been filed. To facilitate discussion of the reach of literal 
claim scope into AAT, this Article distinguishes two dimensions within the generic 
concept of claim scope: breadth and depth. The static breadth of a claim describes the set 
of distinct technologies known to be within the scope of a claim at the time of filing. The 
temporal depth of a claim describes the growth of that set over time as claim scope 

---

\(^{11}\) 35 U.S.C. § 102(a), (e) & (g) (2006).

\(^{12}\) Id. § 103.

\(^{13}\) Id. § 112, 1. The Federal Circuit has held that section 112 codifies three distinct disclosure doctrines: 

**enablement**, written description, and best mode. Univ. of Rochester v. G.D. Searle & Co., 358 F.3d 916, 922 

(2004). For a discussion of written description, see infra notes 44-46 and accompanying text. The best mode is 
a binary doctrine. The specification either discloses the best mode or it does not. Best mode therefore does not 
afford permissible claim scope.


\(^{15}\) Claims can fail to be enabled for two different reasons. First, the specification may not disclose any 
enabled embodiment within the scope of a claim. See In re Glass, 492 F.2d 1228, 1232-33 (C.C.P.A. 1974). 

Second, the disclosure may provide an enabled embodiment, but claim scope may be excessive in relation to the 
enabling disclosure. In re Moore, 439 F.2d 1232, 1236 (C.C.P.A. 1971) (querying "whether the scope of 
enablement provided to one of ordinary skill in the art by the disclosure is such as to be commensurate with 
the scope of protection sought by the claims"). This Article addresses only the latter, commensurability-type 
enablement cases.
reaches into newly discovered AAT.\textsuperscript{16}

The notion of a specification that enables a claim whose depth has grown over time to encompass AAT presents a conceptual difficulty for the commensurability analysis. Because AAT is by definition a technology that is not invented until after a patent application has been filed, it is difficult to understand how a specification can teach the PHOSITA at the time of filing how to make and use AAT. This conceptual difficulty has created a problem in contemporary patent law when literal claims encompass AAT.\textsuperscript{17} The Federal Circuit's cases addressing the enablement of claims encompassing AAT are commonly viewed as inconsistent and chaotic.\textsuperscript{18} Grossly characterized, they contain

\begin{itemize}
  \item The assertion that the literal scope of an enabled claim can grow deeper over time to encompass newly developed AAT is controversial. It is an assertion that many of the arguments in this Article seek to prove, not a premise that is taken for granted. Some courts and commentators argue to the contrary that literal claim scope has only static breadth and no temporal depth. These breadth-only advocates cite two distinct doctrinal justifications for their position, but neither one prevents contemporary patent claims from growing deeper over time. First, they suggest that literal claim scope cannot reach into AAT because the fixation of the meaning of claim terms by the date of filing mandated in claim construction prevents literal claims from becoming deeper over time. See infra note 37 (presenting and rejecting this view). Second, they suggest that enabled claims cannot encompass AAT because enablement employs the "full-scope doctrine." See infra notes 19–21 and accompanying text (discussing the full-scope doctrine). The cases and hypotheticals discussed below in Parts III.B (foreseeability rule) and III.D (complementarity rule) prove, as a descriptive matter, that the full-scope doctrine does not capture the manner in which the contemporary patent regime operates and that enabled claims do routinely encompass AAT and grow deeper over time.

  To clarify, the argument that literal claim scope does (or should) have only static breadth and no progressive depth is usually not an argument that there is (or should be) a categorical bar that prevents earlier inventors from obtaining patents on accused devices containing AAT. The enablement safe harbor for same-thing AAT provided by the identity rule, discussed below in Part III.C, is almost universally recognized (although not by that name) as providing a mechanism through which earlier inventors can use claims with open transitions to reach into later inventors' work. See, e.g., Lemley, Improvement, supra note 2, at 1009; Timothy R. Holbrook, Equivalency and Patent Law's Possession Paradox, HARV. J.L. & TECH. (forthcoming 2009) (manuscript at 13–15, on file with author) (same). In other words, the reach of literal claim scope into AAT sanctioned by the identity rule differs from the reach sanctioned by the foreseeableability and complementarity rules: the identity rule allows the static breadth of literal claims to read on accused devices that embody AAT without any perceived growth in claim depth over time. The position of the breadth-only advocates is also bolstered by the ability of the DOE to provide patentees rights to exclude from AAT that lies beyond literal claim scope. See infra note 52.

  The conceptual difficulty exists only for AAT that makes a claim grow deeper over time. The enablement safe harbor for same-thing AAT provided by the identity rule allows the static breadth of enabled claims to read on accused devices implicating AAT and does not require any growth in claim depth over time. See infra Part III.C (discussing the identity rule).

  See, e.g., Bernard H. Chao, Rethinking Enablement in the Predictable Arts, 2009 STAN. TECH. L. REV. 3, ¶¶ 50–56 (discussing a split in the Federal Circuit's enablement doctrine that implicates the ability of an enabled claim to encompass AAT); Feldman, supra note 2, at 22–29 (describing the "doctrinal chaos" that has resulted from the application of the disclosure doctrines to bioscience claims that literally encompass AAT); Eileen M. Kane, Patent-Mediated Standards in Genetic Testing, 2008 UTAH L. REV. 835, 858 ("The Federal Circuit has not developed a coherent approach to later-developed technology that might fall within the scope of a generally broad claim."); Robert W. Unikel & Douglas M. Eveleigh, Protecting Inventors, Not Fortune Tellers: The Available Patent Protection for After-Developed Technologies, 34 AIPLA Q.J. 81, 99 (2006) ("[N]o other patent law rule or principle has caused as much confusion and consternation with regard to the problem of after-developed technologies than [enablement].") For an argument laying bare the enablement doctrine as a formally unrealizable doctrine, whether applied to AAT or not, see Jeffrey A. Lefstein, The Formal Structure of Patent Law and the Limits of Enablement, 24 BERKELEY TECH. L.J. 1141 (2009).
three irreconcilable variations on the commensurability requirement, each of which has a different implication for the reach of enabled claims into AAT.

First, some cases articulate a strict interpretation of commensurability in the form of the full-scope doctrine under which enabled claims cannot encompass AAT by growing deeper over time. They state that the “full scope” of a claim must be enabled or that “[t]he scope of [patent] claims must be less than or equal to . . . that which is disclosed in the specification plus the scope of what would be known to one of ordinary skill in the art without undue experimentation” at the time of filing. Any claim that grows deeper after it is filed and encompasses AAT that is not enabled by the specification should be invalid for lack of commensurability under the full-scope doctrine. The reason is that the set of things described by the claim becomes larger than the set of things the specification taught the PHOSITA to make and use on the date of filing.

A second line of enablement cases announces the single-embodiment doctrine. These cases move to the opposite extreme from the full-scope doctrine, proclaiming that a claim is enabled so long as the specification teaches the PHOSITA how to make and use any embodiment of the claim. Taken at face value, the single-embodiment doctrine eliminates the commensurability analysis. In its early formulations, the single-embodiment doctrine could be reconciled with the full-scope doctrine because each seemed to apply to a different type of technology. The single-embodiment doctrine governed enablement in predictable (i.e., mechanical) arts, and the full-scope doctrine governed enablement in the unpredictable (i.e., chemical) arts. Thus, enabled claims in the predictable arts could reach infinitely far into AAT, but claims in the chemical arts would lose commensurability with their disclosures if they were to reach into AAT. However, more recently, this dichotomy seems to have broken down. Claims in the mechanical arts have been invalidated under the full-scope doctrine, and claims in the predictable arts have been upheld in cases reciting the rhetoric of the single-embodiment doctrine.

One way of understanding the Federal Circuit’s case law addressing the enablement of claims that grow deeper over time to encompass AAT is that courts exercise discretion and oscillate between the full-scope and single-embodiment doctrines to achieve the

19. See In re Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993); Chao, supra note 18, ¶¶ 23-49 (discussing recent cases employing the full-scope variant of the commensurability requirement).
21. See Cotropia, supra note 2, at 165-68 (arguing that enabled literal claims cannot become deeper over time to encompass AAT); Holbrook, supra note 16, at 38 (arguing that enabled claims cannot encompass technologies that the specification did not teach the PHOSITA to make and use at the time of filing); Timothy R. Holbrook, Possession in Patent Law, 59 S.M.U. L. Rev. 123, 157-58 (2006) (“Enablement doctrine . . . confin[es] the scope of claims to what the inventor actually possessed.”). But cf supra notes 16 & 17 (noting that even the full-scope doctrine respects the identity rule and recognizes that the static breadth of enabled claims can encompass same-thing AAT).
23. See Spectra-Physics, 827 F.2d at 1533 (discussing contexts in which the single-embodiment doctrine is applicable).
24. See Chao, supra note 18, ¶¶ 23-49.
25. See Invitrogen, 429 F.3d at 1070-71.
desired outcome. When they feel like the inventor has overreached, they invoke the full-scope doctrine and invalidate the claim. Alternatively, when they feel that the inventor deserves a right to exclude from the AAT, they employ the single-embodiment rule.

Rhetoric notwithstanding, the Federal Circuit’s contemporary case law on enablement and claim depth can also be understood to apply a third variant of the commensurability requirement: the *reasonableness doctrine*. Early, pre-Federal Circuit enablement cases state that there need only be a “reasonable correlation” between the disclosure and the claims, splitting the difference between the full-scope and single-embodiment doctrines. The downside of the reasonableness doctrine is, of course, that the substantive content of what constitutes a reasonable correlation between a disclosure and a claim encompassing AAT has not been flushed out, so the doctrine remains a relatively fact-intensive, fuzzy, and unclear standard.

**B. Commensurability and the Incentive to Invent**

Patents grant inventors limited rights to exclude others from making, using, selling, offering to sell, or importing the technologies that they invent. Under an incentive-to-invent theory of patent protection, these rights to exclude benefit not only inventors but society at large. They augment the otherwise presumptively inefficiently small incentives for inventors to invest in the production of the ideas required to make new, welfare-enhancing technologies available to society.

The commensurability requirement of the enablement doctrine plays an important role in crafting the patent rights so that they can fulfill the goals of the incentive-to-invent theory. One of the oft-cited virtues of employing the patent regime rather than government-sponsored rewards to foster inventive conduct is that a market, not the government, should determine the nature of the research projects that are valuable and the amount of compensation that an inventor receives. For this market to function effectively, rewards must be proportional to the social value of an inventor’s contribution to technological progress. All else being equal, inventors who generate more highly

---

27. The formulation of the three rules discussed below in Part III can be understood as an attempt to specify in a more rule-like manner the implicit reasonableness standard that the Federal Circuit already employs.
30. This Article uses the incentive-to-invent theory of patent protection to justify both the commensurability requirement of enablement and the individual rules that comprise the multi-rule approach to the enablement of AAT discussed below in Part III. The umbrella, multi-rule approach to enablement does not depend on the strength of the incentive-to-invent theory, but the desired content of the individual rules does. See, e.g., *infra* notes 111, 155 & 197 (discussing how the rules align—or not—with the scope of patent protection that would be desirable under prospect theory).
32. Proportionality, of course, does not require full internalization. See Brett M. Frischmann & Mark A.
sought-after inventions should ideally profit more handsome so that investment is channeled into inventions that yield greater social value. The enablement doctrine helps to make rewards proportionate to technological contributions, taking patent disclosures as a measure of contributions and regulating claim scope as a proxy for profits. By ensuring that claim scope remains commensurate with inventors’ disclosures, consumers’ willingness to pay for patented inventions is more likely to be proportionate to inventors’ contributions to technological progress.

Commensurability is not only a relative concept suggesting that inventors who make equal contributions should receive equal profits. The magnitude of inventors’ average profits from patent claims is also critical. Under an incentive-to-invent theory, patent rights should ideally be just strong enough to afford inventors average profits that induce a socially efficient level of investment in research and development. Commensurability should therefore seek to establish a fixed relationship between disclosures and claims at a middle ground that, when filtered through the market, is neither too hot nor too cold in terms of profits and incentives. As one popular casebook aptly states, the reach of an enabled claim into AAT should respect “the desire to restrict the patentee’s property right to that which she has actually invented, while at the same time guarding against too skimpy a right, which in fact would be no right at all given the ease of inventing around it.” In other words, claims that are commensurate with disclosures should reach into AAT, but not too far.

C. Enablement Does Not Operate in Isolation

Enablement is not the only doctrine that restricts the reach of patent rights into AAT and works to make claim scope a reasonable reflection of an inventor’s contribution to progress. Although this Article does not follow through on this aspiration, it is ultimately important to take a synthetic approach and examine the cumulative impact of all of the patent law doctrines that tailor the reach of patent rights into AAT.

The rules governing claim construction affect the reach of literal claims into AAT.

---

33. Broader claims are more likely to encompass technological substitutes and therefore more likely to allow the patent owner to charge supracompetitive prices.

34. As a corollary, for any individual inventor, the commensurability requirement means that more disclosure (and thus a larger contribution to progress) can lead to more expansive claims and larger profits.

35. This standard is, of course, much easier to articulate than to instrumentize in the patent regime. See John F. Duffy, Intellectual Property Isolationism and the Average Cost Thesis, 83 TEX. L. REV. 1077, 1078–79 (2005) (identifying flaws with the average cost thesis which undermine its benefits to policymakers).


37. Despite some assertions to the contrary, properly construed claims can encompass AAT. The black-letter doctrine of claim construction states that the meaning of claim language is “fixed” at least by the filing date of a claim. Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). Based on a presumption that a post-filing shift in the set of things described by a claim necessitates an impermissible post-filing shift in the meaning of the claim language, this fixation requirement has been interpreted by some courts and commentators to prevent properly construed literal claims from encompassing AAT. See, e.g., Cotropia, supra note 2, at 165–67; Lemley, Changing Meaning, supra note 2, at 116. However, the underlying presumption is not sound. In most cases, courts require only fixation of a claim’s ideational meaning, or “word-
For example, the rule announced in *Phillips v. AWH Corp.* may result in shallower claim constructions. By overruling the strong methodological presumption for dictionary meanings set out in *Texas Digital Systems, Inc. v. Telegenix, Inc.* and encouraging courts to consider the embodiments of an invention disclosed in the specification to construe the meaning of claim terms, *Phillips* may yield claim constructions that are more closely pinned to the technologies in existence at the time a patent is filed. The rules of means-plus-function claiming place much sharper restrictions on the reach of literal claim scope into AAT. Through a statutorily specified method of claim construction, purely functional claim limitations encompass only the structures disclosed in the specification that perform the function and the structures' equivalents. Furthermore, the equivalence analysis is anchored at the time of issuance, meaning that after-arising equivalents are in theory excluded from the literal scope of a means-plus-function claim.

The enablement doctrine is not the only disclosure doctrine that examines the commensurability of the disclosure and the claims. Particularly insofar as it applies to claims filed with the original patent application, the written description requirement also serves this function. Because enablement and written description challenges "usually rise and fall together," many of the rules articulated below in Part III also apply to written description. However, the doctrines do not always rise and fall together, and it may not be possible to simply transpose the rules from enablement to written description.

The reach of a patent owner's rights into AAT is shaped not only by claim construction and the disclosure doctrines, but also by the infringement analysis. A defendant who has invented AAT that falls within the scope of a properly construed, valid claim may yet escape infringement if the reverse doctrine of equivalents (reverse to-word" relationships, during claim construction, and they leave *denotational meaning*, or "word-to-world" relationships, free to expand over time without any destabilization of ideational meaning. See Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 536-53 (2008) (discussing the import of ideational and denotational meaning in claim construction).
DOE) applies. The social importance of AAT can be scored on a continuum that runs from minor improvement over the patented technology, through substantial improvement, and to radical improvement. In theory, the reverse DOE prevents patentees from enforcing their claims against the AAT generated by the most radical of improvers.

Finally, unlike the other doctrines discussed to this point, the doctrine of equivalents (DOE) helps, rather than hinders, patent owners who try to reach into AAT. The DOE allows patent owners to control technologies that are beyond the reach of their literal claims but that have only "insubstantial differences" from the claims. The equivalency inquiry is linked to the date of infringement, not the date of filing or issuance, so AAT can unquestionably infringe a patent owner's rights under the DOE. In fact, some Federal Circuit judges now view AAT as the "quintessential example" of an enforceable equivalent. The reasoning supporting this view is roughly that AAT does not come into existence until after a claim has been filed and that patent applicants are therefore unable to draft claims that describe the AAT.

47. See Lemley, Improvement, supra note 2, at 1019–29 (describing examples of minor, significant, and radical improvers).
48. Graver Tank & Mfg. Co. v. Linde Air Prod., Co., 339 U.S. 605, 608–09 (1950); Robert P. Merges, Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents, 62 TENV. L. REV. 75 (1994) (arguing that the reverse DOE mitigates the costs of bargaining breakdown between patentees and radical improvers). The Federal Circuit has stated that the reverse DOE is superfluous today given that the "requirements for the written description, enablement, definiteness, and means-plus-function claims" that restrict the reach of literal claims "are co-extensive with the broadest possible reach of the reverse doctrine of equivalents." Tate Access Floors, Inc. v. Interface Architectural Res., Inc., 279 F.3d 1357, 1368 (Fed. Cir. 2002). The argument that contemporary patent claims are so shallow that the reverse DOE lacks substantive bite is incorrect as a descriptive matter. The foreseeability rule, infra Part III.B, and the identity rule,infra Part III.C, both allow enabled claims to reach into the radical improvement, substitute AAT to which the reverse DOE is intended apply. See infra notes 108 & 149 (suggesting situations in which the reverse DOE could be called upon to restrict the reach of patent rights into AAT).
50. Id. at 37.
52. Sage Prods., Inc. v. Devon Indus., Inc., 126 F.3d 1420, 1425 (Fed. Cir. 1997). If the fact that enabled claims encompass significant amounts of AAT in the contemporary patent regime is taken as a given, see generally infra Part III, the status of AAT broadly writ as the "quintessential example" of an enforceable equivalent under the DOE must be reexamined. Smithkline Beecham, 356 F.3d at 1364. Actionable equivalents should cluster around the limited situations in which it is the need to use particular claim language to encompass AAT that is after-arising. It is narrowly the after-arising need to use particular language, not broadly the after-arising nature of technology itself, that handicaps claim drafters at the time of filing. See Collins, supra note 37, at 555 n.240 (distinguishing after-arising language from after-arising technology).

Putting aside how contemporary patent law actually works, one interesting normative proposal for dealing with patent rights to AAT involves a doctrinal specialization of labor. Perhaps literal claim scope should be limited to its static breadth, see supra note 16 and accompanying text (distinguishing the breadth and depth dimensions of claim scope); infra note 119 (discussing this proposal), and perhaps the DOE should be a patent owner's sole recourse for rights to exclude others from technologies that the PHOSITA could not make and use at the time of filing. See, e.g., Lemley, Changing Meaning, supra note 2, at 120–21. Because this Article seeks to put the best possible face on the contemporary patent regime, see infra text accompanying notes 61–62, this proposal for a doctrinal specialization of labor cannot be addressed in detail here. However, this Article does identify a previously unnoticed obstacle confronting such a proposal. Part III.D below demonstrates that literal claim scope routinely grows deeper to encompass complementary AAT, and it argues that patentees should have rights to exclude others from complementary AAT in order to promote commensurability. If literal claim scope were limited to its static breadth, then the DOE would have to pick up the slack. All complementary AAT
III. DISCERNING ORDER IN (OR IMPOSING ORDER ON?) THE CHAOS

This Part searches for order hidden in the Federal Circuit’s application of the enablement doctrine to claims that literally encompass AAT.\(^53\) It argues that the order is best captured in the form of a threshold inquiry into predictability, which determines whether there is AAT within the literal scope of a claim, and three safe-harbor rules identifying three categories of AAT that enabled claims can encompass.

Predictability is a commonly discussed factor in the enablement of AAT, but its role has been misconstrued. The conventional view is that enabled claims can reach farther into AAT when the claimed technology is more predictable. Logically, however, predictability presents a threshold question. It determines whether a claimed technology is AAT or, alternatively, whether it is constructively disclosed by the specification and thus not AAT at all.\(^54\)

Derived from the combination of In re Hogan and Plant Genetic Systems v. DeKalb Genetics Corp.,\(^55\) the first rule that determines the permissible reach of an enabled claim into AAT is the foreseeability rule. Because the PHOSITA is a person of ordinary creativity and foresight, AAT can be after-arising in two different ways. Some AAT is known AAT: the PHOSITA may not yet be able to make or use the technology on the date of filing, but she can imagine it and describe it with language, and she may even expect it to be available in the not-too-distant future. Other AAT is unknown AAT: the PHOSITA at the time of filing cannot be charged with knowledge of the yet-to-occur development. The foreseeability rule exempts unknown AAT from the commensurability requirement. It allows the depth of an enabled claim to grow, encompassing unknown AAT as it becomes available over time.\(^56\)

Exemplified by Amgen Inc. v. Hoechst Marion Roussel, Inc.\(^57\) and the basic rules of claims with open transitions, the second rule is the identity rule. Most AAT is distinct-thing AAT: the later-developed technology creates a thing that is distinct from the things already disclosed in the patent specification. However, some AAT is paradoxically same-thing AAT because the later-developed technology is embodied in a thing that is intuitively viewed as a duplicate of a disclosed thing. Broadly stated, the identity rule states that claims that encompass same-thing AAT do not run into commensurability problems. Pragmatically, it holds that a claim to “A” can remain enabled while encompassing instances of A made by after-arising processes, employed in after-arising methods of use, and bundled with severable, after-arising things.\(^58\) Unlike the other two rules, the identity rule does not assume that a literal claim must grow deeper over time in

\(^{53}\) Furthermore, the arguments focus on the enablement of object claims (i.e., claims to machines, manufactures, and compositions of matter) and the objects specified as limitations in process claims.

\(^{54}\) See infra Part III.A.

\(^{55}\) In re Hogan, 559 F.2d 595 (C.C.P.A. 1977); Plant Genetic Sys. v. DeKalb Genetics Corp., 315 F.3d 1335 (Fed. Cir. 2003).

\(^{56}\) See infra Part III.B.

\(^{57}\) Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1335, 1338 (Fed. Cir. 2003).

\(^{58}\) See infra Part III.C.
order to encompass the fruits of ensuing generations of inventors. It describes how patent owners can use the static breadth of their claims to exclude others from particular types of AAT.  

The third rule is the complementarity rule. In determining the reach of enabled claims into AAT, the relationship between the inventive principle underlying the patent claims and the later-arising technological advance is critical. Some AAT is complementary AAT because the later technological development that makes the AAT after-arising is usually consumed together with the earlier invention that gave rise to the patent. Other AAT is substitute AAT because consumers desire goods embodying the after-arising technological development instead of goods desiring the discovery that gave rise to the earlier patent. To promote commensurability, the complementarity rule allows the depth of enabled claims to grow over time and reach into complementary AAT, but not substitute AAT.

A brief caveat about the nature of these rules is in order. Sometimes embracing the basic principles articulated in the contemporary enablement doctrine but giving them an unexpected spin, and sometimes digging below the rhetorical surface of enablement to identify operative principles that neither courts nor commentators have yet recognized, the rules are likely to be an uncanny mix of the familiar and the unfamiliar. They also uncomfortably straddle the divide between descriptive and normative analyses. They are part simple reporting or cartography and part visionary manifesto. Roughly put, they represent an optimist’s take on the Federal Circuit’s enablement cases that involve AAT. The argument distills the most conceptually coherent and normatively justified rule set that still maintains a reasonable fit with data. However, we may not live in the best of all possible worlds, so all may not be for the best as the rules and their asserted justifications imply. Individual cases likely have been decided in a manner that conflicts with the rules and that cannot be supported by the rules' justifications. Furthermore, because the rules seek in part to provide a map of the status quo, they may not be optimal. There is no guarantee that the current rules are better at promoting invention than rules that depart radically from the status quo would be. An essay addressing what the ideal reach of an enabled claim into AAT should be might therefore propose different rules. However, understanding how the contemporary patent regime operates is a critical first step in any reform proposal. If one doesn’t understand how the current patent regime operates, one may wipe out unseen, welfare-enhancing features of the status quo.

A. Predictability as a Threshold Inquiry

When the Federal Circuit applies the enablement doctrine, the predictability or unpredictability of the claimed technology is often a key factual consideration in the

59. See supra note 16 and accompanying text (distinguishing claim depth and breadth).
60. See infra Part III.D.
61. This would be more likely to be true if reforms to the other doctrines affecting the reach of patent rights into AAT were addressed at the same time. See supra Part II.C (discussing other doctrines that affect the reach of patent rights into AAT).
62. Cf. supra note 52 & infra notes 119 & 194 (discussing a proposal that literal claims be limited to their static breadth).
Enabling After-Arising Technology

commensurability analysis. More specifically, predictability is conventionally framed as a factor that determines whether an enabled claim can reach into AAT: enabled claims can reach into AAT when the claimed technology is predictable, but not when it is unpredictable. To the same end, the single-embodiment doctrinal variant of the commensurability requirement, which allows enabled claims to reach into infinite amounts of AAT, is often described as applying only to the predictable arts. However, this conventional framing of the role of predictability in enablement misses the mark. Predictability should only be part of a threshold inquiry that determines whether or not a claim encompasses AAT in the first place.

Assuming the disclosure of information that teaches the PHOSITA how to make and use a single embodiment of a claim, greater predictability in the claimed technology enlarges the set of embodiments that the disclosure enables. If the PHOSITA can examine a patent specification and predictably extrapolate from it knowledge about how to make and use an embodiment that is not literally disclosed, the embodiment is enabled despite the fact that it is not literally disclosed. It is part of the specification’s constructive disclosure: it is enabled because the knowledge possessed by the PHOSITA expands the disclosure beyond its literal examples. Greater predictability in the claimed art means that the constructive disclosure of a specification is broader. “In cases involving predictable factors . . . a single embodiment provides broad enablement in the sense that, once imagined, other embodiments can be made without difficulty and their performance characteristics predicted by resort to known scientific laws.”

The predictability of the mechanical arts means that the specification will often have already taught the PHOSITA how to make and use a broad claim as of the date of filing. As one district court summarized the reasoning involved:

the teaching of one mechanical embodiment is sufficient to suggest to one skilled in the mechanical arts various other mechanical techniques which will function in substantially the same way to achieve substantially the same result. This is, of course, due to the well known and predictable result derived from using mechanical elements.

63. See, e.g., Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362 (Fed. Cir. 1999); In re Wright, 999 F.2d 1557 (Fed. Cir. 1993); In re Vaeck, 947 F.2d 488 (Fed. Cir. 1991); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200 (Fed. Cir. 1991); In re Wands, 858 F.2d 731 (Fed. Cir. 1988); In re Fisher, 427 F.2d 833 (C.C.P.A. 1970); Ex parte Forman, 230 U.S.P.Q. 546, 548 (B.P.A.I. 1986); Alison E. Cantor, Using the Written Description and Enablement Requirements to Limit Biotechnology Patents, 14 HARV. J.L. & TECH. 267, 283-96 (2000) (discussing the courts’ invocation of biotechnology as an uncertain science and its effect of restricting the scope of biotechnology patents). Predictability is technically only one of the Wands factors that courts sometimes use to determine whether claim scope is commensurate with the disclosure. Wands, 858 F.2d at 737.


65. See supra note 23 and accompanying text.

66. Fisher, 427 F.2d at 839.

Inversely, greater unpredictability in the claimed technology means that the constructive disclosure of a specification is narrower and that expansive claims are more likely to encompass AAT. For example, consider the Federal Circuit’s enablement opinion in *In re Wright*, which involved an unpredictable art. A patent applicant disclosed a method of making a vaccine effective against a single retrovirus, and claimed all vaccines effective against all retroviruses. The court deemed the claimed technology to be unpredictable; the PHOSITA of ordinary creativity and foresight could not take the disclosed information and predictably extrapolate from it knowledge about how to make vaccines effective against other retroviruses without undue experimentation. If they were ever developed, other vaccines effective against other retroviruses would be AAT with respect to the disclosure of the *Wright* patent. In sum, “[i]n cases involving unpredictable factors . . . the scope of enablement . . . varies inversely with the degree of unpredictability of the factors involved” because the unpredictability of the technology means that narrow literal disclosures do not yield broad constructive disclosures.

To reiterate, the relative predictability of the claimed technology is a relevant concern during a threshold inquiry into the scope of the constructive disclosure of a patent specification. Predictability influences how broad a claim can be without reaching into AAT. More predictability means claims can be broad without encompassing AAT, whereas less predictability means that claims are likely to encompass AAT when they are broadly drafted.

Framed as a threshold inquiry, the courts’ consideration of the predictability of the claimed technology in the enablement analysis promotes the goal of commensurability. All else being equal, the larger the set of nonobvious embodiments that an inventor’s disclosure enables the PHOSITA to make and use, the broader the permissible scope of the inventor’s claim should be.

However, contrary to conventional wisdom, the predictability of a claimed technology should not determine how far into AAT an enabled claim can reach. What would it mean for AAT to be relatively more or less predictable to the PHOSITA on the date of filing? Predictable AAT is a contradiction in terms: if an embodiment is predictable to the PHOSITA at the time a patent is filed, then the embodiment is not after-arising. The greater predictability of the mechanical arts means that broader claims can be drafted without encompassing AAT, but, once AAT within the scope of a claim in
the mechanical arts has been identified, the relative predictability of the mechanical arts offers no reason to exempt the AAT from enablement's commensurability requirement. Notwithstanding the fact that predictability should be a threshold inquiry, claims in the predictable mechanical arts may raise fewer enablement problems involving AAT, and claims in the unpredictable chemical arts may raise more of them. However, the inverse relationship between predictability and enablement problems is based on correlation, not causation. The three rules described below have disparate impacts in the mechanical and chemical arts, allowing enabled claims in the mechanical arts to encompass more AAT—but the reason for the disparate impact is not related to predictability.75 Additionally, patent doctrines, other than enablement, that restrict the reach of literal claims into AAT are more rigorously applied in the mechanical arts than in the chemical arts.76 For example, the rules of means-plus-function claiming are routinely called on to restrict the scope of functionally defined claims in the mechanical arts, but functional claims in the chemical arts are almost always interpreted using the standard rules of claim construction established in Phillips.77 Because claim construction is performed before enablement, the temporal depth of claims employing functional language in the chemical arts generates enablement problems, but the temporal depth of claims employing functional language in the mechanical arts is restricted before courts arrive at the enablement analysis.

To illustrate this final point, consider one of the claims in the biochemical arts that was at issue in Amgen, Inc. v. Chugai Pharmaceutical Co.: A purified and isolated DNA sequence consisting essentially of a DNA sequence encoding a polypeptide having an amino acid sequence sufficiently duplicative of that of erythropoietin to allow possession of the biological property of causing bone marrow cells to increase production of reticulocytes and red blood cells, and to increase hemoglobin synthesis or iron uptake.78

This claim contains language that approximates a purely functional limitation: it describes any DNA sequence that performs a particular function. (In fact, the language is functional on two nested levels: it describes DNA that has the function of producing a set of proteins defined by their functions.) The Federal Circuit invalidated the claim for lack of enablement because it encompassed too much AAT.79 Claims in the mechanical arts with a similar reliance on function to delineate their outer boundaries are likely to be interpreted as means-plus-function claims and restricted in scope to the disclosed structures and their equivalents known at the time of issuance.80 Similar claims in the mechanical arts, therefore, will not raise enablement problems. The reason for the

75. For example, the distinct-thing, complementary AAT for which the complementarity rule provides an enablement safe harbor is more common in the mechanical arts than in the chemical arts. See generally infra Part III.D (discussing the complementarity rule).
76. See supra notes 37–48 and accompanying text (reviewing the doctrines other than enablement that restrict the reach of literal claim scope into AAT).
77. See supra notes 37–42 and accompanying text (discussing Phillips and means-plus-function claims).
79. Id. at 1212–14; infra notes 128–129 and accompanying text (arguing that the AAT at issue was known AAT because of the vast amount of potential AAT that the claim encompassed).
80. See supra notes 41–42 and accompanying text.
existence of the enablement problem in the chemical arts but not in the mechanical arts, however, is not because mechanical-arts claims reach farther into AAT. The reason is, rather, that the patent doctrines that are deployed before enablement have already prevented the mechanical, but not biochemical, claims from encompassing excessive amounts of AAT.

B. Rule One: The Foreseeability Rule

Captured by the combination of In re Hogan and Plant Genetic Systems v. DeKalb Genetics Corp., the foreseeability rule allows an enabled patent claim to grow deeper over time and encompass AAT only if it would be unreasonable at the time of filing to charge the patent drafter with knowledge of the future development of the AAT, and thus of the need to draft a narrower claim that does not describe it.

Hogan famously rooted the commensurability analysis on the date that a patent was filed. A patent application filed in 1953 claimed a “normally solid homopolymer” made up of a specified monomer. The disclosure taught the PHOSITA how to make and use a low molecular weight, crystalline homopolymer. By the 1960s, however, the art had progressed, and it became possible to make a high molecular weight, amorphous homopolymer that was also normally solid and made up of the monomer specified in the claim, although the branching pattern of the monomers was different. Because the claim was still pending at the PTO after the discovery of the amorphous polymer, the examiner rejected the claim for lack of commensurability under the enablement doctrine, arguing that the full scope of the claim contained both crystalline and amorphous polymers, and that the disclosure enabled only the crystalline polymers. The Court of Customs and Patent Appeals reversed, holding that the full scope of the claim that must be enabled is populated only with the technology that makes up the “state of the art” on the date of filing, i.e., the technology that was known to the PHOSITA based on “the condition of knowledge about all art-related facts existing” on that date. Inversely, rejections based on technologies that constitute a “later state of the art” and that come “into existence after the filing date of an application” are impermissible. Thus, under Hogan, enabled claims can encompass unknown AAT—AAT that is not part of the known state of the art on the date of filing—without running into a commensurability problem.

82. Foreseeability also influences the reach of patent rights into AAT under the DOE: the unforeseeability of an equivalent at the time of filing rebuts the presumption of prosecution history estoppel and allows a finding of infringement under the DOE, despite the equivalent being in the territory that the patent applicant surrendered through a narrowing amendment. Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 740–41 (2002). The combination of Hogan and Plant Genetic Systems necessitates that foreseeability play a role in enablement as well. However, there is no a priori reason why the foreseeability standard in prosecution history estoppel and the foreseeability standard in enablement need to be identical.
83. Hogan, 559 F.2d at 603–07.
84. Id. at 597.
85. Id. at 598–99.
86. Id. at 601.
87. Id. at 603–07.
88. Hogan, 559 F.2d at 605.
89. This holding in Hogan has been repeatedly reaffirmed in subsequent cases. See, e.g., Chiron Corp. v.
Hogan's exemption of unknown AAT from enablement's commensurability requirement explains in part the paradoxical yet routine occurrence of AAT that is patentably nonobvious in relation to an earlier patent's disclosure, but that falls within the scope of the same patent's enabled claims. As per Hogan, enablement is "established for all time" on the date of filing, "and a later change in the state of the art cannot change it," but the set of things that a claim describes for infringement purposes can grow over time as the state of the art progresses. Professor Robert Merges has argued that this divergence between the enablement and infringement analyses implicates a temporal disparity: the meaning of a claim for enablement purposes is fixed on the date of filing, but the meaning of a claim for infringement purposes changes over time and is not fixed until the date of infringement. However, this characterization of a claim's meaning directly contradicts the black-letter doctrine of claim construction that requires the meaning of a claim to be fixed on the date of filing at the latest for infringement purposes. Furthermore, there are many literal claims that grow deeper to encompass AAT whose meanings do not seem to have changed. The disparity between enablement and infringement is therefore better understood as a meaning disparity. The meaning of the claim is fixed on the date of filing for both enablement and infringement purposes, but each doctrine requires fixation of a different type of meaning. Enablement requires fixation of denotational or referential meaning, i.e., the set of possible things known to the PHOSITA that the claim language describes. Infringement, however, usually only requires fixation of ideational meaning on the date of filing. Ideational meaning is a

Genentech, Inc., 363 F.3d 1247, 1254 (Fed. Cir. 2004); CFMT, Inc. v. Yieldup Int'1 Corp., 349 F.3d 1333, 1340 (Fed. Cir. 2003); U.S. Steel Corp. v. Phillips Petroleum Co., 865 F.2d 1247, 1250-52 (Fed. Cir. 1989). Although this Article does not address the written description doctrine in detail, see supra notes 44-46 and accompanying text, it is worth noting that one of the most important divergences between the rules that control the application of enablement to AAT and the rules that control the application of written description to AAT may be that written description does not exempt unknown AAT from the commensurability analysis. See Chiron Corp., 363 F.3d at 1253-58 (upholding a claim encompassing unknown AAT as enabled under Hogan and yet invalidating the claim for lack of commensurability under written description).

90. One of the principal insights that follows from the multi-principle approach to enablement is that Hogan is not solely responsible for this phenomenon. The rules described infra in Parts III.C and III.D explain distinct mechanisms through which enabled literal claims can reach into AAT.

91. Hogan, 559 F.2d at 605.

92. See Merges & Duffy, supra note 36, at 295-97 (arguing that "[f]or purposes of infringement, . . . the [claim language] is determined at the time of the alleged infringement") (italics in original); Robert P. Merges, Rent Control in the Patent District: Observations on the Grady-Alexander Thesis, 78 VA. L. REV. 359, 379 n.73 (1992) (same); see also Lemley, Changing Meaning, supra note 2, at 104 (discussing, but arguing against on normative grounds, "the well-established principle that the meaning of the claim term for infringement purposes [is] determined as of the time of infringement, not the earlier filing date"); Ellen P. Winner, Enablement in Rapidly Developing Arts—Biotechnology, 70 J. PAT. & TRADEMARK OFF. SOC’Y 608, 631 (1988) ("The fact that a claim’s literal meaning may change after the filing date is well recognized and allowed for in the law.").


94. See, e.g., infra Part III.D (discussing enabled claims that grow to encompass complementary AAT over time).

95. The following discussion of theories of meaning is presented at greater length in Collins, supra note 37, at 536-53.

96. See id. at 539-41 (describing denotational meaning as "a set-theoretical construction comprised of possible things").

97. See id. at 548-53 (arguing that ideational meaning is the default theory of meaning in claim
mental construct that operates on a linguistic plane and that fixes the meaning of a word by stabilizing the relationships between the word being defined and other words. Rather than fixing the definition of a word by stabilizing "word-to-world" links as denotational meaning does, it stabilizes only "word-to-word" links. A claim with an ideational meaning that has been fixed on a historical date—but not a claim with a denotational meaning that has been fixed on a historical date—can encompass AAT unknown to the PHOSITA on the date of filing without an impermissible post-filing shift in meaning: the word-to-word links of ideational meaning may remain stable even as technological progress yields new things that the claim language also describes. At the end of the day, however, regardless of whether there is a temporal disparity (Merges) or a meaning disparity (Collins) at issue in the disjunction between enablement and infringement, the bottom line for the enablement doctrine is the same. AAT that is not part of the state of the art known to the PHOSITA on the date of filing can literally infringe a patent claim without rendering the claim invalid for lack of commensurability and enablement.

Hogan does not exempt all AAT from enablement's commensurability analysis. To illustrate the type of AAT that is unaffected by Hogan, consider a simplified version of the facts of Plant Genetic Systems v. DeKalb Genetics Corp. A patent claims a "plant cell containing gene X." At the time of filing, there are, and have been for many years, two known types of plants: monocots and dicots. The disclosure accompanying the claim teaches the PHOSITA how to make only a dicot cell containing gene X. It does not literally disclose how to make a monocot cell containing gene X. Nor does it constructively disclose this information: knowledge of how to make the monocot cell containing gene X cannot be predictably extrapolated from the disclosure at the time of filing; undue experimentation is required to make and use a monocot cell containing gene X. After the date of filing, the alleged infringer produces AAT in the form of (Surprise!) a monocot cell containing gene X. When presented with similar facts and a similar claim in Plant Genetic Systems, the Federal Circuit invalidated the claim for lack of commensurability under the enablement doctrine. Remarking that a monocot cell containing gene X was "not an unknown concept that came into existence only after" the date of filing, the court concluded the AAT at issue was not another example of the unknown AAT that was at issue in Hogan. The court held, rather, that monocot cells containing gene X were "specifically desired but difficult to obtain at the time" of construction, but noting that courts sometimes flip and use denotational meaning under exceptional circumstances).

98. Id. at 541-52 ("The ideational meaning of an expression is determined by the links the expression has with one or more other expressions 'in a complex multi-dimensional network.'").

99. Id. at 541.

100. Collins, supra note 37, at 545-48 ("After the [ideational meaning] of a word has been fixed, a fact finder can still query how a newly discovered thing would have been classified by the preexisting, fixed linguistic network of expressions.").

101. The difference between the Merges and Collins theories becomes significant only when trying to understand how courts perform claim construction.


104. Id. at 1340.
filing. In other words, the court recognized the category of known AAT: technology that is after-arising because the PHOSITA cannot make and use it on the date of filing but that is already a well-established concept that the PHOSITA can readily imagine and that she expects to be able to make in the near future.

In its full form, the foreseeability rule combines Hogan and Plant Genetic Systems and states that the distinction between the unknown and known AAT can be dispositive of the enablement inquiry. Under Hogan, enabled claims can always encompass unknown AAT because unknown AAT is exempted from the commensurability requirement. The eventual appearance of unknown AAT within the scope of a claim never renders the scope of the claim incommensurate with the disclosure. Under Plant Genetic Systems, however, claims that encompass known AAT may be invalid because they fail to satisfy the commensurability requirement of the enablement doctrine.

To the extent that enablement’s commensurability requirement is designed to make the claim scope commensurate with the contribution that an inventor makes to technological progress, the foreseeability rule presents a puzzle. As Professor Robin Feldman has noted, the combination of Hogan and Plant Genetic Systems has a perverse effect. In designing a coherent vision of the footprint of the invention, one would expect to reduce a patent holder’s reach as technology advances farther away from what was known at the time of the patent. The more the science advances, the more we would anticipate that new products are substantially different from what the patent holder accomplished and, therefore, should not be covered by the patent. Thus we would expect to create the strongest limits on a patent holder’s reach for embodiments that are farthest from the state of the art at the time of the invention.

The Plant Genetic Systems limitation [in combination with Hogan], however, has the opposite effect. A patent holder’s reach is most clearly protected in the case of advancements that are beyond anyone’s imagination at the time of the invention. The patent holder’s reach is denied for technology that is closer to the art at the time. Thus, the patent holder has more control over things vastly beyond the state of the art and less control for things close to

---

105. Id.
106. Plant Genetic Systems need not overrule Hogan. For example, consider a hypothetical in which the defendant in Plant Genetic Systems had invented a new “tricot” genus of plants that was not on the radar screen of plant scientists at the time the plaintiff’s claim to “a plant cell containing gene X” was filed. Hogan would likely apply because the AAT was unknown to the PHOSITA at the time of filing.
107. The author has elsewhere described the distinction between known and unknown AAT as the distinction between scope-actualizing and scope-expanding AAT. Collins, supra note 37, at 546 n.194. Because the PHOSITA is aware of the known AAT within the scope of a claim from the date of filing, the technological development that makes it possible to make and use known AAT does not intuitively expand claim scope. Rather, it simply allows new instances of the claimed technology to be made in the actual world. In contrast, the discovery of previously unknown AAT does intuitively expand claim scope when it is discovered.
108. The reach of enabled claims into unknown AAT demonstrates one situation in which the reverse DOE may still have substantive bite. See infra note 119 (arguing that the reverse DOE is not superfluous).
109. Claims encompassing known AAT may remain enabled under the safe harbors of the identity and complementarity rules. See infra Parts III.C & III.D.
110. See supra Part I.I.B.
the state of the art.\textsuperscript{111}

As Professor Feldman notes, the treatment of distant and close AAT under Hogan and Plant Genetic Systems, respectively, is counterintuitive when enablement is framed as a doctrine that is designed to promote commensurability. However, the combination of Hogan and Plant Genetic Systems does serve a rational purpose in a peripheral claiming regime: it toggles on and off the patent applicant’s obligation to draft narrower claims that do not encompass AAT. On the one hand, the patent applicant can be charged with the knowledge that a claim encompassing known AAT describes a set of technologies that is larger than the set that she has taught the public how to make and use at the time of filing. She can draft a narrower claim that does not encompass known AAT.\textsuperscript{112} At the time of filing, she understands how and why the claim is over-inclusive, and she has the language facility to correct the overbreadth. On the other hand, when the AAT is unknown AAT, the patent applicant cannot be expected at the time of filing to either

\begin{itemize}
  \item if a possible later development is so unobvious as to be completely unpredictable, the examiner never thinks of it, so it is not used as a basis for rejection. Thus, the more innovative the later development, the more likely an earlier patent will issue with claims broad enough to encompass it.

  Winner, supra note 92, at 624.

  The combination of Hogan and Plant Genetic Systems cannot be justified under a pioneer-theory variant of the incentive-to-invent justification of patent law, either. Under a pioneer theory of patent scope, inventors who make significant advances and who open up entirely new fields of inquiry (i.e. inventors who are technological pioneers) have made more important contributions to society and they therefore deserve patent protection that reaches further into AAT. See In re Hogan, 559 F.2d 595, 606 (C.C.P.A. 1977) (noting that a solid polymer deserves broad claims since appellants broke new ground and were pioneers in the field). If the Hogan rule allowing an inventor to claim unknown AAT were to apply only to pioneering inventions, then Hogan would further commensurability by making the scope of pioneers’ patents reflect their technological contributions more closely. However, it is far from clear that the courts apply Hogan only to pioneering inventions. Compare Plant Genetic Sys. v. DeKalb Genetics Corp., 315 F.3d 1335, 1339–42 (Fed. Cir. 2003) (rejecting a pioneer theory of enablement), with Enzo Biochem Inc. v. Gen-Probe Inc., 323 F.3d 956, 982 (Fed. Cir. 2002) (Rader, J., dissenting from a denial of a petition to rehear case en banc) (embracing a pioneer theory of enablement). Furthermore, pioneer theory cannot explain why pioneering inventors cannot claim known AAT under Plant Genetic Systems. To adjust claim depth to make pioneering inventors’ patent rights proportional to their contributions, Hogan but not Plant Genetic Systems should apply to pioneering inventions.

  Nor can the combination of Hogan and Plant Genetic Systems be justified by prospect theory. Prospect theory holds that patents benefit society because they allow inventors to minimize duplicative, wasteful expenditures during the development of a new discovery into one or more marketable products. See Edmund W. Kitch, The Nature and Function of the Patent System, 20 J.L. & ECON. 265 (1977). Prospect theory suggests that the enablement doctrine should tailor the reach of an inventor’s rights into AAT to reflect not the contribution to technological progress that the inventor has already made but rather the number of post-filing opportunities for development that the inventor has opened up. Because it allows an inventor’s rights to reach into unknown AAT, Hogan plays an important role in shaping claim scope so that patents can serve as waste-minimizing technological prospects. See id. at 267–68 (noting that claim scope is not commensurate with the scope of the inventor’s discovery and that the “hombook rule” stating it “is very misleading”). However, the enablement rule of Plant Genetic Systems that prevents enabled claims from reaching into known AAT undermines the ability of patent claims to serve as prospects. To enable claims to function as waste-minimizing technological prospects, it would be necessary to uphold Hogan but overrule Plant Genetic Systems.

  Alternatively, she may choose to disclose more information and transform the known AAT into a disclosed technology that the PHOSITA can make and use. Pursuing this option may require her to perform more research and delay the filing date.
\end{itemize}
know that the claim is overbroad or draft narrower claims that exclude the AAT.\(^{113}\) A requirement that the patent applicant be more prescient than the PHOSITA would place an impossible linguistic burden on patent applicants.\(^{114}\) In sum, under the foreseeability rule, a patent applicant bears the linguistic burden of drafting narrower claims only when she can reasonably be expected to modify her behavior in response to the burden. Unknown AAT is exempted from the commensurability requirement because a behavior-shaping burden should not be imposed on an applicant who cannot reasonably be expected to respond to the burden by altering her behavior.

The foreseeability rule is not simply the result of a desire to be fair to patent applicants. From the efficiency perspective of an incentive-to-invent theory of patent protection, it may be rationalized as the lesser of two evils in a peripheral claiming regime.\(^{115}\) If the strict, full-scope doctrine of commensurability were applied to claims encompassing unknown AAT,\(^{116}\) many claims that were valid at the time of filing would become invalid over time for reasons beyond the control of the patentee. The claims of a certain fraction of inventors would be randomly invalidated ex post, and the incentives provided by all patents ex ante would be correspondingly reduced by roughly that same fraction.\(^{117}\) The presumption that justifies the foreseeability rule is that this decrease in overall incentives provided by the patent regime is an unacceptable cost of a more precise correspondence between claims and disclosures.\(^{118}\) Given the choice of either undermining the certainty of all patent protection or over-rewarding selected inventors by allowing their claims to remain enabled while encompassing unknown AAT, the foreseeability rule opts for the latter.\(^{119}\)

\(^{113}\) Neither can the patent applicant be expected to know that she could delay filing, augment her disclosure, and teach the PHOSITA how to make and use the embodiment.

\(^{114}\) *In re Hogan*, 559 F.2d 595, 606 (C.C.P.A. 1977) ("To now say that appellants should have disclosed in 1953 the amorphous form which on this record did not exist until 1962, would be to impose an impossible burden on inventors and thus on the patent system.").

\(^{115}\) See infra note 234 and accompanying text (framing the foreseeability rule as a "second best" rule).

\(^{116}\) See supra notes 19-21 and accompanying text (presenting the full-scope doctrine).

\(^{117}\) Because the AAT was unknown to the PHOSITA on the date of filing, the patent applicant cannot be expected to have drafted a narrower claim that would remain valid. Therefore, the invalidation of a claim that encompasses unknown AAT for lack of enablement would frequently invalidate all patent protection—even the protection for the literally disclosed embodiments.

\(^{118}\) See supra notes 35-36 and accompanying text (noting that commensurability must be established in a manner that is sensitive to the magnitude of patent incentives).

\(^{119}\) A third solution to the problem of unknown AAT is to cut off the enablement problem at the pass, adopt a "breadth-only" approach to literal claim scope, and construe claims during claim construction so that they do not encompass unknown AAT. See Chiron Corp. v. Genentech, Inc., 363 F.3d 1247, 1262–63 (Fed. Cir. 2004) (Bryson, J., concurring) ("I think the proper approach ... is to address cases of new technology by construing claims, where possible, as they would have been understood by one of skill in the art at the time of the invention, and not construing them to reach the as-yet-undeveloped technology that the applicant did not enable."); supra note 16 (discussing the position of "breadth-only advocates"). (Note that this breadth-only approach does not remove the need for some type of foreseeability analysis. It simply moves the foreseeability analysis from enablement to claim construction. Under the breadth-only approach, literal claims would presumably still be construed to encompass known AAT. Otherwise, the proper holding in *Plant Genetic Systems*—and, for that matter, all cases involving distinct-thing AAT—would be that the claim was enabled, narrow, and not infringed.) The breadth-only approach offers a rational solution that promotes commensurability in cases involving unknown AAT. However, the fact that patentees must control complementary AAT if rights and contributions are to be reasonably commensurate creates difficulties for the
The foreseeability rule requires the Federal Circuit to distinguish claims encompassing known AAT from claims encompassing unknown AAT, but there can be no bright-line rule for difficult cases. The Federal Circuit must develop clearer guidance about how this line is drawn on a case-by-case basis, with an eye toward the underlying policy justifications for the foreseeability rule. In fact, Federal Circuit cases addressing the enablement of AAT already suggest two factors that weigh in favor of a determination that a claim encompasses known AAT: the specificity with which the PHOSITA can envision a particular AAT on the date of filing (the specificity factor) and the number of distinct types of AAT the claim might grow to encompass over time (the potential claim-depth factor).

The specificity factor appears in a number of different guises. *Plant Genetic Systems* equates known AAT with AAT that is "specifically desired but difficult to obtain at the time" of filing. In *Chiron Corp. v. Genentech, Inc.*, the term "nascent" was used as a code word to describe a technology that had recently transitioned from unknown to known status. The Federal Circuit also treats the embodiments of an invention that an applicant mentions in the specification, but does not teach the PHOSITA how to make and use, as AAT that was known to the patent applicant with sufficient specificity on the date of filing to qualify as known AAT.

The potential claim-depth factor takes on its greatest weight when the language of the claim flaunts the open-ended nature of the set of technologies that it describes. Here, the potential quantity of AAT within a claim makes up for a lack of certainty about the specific nature of any particular AAT that the claim encompasses. Even if the PHOSITA cannot relate many specifics about the structure or other characteristics of an AAT at the time of filing, the PHOSITA may be charged with knowledge that the claim encompasses AAT because of the large number of distinct embodiments of AAT that the claim might possibly come to embrace. In *In re Fisher*, a patent applicant claimed a purified breadth-only approach: patentees must control even the complementary AAT that is unknown to the PHOSITA on the date of filing. See infra note 194.

120. *See supra* notes 112–119 (discussing the policy justifications of the foreseeability rule). The distinction between known and unknown AAT does not present a question of fact with an answer that is exogenous to patent policy. Rather, it gives the courts another policy lever that they can use to shape the reach of an enabled claim into AAT under the foreseeability rule. *See supra* note 7 (discussing policy levers). The more penetrating the PHOSITA’s gaze into possible future developments and the higher the level of generality at which the concept of a technology may be imagined while still qualifying as known, the larger the set of known AAT and the more restrictive the effect of enablement’s commensurability requirement.


123. This scenario describes many of the enablement cases in which the Federal Circuit has held that claims in the predictable arts are invalid for lack of commensurability. *See, e.g.*, Sitrick v. Dreamworks, LLC, 516 F.3d 993 (Fed. Cir. 2008); Auto. Techs. Int'l, Inc. v. BMW of N. Am., Inc., 501 F.3d 1274 (Fed. Cir. 2007); Liebel-Flarsheim Co. v. Medrad, Inc., 481 F.3d 1371 (Fed. Cir. 2007); AK Steel Corp. v. Sollac & Ugine, 344 F.3d 1234 (Fed. Cir. 2003).

124. A related variable that affects the PTO’s ability to reject claims that encompass known AAT is the burden that a patent examiner must meet to demonstrate that AAT is known to the PHOSITA on the date of filing. *See In re Wright*, 999 F.2d 1557, 1561–62 (Fed. Cir. 1993) (placing the burden on the examiner to explain the adequacy of the disclosure); Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 154–67 (2008) (proposing that the burden of proving enablement should in some situations be shifted to the patent applicant); Winner, *supra* note 92, at 621–23 (discussing case law “allowing
composition of ACTH containing "at least 1 International Unit of ACTH per milligram" but taught the PHOSITA to make and use only compositions ranging from 1 to 2.3 units per milligram. The court invalidated the claim for lack of commensurability because of the open-ended nature of the claimed purity range. In a similar fashion, functional claim language—at least when it is not construed as part of a means-plus-function limitation—often serves as a red flag of a claim's potential depth. For example, in Amgen, Inc. v. Chugai Pharmaceutical Co., an inventor disclosed the DNA sequence of the erythropoietin gene and attempted to claim all DNA sequences encoding amino acids that possessed certain of erythropoietin's biological properties. The specificity factor was not strong: there was no discussion of any particular unenabled amino acid sequence that the PHOSITA expected to have the biological properties of erythropoietin. However, the Federal Circuit invalidated the claim nonetheless because of the sheer quantity of possible, only vaguely anticipated, AAT that the claim might grow to encompass.

The foreseeability rule exempts unknown AAT, but not known AAT, from enablement's commensurability requirement. Yet, the two halves of the rule are not truly symmetrical. The foreseeability rule is a safe-harbor rule for unknown AAT: the presence of unknown AAT within the literal scope of a claim never leads to an enablement problem. In contrast, the presence of known AAT within literal claim scope does not mean that the claim is categorically invalid. As explained below in Parts III.C and III.D, the identity and complementarity rules provide safe harbors for same-thing and complementary AAT, respectively. Therefore, the presence of known AAT within the scope of a claim is not a kiss of death leading to claim invalidity. Claims may encompass known AAT and yet remain enabled so long as the known AAT is also either same-thing AAT or complementary AAT.

C. Rule Two: The Identity Rule

This Part explains the identity rule: a patent claim can always encompass AAT when the AAT is effectively identical to one of the things already disclosed in the patent specification.

The practical effect of the identity rule is easy to convey. It is roughly the sum of three well-established enablement principles that govern object claims. Given a claim to "A," the claim can remain enabled while encompassing instances of A made by after-
arising processes, employed in after-arising methods of use, and bundled with severable
things that are after-arising (such as when the accused device is A+B and B is AAT).132
The intuition in each of these three situations is that the infringing technology is
paradoxically both after-arising in some manner and yet effectively identical to the
technology that the specification taught the PHOSITA to make and use at the time of
filing.133 Instances of A are viewed as effectively identical whether they are made by
the disclosed process or an after-arising process, or whether they are used for the disclosed
utility or an after-arising utility. Similarly, an instance of A in isolation is effectively
identical to an instance of A in the combination A+B, even if B is after-arising. For this
reason, these types of AAT are called same-thing AAT.134 In contrast, the more
conventional type of AAT—the type discussed in the cases that illustrate the
foreseeability and complementarity rules—is distinct-thing AAT. For example, two
proteins with different amino acid sequences are intuitively viewed as distinct things.
Thus, if a claim describes a protein in part by its function and a protein with a new
sequence of amino acids that performs the recited function is discovered only after the
claim's filing date, the later-discovered protein is distinct-thing AAT.

The identity rule describes the enablement safe harbor that exists for same-thing, but
not distinct-thing, AAT. Under the full-scope doctrine, the inclusion of distinct-thing
AAT within literal claim scope destroys the strict commensurability of the claim and the
disclosure.135 The presence of distinct-thing AAT within the literal scope of a claim
means that the set of claimed things at the time of infringement has grown to be larger
than the set of enabled things was at the time of filing.136 In contrast, literal claims can
encompass same-thing AAT without raising a commensurability problem under the full-
scope doctrine. Same-thing AAT is perceived to be identical to a thing already enabled
by the specification. The presence of same-thing AAT within literal claim scope is not
seen as driving a wedge between the size of the set of claimed things and the size of the
set of enabled things. The identity rule therefore differs from the foreseeability and
complementarity rules: the reach of an enabled claim into AAT sanctioned by the
foreseeability and complementarity rules illustrates that the full-scope doctrine does not
describe how the patent regime actually operates, but the reach of an enabled claim into
AAT sanctioned by the identity rule is entirely compatible with the full-scope doctrine.
The literal scope of an enabled claim need not grow or acquire depth over time to
encompass AAT under the identity rule; the identity rule explains how patent owners can
use the static breadth of their literal claims to exclude others from some types of AAT.137

The practical implications of the identity rule are in most cases easy to comprehend,
but an attempt to formulate an analytical definition of the identity rule opens up a philosophical can of worms. How do courts determine if two objects are "effectively identical"? What properties must the disclosed and after-arising things share for the AAT to be same-thing AAT, and with respect to what properties may they differ? Philosophers interested in explaining our widely shared intuitions about the nature of a thing posit a distinction between intrinsic and extrinsic properties.\footnote{The discussion in the remainder of this paragraph is distilled from Collins, supra note 37, at 521–27 (discussing the distinction between intrinsic and extrinsic properties), and the references cited therein.} The intrinsic properties of a thing are what make the thing the type of thing that it is. Roughly stated, the intrinsic properties of a thing are the thing's internal, structural properties. Whenever an after-arising development alters an intrinsic property of the things disclosed in a patent specification, the resulting AAT is distinct-thing AAT. A protein with an after-arising sequence of amino acids is distinct-thing AAT because the molecular makeup of the protein is one of the protein's intrinsic properties—i.e., one of its internal, structural properties. The extrinsic properties of a thing are usually defined in the negative: they are the properties that an instance of a thing possesses that do not contribute to making the thing the type of thing that it is. Whenever an after-arising development alters an extrinsic property of the things disclosed in a patent specification, the resulting AAT is same-thing AAT.

The three well-established enablement principles that constitute the practical effect of the identity rule all involve the after-arising discovery of extrinsic properties for already-invented and already-claimed things.\footnote{See supra text accompanying note 132; Collins, supra note 37, at 530–33 (discussing these three types of extrinsic-property AAT).} An inventor's claim to a protein never becomes incommensurate with the enabling specification when it eventually encompasses AAT in the form of a structurally identical molecule of protein A made by an after-arising method.\footnote{See Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1335, 1338 (Fed. Cir. 2003) (holding that a compound claim encompasses compounds made by any method and that the claim is fully enabled by the disclosure of only a single method of making the compound).} The property of the molecule that makes it after-arising—the property of having been made by an after-arising method—is not an internal structural property of the molecule. The AAT (a molecule of protein A made by an after-arising method) belongs to a thing-type that the PHOSITA could already make and use on the date the protein claim was filed. Nor is there a commensurability problem when the claim encompasses a molecule of protein A that is put to use in an after-arising process.\footnote{See A.B. Dick Co. v. Burroughs Corp., 713 F.2d 700, 703 (Fed. Cir. 1983) ("[A] pencil structurally infringing a patent claim would not become noninfringing when incorporated into a complex machine that limits or controls what the pencil can write.").} The after-arising invention of the property being used for an after-arising purpose for the molecules of protein A disclosed in the specification of the protein A patent does not give rise to a new thing-type. Similarly, there is no enablement problem when an open-transition claim encompasses molecules of protein A used in conjunction with chemical B, even if chemical B is AAT. The infringing molecules of protein A have a new property that was not invented until after the claim to "protein A" was filed—the property being adjacent to after-arising chemical B—yet there is no commensurability problem because the new property is not an internal structural property of protein A and there is...
no distinct, after-arising thing-type. This result is captured more generally in the variant of the extra-element rule of literal infringement that governs enablement. If a patent applicant claims “A,” the accused device is A+B, and B is a physically severable thing (and thus the after-arising property acquired by A is an extrinsic property), then B is an extra element in the accused device that does not make the scope of the claim at the time of infringement incommensurate with the set of technologies that the disclosure taught the PHOSITA how to make and use.

To the extent that enablement is supposed to ensure that inventors’ rights remain commensurate with their contributions to technological progress, some facets of the

142. The claim construction rule states that a claim to “X” with an open transition can literally read on a device that is X+Y because Y is an additional element of the accused device. See MERGES & DUFFY, supra note 36, at 28.

143. The variant of the extra-element rule that applies in enablement differs from the extra-element rule of literal infringement in that it only governs extra elements that are severable things. See infra notes 167–175 and accompanying text.

Courts need not always follow the “widely shared intuitions about the nature of a thing.” See supra text accompanying note 138, when identifying distinct thing-types. Courts confronted with enablement challenges to claims that encompass AAT can engage in “thing construction.” See Collins, supra note 37, at 516–20 (describing the process of thing construction and its import in determining the reach of enabled claims into AAT). They may employ thing construction as a policy lever and actively shape the reach of enabled claims into AAT. See supra note 7 (discussing policy levers). For example, courts may deviate from the widely shared, intuitive notion of things, create “ersatz” extrinsic properties, and allow the static breadth of enabled claims to encompass more AAT. See Collins, supra note 37, at 533–36.

Furthermore, in some marginal cases, there will not be a strong, widely shared intuition about whether a property is relevant to the definition of a thing-type, and courts will be forced to exercise their policy-driven judgment in thing construction. For example, consider a protein molecule. The structure of a protein molecule can be defined at several different levels of generality. The primary structure of a protein is defined by the linear sequence of amino acids that comprises the protein, and the secondary and tertiary structures are the three-dimensional forms that the protein takes on as the linear amino acid sequence folds back onto itself. See Keala Chan & Dennis Fernandez, Patent Prosecution in Proteomics, 19 SANTA CLARA COMP. & HIGH TECH. L.J. 457, 461–62 (2003) (discussing protein structure). Assume that a linear sequence of amino acids can take on two distinct tertiary structures. Are two protein molecules with identical primary structures but different tertiary structures instances of the same thing-type or distinct thing-types? This is the question that a court answers during thing construction, and the court’s answer can influence the reach of an enabled claim into AAT under the identity rule. A first inventor isolates and purifies a protein with a given amino acid sequence, and she claims “protein X.” She discloses how to make and use only one tertiary structure, but it is known at the time of application that the disclosed sequence of amino acids can likely take on other tertiary structures as well. At a later time, a second inventor figures out how to make the sequence of amino acids take on a different tertiary structure. The first inventor sues the second, and the second raises lack of enablement as a defense. If the court constructs the distinct thing-types that populate the thing-scope of the claim to “protein X” with reference only to the primary structure of the protein, then the second inventor’s technology is same-thing AAT, and the enablement defense fails under the identity rule. However, if the court constructs the distinct thing-types with reference to both the primary and tertiary structures of a protein, then the enablement defense should in theory succeed. The AAT is known AAT under Plant Genetic Systems v. DeKalb Genetics Corp., 315 F.3d 1325, 1340 (Fed. Cir. 2003), and it is also distinct-thing AAT. It therefore qualifies for neither the safe harbor provided by the foreseeability rule nor the safe harbor of the identity rule. The bottom line is that courts sometimes have discretion to specify thing constructions at varying levels of granularity. The finer the level of granularity at which courts construct things, the more restricted the reach of enabled claims into AAT. See Collins, supra note 37, at 516–20 (exploring the import and the granularity of the things constructed during thing construction for the reach of literal claim scope into AAT).

144. See supra Part II.B (discussing the proper level of inventors’ incentives).
identity rule are troubling because they undermine commensurability. In particular, the ability of the first person to make a thing to control instances of that same thing made by all after-arising processes and employed in all after-arising methods of use runs against the grain of commensurability. It makes patent protection thing-centric: it shifts the baseline that courts use to measure an inventor’s contribution away from the manner in which the inventor has enriched the public storehouse of knowledge and to the set of things that the inventor teaches the PHOSITA to make and use. Enabled things are only a rough proxy for the knowledge the inventor actually contributed to technological progress. Consider a hypothetical race between two inventors to produce chemical X in which each inventor bets on a radically different method of synthesizing the chemical. One inventor wins the race, files a patent claiming chemical X by its structure, and discloses her method of producing chemical X. The loser eventually succeeds in making chemical X, but her method of making chemical X is after-arising with respect to the winner’s patent. Under the identity rule, the winner of the race gets rights to exclude others from molecules of chemical X made by any method at all, including an after-arising method. Specifically, the winner’s claim will encompass molecules of chemical X made by the loser’s method. Yet, the winner did not teach the public how to make and use molecules of chemical X made with the loser’s method. Nor did the winner’s disclosure even make the loser’s invention any easier to come by, as the winner’s and loser’s methods are presumed to be radically different. Furthermore, the winner can control chemical X made by the loser’s method even if chemical X made by the loser’s method turns out to be the only commercially viable type of chemical X.

The per-se rule that the first person to make a thing can control instances of that same thing made by all after-arising processes and employed in all after-arising methods of use also abandons the logic of Plant Genetic Systems: it eliminates patent applicants’ linguistic burden to restrict their claims to what they have invented in a situation in which they are capable of drafting narrower claims. Under the identity rule, a patent applicant may draft claims broad enough to encompass known AAT without raising an enablement problem so long as the known AAT is also same-thing AAT. If the existence of the race to make chemical X were public knowledge, molecules of chemical X made

145. The facet of the identity rule that allows the inventor of A to exclude others from using the accused device A+B when B is both after-arising and a distinct thing promotes commensurability. See infra notes 190-201 and accompanying text.
146. Chemical X is a convenient place holder. The hypothetical could address a race to produce any machine, manufacture, or composition of matter.
147. See supra note 140 and accompanying text.
148. Another way to capture the distortion of commensurability caused by the identity rule, and its use of things as a proxy for an inventor’s contribution to the storehouse of knowledge in particular, is to note that inventors who make different contributions to the art are rewarded with identical rights. An inventor who conceives of the molecular structure of chemical X and figures out a way of making and using it has contributed more to the progress of the chemical arts than the inventor who learns about the possibility of creating chemical X from someone else and wins the race to synthesize it. Yet, the two inventors are rewarded with the same patent rights.
149. This scenario demonstrates that the reverse DOE may have substantive bite that restrains the reach of fully enabled claims into AAT. See supra note 119 (arguing that the reverse DOE is not superfluous).
150. See supra notes 102-120 and accompanying text (explaining that claims that encompass known AAT may be invalid for lack of enablement under Plant Genetic Systems).
by the loser's method would be known AAT for the PHOSITA at the time of the winner's filing. They would be "specifically desired but difficult to obtain at the time" of filing.151 Therefore, the patent applicant should know that a claim to "chemical X" without a process limitation is overbroad at the time of filing, and she could, in theory, reasonably bear the burden of drafting a narrower, product-by-process claim that does not encompass molecules of chemical X made by the loser's method.152 However, the enablement doctrine places no such obligation to draft narrow claims on the winner of the chemical X race. Economically speaking, the winner and loser in the race to produce chemical X are in positions that are almost identical to the positions of the plaintiff and defendant in *Plant Genetic Systems*.153 Yet the winner of the chemical X race can claim the loser's AAT, whereas the plaintiff in *Plant Genetic Systems* cannot claim the defendant's AAT.

The facets of the identity rule addressing after-arising methods of making and using the things disclosed and claimed in a patent cannot be justified on the basis that they make an inventor's patent rights more commensurate with her contribution to technological progress. However, they can still be justified, at least in theory, under an incentive-to-invent theory of patent protection. Like the foreseeability rule, the identity rule may be the lesser of two evils.154 The identity rule undermines commensurability in that it sanctions claims that over-reward some inventors, but it generates the offsetting benefit of clearer, lower-cost public notice of claim scope and validity.155 Without the identity rule, every structurally defined claim to a thing could be invalidated for lack of commensurability under the enablement doctrine if the PHOSITA expected that there were other, yet-to-be-realized ways of making or using the claimed thing at the time of filing. Furthermore, if patent applicants were to make their claims narrower and include method-of-making and method-of-using limitations in order to reduce this uncertainty, design-around might become trivial and the incentive to invent generated by patent protection might frequently be inefficiently small.156 Process claims and object claims with process limitations (such as product-by-process) claims are also notoriously difficult

---

152. See Atlantic Thermoplastics Co. v. Faytex Corp., 970 F.2d 834, 846-47 (Fed. Cir. 1992) (noting that "process terms in product-by-process claims serve as limitations in determining infringement"); supra notes 63-73 and accompanying text (justifying the *Plant Genetic Systems* rule as a mechanism for placing the burden of drafting narrower claims on the patent applicant only when it is reasonable to do so).
153. Cf. supra notes 103-105 and accompanying text (discussing Plant Genetic Systems). The analogy presumes that the defendant in *Plant Genetic Systems* was the first to discover how to transform monocots with gene X. It also presumes that both the loser of the race to make chemical X and the defendant in *Plant Genetic Systems* generate substitute AAT. See generally Part III.D.2 (distinguishing complementary and substitute AAT).
154. See supra note 115 and accompanying text.
155. In other words, it may be justified under a classic rules-versus-standards argument. See generally FREDERICK SCHAUER, PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE, 104 & n.35 (Clarendon Press 1991) (discussing rules and standards). The identity rule can alternatively be explained though a prospect-theory justification of patent law: the first person to make a thing can exercise centralized control over further research involving the thing. See supra note 111 (discussing prospect theory). In fact, the identity rule and the thing-centric nature of the patent regime that is creates are arguably the best available evidence to support the thesis that the contemporary enablement doctrine is structured to allow patent claims to function as technological prospects.
156. See supra notes 35-36 and accompanying text (noting that commensurability must be established in a manner that is sensitive to the magnitude of patent incentives).
Enabling After-Arising Technology

to enforce, leading to a yet further decrease in the incentive to invent. The bottom line is that the identity rule imposes a cost in that it causes claim scope to mirror technological contribution less precisely, but this cost may, at least in theory, be more than offset by the benefits of the greater certainty and the more robust incentive to invent that follow from a thing-centric patent regime that employs things as proxies for technological contributions.

D. Rule Three: The Complementarity Rule

This section presents the complementarity rule: the Federal Circuit routinely exempts AAT from the commensurability analysis when the AAT embodies an after-arising discovery that is an economic complement to the inventive principle underlying the patent, thereby allowing enabled claims to grow deeper over time. Discussion of the complementarity rule is new to patent scholarship, although its effects are well established. The courts have to date implemented it through silence rather than through open acknowledgement. Therefore, this Part introduces the complementarity rule in the form of a puzzle. Part III.D.1 formulates two commensurability hypotheticals, one in which courts invalidate a claim for lack of enablement when it encompasses AAT and one in which courts sanction the reach of an enabled claim into AAT. These hypotheticals present a puzzle because the different results cannot be explained by the foreseeability rule, the identity rule, or conventional wisdom. Part III.D.2 proposes the complementarity rule as the solution to the puzzle. To nip a potential source of confusion in the bud, Part III.D.3 follows a small detour to distinguish complementary AAT from a complementary patent on a later-developed invention.

1. The Puzzle: Two Commensurability Hypotheticals

Consider two hypotheticals, each involving a patent-owning plaintiff who alleges that a defendant’s AAT literally infringes her claim. On date X, two inventors file for patents on entirely different inventions, and both patents eventually issue. One inventor (X1) claims a new type of plastic, e.g., “a compound comprising molecules that are long, branching chains of [a specific chemical sub-unit].” The PHOSITA knows on date X that there are in theory two types of compounds with distinct chemical structures described by X1’s claim: type A and type B. Inventor X1’s specification, however, only discloses enough information to teach the PHOSITA how to make and use type A. The type B plastic is “specifically desired but difficult to obtain” on date X.

The second inventor (X2) works in an entirely different art and claims “a mechanical widget.” The widget could be anything, but for the sake of concreteness assume that it is an improved mechanism for manually controlling Venetian-blind louvers.

Now, add one more inventor into the mix (Y) who arrives at her invention on date Y, which can be anytime within the twenty years following date X. She discovers how to

---

158. These hypotheticals are a hybrid of In re Hogan, 559 F.2d 595 (C.C.P.A. 1977), and Plant Genetic Systems v. DeKalb Genetics Corp., 315 F.3d 1335 (Fed. Cir. 2003).
159. Plant Genetic Sys., 315 F.3d at 1340.
make the type B plastic addressed above in the context of X1's invention. Inventor Y manufactures a Venetian-blind widget with her type B plastic, and inventors X1 and X2 both sue her for infringement. Y raises an enablement defense in both suits, arguing that the claims are not commensurate with the disclosures because the claims encompass her AAT and the PHOSITA on date X could not make or use a widget made of type B plastic.

How does Y's enablement defense fare in the two infringement suits? According to the rules explained so far, the defense succeeds in the case brought by X1, and thus inventor X1's claim cannot remain valid while literally encompassing Y's AAT. Under the foreseeability rule, X1's claim cannot qualify for the enablement safe harbor created by Hogan because Y's type B plastic was known AAT on date X. The enablement safe harbor created by the identity rule is also inapplicable because Y's type B plastic is distinct-thing AAT. The type A and B plastics have different molecular structures, and molecular structure is a clear example of an intrinsic property. Turning to the case brought by X2, the result should, in theory, be the same if the foreseeability and identity rules offer the only explanations for how enabled claims can reach into AAT. The hypotheticals are deliberately crafted so that neither the foreseeability rule nor the identity rule on its face differentiates X1's case from X2's case. If the type B plastic was known on date X in X1's infringement suit, it must have been known on date X in X2's infringement suit, too. Similarly, Y's AAT is distinct-thing AAT in both infringement suits. The suit brought by X2, however, would almost certainly reach the opposite result in the courts. X2's claim is likely to be upheld as enabled, and Y is likely to be liable for infringement. There is a widely recognized rule of thumb in the mechanical arts that a claim to a mechanical device can read on devices made out of any material without running into an enablement problem. No published case has held that there is an exception to this rule for materials that are "specifically desired but difficult to obtain" on the date a claim is filed. Thus, the X1 and X2 hypotheticals present a puzzle. How can

160. For simplicity, this scenario assumes that Y is both the inventor of type B plastic and the alleged infringer. However, the person who makes the after-arising invention and the person who gets sued for using the after-arising invention in a manufacture need not be the same person.

161. See supra Part III.B (discussing the foreseeability rule).

162. See supra Part III.C (discussing the identity rule).

163. But see infra notes 180–181 and accompanying text (considering the possibility that inventor Y's technology may have been known to the PHOSITA of X1's claim but not the PHOSITA of X2's claim because the PHOSITAs know different arts).

164. But see supra note 143 (noting that courts may use "thing construction" as a policy lever); infra note 172 (same).

165. See Feldman, supra note 2, at 28 (noting the "one embodiment" rule of enablement that applies whenever claims in the mechanical arts are allegedly overbroad because they encompass devices made from many different materials); 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, 1976–77 (2005) ("An inventor, familiar with [a] trend [toward lighter and stronger rackets], should describe the material used to make his racket in general terms, and then the patent claim will literally cover a racket of the same shape and dimension even if it is made from a substance that was not known at the time of the patent application."). Of course, a claim in the mechanical arts cannot read on any material if materiality is a limitation of the claim. A claim to a "plastic widget" cannot encompass a widget made of metal. This restriction on the reach of a claim into AAT is an artifact of claim construction and literal infringement, however, not enablement.

166. Plant Genetic Sys. v. DeKalb Genetics Corp., 315 F.3d 1335, 1340 (Fed. Cir. 2003). At least, no case
the different results concerning the permissible reach of an enabled claim into AAT be explained? Part III.D.2 below offers a conceptually coherent and normatively justifiable answer, but the remainder of this Part first addresses three attempts to explain the puzzle that may initially seem appealing, because they draw from the conventional wisdom about enablement, but that are ultimately unsuccessful.

A first attempt to distinguish the result of the X2 hypothetical might draw upon the enablement variant of the extra-element rule which states that a claim to "A" can remain enabled while reading on the device A+B, even if B is AAT, because B is an extra element.\(^ {167}\) Following this logic, X2's claim might intuitively seem to be capable of remaining enabled while encompassing the AAT because the widget disclosed and claimed by X2 can be viewed as A—the claimed thing—and the materiality of Y's widget can become B—the extra element.\(^ {168}\) When applying enablement, however, the characterization of the X2 hypothetical as an extra-element case is misguided.\(^ {169}\) Because the explanation for the enablement variant of the extra-element rule is lodged in the identity rule, there is an enablement safe harbor only if B is a physically severable thing and, inversely, A is effectively unchanged by the addition of B. If a claim describes "A," the accused device is A+B, and B is a physically severable thing that is AAT, then the presence of B in the accused device does not create a commensurability problem, even under the full-scope doctrine. The A in the accused device of A+B is effectively identical to the A that was enabled by the specification of the patent claiming A.\(^ {170}\) The set of claimed things is no larger than the set of things enabled by the disclosure. However, if the after-arising B is not a severable thing but is instead a newly invented intrinsic property of A, the identity rule cannot provide an enablement safe harbor. In the X2 hypothetical, the accused device is manufactured from an after-arising material. Given the widely shared intuition about the ontology of things, materiality is an intrinsic property; there is no intuitive way in which two objects made from different materials are identical or duplicate instances of the same thing.\(^ {171}\) Therefore, the literal depth of X2's claim must grow over time if it is to encompass a widget manufactured from Y's after-arising type B plastic. The set of things claimed by X2's claim at the time of infringement that the author could find. It is difficult to prove a negative.

\(^ {167}\) See supra notes 142–143 and accompanying text (discussing the enablement variant of the extra-element rule).

\(^ {168}\) This intuition is at its strongest when B does not implicate a claim limitation. For example, X2's claim to "a mechanical widget" does not recite materiality as a claim limitation, so it is intuitive to frame the materiality of Y's accused device as an unclaimed element. However, the recitation of materiality as a claim limitation is irrelevant, provided, of course, that the recitation of materiality as a claim limitation does not place the accused device beyond the literal scope of the claim. See supra note 165. The X1 and X2 hypotheticals would present the same puzzle even if X2's claim were to "a plastic mechanical widget." The normative justification for the complementarity rule applies regardless of whether the claim recites materiality in a generic sense as a claim limitation, i.e., regardless of whether X2's claim is to "a mechanical widget" or "a plastic mechanical widget."

\(^ {169}\) The extra-element rule also plays a role in the literal infringement analysis. See supra note 142. In that context, treating the materiality of a device as an extra element is a harmless error (if it is an error at all).

\(^ {170}\) The A in the accused device A+B has an after-arising property—the property of being adjacent to an after-arising B—but this new property is an extrinsic property and is therefore not viewed as transforming the A into an after-arising thing. See supra text accompanying note 142.

\(^ {171}\) See supra text accompanying note 138 (defining an intrinsic property and discussing the widely shared intuition about the ontology of things).
becomes larger than the set of things the PHOSITA could make and use at the time of filing, so the claim is invalid under the strict full-scope doctrine. In sum, regardless of how intuitive it may have become, the notion that the after-arising materiality of an accused device does not create an enablement commensurability problem because materiality is an unclaimed, extra element of the accused device has no rational basis. It papers over the interesting question with an unacknowledged legal fiction, holding that objects made out of different materials are effectively the same thing.

Furthermore, if unclaimed, after-arising features of accused devices never raise enablement problems, then it is a wonder that there are ever any controversial enablement cases involving AAT. Consider *In re Hogan*. The claim described a “normally solid homopolymer” made up of a specified monomer, and the accused device was AAT because it had unclaimed, after-arising features: it was amorphous rather than solid, it had a higher molecular weight, and it had a different pattern of branching in its chemical structure. If unclaimed, after-arising features of accused devices do not raise enablement problems, why does *Hogan* generate so much interest? To the same effect, consider *Plant Genetic Systems*. The claim roughly described “a plant cell” with a gene inserted therein, and the accused device was AAT because it had an unclaimed, after-arising feature: the accused device was a monocot. If unclaimed, after-arising features of accused devices never raise enablement problems, why was the claim invalidated for lack of enablement in *Plant Genetic Systems*? The answer to these questions lies in the fact that the variant of the extra-element rule that applies in enablement only provides a rational explanation for how enabled claims can reach into AAT when a patent claims “A,” the accused device is A+B, and B is a physically severable thing. When the after-arising “extra element” B is in fact a change to the nature of A as a thing—as it is in *Hogan*, *Plant Genetic Systems*, and the X1 and X2 hypotheticals—the identity rule does not create a safe harbor, and the presence of the after-arising “extra element” B in the accused device should, in theory, lead to a commensurability problem under a literal application of the full-scope doctrine.

A second superficially appealing, but ultimately infirm, explanation for the differential treatment calls upon the conventional wisdom on the role of predictability in enablement. Courts often label the mechanical arts as predictable and conclude that the disclosure of a single embodiment can enable a claim that reaches into AAT, and they often label the chemical arts as unpredictable and conclude narrow disclosures cannot enable claims that reach into AAT. This conventional wisdom does map nicely onto the results of the two hypotheticals. X2 claims an invention in the mechanical arts and her

---

172. There is nothing wrong with legal fictions, but they should be openly embraced as policy tools rather than passed off as the result of the deterministic application of law to facts. The end goal of the complementarity rule can be achieved through a “things by policy” approach to thing construction. See supra note 143.

173. *In re Hogan*, 559 F.2d 595 (C.C.P.A. 1977); see supra notes 83–89 (presenting *Hogan*). The X1 hypothetical also involves similar facts for the point being made here.

174. *Plant Genetic Sys. v. DeKalb Genetics Corp.*, 315 F.3d 1335 (Fed. Cir. 2003); see supra notes 103–106 (presenting *Plant Genetic Systems*).

175. Changes to “the nature of A as a thing” are changes to the intrinsic properties of A. See supra text accompanying note 138.

176. See supra notes 64–65 and accompanying text.
claim can remain enabled while reaching into Y’s AAT, whereas X1 claims an invention in the chemical arts and her claim cannot remain enabled while reaching into Y’s AAT. However, the difference in predictability between the chemical and mechanical arts does not provide a logically sound reason for the different fates of the claims of inventors X1 and X2. The predictability of an art is only relevant to the threshold inquiry into whether a claim encompasses AAT or, alternatively, whether all of the embodiments of a claim are constructively disclosed by the patent specification.177 Once it has been determined that the claims of both X1 and X2 encompass AAT, the predictability of the art should no longer be relevant to commensurability.178 Furthermore, although X2’s claim is in the mechanical arts, Y’s AAT results from a chemical invention, not a mechanical invention. The rule that a single embodiment can enable a broad claim in the mechanical arts without reaching into AAT is based on a presumption that the difference between the literally-disclosed and not-literally-disclosed embodiments is itself a mechanical difference.179

A third way to attempt to rationalize the different results in the X1 and X2 hypotheticals is to rely on the fact that the PHOSITA is different in each infringement suit. Inventor X1’s infringement suit implicates the PHOSITA of Venetian blinds, whereas inventor X2’s infringement suit implicates the PHOSITA of industrial plastics. It is intuitive to posit that, on date X, inventor Y’s technology was known AAT for the industrial-plastics PHOSITA in X1’s infringement suit but unknown AAT for the Venetian-blinds PHOSITA in X2’s infringement suit. If knowledge is allocated in this manner, X2’s claim can encompass Y’s AAT under the safe harbor created by the foreseeability rule, but X1’s claim cannot.180 This ignorance-is-bliss theory has power as a descriptive tool to explain the outcomes in the hypotheticals, but it begs the question as a matter of policy. The PHOSITA is a judicial construct, and the knowledge possessed by the PHOSITA is the result of judge-made rules.181 What policy concerns should courts consider to determine the set of arts in which any given PHOSITA is held to be knowledgeable? The best answer to this question is precisely the one explored in the next section: the PHOSITA is deemed to be ignorant of impending advances in the arts that are likely to generate after-arising complements for the patented invention.

2. The Answer: A Safe Harbor for Complementary AAT

X2’s claim, but not X1’s claim, can absorb Y’s known, distinct-thing AAT and yet remain enabled because, under the complementarity rule, courts exempt complementary

177. See supra notes 66–73 and accompanying text.
178. See supra note 74 and accompanying text.
179. See supra note 67 and accompanying text. For this very reason, courts have cautioned against reflexive invocation of the simple trope that disclosures in the mechanical arts are broadly enabling, and they have instead focused on the predictability of the “factors” that distinguish the disclosed and non-disclosed embodiments in any given case. See In re Cook, 439 F.2d 730, 734 (C.C.P.A. 1971); In re Fisher, 427 F.2d 833, 830–40 (C.C.P.A. 1970). In the X1 and X2 hypotheticals, it is the identical “factor” that distinguishes inventor Y’s AAT from the disclosed embodiments in the patents belonging to X1 and X2, despite the fact that the inventions of X1 and X2 reside in different arts.
180. See supra Part III.B (discussing the foreseeability rule).
AAT, but not substitute AAT, from enablement’s commensurability requirement.\textsuperscript{182} AAT is complementary AAT when Y’s after-arising advance is an economic complement to the inventive principle that underlies X’s patent claims: consumers want to consume goods made with both X’s earlier inventive principle and Y’s after-arising advance together. AAT is substitute AAT when Y’s after-arising advance is an economic substitute for the inventive principle that underlies X’s patent claims: consumers want to consume goods embodying either Y’s after-arising advance or X’s earlier inventive principle.

When identifying complementary and substitute AAT, it is crucial to understand what must be a complement or substitute for what. With respect to the AAT, it is the technological advance that makes the AAT after-arising that is important. The complementarity rule focuses on the after-arising technological advance that differentiates the AAT from the set of things that the PHOSITA could make on the date of filing. It hone in on what the inventor of the AAT contributed to technological progress, i.e., on the reason why the infringing AAT was beyond the PHOSITA’s ability to make and use on the date of the patent’s filing. In the plastic/widget hypotheticals, for example, Y’s after-arising invention is type B plastic. Y may be selling a widget made of the after-arising plastic in the hypotheticals, but the fact that the manufactured good is a widget is not important to the complementarity rule.\textsuperscript{183} With respect to the patented invention, it is the inventive principle that renders the technology patentable that is important. The complementarity rule again hone in on the contribution technological progress—this time the one made by the patentee.\textsuperscript{184} The inventive principle underlying X1’s patent is type A plastic. X1 may seek a narrow, dependent claim to a bottle or a widget made of type A plastic, but the scope of any particular claim is not important to the complementarity rule. The inventive principle underlying X2’s patent is the improved widget.

The story of inventor X2 illustrates the enablement safe harbor for complementary AAT.\textsuperscript{185} Y’s invention of type B plastic is a complement for X2’s widget invention: consumers are likely to consume a good embodying both inventions together in the form

\begin{itemize}
\item \textsuperscript{182} This Article uses “complement” and “substitute” as economic terms of art. If the demand for good one goes up when the price for good two goes up, then good one is a substitute for good two. The intuition at work is that the consumer substitutes good one for good two and consumes goods one instead of consuming good two. To the contrary, if the demand for good one goes down when the price for good two goes up, then good one is a complement for good two. The intuition here is that the consumer consumes goods one and two together, so an increase in the price of one reduces the demand for both. If a change in the price of good two has no effect on the demand for good one, then goods one and two are neutral goods. See HAL R. VARIAN, INTERMEDIATE MICROECONOMICS: A MODERN APPROACH 111–12 (4th ed. 1996). Complementary and substitute AAT are not categories that are binary opposites. Goods fall on a spectrum that runs from perfect complements at one pole through neutrality to perfect substitutes at the other pole. In theory, courts can shape the reach of enabled claims into AAT by shifting the degree of complementarity between the patented and after-arising inventions required for an exemption from the commensurability requirement.
\item \textsuperscript{183} It is, of course, important during the infringement analysis.
\item \textsuperscript{184} The purpose of the complementarity rule is to allow enabled claims to track the presence of the inventive principle contributed by an inventor/patentee through multiple generations of goods. See infra notes 198–201 and accompanying text. Therefore, the rule’s focus must remain on the relationship between the technological advance made by the later inventor/infringer and the inventive principle underlying the patent.
\item \textsuperscript{185} See supra notes 158, 165–166 and accompanying text (presenting the X2/Y hypothetical).
\end{itemize}
of a widget made from type B plastic. Because X2 prevails in her infringement suit against Y, the story of X2 and Y fits the thesis that an inventor X’s claim can remain enabled while reaching into an inventor Y’s known, distinct-thing AAT when the inventions in successive generations are complements.

The story of inventor X1 illustrates the other half of the complementarity rule, namely that courts do not exempt substitute AAT from the commensurability requirement. The inventions of X1 and Y are substitutes: consumers are likely to consume either type A plastic or type B plastic. Because X1 cannot prevail in her infringement suit against Y, the story of X1 and Y supports the thesis that the claim of an inventor X that reaches into an inventor Y’s substitute AAT may be invalid for lack of enablement. (Because the distinction between complementary and substitute AAT turns on the relationship between the patented invention and the after-arising invention, Y’s type B plastic can be substitute AAT with respect to X1’s plastics invention and complementary AAT with respect to X2’s widget invention.)

The complementarity rule promotes commensurability. To see in an intuitive way why this is true, consider initially how the patent regime treats inventors in subsequent generations who generate physically distinct, complementary goods. For example, assume that an earlier inventor X invents and claims the hammer, and that a later inventor Y invents the nail. The later-developed nail is a complement to the earlier-invented hammer, as consumers tend to consume the two inventions together. Because the inventions are complements, the nail increases consumers’ willingness to pay for hammers and likely the profits that the hammer inventor can earn thanks to her patent. Under no circumstances does the complementary AAT decrease the value of the earlier inventor’s patent.

An exemption from a strict interpretation of enablement’s full-scope doctrine is needed for complementary AAT to replicate this economic outcome for complementary inventions in subsequent generations when the things that embody the later invention are not physically severable from the things that embody the earlier invention. For example,

186. A decrease in the price of Y’s type B plastic invention increases the demand for X2’s widget invention. See supra note 182 (explaining the logic of complementary goods). Importantly, the relevant comparison does not involve a comparison of Y’s accused device and X2’s widget claim. It is true that the widget that Y manufactured and the widget that X2 disclosed in her patent are economic substitutes, but this fact is irrelevant.

187. See supra notes 158–161 and accompanying text (presenting the X1/Y hypothetical).

188. A decrease in the price of Y’s type B plastic decreases the demand for X1’s type A plastic. See supra note 182 (explaining the logic of complementary goods).

189. Because the rules presented in this Part are safe harbors, an enabled claim may encompass substitute AAT if it is also either unknown AAT, see supra Part III.B (discussing the foreseeability rule), or same-thing AAT, see supra Part III.C (discussing the identity rule).

190. See supra Part II.B (presenting the commensurability policy goal of enablement). The normative justification of the complementarity rule therefore inverts the normative justifications of the foreseeability and identity rules. Cf. supra notes 110–119 & 144–153 and accompanying text (arguing that the reach of an enabled claim into AAT permitted by the foreseeability and identity rules undermines commensurability in order to achieve other goals).

191. To avoid utility problems, assume that the hammer inventor describes the hammer as a tool for pounding on pegs.

192. In other words, a decrease in the price of nails increases demand for hammers. See supra note 182 (explaining the logic of complementary goods).
consider again the hypothetical in which X2 invents and claims a widget, Y subsequently invents type B plastic, and Y manufactures a widget made from type B plastic.\textsuperscript{193} Y’s complementary, later-developed invention of type B plastic may increase consumers’ willingness to pay for X2’s widget invention because widgets may be made stronger and more durable for the same price. To put the widget inventor X2 in the same economic position occupied by the hammer inventor, X2’s profits must either increase after Y’s invention or, in the worst-case scenario, remain constant. To realize this outcome, X2’s claim must remain enabled while reaching into Y’s complementary AAT. Just as the hammer and nail inventors could obtain blocking patents for the hammer-and-nail bundle, the widget inventor (X2) and the type B plastic inventor (Y) should have blocking patents for the bundle of their inventions, namely a widget made out of type B plastic. The opposite result—the invalidation of X2’s widget claim—would produce absurd results. The development of a widget made from Y’s after-arising type B plastic would invalidate X2’s widget claim. It would be as if the later invention of the nail were to invalidate the earlier patent on the hammer.\textsuperscript{194}

Inversely, enabled claims should not reach into substitute AAT. For example, assume now that an earlier inventor again invents and claims the hammer and that a later inventor invents the staple gun. The after-arising staple-gun is a substitute for the hammer: consumers tend to consume one invention instead of the other.\textsuperscript{195} Hammers and staple guns compete in the market for industrial affixing devices, so the ability of the owner of the patent on the hammer to collect economic rent is reduced upon the marketing of the staple gun. In order to replicate this result in situations in which the after-arising complementary invention is not embodied in a thing that is physically severable from the earlier invention, the compound claim of X1 (who invented type A

\textsuperscript{193} See \textit{supra} notes 158–166 and accompanying text.

\textsuperscript{194} Similarly, it would be absurd to adopt a breadth-only rule of literal claim construction, restrict the scope of X2’s widget claim so that it encompasses only widgets that the PHOSITA could make and use at the time the claim was filed, and exclude anything made of Y’s after-arising type B plastic from the scope of X2’s claim. \textit{See supra} note 16 and accompanying text (distinguishing claim breadth and depth); \textit{supra} note 119 (discussing a breadth-only proposal for literal claim scope under which properly construed literal claims are limited to technologies known to the PHOSITA at the time of filing). It would be as if the later invention of the nail were to allow the nail inventor to sell hammers bundled with nails without paying a royalty to the owner of the earlier hammer patent. This result undermines commensurability to an unacceptable extent. The normative shortcomings of a breadth-only approach to literal claim scope could, in theory, be rectified if the DOE were adjusted to pick up the slack: complementary AAT could be uniformly treated as an actionable equivalent. \textit{See supra} note 52 (discussing a proposal in which the DOE is the sole recourse for patentees who seek to exclude others from distinct-thing AAT). A normatively acceptable strict breadth-only proposal for literal claim scope might therefore simply shift complementary AAT from the literal-infringement basket where it is today to the actionable-equivalent basket. Given that the DOE is usually associated with greater uncertainty and higher costs of administration, \textit{see} Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 29 (1997), the fact that patentees should control complementary AAT is a consideration that weighs against the adoption of a breadth-only approach to literal claim scope. Furthermore, a breadth-only approach to literal claim scope would require patentees and alleged infringers to address whether an accused device constitutes complementary AAT or whether it is constructively disclosed by the specification. Under a breadth-only approach, the latter would mean that infringement could lie only under the DOE, whereas the former would mean that the device could literally infringe. Under the contemporary regime in which complementary AAT can infringe literally, however, the distinction is irrelevant and therefore need not be litigated.

\textsuperscript{195} In other words, a decrease in the price of staple guns decreases demand for hammers. \textit{See supra} note 182 (explaining the logic of substitute goods).
plastic) should not remain enabled while reaching into the substitute AAT of inventor Y (who invented type B plastic). The earlier inventor XI should be limited to a claim to type A plastic.

The complementarity rule helps to ensure that claim scope (and thus profits) remains commensurate with the inventive principle that the inventor discloses in the specification, not more restrictively with the set of things that the disclosure teaches the PHOSITA how to make and use on the date of filing. When earlier patented inventions and after-arising advances are embodied in distinct things, there is no difference between the embodiments of an inventive principle and the set of things the PHOSITA could make and use at the time of filing, even as time progresses. The hammer used to pound on a nail remains the very hammer that was disclosed in the specification of the hammer patent. However, when multiple generations of inventions are embodied in a single thing and cannot be physically severed—i.e., when the after-arising invention is a new intrinsic property for the things that the disclosure of the earlier patent taught the PHOSITA how to make and use—the distinction between the inventive principle and the disclosed set of things takes on great significance. The set of things that a disclosure teaches the PHOSITA how to make and use at the time of filing does not grow over time, but the set of things that embodies the inventive principle that the specification discloses does. Venetian blind widgets are eventually manufactured from after-arising plastics. More broadly, the set of things described by a claim that can be realized in the world grows over time to include things with after-arising intrinsic properties, and the categories of complementary and substitute AAT are useful tropes for tracking which of these newly realized things still embody the inventive principle disclosed in the patent specification. Complementary AAT still embodies the inventive principle. The later

---

196. See supra notes 187–188 and accompanying text (explaining that Y's AAT is a substitute for XI's invention). If X2's rights were to extend Y's AAT, it would be as though the inventor of the hammer could absurdly prevent the inventor of the staple gun from making staple guns.

197. A prospect-theory justification of patent protection cannot explain the reach of an enabled claim into complementary AAT but not substitute AAT. See supra note 111 (discussing prospect theory). If patent claims are to function as waste-minimizing technological prospects, they should encompass all of the follow-on innovations that an invention opens up, regardless of whether the follow-on innovation is a complement or a substitute.

198. Cf. Merges & Nelson, supra note 2, at 845–52 (noting that the purpose of enablement is to tailor claim scope to reflect the inventive principle that an inventor has discovered). Considered together with the identity rule, the complementarity rule demonstrates an asymmetry in the thing-centric nature of patent protection. Under the facet of the identity rule that deals with objects made by after-arising methods and put to after-arising uses, the things that the patent applicant has taught the PHOSITA how to make and use at the time of filing are employed as a proxy for an inventor's contribution to technological progress, and the proxy is over-inclusive. See supra notes 144–145 and accompanying text. Under the complementarity rule, the things that the patent applicant has taught the PHOSITA how to make and use at the time of filing are not employed as a proxy for an inventor's contribution to technological progress in a context in which the proxy would be under-inclusive. Enabled things currently serve as a floor, but not a ceiling, in establishing an inventor's contribution to progress.

199. See supra note 142 and accompanying text (discussing the form of same-thing AAT that develops when an existing invention is used in conjunction with a physically distinct AAT).

200. Cf. supra note 138 and accompanying text (defining intrinsic properties).

201. In other words, the complementarity rule is a ghost of the "central" claiming regime of the nineteenth century that continues to haunt the contemporary "peripheral" claiming regime. See Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 27 n.4 (1997); Jeanne C. Fromer, Claiming Intellectual Property, 76 U. CHI. L. REV. (forthcoming 2009) (discussing contemporary patent claims as a hybrid of central and peripheral
A technological advance that was beyond the ability of the PHOSITA to make and use at the time of filing and that is present in the accused device simply makes the inventive principle of the earlier patent more valuable to the consumer. In contrast, substitute AAT no longer embodies the inventive principle. The after-arising technological advance supplants the utility of the inventive principle of the earlier patent, making consumers desire goods embodying either the after-arising advance or the inventive principle of the earlier patent.

Given the contemporary judicial rhetoric on enablement, it may be a counterintuitive idea that the commensurability of an inventor's technical contribution and her claim scope (and thus her profits) requires enabled claims to reach into technology that the patent disclosure did not teach the PHOSITA how to make and use at the time of filing. In both enablement and claim construction cases, the Federal Circuit has repeatedly suggested the opposite. It has repeatedly insisted that commensurability is achieved by limiting the scope of claims to the technology that the PHOSITA could make and use at the time of filing. Allowing claims to encompass any AAT has been described as an "error" that "compromises two fundamental tenets of the patent system: first, that the applicant must be the 'inventor' of the things covered by the patent claims, and second, that the right to exclude will be no broader than the inventor's enabling disclosure."²⁰² To the same end, "[w]hat must be guarded against . . . is . . . to hold that claims that are enabled by the original application may be construed broadly enough to encompass technology that is not developed until later and was not enabled by the original application."²⁰³ These statements are misleading because enabled claims must extend into complementary AAT for claim scope to be commensurate with the inventive principles that inventors have contributed to technological progress.²⁰⁴ The reach of literal claim scope into AAT sanctioned by the complementarity rule does not undermine commensurability. It promotes commensurability.

The Federal Circuit administers the complementarity rule through two different mechanisms: rule-like generalizations and case-by-case adjudications.²⁰⁵ If it is possible to identify ex ante specific types of AAT that are likely to be complementary AAT when

204. One explanation for these misleading statements is the blindness thesis: judges and patent practitioners simply fail to recognize that complementary AAT is in fact after-arising. Once the goal of making rewards proportional to technological contributions is internalized, the ability of a patent owner to control complementary AAT may seem so intuitive that the status of complementary AAT as something that the PHOSITA cannot make and use at the time of filing may go unnoticed. Support for the blindness thesis exists in the fact that even means-plus-function claims routinely encompass complementary AAT. The Federal Circuit has expressly stated that the literal scope of means-plus-function claims cannot encompass AAT. See supra notes 41–42 and accompanying text. Yet, means-plus-function claims regularly encompass complementary AAT. Claims to programmed computers based on inventive software are often written in means-plus-function format, WMS Gaming Inc. v. Int’l Game Tech., 184 F.3d 1339, 1346–47 (Fed. Cir. 1999), as are claims to mechanical devices, Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc., 145 F.3d 1303, 1305–06 (Fed. Cir. 1998). Yet, the author could not find any defendant or court that has raised a no-literal-infringement defense to a means-plus-function claim based on the presence of after-arising computer hardware or an after-arising material in the allegedly infringing technology.
205. These two mechanisms are not a dichotomy. They are the poles of a continuum.
Enabling After-Arising Technology

considered in relation to specific types of patented inventions, courts create categorical rules that allow the earlier inventors' claims to remain enabled while reaching into the identified type of AAT. The simple rule for the materiality of mechanical inventions fits this pattern: after-arising materials (a specific type of AAT) are likely to be complementary AAT with respect to claims that describe new mechanical devices (a specific type of invention). For another example of a rule-like implementation of the complementarity rule, consider the enablement inquiry as applied to claims to computer software. Software claims are commonly drafted not only as method claims, describing the procedures performed by the software, but also as system claims, describing computers programmed with software capable of performing those same procedures. Programmed-computer claims have by now been around for many years, and yet courts never pause to consider whether a computer program executed on after-arising hardware raises an enablement problem. Given that computer hardware has undergone nearly constant technological revolution during the last several decades, claims to programmed computers must routinely reach into AAT in the sense that they must routinely encompass computer hardware technology that the PHOSITA at the time of the filing could not have made without undue experimentation. Thus, courts have silently adopted a rule that after-arising hardware is exempt from enablement’s commensurability requirement when the inventive principle that gives rise to a claim to a programmed computer is a software invention. This technology-specific rule fits perfectly with the thesis that complementary AAT is routinely exempted from the commensurability analysis in a rule-like manner: computer hardware (the after-arising advance) can be identified on an ex ante basis as a complement to computer software (the inventive principle underlying the patent claims).

In other situations, however, the complementarity rule may not take the form of an art-specific rule but may instead play a role in courts’ fact-specific, case-by-case

206. See supra notes 165–166 and accompanying text.

207. These two types of claims today usually rise and fall together. See Arrhythmia Research Tech., Inc. v. Corazonix Corp., 958 F.2d 1053, 1061 (Fed. Cir. 1992) (holding both the apparatus and method claims invalid). The Federal Circuit treats old, general-purpose computers programmed with new software as new things, so there is no novelty problem with claims to programmed computers. In re Alappat, 33 F.3d 1526, 1545 (Fed. Cir. 1994) (en banc).


209. For a striking example involving a close cousin of a claim to a programmed computer, consider Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323 (Fed. Cir. 2001). The plaintiff had filed a claim to an “information manufacturing machine” in 1982, and the plaintiff alleged that the claim read on a personal computer connected to the Internet in the late 1990s. Id. at 1327–29. No enablement defense concerning the after-arising hardware was mentioned in any of the several opinions written in the case.

210. A similar rule implicitly governs Beauregard claims that describe “computer programs embodied in a tangible medium, such as floppy diskettes.” In re Beauregard, 53 F.3d 1583, 1583 (Fed. Cir. 1995). The medium in which a program is embodied is a complement to the computer program, so no Beauregard claim has ever been challenged for lack of enablement because the computer program was subsequently embodied in a new storage medium that the PHOSITA at the time of filing could not make and use. In other words, no Beauregard claim filed in the mid-1990s has been limited to software recorded on media such as floppy diskettes and Zip disks. Beauregard claims filed in the 1990s remain enabled even as they read on computer programs embodied on after-arising USB flash drives.
determinations affecting the reach of literal claims into AAT. When the AAT at issue is complementary AAT, the courts may look more favorably on claim constructions that allow earlier inventors to control later inventors’ efforts, and they may be more likely to sweep potential enablement problems under the rug. These are sweeping empirical claims, but they are supported by anecdotal evidence. The high-profile opinions that have expressly discussed and sanctioned the reach of literal claim scope into AAT have all involved complementary AAT. Inversely, none of the recent cases in which courts invalidated claims as overbroad for encompassing known AAT have involved complementary AAT.

3. Complementary AAT Versus Complementary Patents

To avoid confusion, a brief detour is needed to explain how the concept of complementary AAT is different from the better-known concept of a complementary patent. In order to identify the procompetitive and anticompetitive effects of patent cross-licenses and pools, the patents involved in these transactions are often categorized as being complementary, competing, or blocking. Patents are complementary when they cover physically distinct goods, and the use of one good makes the use of the other good more valuable to a consumer. If one patent encompasses good A, another encompasses good B, and consumers desire A+B, then the two patents are complementary patents. Patents are competing when they cover distinct products that consumers view as substitutes in the marketplace. If one patent encompasses good A, another encompasses good B, and consumers desire either A or B, then the two patents are competing patents. Finally, patents are blocking if there is a product that infringes both patents. Blocking patents occur when an earlier patent claim reaches into AAT and

---

211. For example, Laser Alignment, Inc. v. Woodruff & Sons, Inc., 491 F.2d 866 (7th Cir. 1974), is a classic example of a case in which a literal, enabled claim was allowed to reach into AAT. See Lemley, Changing Meaning, supra note 2, at 109 (using Laser Alignment as an example of a literal claim that reaches into AAT). The patented invention involved a new method of laying pipe. Where the laying of pipe had previously used a string as a linear reference to ensure the overall alignment of the individual pipe sections, the patent taught the use of a focused beam of light to align the pipe sections. Laser Alignment, Inc., 491 F.2d at 869 & n.1. The patent claimed: “[a] method of laying ... pipe sections ... comprising the steps of [(a)] projecting a collimated narrow beam of light from said source position along the selected axis,” and (b) using the beam of light to align the pipe sections. Id. at 869 n.1. The allegedly infringing technology used a laser to generate the reference mark—a technology that was not invented until after the claim had been filed. Id. at 869. The later-developed invention of the laser beam—or any other specific type of “collimated narrow beam of light”—is complementary AAT with respect to the inventive principle of the patent which involved an improved method of laying pipe.

212. See supra notes 121-129 and accompanying text (discussing such recent cases).


214. See 2 HOVENKAMP, JANIS, & LEMLEY, supra note 213, § 34.2c, at 34-7.

215. Id.

216. Id. at 34-6 to -7. Presumably, the category of blocking patent is further restricted by the fact that the
Enabling After-Arising Technology

In the antitrust inquiry, a convenient, although imperfect, rule of thumb is that cross licenses and patent pools may have procompetitive consequences when they involve complementary and blocking patents, and that they may have anticompetitive consequences when they involve competing patents.

The concept of complementary AAT that factors into the enablement doctrine is distinct from the concept of complementary patent rights possessed by earlier and later generations of inventors for two reasons. First, and most simply, complementary patents arise only when the inventors in both generations seek patent protection, but whether the complementary, after-arising invention is patented is irrelevant to the enablement inquiry concerning the earlier inventor’s patent claim. Under the complementarity rule, X2’s claim can remain enabled while encompassing a widget made from Y’s after-arising, complementary type-B plastic whether or not Y (or any other person) patents type-B plastic. Second, presuming that Y seeks and obtains patent protection for her later-developed technology, complementary AAT does not always give rise to complementary patents. Under different circumstances, complementary AAT may give rise to complementary patents, blocking patents, or some tertium quid.

Complementary AAT gives rise to complementary patents when the earlier and later inventions happen to be embodied in physically distinct things. If, as explored above, an earlier inventor invents and claims the hammer, and a later inventor invents and claims the nail, the after-arising invention of the nail is complementary AAT. Furthermore, the hammer and nail patents are complementary patents. However, the situations in which complementary AAT gives rise to complementary patents do not implicate the complementarity rule of enablement. They implicated the identity rule: there is no intuitive sense in which the scope of the hammer patent needs to grow after its filing date for the owner of the hammer patent to be able to exclude the nail inventor from selling a good that infringes both patents cannot be physically severed into two components, each of which infringes a different patent. Without this limitation, then complementary patents are simply a subset of blocking patents.

As explained above, the earlier patent may remain enabled and yet reach into AAT because the AAT is unknown AAT, see supra Part III.B, same-thing AAT, see supra Part III.C, or complementary AAT, see supra Part III.D.2.

Roughly sketched, cross-licenses and patent pools involving substitute patents are often anticompetitive, as they may simply be horizontal agreements not to compete among parties who, absent the agreement, would be competitors. See Shapiro, supra note 213, at 134. In contrast, complementary and blocking patents mean that there is a good (or bundle of goods) that cannot legally be produced without access to both patents, and multiple patent burdens imposed without coordination among various patent owners can increase transaction costs and exacerbate the dead-weight loss of monopoly. See id. at 122–24 (discussing the “complements problem”). Because blocking patents can implicate substitute AAT as well as complementary AAT, see infra note 220, it is incorrect to state that the situations in which cross-licensing is presumed to be procompetitive are all situations in which the inventions in successive generations are economic complements.

See supra Part III.D.2 (discussing the complementarity rule).

Furthermore, blocking patents on inventions in subsequent innovations may involve substitute AAT as well as complementary AAT. Because they are safe harbors, both the foreseeability rule, see supra Part III.B, and the identity rule, see supra Part III.C, allow enabled claims of an earlier generation of inventors to reach into the substitute AAT produced by a later generation of inventors.

See supra note 214 and accompanying text (defining complementary patents).

See supra notes 192–194 and accompanying text (explaining complementary patents using the hammer and nail example).
hammer together with a nail.\footnote{223} Thus, paradoxically, complementary AAT is an interesting category in enablement's commensurability analysis only when patents on the earlier and later inventions are not complementary patents.

Furthermore, whether the patents on an earlier invention and complementary AAT are blocking or some \textit{tertium quid} depends on whether the claim to the earlier invention can remain enabled while reaching into AAT. For example, consider again the hypothetical involving an inventor X2 who invents and claims a widget and an allegedly infringing inventor Y who invents type-B plastic and manufactures a widget made of type-B plastic.\footnote{224} Y's after-arising invention is complementary AAT.\footnote{225} Additionally, to have two patents in the picture, assume that inventor Y obtains a patent claiming "type B plastic." If X2's widget claim can remain enabled while reaching into widgets made from Y's after-arising plastic, then X2 and Y have blocking patents because a widget comprised of type B plastic can be manufactured only with the permission of both patentees.\footnote{226} However, if X2's claim cannot encompass any AAT, then X2 and Y do not have blocking patents. X2 can manufacture a widget made out of type A plastic, Y can manufacture a widget made out of type B plastic, and these two products can compete in the marketplace.

IV. A BRIEF SYNTHESIS

This Part assembles the rules. Part IV.A considers the collective impact of the rules on the validity of claims that encompass AAT. Part IV.B reviews the relationship of the rules to the commensurability goal of enablement.

\textbf{A. The Rules as Enablement Safe Harbors}

The foreseeability, identity, and complementarity rules do not apply to distinct sets of cases. Every accused device that is AAT gets a label under each of the rules. The AAT at issue in \textit{Hogan} was unknown, distinct-thing, substitute AAT;\footnote{227} the AAT at issue in the X2 hypothetical was known, distinct-thing, complementary AAT.\footnote{228} All three rules apply to every case that implicates the enablement of AAT, and each rule offers a sufficient reason for allowing an enabled claim to encompass a particular type of AAT. In other words, each rule establishes a safe harbor for patentees from an infringer's enablement invalidity defense. Under the foreseeability rule, a claim that encompasses unknown AAT cannot be successfully challenged for lack of commensurability.\footnote{229} Under the identity rule, a claim that encompasses same-thing AAT cannot be successfully challenged for lack of commensurability.\footnote{230} Under the complementarity rule, a claim that encompasses complementary AAT cannot be successfully challenged for lack of

\begin{footnotes}
\footnote{223} See supra Part III.C (discussing the identity rule).
\footnote{224} See supra notes 158, 165–166 and accompanying text (presenting the X2/Y hypothetical).
\footnote{225} See supra notes 185–186 and accompanying text.
\footnote{226} See supra note 216 and accompanying text (defining blocking patents). Technically, these claims are better described as "partially" blocking claims. See Lemley, Improvement, supra note 2, at 1010 n.88.
\footnote{227} See supra notes 83–89 and accompanying text.
\footnote{228} See supra notes 158–159 and accompanying text.
\footnote{229} See supra Part III.B (discussing the foreseeability rule).
\footnote{230} See supra Part III.C (discussing the identity rule).
\end{footnotes}
Enabling After-Arising Technology

Shifting focus from the figures of the safe harbors to the remaining ground, the only AAT that raises a commensurability problem when it falls within literal claim scope is known, distinct-thing, substitute AAT.

B. The Rules and Commensurability

The three rules rest on two distinct types of policy justifications. The complementarity rule allows an inventor to control AAT in order to promote commensurability, whereas the control over AAT sanctioned by the foreseeability and identity rules sacrifices commensurability to achieve other ends.

The complementarity rule allows enabled claims to reach into AAT to make claim scope more accurately reflect the contribution to technological progress that the patent regime should incentivize.232 The ideal baseline for determining profit (and thus incentive) under an incentive-to-invent theory of patent protection is the inventive principle that the inventor contributes to technological progress, not simply the set of technological things that disclosure teaches the PHOSITA to make and use at the time the claim is filed and that is frozen in time. In the case of same-thing, complementary AAT, these two metrics coincide. However, in the case of distinct-thing, complementary AAT, they do not. Enabled claims must be able to grow deeper after they are filed to encompass complementary AAT to ensure that the commensurability achieved through the enablement doctrine facilitates the desired allocation of incentives among inventors.

In contrast, the control over AAT sanctioned by the foreseeability rule and the identity rule—or, more precisely, the facets of the identity rule dealing with objects made by after-arising processes and put to after-arising uses—both make claim scope less commensurate to an inventor's contribution to technological progress.233 These are "second-best" rules: taking the existence of the peripheral claiming regime as a given, they distort the variable of commensurability away from its optimum in order to promote other goals and achieve offsetting gains.234 The foreseeability rule allows claims to reach into all unknown AAT despite the cost to commensurability when the unknown AAT is also substitute AAT. The operative presumption must be that the cost of the reduction in the overall magnitude of the incentive to invent that inheres in not allowing enabled claims to encompass unknown AAT is yet greater.235 Similarly, the identity rule allows claims to reach into all same-thing AAT despite the cost to commensurability when the same-thing AAT is also substitute AAT. Again, the operative presumption must be that the cost of administering a system that does not employ a thing-centric baseline for the commensurability analysis is yet greater.236

231. See supra Part III.D (discussing the complementarity rule).
232. See supra notes 190–204 and accompanying text.
233. See supra notes 110–119 & 144–153 and accompanying text. The enablement variant of the extra-element rule is also a facet of the identity rule, and it promotes commensurability. See supra notes 142–143 & 190–201 and accompanying text.
235. See supra notes 115–119 and accompanying text.
236. See supra notes 155–157 and accompanying text.
The reach of literal claims into AAT permitted the contemporary enablement doctrine can best be explained through a multi-rule approach in which enablement safe harbors are available for three types of AAT. Under the foreseeability rule, unknown AAT is exempted from the commensurability analysis, but known AAT is not.\(^2\) Under the identity rule, same-thing AAT never raises a commensurability problem, but distinct-thing AAT may.\(^3\) Under the complementarity rule, complementary AAT gets a free pass during the commensurability analysis, but substitute AAT does not.\(^4\) (Importantly, the predictability of a claimed technology does not shape the reach of enabled claims into AAT, conventional wisdom notwithstanding. Predictability is only relevant in the threshold inquiry into whether or not a claim encompasses AAT.)\(^5\) The complementarity rule promotes the commensurability of an inventor's claims and her disclosure, but the foreseeability and identity rules can both undermine commensurability in order to achieve other goals.\(^6\)

The contemporary doctrine that courts use to determine the reach of an enabled claim into AAT is chaotic.\(^7\) However, the chaos can be traced to the courts' failure to recognize the taxonomy of AAT upon which the three rules are premised. In addition to being viewed as embodying improvements that run from the minor to the radical,\(^8\) AAT needs to be openly discussed as known or unknown to the PHOSITA at the time of filing, as the same as or distinct from the things disclosed in the patent specification, and as the embodiment of an after-arising discovery that is either a complement or a substitute for the patented invention. Until this taxonomy of AAT works its way into patent opinions and scholarship, the enablement doctrine is likely to remain incoherent in its application to cases involving allegedly infringing AAT.

\(^{237}\) See supra Part III.B (discussing the foreseeability rule).

\(^{238}\) See supra Part III.C (discussing the identity rule).

\(^{239}\) See supra Part III.D (discussing the complementarity rule).

\(^{240}\) See supra Part III.A (discussing predictability as a threshold inquiry).

\(^{241}\) See supra Part IV.B (synthesizing the effects of the three rules on commensurability).

\(^{242}\) See supra note 18.

\(^{243}\) See supra note 47 and accompanying text (discussing the categorization of AAT under the reverse DOE).