William & Mary Law Review

Volume 61 (2019-2020)
Issue 5

Article 2

4-2020

Artificial Stupidity

Clark D. Asay

William & Mary
Law Review

VOLUME 61 NO. 5, 2020

ARTIFICIAL STUPIDITY

CLARK D. ASAY*

ABSTRACT

Artificial intelligence is everywhere. And yet, the experts tell us, it is not yet actually anywhere. This is because we are yet to achieve artificial general intelligence, or artificially intelligent systems that are capable of thinking for themselves and adapting to their circumstances. Instead, all the AI hype—and it is constant—concerns narrower, weaker forms of artificial intelligence, which are confined to performing specific, narrow tasks. The promise of true artificial general intelligence thus remains elusive. Artificial stupidity reigns supreme.

What is the best set of policies to achieve more general, stronger forms of artificial intelligence? Surprisingly, scholars have paid little

* Professor of Law, BYU Law School. J.D., Stanford Law School. M.Phil., University of Cambridge. Many thanks to Stephanie Bair, Jonathan Barnett, Bryan Choi, Ben Depoorter, Roger Ford, Jeanne Fromer, Eric Goldman, Matthew Jennejohn, Mark Lemley, David Levine, Michael Meurer, David Schwartz, Harry Surden, and Christopher Yoo; participants at the 2019 Works-in-Progress conference at the University of Houston Law Center; participants at the 2019 Deals Conference in Park City, Utah; participants at a BYU Law School works-in-progress presentation; and participants at the 2019 Junior Faculty Forum for Law and STEM for helpful comments on the ideas in this paper.

attention to this question. Scholars have spent considerable time assessing a number of important legal questions relating to artificial intelligence, including privacy, bias, tort, and intellectual property issues. But little effort has been devoted to exploring what set of policies is best suited to helping artificial intelligence developers achieve greater levels of innovation. And examining such issues is not some niche exercise, because artificial intelligence has already or soon will affect every sector of society. Hence, the question goes to the heart of future technological innovation policy more broadly.

This Article examines this question by exploring how well intellectual property rights promote innovation in artificial intelligence. I focus on intellectual property rights because they are often viewed as the most important piece of United States innovation policy. Overall, I argue that intellectual property rights, particularly patents, are ill-suited to promote more radical forms of artificial intelligence innovation. And even the intellectual property types that are a better fit for artificial intelligence innovators, such as trade secrecy, come with problems of their own. In fact, the poor fit of patents in particular may contribute to heavy industry consolidation in the AI field, and heavy consolidation in an industry is typically associated with lower than ideal levels of innovation.

I conclude by arguing, however, that neither strengthening AI patent rights nor looking to other forms of law, such as antitrust, holds much promise in achieving more general forms of artificial intelligence. Instead, as with many earlier radical innovations, significant government backing, coupled with an engaged entrepreneurial sector, is at least one key to avoiding enduring artificial stupidity.

TABLE OF CONTENTS

INTRODUCTION

Forms of artificial intelligence (AI)—computing systems that perform tasks that normally would require human intelligence—are everywhere.[1] AI determines what appears in our news feeds,[2] which ads we are served,[3] our search results,[4] and how personal assistants such as Siri and Alexa respond to us.[5] AI also increasingly determines our credit scores,[6] mortgage and loan interest rates,[7]

1. To be clear, AI is an acronym that means many different things to many different people. *See, e.g.*, Michael Jordan, *Artificial Intelligence—The Revolution Hasn't Happened Yet*, MEDIUM (Apr. 19, 2018), https://medium.com/@mijordan3/artificial-intelligence-the-revolution-hasnt-happened-yet-5e1d5812e1e7 [https://perma.cc/693C-5FPY] (discussing how the AI acronym is often used to mean things, such as machine learning, that aren't technically AI, at least as understood in certain disciplines such as computer science); Bernard Marr, *The Key Definitions of Artificial Intelligence (AI) that Explain Its Importance*, FORBES (Feb. 14, 2018, 1:27 AM), https://www.forbes.com/sites/bernardmarr/2018/02/14/the-key-definitions-of-artificial-intelligence-ai-that-explain-its-importance/ [https://perma.cc/V3PH-J7J2] (discussing a variety of different understandings of what AI constitutes). When I refer to AI in this Article, I mean to do so broadly, because the innovation policy ramifications that I discuss herein apply to that broader conception, not just what specific disciplines more narrowly mean when they use the AI acronym.

2. *Google Pushes Artificial Intelligence for Upgraded News App*, PHYS.ORG (May 20, 2018), https://phys.org/news/2018-05-google-artificial-intelligence-news-app.html [https://perma.cc/TT58-K6WA] (discussing Google's use of AI in structuring its newsfeed).

3. Mike Kaput, *What You Need to Know About AI and the Future of Advertising*, MARKETING ARTIFICIAL INTELLIGENCE INST. (Sept. 25, 2018), https://www.marketingaiinstitute.com/blog/ai-in-advertising-what-you-need-to-know [https://perma.cc/2BH8-V9YX] (discussing the role of AI in advertising).

4. Mike Kaput, *How Search Engines Use Artificial Intelligence*, MARKETING ARTIFICIAL INTELLIGENCE INST. (May 6, 2018), https://www.marketingaiinstitute.com/blog/how-search-engines-use-artificial-intelligence [https://perma.cc/ASQ3-BMHW] (discussing the role of AI in search).

5. Alistair Charlton, *Hello, Computer: As Alexa Soars and Siri Flags, What's Next for the Virtual Assistant?*, GEARBRAIN (Nov. 20, 2017), https://www.gearbrain.com/alex-siri-ai-virtual-assistant-2510997337.html [https://perma.cc/6MHQ-9DFN] (discussing the growing importance of automated personal assistants).

6. Penny Crosman, *Is AI Making Credit Scores Better, or More Confusing?*, AM. BANKER (Feb. 14, 2017, 3:35 PM), https://www.americanbanker.com/news/is-ai-making-credit-scores-better-or-more-confusing [https://perma.cc/LHG3-89UZ] (discussing the role of AI in determining credit scores).

7. Charles Lane, *Will Using Artificial Intelligence to Make Loans Trade One Kind of Bias for Another?*, NPR (Mar. 31, 2017, 5:06 AM), https://www.npr.org/sections/alltechconsidered/2017/03/31/521946210/will-using-artificial-intelligence-to-make-loans-trade-one-kind-of-bias-for-anot [https://perma.cc/UFU4-D26E] (discussing the growing role of AI systems in determining who gets which loans, and at which rates).

insurance premiums,[8] how much we pay for goods and services,[9] where our money is invested,[10] and our job prospects.[11] In the criminal justice context, AI plays a growing role in determining who to police and, ultimately, what criminal sanctions to impose.[12] AI plays a vital role in foreign intelligence and national security matters as well.[13] AI is projected to affect every industry and sector of society, if it has not already;[14] it is fast becoming the most important technological development in some time.[15] Indeed, some

8. Edmund Zagorin, *Artificial Intelligence in Insurance—Three Trends that Matter*, EMERJ (June 10, 2019), https://emerj.com/ai-sector-overviews/artificial-intelligence-in-insurance-trends/ [https://perma.cc/9AA8-K3G4] (discussing the growing use of AI in the insurance industry).

9. Charlie Osborne, *Uber Uses Artificial Intelligence to Figure Out Your Personal Price Hike*, ZDNET (May 22, 2017, 5:30 PM), https://www.zdnet.com/article/uber-uses-artificial-intelligence-to-figure-out-your-personal-price-hike/ [https://perma.cc/TD4P-V3H4] (discussing how Uber uses AI to determine how much users pay).

10. Alex Veiga, *Trust the Machines? These Funds Are Run by Artificial Intelligence*, SEATTLE TIMES (July 7, 2018, 8:00 AM), https://www.seattletimes.com/business/trust-the-machines-these-funds-are-run-by-artificial-intelligence/ [https://perma.cc/5TM4-XAPU] (discussing the role of AI systems in making investment decisions and contrasting this AI-centric approach with "conventional" algorithmic trading and robo-advisers, which are also earlier forms of AI systems).

11. *Amazon Ditched AI Recruiting Tool that Favored Men for Technical Jobs*, GUARDIAN (Oct. 10, 2018, 7:42 PM), https://www.theguardian.com/technology/2018/oct/10/amazon-hiring-ai-gender-bias-recruiting-engine [https://perma.cc/J3R4-DLUK] (discussing the use of AI in recruiting by Amazon, and how the company ultimately eliminated a particular use because it was resulting in gender bias in hiring).

12. *See, e.g.*, Christopher Rigano, *Using Artificial Intelligence to Address Criminal Justice Needs*, NAT'L INST. JUST. (Oct. 8, 2018), https://nij.ojp.gov/topics/articles/using-artificial-intelligence-address-criminal-justice-needs [https://perma.cc/H9RM-Z88Z] (discussing the use of AI in the criminal justice context); Vincent Southerland, *With AI and Criminal Justice, the Devil Is in the Data*, ACLU (Apr. 9, 2018, 11:00 AM), https://www.aclu.org/issues/privacy-technology/surveillance-technologies/ai-and-criminal-justice-devil-data [https://perma.cc/43RX-MCG6].

13. Michael Horowitz et al., *Artificial Intelligence and International Security*, CTR. FOR NEW AM. SECURITY (July 10, 2018), https://www.cnas.org/publications/reports/artificial-intelligence-and-international-security [https://perma.cc/QN78-Q4DW] (discussing the roles of AI in international security); Mara Karlin, *The Implications of Artificial Intelligence for National Security Strategy*, BROOKINGS INST. (Nov. 1, 2018), https://www.brookings.edu/research/the-implications-of-artificial-intelligence-for-national-security-strategy/ [https://perma.cc/4JV8-CM7H] (discussing the future of AI in national security).

14. Norm Judah, *The Global Impact of AI Across Industries*, MICROSOFT (July 30, 2018), https://news.microsoft.com/transform/the-global-impact-of-ai-across-industries/ [https://perma.cc/E6A2-MTGS] ("Artificial Intelligence (AI) is already having a transformative impact across every industry." (emphasis omitted)).

15. Chad Steelberg, *Why Artificial Intelligence Will Shift Human Innovation into Overdrive*, FORBES (May 10, 2018, 7:45 AM), https://www.forbes.com/sites/forbestechcouncil/

have dubbed AI the most central part of the "fourth industrial revolution."[16]

Because of its growing ubiquity and importance, AI has attracted the attention of legal scholars.[17] Privacy scholars, for instance, have largely bemoaned the lack of transparency and accountability associated with AI systems, with one prominent scholar referring to the world that we now live in as a "Black Box Society."[18] Other scholars have worried about the biases that afflict many AI systems,[19] and yet others have analyzed who should take responsibility when AI runs amok.[20] Intellectual Property (IP) scholars have also examined a number of important IP-related questions,[21] including whether IP rights should apply to the products of these autonomous, automated systems.[22] Are patents and copyrights justified, for instance, in cases where the AI system, rather than a human subject, creates the outputs?[23]

Despite this attention, many crucial questions remain. What, for instance, is the best innovation policy for spurring radical AI innovation? If AI is the most important technological development

---

2018/05/10/why-artificial-intelligence-will-shift-human-innovation-into-overdrive/ [https://perma.cc/23QT-S4NS] ("Civilization has reached a major inflection point, with the development of artificial intelligence technology triggering a massive acceleration in the pace of human innovation.").

16. Alan Crameri, *Artificial Intelligence: The Fourth Industrial Revolution*, INFO. AGE (Oct. 3, 2018), https://www.information-age.com/artificial-intelligence-fourth-industrial-revolution-123475170/ [https://perma.cc/S53V-SZFP].

17. *See, e.g.*, Amanda Levendowski, *How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem*, 93 WASH. L. REV. 579, 583 (2018); Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 87, 88 (2014) (discussing use of machine learning in the practice of law).

18. FRANK PASQUALE, THE BLACK BOX SOCIETY 3 (2015).

19. Levendowski*, supra* note 17, at 583.

20. *See, e.g.*, Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513, 515 (2015).

21. Ryan Abbott, *Everything Is Obvious*, 66 UCLA L. REV. 2, 8 (2019) (arguing that AI in time will render nearly all innovations obvious, thereby obviating patent law in its current form).

22. *See, e.g.*, Robert C. Denicola, *Ex Machina: Copyright Protection for Computer-Generated Works*, 69 RUTGERS U. L. REV. 251, 253 (2016); Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185, 1186-87 (1986) (discussing whether copyright rights should attach to the creations of AI systems).

23. Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1080 (2016); Ben Hattenback & Joshua Glucoft, *Patents in an Era of Infinite Monkeys and Artificial Intelligence*, 19 STAN. TECH. L. REV. 32, 46 (2015).

in some time, as some claim,[24] then better understanding what innovation policies are best suited to ensure its success is vital. Otherwise, artificial stupidity, rather than true artificial general intelligence, will continue as the norm.[25] Indeed, despite the incessant hype about and ever-growing uses of AI, many AI experts lament a lack of any real progress in the AI space.[26] As one such expert recently opined, "People worry that computers will get too smart and take over the world, but the real problem is that they're too stupid and they've already taken over the world."[27] While access to vast amounts of processing power and data have enabled applications of some basic AI techniques to perform specific tasks, a more general form of AI, capable of thinking for itself beyond those specific tasks, still eludes us.[28] Our computerized world is thus plagued with an artificial stupidity confined to carrying out particular, narrow tasks, and not often very well.[29] This is not to claim, of course, that narrower, weak forms of AI are not often quite valuable—we all benefit from them in a variety of ways.[30] But it is to say that realizing the full potential of AI—by acheiving stronger, more general forms of AI—requires us to examine how best to spur its further development.

---

24. *See, e.g.*, Crameri, *supra* note 16.

25. *See, e.g.*, Will Knight, *Progress in AI Isn't as Impressive as You Might Think*, MIT TECH. REV. (Nov. 30, 2017), https://www.technologyreview.com/s/609611/progress-in-ai-isnt-as-impressive-as-you-might-think/ [https://perma.cc/G747-ET8N]; Melanie Mitchell, *Artificial Intelligence Hits the Barrier of Meaning*, N.Y. TIMES (Nov. 5, 2018), https://www.nytimes.com/2018/11/05/opinion/artificial-intelligence-machine-learning.html [https://perma.cc/DM7V-8AUH] (discussing the lack of true general AI).

26. *See, e.g.*, Mitchell, *supra* note 25.

27. PEDRO DOMINGOS, THE MASTER ALGORITHM 286 (2015).

28. James Vincent, *This Is When AI's Top Researchers Think Artificial General Intelligence Will Be Achieved*, VERGE (Nov. 27, 2018, 1:05 PM), https://www.theverge.com/2018/11/27/18114362/ai-artificial-general-intelligence-when-achieved-martin-ford-book [https://perma.cc/P2ZE-B37J].

29. *See, e.g.*, James Vincent, *Google 'Fixed' Its Racist Algorithm by Removing Gorillas from Its Image-Labeling Tech*, VERGE (Jan. 12, 2018, 10:35 AM), https://www.theverge.com/2018/1/12/16882408/google-racist-gorillas-photo-recognition-algorithm-ai [https://perma.cc/67CK-DMVN].

30. *See, e.g.*, Ben Dickson, *What Is Narrow, General, and Super Artificial Intelligence*, TECHTALKS (May 12, 2017), https://bdtechtalks.com/2017/05/12/what-is-narrow-general-and-super-artificial-intelligence/ [https://perma.cc/2GUA-QWYR] (discussing some of the benefits of narrow AI).

Scholarly conversations about how best to incentivize AI innovation have been lacking.[31] Some of this neglect may owe to the fact that AI systems are comprised of software, hardware, data, and other technologies that have been around for some time.[32] Hence, whatever innovation policies we have had for these types of technologies may be good enough for the AI systems that utilize them. But in this Article, I argue that the nature of many AI systems challenges some of the basic assumptions underlying traditional United States innovation policy as reflected in its intellectual property laws, thus necessitating a reexamination of several of those assumptions. And doing so is not some niche exercise, because AI is not some niche technology. Instead, because AI increasingly pervades nearly every major modern-day technological system,[33] the innovation policy ramifications that I discuss in this Article will tend to apply more broadly to technological development in general.

Traditionally, IP laws form a vital, and perhaps the most important, part of United States innovation policy.[34] Hence, this Article examines several different forms of IP rights, including patents, trade secrecy, and copyrights, and assesses how each is likely to affect developers of AI systems. Doing so reveals a number of important implications for AI and technological innovation going forward.

---

31. For an exception in the pharmaceutical context, see W. Nicholson Price II, *Big Data, Patents, and the Future of Medicine*, 37 CARDOZO L. REV. 1401, 1405 (2016) (discussing, among other things, a number of shortcomings in innovation policy in the health care context, particularly in light of increasing reliance on AI systems).

32. *See, e.g.*, Stefano Ambrogio, *The Future of AI Needs Hardware Accelerators Based on Analog Memory Devices*, PHYS.ORG (June 14, 2018), https://phys.org/news/2018-06-future-ai-hardware-based-analog.html [https://perma.cc/Y57Z-SCGT] (describing various hardware, software, and data needs for improving today's AI technologies).

33. *See, e.g.*, Saryu Nayyar, *AI Is Taking Over Our Lives—When Will It Arrive in Cybersecurity?*, FORBES (June 1, 2018, 7:15 AM), https://www.forbes.com/sites/forbestechcouncil/2018/06/01/ai-is-taking-over-our-lives-when-will-it-arrive-in-cybersecurity/ [https://perma.cc/9KE6-92VM] (describing the growing pervasiveness of AI technologies in our daily lives).

34. Jeanne C. Fromer, *The Intellectual Property Clause's External Limitations*, 61 DUKE L.J. 1329, 1331-32 (2012) (arguing that the Constitution's IP Clause limits Congress's authority "[t]o promote the Progress of Science and useful Arts" other than through intellectual property laws).

First, patent law, often viewed as a key vehicle for incentivizing inventive innovation,[35] is often a poor fit for incentivizing radical AI innovation. This is so for a number of reasons, including the Supreme Court's recent patentable subject matter rulings that have made effectively patenting software innovations, of which AI innovations are a subset, more difficult.[36]

Second, trade secrecy, often viewed as the primary alternative to patent protection, provides AI developers with several key advantages in comparison to patent protection.[37] For instance, keeping an AI system's technical details under wraps is often a key competitive advantage because doing so can provide significant lead-time advantages.[38] Trade secrecy allows AI developers to keep their systems secret, whereas patenting the same invention requires disclosure of key technical details as part of the patenting process.[39] Furthermore, even in cases where parties may prefer patent protection,[40] the relative ineffectiveness of AI patent protection means that more AI innovators are likely to choose trade secrecy over patent protection for their AI innovations. Thus, trade secrecy is

35. Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 247-48 (1994) (identifying the patent system's main goal as promoting research and development (R&D) innovation).

36. Lauren Hockett & Vlad Teplitskiy, *Post-*Alice *Section 101 Eligibility Roadmap for Software Inventions*, KNOBBE MARTENS (Dec. 12, 2016), https://www.knobbe.com/news/2016/12/post-alice-section-101-eligibility-roadmap-software-inventions [https://perma.cc/43C8-E4NE]. In fact, the subject matter difficulties that recent Supreme Court decisions introduced go beyond software. *See* Susan Y. Tull & Paula E. Miller, *Patenting Artificial Intelligence: Issues of Obviousness, Inventorship, and Patent Eligibility*, 1 J. ROBOTICS, ARTIFICIAL INTELLIGENCE & L. 313, 316 (2018) (discussing subject matter problems in the context of medicinal products).

37. Of course, trade secrecy and patent protection can coexist in a number of important contexts. *See* Brenda M. Simon & Ted Sichelman, *Data-Generating Patents*, 111 NW. U. L. REV. 377, 379 (2017) (describing the typical account of trade secrecy as an economic substitute to patent protection, while pointing to instances where trade secrecy functions as an economic complement instead). But for reasons discussed in greater detail below, AI developers face growing challenges in maintaining both trade secrecy and patent protection for important parts of their AI systems. *See infra* Parts I.A.-B.

38. PASQUALE, *supra* note 18, at 83.

39. Orly Lobel, *Filing for a Patent Versus Keeping Your Invention a Trade Secret*, HARV. BUS. REV. (Nov. 21, 2013), https://hbr.org/2013/11/filing-for-a-patent-versus-keeping-your-invention-a-trade-secret [https://perma.cc/2ZJ5-HRA9].

40. This may be, for instance, because of trade secrecy's relative weaknesses. *See, e.g.*, Jonathan C. Lipson, *Remote Control: Revised Article 9 and the Negotiability of Information*, 63 OHIO ST. L.J. 1327, 1355-56 (2002) (reviewing some of the common weaknesses of trade secret protection).

increasingly displacing patent protection as the preferred form of legal protection in a growing number of AI contexts.[41]

Third, these IP realities mean that the AI industry is likely to become increasingly consolidated as a limited number of large, incumbent firms dominate it.[42] The reasons for this relate both to the IP choices available to industry participants as well as the nature of AI innovation in general. For instance, in industries with "weak appropriability regimes," large incumbent firms have an easier time fending off would-be competitors in part because ineffective patent protection means the potential rivals have greater difficulty realizing the value of their innovations.[43] Ineffective patent protection is also likely to contribute to higher costs of parties doing business with each other, so that market participants are more likely to "vertically integrate" than strike arms-length deals in the marketplace.[44] Furthermore, large, incumbent AI firms control important "complementary assets" necessary for running AI systems, such as large troves of data and access to computational power.[45] This all means that instead of numerous small, nimble AI companies forging ahead in developing innovative, new AI products and services, large incumbent firms are likely to increasingly monopolize the AI space. In fact, as this Article details, we already see some evidence of such a vertically integrated AI industry developing.[46]

---

41. *See, e.g.*, Jeanne C. Fromer, *Machines as the New Oompa-Loompas: Trade Secrecy, the Cloud, Machine Learning, and Automation*, 94 N.Y.U. L. REV. 706, 712 (2019) (discussing this preference for trade secrecy).

42. *See* John Stuckey & David White, *When and When Not to Vertically Integrate*, MCKINSEY Q. (Aug. 1993), https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/when-and-when-not-to-vertically-integrate [https://perma.cc/B7AY-CWWX] (discussing what vertical integration in an industry entails).

43. Anita M. McGahan & Brian S. Silverman, *Profiting from Technological Innovation by Others: The Effect of Competitor Patenting on Firm Value*, 35 RES. POL'Y 1222, 1222, 1224 (2006) (pointing to empirical evidence showing that weak patent rights in an industry can increase incumbent firm's value because that weakness means that spillover effects predominate "market-stealing" effects).

44. *See* David T. Levy, *The Transactions Cost Approach to Vertical Integration: An Empirical Examination*, 67 REV. ECON. & STAT. 438, 438-39 (1985) (reviewing some of the theoretical development behind the transaction cost theory behind vertical integration).

45. *See* David J. Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy*, 15 RES. POL'Y 285, 285, 288 (1986) (pointing to the importance of complementary assets and arguing that their owners are often better able to realize the value of industry-wide innovations).

46. William Vorhies, *Comparing AI Strategies—Vertical vs. Horizontal*, DATA SCI. CENT.

Finally, AI industry consolidation is likely to result in greater AI innovation inefficiencies and, thus, ongoing artificial stupidity, because a good amount of evidence shows that smaller, more nimble firms are typically more innovative than larger ones.[47] Hence, in order to best promote more far-reaching AI development, our innovation policy is in need of some changes, and this Article briefly explores some potential solutions, including strengthening AI patents[48] and resorting to other sources of law such as antitrust.[49] However, I conclude that neither solution holds much promise. Instead, I point to significant government backing as the best candidate for helping AI innovators ultimately achieve more general forms of AI.[50]

This Article has three parts. Part I examines the three bodies of IP law that are most directly relevant to AI development. It argues that patents are a poor fit for many AI systems and that reality has a number of important ramifications, including a greater reliance on trade secrecy and copyright. Part II then examines how these IP realities are likely to affect AI industrial organization over time. It suggests that the nature of many AI systems and the IP protections available for them are likely to result in significant vertical integration and, thus, heavy industrial consolidation. The result of such industry consolidation, in turn, is likely to be enduring artificial stupidity. Part III examines some potential solutions to these issues.

(July 17, 2018, 7:00 AM), https://www.datasciencecentral.com/profiles/blogs/comparing-ai-strategies-vertical-vs-horizontal [https://perma.cc/LCP4-9J4D] (reporting that in 2017, "of the 120 AI [start-ups] that exited the market, 115 did so by acquisition," with the majority of those acquisitions being done by nine large technology companies).

47. Peter Lee, *Innovation and the Firm: A New Synthesis*, 70 STAN. L. REV. 1431, 1490-91 (2018); Robert P. Merges, *Patent Markets and Innovation in the Era of Big Platform Companies* (Feb. 28, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3340648 [https://perma.cc/A63R-KMF8].

48. *See infra* Part III.A.

49. *See infra* Part III.B.

50. *See infra* Part III.C.

I. IP FOR AI

Patents, trade secrecy, and copyright are the three most relevant bodies of IP law for protecting AI systems.[51] Below I consider each of them in turn.

A. Patents

Patents provide parties with a number of possible benefits. Historically, a patent's primary theoretical purpose is to incentivize parties to undertake socially beneficial activities that, absent the patent, the parties would forego.[52] These utilitarian theories posit that without the rights of exclusivity that come with a patent, parties would be reluctant to develop inventions because third parties could replicate the inventions without incurring the same costs.[53] Hence, by granting the inventor an ability to prevent others from making, using, and selling the invention, a patent allows the inventor to recoup her costs of invention.[54] In so doing, a patent thus provides inventors with the necessary economic incentives to pursue socially beneficial activities.[55] And, though it is far from clear whether patents actually perform these functions in the aggregate, these theories remain an important basis for why we have patents.[56]

---

51. Trademarks are undoubtedly also an important form of intellectual property protection for AI firms. But this Article focuses on the intellectual property forms that are most relevant to directly incentivizing AI development, and trademark protection's link to incentivizing AI development is, at best, indirect. *See generally* Mark P. McKenna, *The Normative Foundations of Trademark Law*, 82 NOTRE DAME L. REV. 1839, 1844 (2007) (summarizing the historical theoretical justifications underlying trademark law).

52. Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 736 (2012) ("We grant patents ... to encourage inventions we wouldn't otherwise get."); Stephen Yelderman, *Coordination-Focused Patent Policy*, 96 B.U. L. REV. 1565, 1566-67 (2016).

53. *See* Yelderman, *supra* note 52, at 1566.

54. *See id.*

55. *See id.*

56. After studying the patent system for a number of years, Fritz Machlup is famous for remarking that

> [i]f we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it.

A related strand of patent law theory posits that patents provide an important coordination mechanism in the marketplace. For instance, patent rights may encourage parties to disclose information about their inventions to third parties because patents reduce their risks of so doing.[57] Patents may also communicate useful information to the market, and that information may facilitate any number of socially productive activities.[58] Hence, in addition to incentivizing invention, patents may also "grease the wheels" of a variety of beneficial commercial activities.

In this vein, some argue that strong patents enable greater economic efficiencies by reducing transaction costs between parties, thereby promoting greater economic specialization and industrial disaggregation.[59] That specialization and disaggregation, in turn, are said to promote innovation, as smaller, more nimble industry players are able to better compete in the marketplace.[60]

Do patents perform these roles? That is an empirical question that neither this Article, nor any existing research, can easily answer. As far back as the late 1950s, Professor Fritz Machlup famously described the evidence as ambiguous at best,[61] and some commentators believe that the equivocal state of affairs remains intact.[62] But, as discussed in greater detail below, there are several

---

STAFF OF S. SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 80 (Comm. Print 1958) (Patent Study of Fritz Machlup). His sentiment is often pointed to as a poignant summary of the state of opinion regarding whether the patent system serves its intended purposes.

57. *See, e.g.*, Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1496, 1503 (2005) (arguing that property rights such as patents help reduce the risk of disclosing sensitive information in the marketplace).

58. *See, e.g.*, Clark D. Asay, *The Informational Value of Patents*, 31 BERKELEY TECH. L.J. 259, 265, 276-77 (2016) (discussing the ways in which patents are often used to communicate information about the patent holders to product, capital, and labor markets); Colleen V. Chien, *Opening the Patent System: Diffusionary Levers in Patent Law*, 89 S. CAL. L. REV. 793, 804-05, 826, 846 (2016) (discussing a number of ways the patent system might be used to better diffuse technical information throughout the marketplace).

59. *See infra* Part II.

60. *See infra* Part II.

61. STAFF OF S. SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, *supra* note 56.

62. *See, e.g.*, Lisa Larrimore Ouellette, *Patent Experimentalism*, 101 VA. L. REV. 65, 76 (2015) (concluding that none of the current evidence that we have regarding the patent system "resolves whether patents have a net positive effect on innovation, much less their net welfare effect, or whether alternative innovation incentives such as grants, prizes, and tax credits are inferior").

reasons to believe that patents are a poor fit for many types of AI innovation, including stronger forms of AI. First, patenting standards make patenting important parts of many AI systems difficult and in some cases impossible. Second, patenting requirements present a number of significant disadvantages to many AI innovators, such that many AI innovators are likely to choose to forego patent protection for their AI innovations altogether. As a result, the future of AI innovation may be one lacking whatever benefits patents provide. Such a development may be beneficial in some respects, because patents impose several known social costs, and other incentives may still propel AI innovators to pursue their innovations without imposing those patenting costs. But an AI world without robust patenting may contribute to consolidation in the AI industry, and that consolidation may significantly undermine radical AI innovation, as Part II will explore.

1. Patentable Subject Matter

One reason that patents are a poor fit in many AI contexts relates to patent law's subject matter requirements. In general, the subject matter of patents is quite broad; parties can obtain patents relating to "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[63] On its face, the Patent Act is thus quite liberal in what parties can patent; the only real limitation is that the invention must fit into one of the four broad categories, which typically is not much of an obstacle at all.[64]

But over the years, courts have carved out a number of exceptions to what parties can patent.[65] These exceptions to patentable subject matter include abstract ideas, laws of nature, and natural phenomena.[66] These, the Supreme Court has found, are the building blocks

63. *See* 35 U.S.C. § 101 (2012) (setting forth patent law's subject matter requirement).

64. Gene Quinn, *Patentability Overview: When Can an Invention Be Patented?* IPWATCHDOG (June 3, 2017), http://www.ipwatchdog.com/2017/06/03/patentability-invention-patented/id=84071/ [https://perma.cc/4M5U-56LR] (indicating that because of the breadth of these categories, "virtually everything ha[s] been viewed as being patent-eligible subject matter").

65. *Id.*

66. *Id.*

of invention, and allowing parties to patent them would inhibit rather than encourage innovation.[67] Hence, in order to further patent law's purpose of "promot[ing] the Progress of Science and useful Arts,"[68] courts have barred patents on "the handiwork of nature."[69]

Yet determining what counts as mere abstract ideas, laws of nature, and natural phenomena remains a difficult inquiry.[70] In reality, all inventions involve some mix of abstract ideas, laws of nature, and natural phenomena; otherwise, the inventions would not work in the real world.[71] In part because of ongoing questions about where to draw the line between what can and cannot be patented, the Supreme Court has recently ruled on several of these exceptions.[72]

Most recently, the Court reviewed the abstract idea exception in its 2014 *Alice Corp. v. CLS Bank International* decision, there ruling that an electronic escrow service implemented in a generic computing environment was an ineligible abstract idea outside the scope of patentable subject matter.[73] In so concluding, the *Alice* Court consolidated some of its earlier patentable subject matter decisions into a two-part test for assessing exceptions to what can be patented.[74]

The test's first step is to determine whether the patent at issue claims an ineligible abstract idea, law of nature, or physical

---

67. Alice Corp. v. CLS Bank Int'l, 573 U.S. 208, 216 (2014) (citation omitted).

68. U.S. CONST. art. I, § 8, cl. 8.

69. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 131 (1948).

70. *See* Ted G. Dane, *Are the Federal Circuit's Recent Section 101 Decisions a "Specific Improvement" in Patent Eligibility Law?*, 26 FED. CIR. B.J. 331, 332, 340, 359-60 (2017) (describing ongoing confusion about the state of patent eligibility law).

71. *See* Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 71 (2012) ("For all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas.").

72. *See* Ass'n Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 577 (2013) (holding that isolated DNA sequences were ineligible subject matter—they occur in nature—and thus could not be patented); *Mayo*, 566 U.S. at 72, 92 (holding that the patent at issue sought to claim laws of nature relating to appropriate drug dosages and thus fell outside the scope of patentable subject matter); Bilski v. Kappos, 561 U.S. 593, 598, 611-12 (2010) (concluding that a patent covering a method for hedging against risk in energy markets claimed a "fundamental economic practice long prevalent in our system of commerce" and was thus a mere "abstract idea" ineligible for patent protection).

73. 573 U.S. 208, 212, 227 (2014).

74. *Id.* at 217-18.

phenomena.[75] In the *Alice* decision itself, the Court confirmed some of its earlier decisions in indicating that "fundamental ... practice[s] long prevalent in our system of commerce" are clear examples of abstract ideas.[76] But the Court gave no further guidance about how the United States Patent and Trademark Office (USPTO) and future courts are to determine what constitutes such a fundamental practice (or, for that matter, how to determine what counts as a mere law of nature or physical phenomena).[77] The Court did suggest that if a patent claims "a building block of the modern economy," the patent is attempting to claim an ineligible abstract idea.[78] But again, the Court left it up to the USPTO and future courts to sort out what counts as such a building block and what does not.[79]

The *Alice* test's second step is to determine whether the patent claim involves an "inventive concept" sufficient to transform the ineligible abstract idea, law of nature, or physical phenomenon into a patent-eligible application.[80] Here, too, the Court fell short of providing clarity around what counts as an inventive concept.[81] The Court merely indicated that patents claiming ineligible concepts must include "additional featur[es]" so that "the [claim] is more than a drafting effort designed to monopolize the [abstract idea]."[82] In other words, patent applicants cannot simply recite the abstract idea "while adding the words 'apply it.'"[83] There must be "significantly more" than just the abstract idea, law of nature, or physical phenomenon.[84] Hence, because the Court concluded in *Alice* that the patent owner had merely described the abstract idea of intermediated settlement as implemented in a generic computing environment (without otherwise describing improvements to the underlying computer technology that implemented the idea), the patent claim failed to include an inventive concept sufficient to

75. *Id.* at 217.
76. *Id.* at 219 (citation omitted).
77. Clark D. Asay, *Patenting Elasticities*, 91 S. CAL. L. REV. 1, 45-46 (2017).
78. *Alice*, 573 U.S. at 220.
79. Asay, *supra* note 77, at 45-46.
80. *Alice*, 573 U.S. at 217-18.
81. Asay, *supra* note 77, at 46.
82. *Id.* at 224 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 77 (2012)).
83. *Id.* at 221 (citing *Mayo*, 566 U.S. at 72).
84. *Id.* at 225-26 (citing *Mayo*, 566 U.S. at 79).

transform the abstract idea of escrow services into patent-eligible subject matter.[85]

It is debatable what these decisions' collective impact will ultimately be; those questions remain an important part of an ongoing discussion about patent law's best way forward.[86] But the decisions have undoubtedly affected AI innovators and their patent prospects. In particular, *Alice*'s two-part test for assessing patentable subject matter has made patenting software innovations, including AI innovations, more challenging.[87] As some scholars have suggested, the *Alice* test's standards can be read to preclude most, if not all, existing software patents.[88] And because software is at the heart of AI inventions, *Alice* can often be read to preclude many if not all AI-related patents.[89]

For instance, it is quite possible to frame many AI-related inventions as simply abstract ideas implemented in generic computing environments, all without improving specific "computer capabilities."[90] In fact, prior to *Alice*, software patent drafters often purposefully focused patent claims on the invention's broader idea or function, rather than narrower technological improvements, in order to broaden the patent's scope and therefore make it more valuable.[91] Because of this, most, if not all, software patents—including

85. *Id.*

86. Congress, in fact, is currently considering amending patent law's patentable subject matter requirements in light of the Supreme Court's decisions described above. *See, e.g.*, Ryan Davis, *Sens. Appear Keen on Drafting New Patent Eligibility Law*, LAW360 (Dec. 17, 2018, 10:47 PM), https://www.law360.com/ip/articles/1112205/ [https://perma.cc/RNR3-54HG].

87. Jonathan Stroud & Derek M. Kim, *Debugging Software Patents After* Alice, 69 S.C. L. REV. 177, 178, 191, 205, 218 (2017) (discussing some of the difficulties post-*Alice* in patenting software, while noting that software patenting, despite these difficulties, remains robust).

88. Gene Quinn, *The Ramifications of* Alice*: A Conversation with Mark Lemley*, IPWATCHDOG (Sept. 4, 2014), https://www.ipwatchdog.com/2014/09/04/the-ramifications-of-alice-a-conversation-with-mark-lemley/id=51023/ [https://perma.cc/ZH34-2KRS].

89. *Artificial Intelligence: What It Is and Why It Matters*, SAS, https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html [https://perma.cc/59NL-HQSH] (describing how AI works and the vital role that software plays in how it works).

90. BSG Tech LLC v. BuySeasons, Inc., 899 F.3d 1281, 1286 (Fed. Cir. 2018) (framing the claim as the abstract idea of "considering historical usage information while inputting data," even though, when one reads the patent claims, the claims are certainly more detailed and less abstract than the court articulates).

91. *See* Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905, 907-08 (discussing how patent drafters in the software industry prior to *Alice* had increasingly claimed the broader function of their inventions, rather than the specific implementations, in order to gain more technical territory and thereby increase their

AI-related patents—obtained prior to *Alice* are likely suspect under the *Alice* test.[92]

The *Alice* test may be particularly challenging for AI patent seekers going forward. This is because by definition, many AI systems are meant to carry out some abstract idea or concept that humans would normally perform, just in a computing environment and with greater efficiency and precision.[93] Think, for instance, of Google's recently debuted Duplex technology, an AI personal assistant that makes real world calls on users' behalf for things such as restaurant reservations.[94] Making appointments on others' behalf is clearly a fundamental practice long prevalent in society—third-party agents have been engaging in this type of behavior for thousands of years. Hence, it would seem quite straightforward for the USPTO or a court to frame such an AI system as an ineligible abstract idea. Consequently, if Google were to seek patents on this technology, it may face challenges in describing the AI system as broadly as would be ideal, because doing so would lead to *Alice* problems.

This is not to say that patent drafters will fail to find ways to draft around these types of issues. Indeed, parties pursuing AI-related patents subsequent to *Alice* have the benefit of taking *Alice*'s admonitions into account, and patent prosecutors across the globe have begun developing drafting strategies to get around the *Alice* test's restrictions.[95] But it is to say that the nature of many AI

---

patents' values).

92. *See BSG Tech*, 899 F.3d at 1286-88 (analyzing Federal Circuit precedent under *Alice* step one to conclude that patent claims must specify something more specific than a generic computing function and that an abstract idea applied narrowly is insufficient).

93. *See, e.g.*, Timothy Geigner, *USPTO Suggests that AI Algorithms Are Patentable, Leading to a Whole Host of IP and Ethics Questions*, TECHDIRT (Apr. 30, 2018, 3:44 PM), https://www.techdirt.com/articles/20180419/10123139671/uspto-suggests-that-ai-algorithms-are-patentable-leading-to-whole-host-34 [https://perma.cc/W7MY-EMYZ] (arguing that AI algorithms are essentially laws of nature, or "math," that should not be patent eligible); Tom Simonite, *Despite Pledging Openness, Companies Rush to Patent AI Tech*, WIRED (July 31, 2018, 7:00 AM), https://www.wired.com/story/despite-pledging-openness-companies-rush-to-patent-ai-tech/ [https://perma.cc/5HH6-G7S2] (discussing some pushback to patenting AI techniques because "assigning legal ownership of relatively abstract ideas doesn't fit with the open progress" of recent AI innovations).

94. Jason Cipriani, *What Is Google Duplex?*, CNET (May 24, 2018, 4:09 PM), https://www.cnet.com/how-to/what-is-google-duplex/ [https://perma.cc/3BJT-DZYN].

95. *See, e.g.*, Babak Nouri, *A Realistic Perspective on Post-*Alice *Software Patent Eligibility*, IPWATCHDOG (Oct. 14, 2018), https://www.ipwatchdog.com/2018/10/14/realistic-perspective-

systems means that getting around the *Alice* test's first step may be particularly challenging and force patent drafters to write the patent claims in ways that limit their breadth and thus value.[96] Hence, while the *Alice* test's first step certainly has not foreclosed AI-related patents, it has made knowing how to obtain them and the prospect of eventually enforcing them more uncertain.[97]

The *Alice* test's second step exacerbates these concerns. Because one can characterize many AI systems as simply some abstract idea implemented in a typical computing environment, the second step's requirement that the patent go beyond merely applying or limiting the ineligible abstract idea to a particular technological environment[98] becomes challenging in many AI contexts. One can easily describe Google Duplex, for instance, as simply implementing the abstract idea of making appointments on behalf of others in a generic computing environment.[99] In fact, much of the media surrounding Google Duplex describes the technology in precisely those terms.[100] Hence, because the actual nature of many AI systems is simply a generic computing device, rather than a human, performing a variety of common practices, *Alice*'s second step also poses patenting challenges for AI innovators.

Of course, as with *Alice*'s first step, patent prosecutors have begun to develop strategies for getting around *Alice*'s second step.[101]

---

post-alice-software-patent-eligibility/id=101977/ [https://perma.cc/398E-RM6S] (recommending that practitioners clearly articulate technically distinct aspects to obtain software patents post-*Alice*); Gene Quinn, *How to Patent Software in a Post* Alice *Era*, IPWATCHDOG (Nov. 17, 2016), http://www.ipwatchdog.com/2016/11/17/patent-software-post-alice/id=74750/ [https://perma.cc/UUJ6-PFEL] (describing strategies to obtain software patents in spite of *Alice*).

96. John M. Rogitz, *Using Narrow Claim Breadth as a Sign of Software Patent-Eligibility*, IPWATCHDOG (July 26, 2016), http://www.ipwatchdog.com/2016/07/26/narrow-claim-software-patent-eligibility/id=71273/ [https://perma.cc/38CY-C55A] (discussing narrowing claims as a means by which to avoid application of *Alice*, as evidenced in several recent Federal Circuit rulings).

97. *See, e.g.*, Daniel Nazer, *Happy Birthday* Alice*: Four Years Busting Software Patents*, ELECTRONIC FRONTIER FOUND. (June 22, 2018), https://www.eff.org/deeplinks/2018/06/happy-birthday-alice-four-years-busting-software-patents [https://perma.cc/A494-N8Z8] (reviewing data showing greater difficulty in obtaining and enforcing software patents post-*Alice*).

98. *See* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208, 221 (2014).

99. *See* Cipriani, *supra* note 94.

100. *See id.*

101. *See* Steve Shumaker & Al Vredeveld, *Specific Improvements to Computer-Related Technology Are Not Abstract Under* Alice *101 Framework*, SHUMAKER SIEFFERT (May 2016), https://www.ssiplaw.com/news/201605/specific-improvements-computer-related-technology-

For instance, patent prosecutors have begun to emphasize specific technological improvements in patent claims.[102] By highlighting specific technological feats carried out in furtherance of implementing that idea, this strategy is meant to demonstrate that the patents claim more than simply an ineligible abstract idea implemented in a generic computing environment.[103] Instead, according to this approach, the claims highlight specific technological advances to the underlying computer technology itself.[104]

But while such strategies may ultimately succeed, they come with several drawbacks. First, these approaches are likely to narrow many AI-related patents significantly.[105] That narrowing may mean that in many AI contexts, including the development of more general, stronger forms of AI, parties will forego patenting their AI innovations, because the patents' narrowness means the patents are simply not valuable enough to pursue.[106] Second, as with the first step, much about how to pass the *Alice* test's second step remains uncertain, because courts are still in the early days of defining what is "significantly more" and goes beyond "well-understood, routine, conventional" methods.[107] In fact, the *Alice* decision's lack of concrete

---

are-not-abstract-under-alice-101 [https://perma.cc/D9U5-S85U].

102. In fact, doing so may mean that parties need not even deal with *Alice*'s second step, because that focus means the claims do not purport to claim an ineligible abstract idea, law of nature, or physical phenomenon. *See id.*

103. *See id.*

104. *Id.*

105. *See* Peter Glaser & William Gvoth, *Changes in Patent Language to Ensure Eligibility Under* Alice, IPWATCHDOG (Dec. 6, 2017), http://www.ipwatchdog.com/2017/12/06/changes-patent-language-ensure-eligibility-alice/id=90721/ [https://perma.cc/83DN-SF5B] (indicating that patent applicants have narrowed their claims and increased their technical disclosures in response to *Alice*).

106. *See* Todd Hixon, *For Most Small Companies Patents Are Just About Worthless*, FORBES (Oct. 4, 2013, 12:57 AM), https://www.forbes.com/sites/toddhixon/2013/10/04/for-most-small-companies-patents-are-just-about-worthless/ [https://perma.cc/A9YP-YMHX] (indicating how the narrowness of many patents diminishes their actual value, particularly for small companies).

107. *See* Alice Corp. v. CLS Bank Int'l, 573 U.S. 208, 215, 225 (2014) (citations omitted). These questions have a long history of answers in the context of other requirements under patent law, such as the novelty and nonobviousness requirements. *See generally* Mark A. Lemley, *Point of Novelty*, 105 NW. U. L. REV. 1253 (2011) (describing patent law's novelty requirement). But presumably patentable subject matter is supposed to answer these questions differently since it is technically a separate requirement. *Compare* 35 U.S.C. § 101 (2012), *with* 35 U.S.C. § 102 (2012). Because of this seeming conflation, some have argued that patent law's subject matter requirement should simply be eliminated. *See* Michael Risch,

guidance on this question means that subsequent case law on the question will remain in a state of some uncertainty, at least until and if the Supreme Court again decides to step in.[108]

Thus, patent law's current eligibility requirements pose an uncertain future for AI innovators' patent prospects. Many parties are likely to forego patent protection altogether because current eligibility requirements make patenting their innovations difficult and, in some cases, impossible.[109] Indeed, the lack of effective patent protection in the AI space may disincentivize at least some AI innovators from pursuing more far-reaching forms of AI development, if we are to believe predominant patent law theory. And even for those parties that could patent their AI-related innovations, doing so may not be worth it due to the likely narrowness of the resulting patent claims.[110] Overall, *Alice* thus points to a future of relatively narrow, uncertain AI-related patents. Because of these and other realities discussed below, some and perhaps many AI innovators are likely to opt to rely on other forms of protection, such as trade secrecy, as discussed in Part I.B. Or, as mentioned above, they may redirect their innovative capacities to areas where IP protection is more certain. And while less AI patenting may yield some positive results—fewer frivolous and abusive patent assertions, for instance—it may also contribute to lower levels of AI innovation overall, as discussed in Part II.

2. Disclosure Requirements

Patent law's disclosure requirements also pose challenges to AI innovators. Patent law requires those wishing to obtain a patent to disclose important details about their invention to the USPTO as part of the patent prosecution process.[111] These requirements

---

Everything Is Patentable, 75 TENN. L. REV. 591, 591 (2008).

108. The Supreme Court may not revisit its patent eligibility decisions, though, as some have argued. *See* David O. Taylor, *Amending Patent Eligibility*, 50 U.C. DAVIS L. REV. 2149, 2151 (2017) (arguing that Congress will need to amend patent eligibility requirements because the Supreme Court is unlikely to do so).

109. *See* Nazer, *supra* note 97; *see also* Hixon, *supra* note 106.

110. *See* Hixon, *supra* note 106.

111. Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 545-47 (2009) (discussing patent law's disclosure requirements).

include disclosing to the USPTO enough technical details about the invention so that a person ordinarily skilled in the field could replicate the invention without undue experimentation and recognize that the applicant is in possession of the claimed invention.[112] These provisions also require the applicant to draft the patent claims with enough precision so that a person ordinarily skilled in the relevant field can ascertain the scope of the claimed invention with reasonable certainty.[113]

These disclosures ultimately become part of the patent application and issued patent, if things get that far.[114] The USPTO generally publishes patent applications eighteen months after the application is filed even if the patent application does not ultimately result in an issued patent.[115] Issued patents are also eventually published.[116] Hence, as part of what many call the quid pro quo of obtaining a patent's rights of exclusion, the patentee must disclose to the public a significant amount of technical information relating to the patentee's invention.[117]

These disclosure requirements are an obstacle for all patent applicants. But they can be particularly difficult for AI developers to stomach for a number of reasons. First, as discussed above, the Supreme Court's recent patentable subject matter decisions have effectively forced AI patent applicants to disclose more technical details about their innovations and to narrow their claims to specific technological improvements to avoid rejections at the USPTO and invalidation later in the courts.[118] Yet disclosing that additional information and narrowing their claims can significantly undermine the patent's value because of the more circumscribed scope of the patent.[119] This may mean that, for many AI innovators, pursuing a

112. *Id.* at 546.
113. *See id.* at 547.
114. *See id.* at 546.
115. *See id.*
116. *See id.* at 555.
117. Fromer, *supra* note 111, at 553.
118. *See* Michael Borella, *On the Patent Eligibility of Machine Learning*, MANAGING INTELL. PROP., Dec. 17, 2018, at 3, ProQuest, File No. 2168785930 (indicating that those wishing to patent machine learning, an important form of AI, should focus on "well-defined technological need or advantage"); Glaser & Gvoth, *supra* note 105.
119. Stephen Key, *In Today's Market, Do Patents Even Matter?*, FORBES (Nov. 13, 2017, 4:45 PM), https://www.forbes.com/sites/stephenkey/2017/11/13/in-todays-market-do-patents-

patent on their AI innovations is simply not worth it, particularly if other forms of protection, such as trade secrecy and copyright, provide adequate protection. This may be particularly true for AI innovators pursuing more radical forms of AI innovation.

Second and related, for many AI systems, secrecy is a key competitive advantage.[120] Most of the foundational technology for modern-day AI systems has been around for some time.[121] Hence, for many commercial AI systems, it is the particular implementation of those public domain techniques that constitutes the real value of the system.[122] And, as others have documented, companies are often quite guarded in how and what they reveal about their AI systems to the public; they may wish to be particularly guarded about their innovations if they develop a more far-reaching implementation of a known AI technique.[123] Consequently, disclosing details about that implementation as part of the patenting process can undermine whatever competitive advantage the party has.

In days gone by, obtaining a patent on the implementation, while preserving many of the technical details as secrets, may have been more feasible.[124] But with the Supreme Court's recent patentable subject matter decisions, doing so is increasingly difficult because today's standards force AI innovators to disclose more information about their inventions than previously.[125] If a party does not pursue a patent on the particular implementation, conversely, details about the party's implementation are often safe from public view because the AI system may operate in the cloud or otherwise "behind closed doors," meaning that third parties, absent disclosure, have difficulty

---

even-matter/ [https://perma.cc/JM5H-69LV] (arguing that most patents are too narrow to even be valuable).

120. *See* PASQUALE, *supra* note 18, at 4-8 (describing the search, reputation, and finance sectors as relying on the secrecy of their AI systems as a key competitive advantage).

121. MICHAEL NEGNEVITSKY, ARTIFICIAL INTELLIGENCE: A GUIDE TO INTELLIGENT SYSTEMS 4-21 (2d ed. 2005) (describing how many of the foundational algorithmic techniques in use today were developed decades ago, but only more recently did the computing power and financial means necessary to implement them become available).

122. *See id.* at 14-17.

123. *See* PASQUALE, *supra* note 18, at 6-8.

124. *See* J. Jonas Anderson, *Secret Inventions*, 26 BERKELEY TECH. L.J. 917, 941 (2011) (describing how parties often both patent their inventions and preserve key technical details pertaining to those patented inventions as trade secrets).

125. Glaser & Gvoth, *supra* note 105.

figuring out how the AI system works.[126] Hence, patent law's disclosure requirements, particularly in light of current patent eligibility standards, mean that patenting AI-related inventions can significantly undermine a party's competitive advantages.

Again, fewer AI patents may certainly bring a number of benefits, including less frivolous and wasteful patent litigation and, generally, greater freedom to operate.[127] But again, if we are to believe predominant patent law theory, the lack of effective patent protection may disincentivize at least some parties from pursuing more radical forms of AI innovation. Yet even if incentives beyond patents push parties to continue to pursue AI innovation, the relative lack of AI patenting may contribute to a suboptimal path for AI innovation, as Part II will explore.

3. Novelty and Nonobviousness

AI developers also face challenges in patenting their innovations because of patent law's novelty and nonobviousness standards. The novelty requirement stipulates that an innovation must be new for it to be patented; a party technically cannot patent something that others have already invented.[128] Hence, if some invention is already available to the public—what patent law calls a "prior art reference"—and that available invention includes each element found in the patent applicant's invention, the patent application lacks novelty and will fail.[129]

The nonobviousness standard is related. It stipulates that a party cannot patent an invention if the invention is obvious in light of what others have already invented.[130] Hence, though no single prior

126. *See* PASQUALE, *supra* note 18, at 6-8 (discussing large corporations' efforts to keep their algorithms secret).

127. *See* F. Scott Kieff, *On Coordinating Transactions in Intellectual Property: A Response to Smith's Delineating Entitlements in Information*, 117 YALE L.J.F. 35 (2007), https://www.yalelawjournal.org/forum/on-coordinating-transactions-in-intellectual-property-a-response-to-smiths-delineating-entitlements-in-information [https://perma.cc/DGJ5-RWPG].

128. *See* Lemley, *supra* note 107, at 1255-56 (describing patent law's basic requirement that a patent application must claim something new).

129. *See* Gene Quinn, *Patentability: The Novelty Requirement of 35 U.S.C. 102*, IPWATCHDOG (June 10, 2017), http://www.ipwatchdog.com/2017/06/10/patentability-novelty-requirement-102/id=84321/ [https://perma.cc/AG8H-5HXZ].

130. 35 U.S.C. § 103 (2012) (setting forth patent law's nonobviousness requirement).

art reference may anticipate the patent applicant's invention—in other words, the applicant passes the novelty threshold—the applicant may still be denied a patent because the application is an obvious change to an invention or inventions that already exist.[131] Thus, a party may be denied a patent on an invention if the invention is an obvious improvement or combination of preexisting technologies, even if it is technically different from earlier existing inventions.[132]

As with the other patent law requirements reviewed, these conditions are obstacles for all patent applicants. But in the AI context, they may be particularly challenging. As previously mentioned, much of the foundational technology behind current AI systems has been available as part of the public domain for some time.[133] Indeed, some experts in the AI field complain that little if any real innovation is happening in the AI space today,[134] even if it is clear that uses of long-standing AI techniques have improved due to greater computational power and the availability of greater amounts of data.[135] Furthermore, the free and open source software (FOSS) movement,[136] a hugely successful collaborative approach to software development generally, is proving fruitful with respect to AI-related software as well, with both companies and others making significant pieces of AI-related software available to the public.[137]

---

131. *See generally* Daralyn J. Durie & Mark A. Lemley, *A Realistic Approach to the Obviousness of Inventions*, 50 WM. & MARY L. REV. 989 (2008) (discussing the obviousness requirement).

132. *See id.* at 990, 1000-02.

133. *See* Jordan, *supra* note 1 (arguing that much of the current AI innovation is spearheaded by large technology companies who focus on specific engineering tasks and rely on algorithmic techniques that have been in use since at least the 1980s); *see also* Rockwell Anyoha, *The History of Artificial Intelligence*, SCI. NEWS (Aug. 28, 2017), http://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/ [https://perma.cc/EES3-FF7U] (noting that AI algorithms have not improved much in the last several decades, but improvements in computing capacity and access to troves of data have allowed for advances in narrow forms of AI).

134. *See* Jordan, *supra* note 1.

135. Anyoha, *supra* note 133.

136. *Free and Open-Source Software (FOSS)*, TECHNOPEDIA, https://www.techopedia.com/definition/24181/free-and-open-source-software--foss [https://perma.cc/7KY4-3Z4Y].

137. CBINSIGHTS, WHAT'S NEXT IN AI?: ARTIFICIAL INTELLIGENCE TRENDS 6 (2019) (describing the success of several AI FOSS projects); Sam Dean, *Open Source AI for Everyone: Three Projects to Know*, LINUX FOUND. (May 10, 2018), https://www.linuxfoundation.org/blog/2018/05/open-source-ai-for-everyone-three-projects-to-know/ [https://perma.cc/DA4U-JPEF]

This trend, too, means that AI innovators wishing to patent their AI inventions have a larger pool of prior art to overcome.

Hence, those seeking AI-related patents may fail because their implementations of long-standing AI techniques are not actually new—they rely on a number of basic AI techniques that have been in use for some time, including in the context of FOSS projects.[138] Or, even, if these patent seekers pass the novelty threshold, their innovations may often be obvious in light of the basic algorithmic techniques AI researchers provided to the public long ago (for instance, as already implemented in various FOSS projects).[139] Even if a company implements those technologies in a commercially useful way, patents on those implementations may often be obvious, even when the implementations at scale are technically new.[140]

These realities may mean that for those parties who pursue and obtain patents on their AI innovations, the resulting patents may often be quite narrow. This is not to say that pioneering AI innovation is impossible.[141] Indeed, the novelty and nonobviousness requirements may be less significant hurdles for those pursuing more radical forms of AI innovation because stronger forms of AI would presumably pass these thresholds. But it is to say that for those parties that mostly recycle preexisting AI technologies—which, according to some, is much of what is currently happening in the AI industry[142]—any patents that they obtain are likely to be significantly restricted in their scope. And such narrow patenting outcomes are only more likely because of the patentable subject matter and disclosure requirements discussed above. Hence, because innovation is typically incremental, the lack of robust patent protections for AI innovation in these early days may inhibit

(discussing some of the success of the FOSS movement with respect to AI-related software).

138. *See* Anyoha, *supra* note 133 (discussing how the fundamental techniques of AI coding have not changed for decades).

139. *See id.*

140. *See, e.g.*, Khari Johnson, *AI Weekley: Computing Power Is Shaping the Future of AI*, VENTUREBEAT (May 18, 2018, 7:14 PM), https://venturebeat.com/2018/05/18/ai-weekly-computing-power-is-shaping-the-future-of-ai/ [https://perma.cc/F7NY-Z7B2] (discussing how advances in computing power have resulted in much of the recent progress in AI innovation, rather than new or revolutionary AI techniques).

141. *See* Jordan, *supra* note 1 (making pleas for such pioneering AI innovation).

142. *See id.* (discussing how most of modern AI technology is what has been called machine learning for decades and how progress towards human-imitative AI is lagging).

developments that ultimately lead to more general, stronger forms of AI.

Of course, these novelty and obviousness issues may not prevent many parties from actually obtaining AI patents if they so desire. This is so for at least two reasons. First, the USPTO mostly looks to prior patents when examining prior art.[143] But much of the relevant prior art in the AI space is not actually patented, so that USPTO examiners may often miss important pieces of AI prior art entirely when assessing AI-related patent applications.[144] In fact, this has been a long-standing complaint with regards to software patents more generally.[145] Hence, patent applicants may still obtain patents on AI technologies that have existed for some time, as has already been happening in the broader software space.[146]

Second and related, patent applicants have the upper hand in obtaining patents, particularly if they are willing to spend the time and money to fight it out with the USPTO.[147] For instance, patent applications are never actually finally rejected unless a patent applicant opts to abandon the application or simply ceases pursuing it.[148] Furthermore, the onus is on the USPTO examiner to provide reasons for rejection, meaning that well-resourced applicants can often eventually wear down examiners into submission.[149]

---

143. Clark D. Asay, *Enabling Patentless Innovation*, 74 MD. L. REV. 431, 484 (2015).

144. *Id.* at 450.

145. JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 160-64 (2008).

146. Jeremy Gillula & Daniel Nazer, *Stupid Patent of the Month: Will Patents Slow Artificial Intelligence*, ELECTRONIC FRONTIER FOUND. (Sept. 29, 2017), https://www.eff.org/deeplinks/2017/09/stupid-patent-month-will-patents-slow-artificial-intelligence [https://perma.cc/7EEP-A45D].

147. Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 68 (2004) ("There is no way an examiner can ever cause a determined applicant to go away, although allowing the applicant's patent claims increases the chance that the case will finally be disposed of.").

148. *See id.* at 64 ("One of the oddest things about the United States patent system is that it is impossible for the U.S. Patent and Trademark Office ... to ever finally reject a patent application."); Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 607 (1999) ("Because of the nature of prosecution procedure, 'final' rejections do not in fact always result in the end of the examination; post-'final' action amendments and the like are often permitted.").

149. Lemley & Moore, *supra* note 147, at 64 (discussing how applicants can abuse the continuation process to evade rejections and keep their patent applications alive as long as they wish).

But while applicants have some advantages at the USPTO, enforcing those same patents can present a number of challenges. For one, patent infringement defendants are strongly motivated to find all relevant prior art in defending themselves, and, thus, are more likely to identify the troves of nonpatented AI-related prior art in countering that the asserted patents lack novelty or are obvious in light of that prior art.[150] Second, even though patent owners may succeed in browbeating the USPTO into submission, the resulting patents are often still likely to be narrow such that asserting them successfully against defendants is difficult.[151] Finally, in addition to the traditional court system, defendants have a number of other administrative options for having AI-related patents reviewed and ultimately invalidated.[152] Indeed, some have referred to these administrative procedures for assessing the validity of patent claims as "Patent Death Squad[s]" because they have proven so effective in invalidating patent claims, particularly software patents.[153] Hence, patent law's novelty and nonobviousness requirements, while not foreclosing the possibility of obtaining patents on the road to stronger forms of AI, certainly make that road more difficult.

4. Patenting Elasticities

Despite these possible effects on AI patenting, it should be emphasized that not all patent applicants will be affected equally. In prior work, I have argued that parties exhibit different levels of demand for patents based on their relative resources.[154] For instance, large, well-resourced companies derive much of their value

150. Andrew M. Solomon et al., *Defending a Patent Infringement Case by Finding Unusual Prior Art*, ACC DOCKET, Oct. 2011, at 63, 63-68 (describing several instances of defendants exerting significant efforts to locate atypical sources of prior art in defending against patent infringement claims).

151. Key, *supra* note 119.

152. Paul R. Steadman et al., *Post-Issuance Patent Review*, INTELL. PROP. MAG., Nov. 2011, at 99, 100-02 (discussing a variety of patent review mechanisms that the America Invents Act introduced in 2011).

153. Charles Sauer, *Anti-Innovation Patent Tribunal Is Begging SCOTUS to Check Its Power*, THE HILL (Oct. 19, 2017, 3:30 PM), https://thehill.com/opinion/judiciary/356267-anti-innovation-patent-tribunal-is-begging-scotus-to-check-its-power [https://perma.cc/7W5M-HR82]; *see* Jasper L. Tran, *Two Years After* Alice v. CLS Bank, 98 J. PAT. & TRADEMARK OFF. SOC'Y 354, 358-59 (2016) (pointing to high invalidation rates of software patents at the PTAB).

154. Asay, *supra* note 77, at 6-9, 13-16.

from patents in large aggregations.[155] Hence, the narrowness or strength of a particular patent in that large portfolio is not terribly important to such a company; it is the aggregate effect of that large portfolio that really matters.[156] Furthermore, the costs of patenting are only a small proportion of such an entity's overall resources, meaning that fluctuations in those costs are less likely to affect their patenting decisions.[157] Consequently, large, well-resourced companies tend to pursue large numbers of patents as a matter of course, with their demand for such patenting exhibiting little to no change in response to fluctuations in patent law standards.[158]

Smaller, more poorly resourced entities, on the other hand, are more likely to exhibit greater fluctuations in their demand for patents.[159] For instance, increased costs of patenting are more likely to diminish such parties' appetite for patents, because those increased costs would end up consuming a larger proportion of their overall resources and, thus, possibly get in the way of other, more vital business objectives.[160] The relative costs (and value) of patents is, therefore, much more likely to matter to such entities, particularly if other forms of protection are less costly and provide similar—or perhaps even greater—advantages.

Consequently, the downsides of the current patent system as they relate to AI innovation may disproportionately affect poorly resourced AI innovators: the growing relative costs of patenting may push increasingly more such parties to forego seeking patents on their AI innovations, instead relying on other forms of protection when available, while their larger, well-resourced competitors go about their patenting business as usual. Or, the downsides of patenting may push poorly resourced parties out of the AI space altogether. In fact, recent AI-related patenting data provide some substantiation to these concerns, with a vast majority

155. *Id.* at 15-16, 26-27.

156. *Id.* at 26-27.

157. *Id.*

158. *Id.* at 15-18. *See generally* Mark A. Lemley, *The Surprising Resilience of the Patent System*, 95 TEX. L. REV. 1 (2016) (arguing that the patent system in general, including demands for patents, the number issued, and the number of lawsuits filed, exhibits very little change in response to changes in patent law standards).

159. Asay, *supra* note 77, at 7, 9, 13-14.

160. *Id.* at 12-15.

of recent AI-related patenting activity owing to large, multinational companies.[161] Of course, large firms own the vast majority of patents in most fields of innovation,[162] so this data certainly does not prove the above hypothesis. But other patenting data suggest that poorly resourced companies decrease their patenting rates more than their well-resourced counterparts in response to difficult economic circumstances.[163] It stands to reason, then, that the growing relative costs of AI patenting are more likely to diminish poorly resourced parties' demand for patents than the patenting activities of their well-resourced competitors. And, to the extent that poorly resourced AI inventors decrease their AI-related patenting while large firms maintain or even increase theirs, that reality is likely to have important repercussions on the overall organization of the AI industry, as discussed in Part II below.

5. Summary

In sum, while AI-related patenting is unlikely to grind to a halt anytime soon,[164] current patent law realities may frequently curb some AI developers' patenting enthusiasm for at least three interrelated reasons. First, recent developments in patent law's subject matter requirement have made it more difficult to obtain AI-related

161. Michael Webb et al., *Some Facts of High-Tech Patenting* 2, 14, 25 (Nat'l Bureau of Econ. Research, Working Paper No. 24793, 2018), https://www.nber.org/papers/w24793.pdf [https://perma.cc/7YQB-L273]; *see also* Dean Alderucci et al., *Mapping the Movement of AI into the Marketplace with Patent Data* 3, https://www.cmu.edu/block-center/images/center-images/AI-patent-project-media-summary.pdf [https://perma.cc/NB48-Z6WJ] (showing that the vast majority of AI-related patents are obtained by large, multinational firms, while also noting that a large number of start-ups have recently patented AI-related innovations, though clearly in lower overall numbers).

162. *See, e.g.*, Anthony Breitzman, *Patent Trends Among Small and Large Innovative Firms During the 2007-2009 Recession*, ROWAN DIGITAL WORKS 4, 10 (May 2013), https://rdw.rowan.edu/cgi/viewcontent.cgi?article=1039&context=csm_facpub [https://perma.cc/S9LG-36U6] (finding that small firms owned between 5-8 percent of total patents in the study, whereas larger firms in the study owned over 80 percent of the patents); Samuel Stebbins, *The World's 50 Most Innovative Companies*, USA TODAY (Jan. 12, 2018, 8:00 AM), https://www.usatoday.com/story/money/business/2018/01/12/worlds-50-most-innovative-companies/1023095001/ [https://perma.cc/F75B-SPQ2] (describing the top fifty patent grantees from the year 2017, each of which obtained hundreds and in some cases thousands of patents that year, and all of which are large, multinational companies).

163. Breitzman, *supra* note 162, at 4, 16.

164. Webb et al., *supra* note 161, at 5-7 (showing a recent surge in AI-related patenting).

patents.[165] And while parties may still succeed in obtaining such patents, those patents are likely to be narrower than ideal.[166] Second, patent law's disclosure requirements put some AI developers in a bind because the secrecy of many AI systems is a significant competitive advantage.[167] Though in the past parties have patented inventions while withholding key technical details about the invention from the patent application, recent patent law developments make doing so increasingly difficult.[168] Third, patent law's novelty and nonobviousness requirements may be particularly challenging for many AI innovators because so much of what passes for AI innovation today is simply implementations of common AI techniques in environments enabled by growth in computing power.[169] And while determined AI innovators may still obtain patents, those patents may be technically invalid or otherwise narrower than ideal in light of the existing prior art. Furthermore, these prior art realities are more likely to come to light given new administrative procedures for reviewing and invalidating issued patents.[170]

Of course, these patenting obstacles may yield some positive results, such as less frivolous patent litigation and greater freedom to operate generally.[171] Those results, in turn, may help propel the AI industry towards greater levels of AI innovation. Yet the patenting realities discussed above also seem more likely to deter smaller entities from patenting their AI innovations than larger firms, or motivate them to get out of the AI game altogether.[172] And that possibility may have important industrial organization and AI innovation implications, as discussed in greater detail in Part II, including inhibiting more radical forms of AI innovation.

165. *See* Tull & Miller, *supra* note 36, at 315-17.
166. *See* Key, *supra* note 119.
167. *See* PASQUALE, *supra* note 18, at 3-9.
168. *See* Hockett & Teplitskiy, *supra* note 36.
169. *See* Anyoha, *supra* note 133.
170. *See* Steadman et al., *supra* note 152, at 100-02.
171. *See* Kieff, *supra* note 127.
172. Asay, *supra* note 77, at 12-13.

B. Trade Secrecy

Trade secrecy is another form of legal protection upon which many AI developers rely.[173] Like patent law, trade secrecy finds its major justification in incentivizing parties to undertake socially beneficial activities, such as investing in the development of valuable information that, absent trade secret protection, parties may be reluctant to pursue.[174] Ironically, trade secrecy may also encourage parties to disclose their secret information to third parties in pursuit of any number of commercial objectives.[175]

Trade secrecy is often treated as the primary alternative to patent protection;[176] parties choose one or the other, but they cannot choose both.[177] Scholars, however, have shown that parties are sometimes able to obtain patents while still protecting some of the related information as trade secrets.[178] Such "double-dipping" certainly remains available with respect to important parts of AI systems, particularly the data used to train the AI systems, which is outside the scope of patent protection.[179] But as we have seen, recent

173. David A. Prange & Alyssa N. Lawson, *Re-Evaluating Companies' AI Protection Strategies*, MANAGING INTELL. PROP. 35-38 (Jan. 29, 2018), http://www.managingip.com/Article/3783768/Re-evaluating-companies-AI-protection-strategies.html [https://perma.cc/V62S-VSXU] (discussing the merits of trade secret protection with respect to AI inventions); Cullen Taylor, *AI Meets IP*, PHARMATIMES ONLINE (Apr. 2018), http://www.pharmatimes.com/magazine/2018/may_2018/ai_and_ip [https://perma.cc/BM56-RXRG] (noting that many AI developers use trade secrecy to protect their algorithms, while noting that AI itself may pose threats to this strategy by allowing the algorithms to be reverse engineered).

174. Ian Johnson, *Trade Secrets: Protecting Innovation and Building Value*, CPA GLOBAL (Apr. 16, 2018), https://www.cpaglobal.com/cpa-global-blog/trade-secrets-protecting-innovation-and-building-value [https://perma.cc/LC4H-9XE7]. Another venerable line of thinking justifies trade secret protection as a means of deterring wrong-doing, thus sounding in tort principles.

175. Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 336 (2008) (arguing that trade secret law is actually designed to encourage parties to disclose their trade secrets to others).

176. *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 487-88 (1974) (discussing the choice between patents and trade secrecy).

177. Lobel, *supra* note 39 ("Patents and trade secrets present opposing choices.").

178. Anderson, *supra* note 124, at 941; Simon & Sichelman, *supra* note 37 (describing circumstances in which patents covering data-generating inventions allow the inventors to maintain secrecy with respect to the valuable data while patenting the means by which to obtain that data).

179. Price, *supra* note 31, at 1433 ("Sets of data are not generally protectable with patents or copyrights in the United States, but can be kept secret."). *But see* Anderson, *supra* note 124, at 972 & n.282.

patentable subject matter developments, coupled with patent law's disclosure requirements, are forcing AI developers to more frequently make a dichotomous choice as to which form of protection they prefer.[180]

Going forward, more AI developers may choose trade secrecy over patents because of trade secrecy's relative advantages.[181] To understand these advantages, it is vital to understand some of the primary differences between patent protection and trade secrecy, as described below.

1. Threshold for Protection

First, parties do not pursue trade secrecy in the same way that parties pursue patents; unlike patent law, there is no costly, stringent application process for trade secrecy.[182] Instead, a party generally qualifies for trade secret protection in both federal and state courts if the information they wish to protect has commercial value, is not generally known, is not readily ascertainable, and the party has undertaken reasonable precautions to protect the secrecy of the information.[183]

Courts and commentators generally view these standards as more lax than patent law's related requirements; for instance, trade secrecy's nonascertainable and generally unknown requirements are typically regarded as less demanding than patent law's related novelty and nonobviousness standards.[184] In fact, multiple parties

180. *See, e.g.*, Glaser & Gvoth, *supra* note 105 (highlighting a number of metrics showing that, post-*Alice*, patent seekers have increased their patent disclosures and narrowed their claims, with one implication being that maintaining previously undisclosed information as trade secrets is now off the table); Prange & Lawson, *supra* note 173, at 35 (indicating that recent changes in U.S. patent law are pushing more AI innovators to choose trade secrecy over patent protection).

181. *See* Prange & Lawson, *supra* note 173, at 35-38 (discussing several of these advantages).

182. Anderson, *supra* note 124, at 925 (noting that trade secrecy "requires no legal formalities to obtain exclusionary rights," whereas patent protection "involves a lengthy, expensive process").

183. UNIF. TRADE SECRETS ACT § 1(4) (amended 1985) (setting forth the requirements for trade secrecy, which the vast majority of states have adopted).

184. *See, e.g.*, Cataphote Corp. v. Hudson, 422 F.2d 1290, 1293-94 (5th Cir. 1970) (indicating that relative novelty is all that is required for trade secret protection); Amberley Co. v. Brown Co., No. 5407, 1967 WL 7522, at *11 (S.D. Ohio, Dec. 21, 1967) (holding that the

can technically maintain the same trade secrets simultaneously, whereas multiple parties cannot technically maintain patents on the same invention.[185] Furthermore, recent federal law changes may have slightly increased the scope of what parties can protect as trade secrets.[186] Hence, unlike the shrinking scope of patent protection, trade secrecy provides AI developers with a potentially broader scope of protection in both federal and state courts.[187]

This broader scope of protection may be particularly advantageous to AI innovators for a number of reasons. For starters, as alluded to above, that broader scope can provide legal protection to parts of AI systems that are outside the patent system's ambit, such as the training data upon which many AI systems rely.[188] But even for parts of AI systems that are otherwise patentable, trade secrecy's broader scope can more readily encompass many elements of AI systems than patent law. For instance, because much of the foundational AI technology is in the public domain, parties that implement that technology, even in new contexts, may face uncertain patenting prospects in light of patent law's novelty and nonobviousness standards.[189] That uncertainty could mean that many modern-day implementations fail one or both of these requirements. Or, even if an AI inventor is able to surmount both, the public

---

plaintiff had clearly met the novelty threshold for patentability, "let alone [for] trade secrecy"); Eric R. Claeys, *Private Law Theory and Corrective Justice in Trade Secrecy*, 4 J. TORT L. 1, 35 n.170 (2011) ("[P]atent's novelty, utility, and non-obviousness requirements are more demanding than trade secrecy's non-ascertainability requirement.").

185. Chris Kokoska et al., *Trade Secrets: Intellectual Property Considerations and Guidance for Start-Ups*, IPWATCHDOG (Nov. 3, 2018), https://www.ipwatchdog.com/2018/11/03/trade-secrets-intellectual-property-considerations-start-ups/id=102912/ [https://perma.cc/C59L-L658] ("Multiple parties may share the same trade secret, but a trade secret ceases to exist when it becomes common knowledge."). Patent law, by contrast, only allows one patent per invention, in accordance with its novelty requirement. *See* Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 922-24 (2011) (discussing patent law's novelty requirement).

186. Eric Goldman, *The New 'Defend Trade Secrets Act' Is the Biggest IP Development in Years*, FORBES (Apr. 28, 2016, 1:04 PM), http://www.forbes.com/sites/ericgoldman/2016/04/28/the-new-defend-trade-secrets-act-is-the-biggest-ip-development-in-years [https://perma.cc/UB3Q-RMDW] (discussing how recent federal trade secret law changes have supplemented typical state law trade secret protections with more federal options).

187. *See id.* ("Trade secret owners will win more cases.").

188. *See* Christian Ehl, *Data—The Fuel for Artificial Intelligence*, MEDIUM (Jan. 14, 2018), https://medium.com/@cehl/data-the-fuel-for-artificial-intelligence-ed90bf141372 [https://perma.cc/2GZG-L9RL] (discussing the importantance of training data for many AI systems).

189. *See supra* Part I.A.3.

domain status of the foundational AI techniques underlying the AI innovations may mean that any patents the innovator does obtain are quite narrow (and thus less valuable).[190]

Trade secrecy, on the other hand, provides such parties legal coverage under its less demanding standards, as discussed above. While it is no small feat to win a trade secret misappropriation claim,[191] parties can nonetheless successfully press such claims despite their trade secrets lacking novelty or being obvious under patent law standards.[192] If a former employee left one AI company for another, for instance, and shared how her previous employer implemented a number of public domain AI techniques, the former employer could successfully mount a trade secret claim against the former employee and the new employer if the shared information otherwise qualified as a trade secret.[193] And this would be so even if that implementation lacked novelty or was obvious in light of the current state of AI technologies.

2. (Non)Disclosure Requirements

A second important difference between trade secrecy and patent law relates to disclosure requirements (or lack thereof) under each regime. Unlike patent law, trade secret protection allows, and even requires, parties to maintain their inventions as secrets.[194] In fact, failing to do so eliminates trade secret protection going forward.[195] Hence, for AI innovators that derive significant competitive advantages by maintaining the secrecy of their systems—and much evidence suggests this is true for many AI innovators—trade secrecy can be much more advantageous than patent protection.[196]

---

190. *See supra* Part I.A.3.

191. *See* James Morando, *Defending Trade-Secret Claims*, FARELLA BRAUN & MARTEL LLP (2008), https://www.fbm.com/content/uploads/2019/01/6154c86f-0cf6-42d3-8037-5c2f2cb0822f_document.pdf [https://perma.cc/R9SU-F47N] (explaining that trade secret litigation is often just as costly as patent litigation).

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

193. *See* David S. Almeling, *Seven Reasons Why Trade Secrets Are Increasingly Important*, 27 BERKELEY TECH. L.J. 1091, 1101 (2012) (noting that former employees are the most likely party to be sued under a trade secret misappropriation claim).

194. *See* UNIF. TRADE SECRETS ACT § 1(4) (amended 1985).

195. *See* Asay, *supra* note 77, at 22.

196. *See* PASQUALE, *supra* note 18, at 82 (explaining Google's competitive advantage by

Of course, for certain types of products and services, maintaining trade secrecy can be difficult. And those difficulties may push some innovators to pursue patents instead of trade secrecy. For instance, if a party sells a product on the open market that incorporates or otherwise exposes its trade secrets, then third parties purchasing those products may be able to gain access to the trade secrets through observation or reverse engineering.[197] And doing so typically does not count as a trade secret misappropriation, whereas it is more likely to count as patent infringement if a patent is in place.[198] Furthermore, if a trade secret is disclosed, even inadvertently or through a breach of confidence, putting the genie back into the trade secret bottle is often impossible.[199]

While these types of risks may push some AI innovators to choose patent protection over trade secrecy, in many AI contexts such risks are less of a concern. For instance, because much of modern computing happens in the cloud,[200] many AI innovators need not directly provide the public with products incorporating their AI-related trade secrets. Instead, those secrets are often relatively safe on the party's servers, from where the AI service is provided to third parties as a hosted service.[201] Hence, the risk of those trade secrets being exposed, whether through observation or reverse engineering, is less. In fact, because of the lack of transparency surrounding AI systems in a number of important industries, some scholars have complained that such AI systems are a "black box."[202]

---

keeping their methods secret); Vincent Manancourt, *Trade Secrets Better Suited to AI Inventions than Patents, Experts Say*, GLOBAL DATA REV. (Oct. 31, 2018), https://globaldatareview.com/article/1176313/trade-secrets-better-suited-to-ai-inventions-than-patents-experts-say [https://perma.cc/6UJF-8YXX] (discussing a number of reasons that experts offer in favor of maintaining trade secrecy for AI inventions, rather than pursuing patents).

197. *See* Anderson, *supra* note 124, at 924-25.

198. *Id.*

199. *See id.*

200. Steve Ranger, *Cloud Computing Will Virtually Replace Traditional Data Centers Within Three Years*, ZDNET (Feb. 6, 2018, 11:16 AM), https://www.zdnet.com/article/cloud-computing-will-virtually-replace-traditional-data-centers-within-three-years/ [https://perma.cc/4MHH-HJDJ] (discussing the dominance of cloud services).

201. Janakiram MSV, *The Rise of Artificial Intelligence as a Service in the Public Cloud*, FORBES (Feb. 22, 2018, 10:13 AM), https://www.forbes.com/sites/janakirammsv/2018/02/22/the-rise-of-artificial-intelligence-as-a-service-in-the-public-cloud/ [https://perma.cc/Z3CJ-V5MD] (discussing the rise of AI as a hosted service).

202. PASQUALE, *supra* note 18, at 3.

Furthermore, while the risk of rogue former employees taking an AI company's secrets to a competitor is real, the complexity of many AI implementations can help reduce that risk by making it more difficult for any given employee to walk away with everything needed to run the AI system.[203] In fact, in general the world economy is dogged by a shortage of technologists capable of understanding and implementing AI techniques in modern commercial environments.[204] While this reality may increase AI employee mobility as firms fight over available talent (and thus contribute to trade secret leakages), the fact remains that top-end AI talent capable of fully understanding modern-day AI implementations remains sparse.[205]

Consequently, while the risk of disclosure may persuade some AI innovators to choose patents over trade secrecy, the certainty of disclosure under patent law is likely to deter many AI innovators from choosing such a path. This may be particularly so where the risks of disclosure are diminished, as they are with many AI products and services that operate behind closed, highly complex doors.

3. Duration

A third difference between trade secrecy and patent protection relates to duration. Trade secrecy can technically last forever.[206] Unlike patent protection, which lasts twenty years from the date of filing, trade secrecy has no set duration, so long as the information remains valuable, is not generally known or readily ascertainable,

---

203. *See, e.g.*, Dave Gershgorn, *AI Is Now So Complex Its Creators Can't Trust Why It Makes Decisions*, QUARTZ (Dec. 7, 2017), https://qz.com/1146753/ai-is-now-so-complex-its-creators-cant-trust-why-it-makes-decisions/ [https://perma.cc/A28P-ZT3S] (discussing how complicated modern AI systems have become).

204. Bernard Marr, *The AI Skills Crisis and How to Close the Gap*, FORBES (June 25, 2018, 2:10 AM), https://www.forbes.com/sites/bernardmarr/2018/06/25/the-ai-skills-crisis-and-how-to-close-the-gap/ [https://perma.cc/K5ZH-U7H3].

205. Cade Metz, *Tech Giants Are Paying Huge Salaries for Scarce A.I. Talent*, N.Y. TIMES (Oct. 22, 2017), https://www.nytimes.com/2017/10/22/technology/artificial-intelligence-experts-salaries.html [https://perma.cc/S8C2-65GZ] (noting that "[i]n the entire world, fewer than 10,000 people have the skills necessary to tackle serious artificial intelligence research," while the number of industries seeking such talent continues to expand).

206. Anderson, *supra* note 124, at 924.

and the trade secret owner continues to employ reasonable precautions in protecting the information.[207] In fact, the owners of Coke have maintained its recipe as a trade secret under lock and key for nearly one hundred years.[208]

In many cases, twenty years of protection may be more than sufficient, particularly in the fast-paced world of AI innovation.[209] But in others, the lure of possible infinite duration, or even shorter-term secrecy, may be more attractive than the patent alternative and its disclosure requirements, particularly if that secrecy enhances a party's lead-time advantages.[210] Indeed, delays at the USPTO can sometimes mean that a party's secrets are disclosed before patent protection is in place, and the lifespan of some AI innovations may not even be as long as that gap in protection.

4. Patenting Elasticities Revisited

Trade secrecy can present AI innovators with a number of advantages vis-à-vis patent protection, as discussed above. And while in some cases AI innovators may be able to maintain patent protection and trade secrecy simultaneously, recent developments in patent law point to a future of more binary patent-trade secrecy decisions.[211]

The resources available to an AI innovator, furthermore, seem likely to affect which choice that innovator makes. As discussed earlier, cash-strapped AI innovators, such as many start-up companies, seem more likely to decrease their patenting activities as the relative costs of patents rise (and, impliedly, the relative value of the

207. *Id.*; *see* UNIF. TRADE SECRETS ACTS § 1(4) (amended 1985).

208. Anderson, *supra* note 124, at 924; Ivana Kottasova, *Does Formula Mystery Help Keep Coke Afloat?*, CNN (Feb. 19, 2014, 7:55 AM), http://edition.cnn.com/2014/02/18/ business/coca-cola-secret-formula/index.html [https://perma.cc/LED3-P3AZ].

209. Chad Steelberg, *Why Artificial Intelligence Will Shift Human Innovation into Overdrive*, FORBES (May 10, 2018, 7:45 AM), https://www.forbes.com/sites/forbestechcouncil/2018/05/10/why-artificial-intelligence-will-shift-human-innovation-into-overdrive/ [https://perma.cc/23QT-S4NS] (discussing how AI generally increases the speed of innovation).

210. *See* PASQUALE, *supra* note 18, at 82-83 (discussing how in the search, reputation, and finance industries, maintaining trade secrecy with respect to their AI systems is a key competitive advantage).

211. *See* David S. Levine & Ted Sichelman, *Why Do Startups Use Trade Secrets?*, 94 NOTRE DAME L. REV. 751, 810 (2018) (finding that tech start-ups generally show a preference for secrecy over patenting).

patents decreases).[212] The natural and primary beneficiary of such choices is trade secrecy.[213] Indeed, the natural advantages of trade secrecy vis-à-vis patent protection—being able to maintain the innovations as secrets, despite a lack of novelty and being obvious, for a possibly infinite period of time—are only likely to reinforce such decisions for many poorly resourced companies.[214]

Well-capitalized parties, on the other hand, are less likely to be concerned with the rising relative costs of patenting when choosing between patents and trade secrecy. In many cases, trade secrecy's relative advantages are certain to persuade some such parties to choose it over patent protection, regardless of the relative costs.[215] But in situations where trade secrecy's advantages are less clear, the rising relative costs of patenting are likely to play little to no role in affecting the party's IP decision. Hence, well-capitalized parties seem more likely to patent some AI innovations that poorly capitalized parties, because of the rising relative costs of patenting, would not.[216] In Part II, I return to this theme in assessing how, collectively, this dynamic is likely to affect AI's industrial structure and overall levels of AI innovation.

C. Copyright

Copyright is another form of intellectual property protection that can be important to AI developers.[217] Of the three forms of legal protection discussed in this Article, copyright is in some ways the easiest to obtain. Copyright automatically subsists in any original

---

212. *See supra* Part I.A.3.

213. For a review of why start-up companies often pick trade secrecy, see generally Levine & Sichelman, *supra* note 211.

214. *See generally id.*

215. *See* David S. Levine, *Confidentiality Creep and Opportunistic Privacy*, 20 TUL. J. TECH. & INTELL. PROP. 11, 20, 25, 27 (2017) (discussing the lure of secrecy in general for many companies); David S. Levine, *Secrecy and Unaccountability: Trade Secrets in Our Public Infrastructure*, 59 FLA. L. REV. 135, 145-50 (2007) (discussing how large companies that provide critical infrastructure often rely on trade secrecy because of its advantages to the company).

216. *See* Levine & Sichelman, *supra* note 211, at 761-62.

217. Andrea Weiss Jeffries & Emily J. Tait, *Protecting Artificial Intelligence IP: Patents, Trade Secrets, or Copyrights?*, JONES DAY: INSIGHTS (Jan. 2018), https://www.jonesday.com/en/insights/2018/01/protecting-artificial-intelligence-ip-patents-trad [https://perma.cc/W8EU-LC6U] (discussing some of the ways in which copyright applies to elements of AI systems).

work of authorship that is fixed in some tangible medium for more than a transitory period.[218] Basically, a party need merely create an original work of authorship for copyright to apply.[219] Hence, unlike patent protection, parties need not formally apply for copyright protection.[220] Nor need parties demonstrate that the work is novel and nonobvious in light of what others have already done, as patent law requires.[221] The work must merely include some "modicum" of creativity—merely a mote will do—that the author independently came up with.[222] And unlike trade secrecy, a copyrighted work need not exhibit commercial value or be kept secret.[223] Instead, copyright applies regardless of the value of the work, and mostly irrespective of the effort a party put into creating it.[224]

Authors of copyrighted works obtain a number of exclusive rights vis-à-vis the rest of the world.[225] These include the rights to prohibit others from reproducing, creating derivative works of, distributing,

---

218. *See* 17 U.S.C. § 102(a) (2012) ("Copyright protection subsists ... in original works of authorship fixed in any tangible medium of expression ... from which they can be perceived, reproduced, or otherwise communicated."); *see also id.* § 101 (defining fixation as when the work is embodied in a copy or phonorecord "for a period of more than transitory duration").

219. *See, e.g.*, Christopher Sprigman, *Reform(aliz)ing Copyright*, 57 STAN. L. REV. 485, 487-88 (2004) (discussing how copyright today applies regardless of whether parties undertake a series of formal registration steps, which in the past were necessary for copyright to arise).

220. *Id.* However, doing so comes with a number of benefits, including the right to assert a copyright claim in federal courts, and access to enhanced remedies, among others. 17 U.S.C. § 411; *id.* § 504(b)-(c).

221. *See, e.g.*, Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54 (2d Cir. 1936) (indicating that "if by some magic a man who had never known it were to compose anew Keats's Ode on a Grecian Urn," that person would be able to copyright the poem, despite the work lacking novelty).

222. *See, e.g.*, Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345-47 (1991) (indicating that originality requires independent creation and a modicum of creativity, and that "even a slight amount [of creativity] will suffice").

223. *See, e.g.*, Jane C. Ginsburg, *Creation and Commercial Value: Copyright Protection of Works of Information*, 90 COLUM. L. REV. 1865, 1866 (1990) ("[Copyright] [p]rotection depends on whether the work manifests authorial personality, not whether that personality demonstrates either taste or talent.").

224. *See, e.g.*, *Feist*, 499 U.S. at 352-54 (rejecting a "sweat of the brow" basis for copyright).

225. 17 U.S.C. § 106 (listing the five primary exclusive rights for copyright owners). Enforcing these rights in federal courts does require the copyright owner to undertake a number of formalities with the U.S. Copyright Office, including registering the work with the Office. *Id.* § 411(a) ("[N]o civil action for infringement of the copyright in any United States work shall be instituted until preregistration or registration of the copyright claim has been made.").

publicly performing, and publicly displaying the work.[226] Remedies for copyright infringement can be significant. In addition to possible criminal sanctions, injunctive relief, and actual damages, the Copyright Act includes statutory damages up to $150,000 for willful infringement of a copyrighted work.[227]

These rights may help AI developers in a number of ways. For starters, software, a primary component of any AI system, is subject to copyright protection as a "literary work."[228] Consequently, AI developers may rely on copyright protection to prevent third parties from copying, modifying, distributing, or publicly performing their AI-related software.[229] This role for copyright is consistent with predominant copyright theory, which posits that copyright, by granting these rights, provides parties such as AI innovators with the necessary economic incentives to invest in producing creative AI works.[230]

Relatedly, copyright protection may encourage AI developers to transact with third parties in further developing AI-related software, as some theory suggests.[231] For instance, the assurance of copyright protection may embolden AI developers to disclose the software to third parties in discussions about possible sales or co-development activities.[232] Copyright may also provide a coordination mechanism for collaborative AI-related software development.[233]

---

226. 17 U.S.C. § 106.

227. *Id.* §§ 501-506 (delineating the types of remedies available to copyright owners).

228. *See, e.g.*, Julie E. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs*, 68 S. CAL. L. REV. 1091, 1107-09 (1995) (acknowledging computer programs as literary works and discussing some problems with classifying software under the Copyright Act as a literary work).

229. *See* 17 U.S.C. § 106.

230. *See, e.g.*, Harper & Row, Publishers, Inc. v. Nation Enters., 471 U.S. 539, 558 (1985) ("By establishing a marketable right to the use of one's expression, copyright supplies the economic incentive to create and disseminate ideas.").

231. *See generally* Jonathan M. Barnett, *Copyright Without Creators*, 9 REV. L. & ECON. 389 (2013) (arguing that copyright might be justified on the basis of providing incentives for intermediaries, rather than the actual creators, to distribute and market the content).

232. *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 615, 617 (Nat'l Bureau of Econ. Research ed., 1962) (pointing to intellectual property rights as one important means by which to ensure that third parties to whom the information is disclosed cannot simply take it).

233. *See, e.g.*, James Gibson, *Once and Future Copyright*, 81 NOTRE DAME L. REV. 167, 202-03 (2005) (discussing how the FOSS movement uses copyright for purposes of facilitating

Indeed, in the past several decades, copyright has played this latter role in the software industry more generally, particularly in the context of FOSS development.[234] This trend appears to continue unabated in the AI context, as AI FOSS projects are thriving.[235]

Yet the role that copyright plays in the AI context depends to a large extent on what parts of software are subject to copyright. Indeed, despite software generally being considered a literary work subject to copyright, software has always been a difficult copyright fit because of its functional nature.[236] As the Supreme Court has noted, copyright is meant to incentivize and protect creative expression, while patent protection is meant to incentivize and protect utilitarian solutions.[237] But it is not always clear which aspects of a software program are protectable under copyright, and which are excluded.[238] Copyright law includes a number of doctrines meant to screen out utilitarian aspects of creative works from copyright protection.[239] But applying these doctrines to software is particularly difficult because software, by its very nature, is a utilitarian solution to some computing problem.[240] Consequently, courts have struggled to separate the "wheat from the chaff" in the software copyright context.[241]

---

software collaboration).

234. *See generally* Clark D. Asay, *A Case for the Public Domain*, 74 OHIO ST. L.J. 753 (2013) (explaining how FOSS developers rely on copyright to promote their collaborative software development model, while arguing that copyright is not as necessary as is often imagined).

235. David Ramel, *GitHub Report Charts Rise of Open Source AI*, PURE AI (Oct. 24, 2018), https://pureai.com/articles/2018/10/24/octoverse-ai.aspx [https://perma.cc/3UB6-9GBW] (documenting growing numbers of AI-related FOSS projects).

236. Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2310-12 (1994) (arguing on this basis for a *sui generis* legal regime for software).

237. Baker v. Selden, 101 U.S. 99, 102-05 (1879).

238. *See* Peter S. Menell, *Rise of the API Copyright Dead?: An Updated Epitaph for Copyright Protection of Network and Functional Features of Computer Software*, 31 HARV. J.L. & TECH. 305, 308-12 (2018) (discussing court battles over the scope of copyright protection in software programs).

239. Clark D. Asay, *Intellectual Property Law Hybridization*, 87 U. COLO. L. REV. 65, 75, 77-78 (2016) (discussing many of these doctrines).

240. *See, e.g.*, Clark D. Asay, *Transformative Use in Software*, 70 STAN. L. REV. ONLINE 9, 14 (2017).

241. Pamela Samuelson, *Functionality and Expression in Computer Programs: Refining the Tests for Software Copyright Infringement*, 31 BERKELEY TECH. L.J. 1215, 1215 (2016) ("Courts have struggled for decades to develop a test for judging infringement claims in software copyright cases that distinguishes between program expression that copyright law

For some aspects of software, however, there is greater clarity. For instance, software is often written initially as "source code," or the human-readable version of the software.[242] This is the version of the software in which programmers write software programs.[243] A computer, however, cannot typically directly execute the source code.[244] Instead, what is called a compiler translates the source code into "object code," or the machine-readable version of the software.[245] This series of 1's and 0's is typically the version of the software that computing devices use to execute whatever functions the software specifies.[246]

Courts have determined that both source and object code are subject to copyright.[247] In doing so, they have analogized software code to the literal text of a book, which, if copied, would constitute copyright infringement.[248] Hence, AI programmers can count on copyright to provide legal protection for both the object and source code relating to their AI innovations.

But copyright goes beyond just protecting literal code.[249] For instance, suppose that someone copied the main plots and subplots of *Harry Potter*, along with the main characters and events, all without using any of the actual text or names of people and places from *Harry Potter*. If copyright covered only the literal text of a work, copycats could easily get around that restriction.[250] But over time, courts have expanded copyright protection to protect against

---

protects and program functionality for which copyright protection is unavailable."); *see* Menell, *supra* note 238, at 310-12 (arguing that after a long battle, courts largely came to a consensus, but that consensus has recently been disrupted).

242. *Object Code Definition*, LINUX INFO. PROJECT (Aug. 7, 2005), http://www.linfo.org/object_code.html [https://perma.cc/SQ34-GBKL].

243. *Id.*

244. *Id.*

245. *Id.*

246. *Id.*

247. Apple Comput., Inc. v. Franklin Comput. Corp., 714 F.2d 1240, 1249 (3d Cir. 1983) (finding both object and source code subject to copyright protection as a literary work).

248. *Id. But see* Pamela Samuelson, *CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form*, 1984 DUKE L.J. 663, 675, 710, 715 (arguing against granting copyright protection to object code).

249. *See, e.g.*, Pamela Samuelson, *A Fresh Look at Tests for Nonliteral Copyright Infringement*, 107 NW. U. L. REV. 1821, 1824-40 (2013) (describing and critiquing tests for nonliteral copyright infringement).

250. Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1016 (1997).

instances of "nonliteral" infringement as well, including in the software context.[251]

In fact, the scope of copyright protection for software programs may be on the rise. The Court of Appeals for the Federal Circuit recently concluded that Google's copying of certain elements of Oracle's Java software constituted copyright infringement.[252] Google's copying related to both literal elements of the Java technology—bits of source code called application program interface "headers"—and nonliteral components—the sequence, structure, and organization of the Java software program.[253] Prior to the decision, a growing consensus had emerged among practitioners, academics, and courts that these types of software components were outside the scope of copyright, in part because they were functional in nature.[254] But with the recent Federal Circuit decision, doubts about the extent to which copyright can protect functional aspects of software programs have grown.[255] Only recently the Supreme Court agreed to review the case, the outcome of which could significantly impact AI developers in any number of directions by changing the scope of copyright as applied to software.[256]

Hence, going forward, AI developers may be able to rely on copyright to protect not only the expressive elements of their AI-related software, but, increasingly, more of the functional aspects thereof as well.[257] That reality, furthermore, may reinforce parties' preference for trade secrecy over patent protection. This may be so because AI developers can rely on copyright protection, which easily coexists with trade secrecy, to provide patent-like protections

---

251. Comput. Assocs. Int'l., Inc. v. Altai, Inc., 982 F.2d 693, 702, 715 (2d Cir. 1992) (recognizing the vitality of nonliteral copyright infringement principles in the software context while rejecting their application in the case at hand); Lemley, *supra* note 250, at 1016.

252. Oracle Am., Inc. v. Google Inc., 750 F.3d 1339, 1381 (Fed. Cir. 2014).

253. *Id.* at 1355-56.

254. *See, e.g.*, Menell, *supra* note 238, at 309 (reviewing the history of industry and court approaches to software copyrightability).

255. *See, e.g.*, Pamela Samuelson, *Staking the Boundaries of Software Copyrights in the Shadow of Patents*, 71 FLA. L. REV. 243, 245-46 (2019) (discussing how the decision threw into doubt the division between patent protection and copyright protection).

256. Adam Liptak, *Supreme Court to Hear Google and Oracle Copyright Case*, N.Y. TIMES (Nov. 15, 2019), https://www.nytimes.com/2019/11/15/us/supreme-court-google-oracle.html [https://perma.cc/3J36-RBNK].

257. Samuelson, *supra* note 255, at 301-02.

without actually having to obtain a patent.[258] Hence, the natural attractions of trade secrecy, combined with growing patent-like protections available via copyright, may make the decision in favor of trade secrecy over patents that much easier for many AI developers.[259]

Of course, copyright is generally a weaker form of protection than patent protection.[260] For instance, independent creation is a viable defense to claims of infringement under copyright law,[261] whereas patent law provides no equivalent defense.[262] Hence, AI developers wishing to protect functional elements of their AI-related software via copyright would have to demonstrate, among other things, that the purported infringer actually copied the software from them (rather than coming up with it on their own).[263] But if the AI developer is also maintaining the copyrighted software as a trade secret, then in many cases proving that the alleged infringer had access to the software may be impossible.[264] With a patent in place, on the other hand, the AI developer would merely need to show that the patent covers the allegedly infringing product, regardless of whether the alleged infringer had access to the patent owner's AI innovations.[265]

Despite this limitation, the trade secrecy-copyright combination seems viable in a whole range of other scenarios. For instance, a party can maintain trade secrecy while disclosing its inventions to

---

258. *See, e.g.*, Comprehensive Techs. Int'l., Inc. v. Software Artisans, Inc., 3 F.3d 730, 736 n.7 (4th Cir. 1993) (indicating that parties can maintain copyright and trade secret claims relating to the very same act).

259. *See* Viva R. Moffat, *Mutant Copyrights and Backdoor Patents: The Problem of Overlapping Intellectual Property Protection*, 19 BERKELEY TECH. L.J. 1473, 1532 (2004) (discussing problems that arise due to overlapping intellectual property protections).

260. Asay, *supra* note 239, at 99.

261. For reasons why the defense under copyright law is largely illusory but may gain greater traction in a world of AI, see Clark D. Asay, *Independent Creation in a World of AI*, FLA. INT'L U. L. REV. (forthcoming 2020).

262. Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 479-80 (2006) (advocating for such a defense under patent law).

263. *See* Glynn S. Lunney, Jr., *Reexamining Copyright's Incentives-Access Paradigm*, 49 VAND. L. REV. 483, 510-12 (1996) (discussing this requirement of copyright infringement analysis).

264. *See id.* at 510.

265. *See* Jeanne C. Fromer & Mark A. Lemley, *The Audience in Intellectual Property Infringement*, 112 MICH. L. REV. 1251, 1265 (2014) (discussing the means by which to prove patent infringement).

third parties, so long as the party takes reasonable precautions to maintain the inventions' secrecy (by, for example, having the receiving party sign a confidentiality agreement).[266] Such a party could still rely on copyright to protect its AI-related software—including possibly functional elements thereof—from use by such parties.[267] And uses by third parties in these kinds of scenarios may be the primary ones with which the party is concerned in any event, since the party is guarding its secrets from everyone else.[268] Trade secret law would also likely provide the party legal protections in such cases, but copyright remedies present a number of advantages when compared to trade secret remedies.[269]

Furthermore, the trade secrecy-copyright combination may be particularly enticing to parties with a more elastic demand for patent protection, such as start-up companies. That is, given the growing uncertainty surrounding AI patents discussed above, the appeal of simply relying on a combination of trade secrecy and copyright to protect an AI developer's inventions may be particularly high to those for whom the costs of patenting matter. Of course, a party can rely on both copyright and patent protection for the same inventions, and even in some cases maintain portions of the invention as trade secrets.[270] And parties with a less elastic demand for patents, such as large, multinational corporations, are more likely to maintain all types of intellectual property protections simultaneously, when available.[271] But in instances in which the growing uncertainties and costs of patenting make a difference, such

266. Gene Quinn, *Protecting a Trade Secret: Taking Precautions to Preserve Secrecy*, IPWATCHDOG (Apr. 16, 2016), http://www.ipwatchdog.com/2016/04/16/trade-secret-preserve-secrecy/id=68168/ [https://perma.cc/47PB-ALFN] (discussing this requirement).

267. *See supra* notes 247-58 and accompanying text.

268. *See* Quinn, *supra* note 266. One potential problem with maintaining trade secrecy while also relying on copyright protection is that enforcing copyright in federal courts requires a party to register their work with the Copyright Office, which can make maintaining trade secrecy difficult.

269. For instance, copyright law provides for possible statutory damages. *See, e.g.*, Pamela Samuelson & Tara Wheatland, *Statutory Damages in Copyright Law: A Remedy in Need of Reform*, 51 WM. & MARY L. REV. 439, 441 (2009) (discussing and critiquing this facet of copyright law).

270. *See, e.g.*, Mark P. McKenna, *An Alternate Approach to Channeling?*, 51 WM. & MARY L. REV. 873, 884 (2009) (discussing how parties often use each type of intellectual property to protect different features of the same product or service).

271. *See id.* at 878.

as for cash-strapped AI innovators, the combination of copyright and trade secrecy may strike the exact right balance.[272] The next Part discusses some possible implications of these intellectual property considerations.

II. AI'S INDUSTRIAL ORGANIZATION

A. The Theory of the Firm

Scholars have argued that intellectual property rights—including the types of rights available—can affect how industries organize themselves.[273] Typically, scholars have pointed to patent rights as the most important form of intellectual property that can affect industrial organization.[274] Patent rights may affect industrial organization by reducing (or increasing) the costs of transacting with third parties over the provision of some good or service.[275] Theory of the firm scholars typically refer to such costs collectively as "transaction costs."[276]

Whether intellectual property rights affect industrial organization is a different question from whether intellectual property rights are necessary to incentivize innovation. As discussed above, predominant theories of intellectual property often concentrate on this latter

---

272. *See id.*

273. *See* Lee, *supra* note 47, at 1439-42 (summarizing some of this research).

274. *See, e.g.*, Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 451, 455 (2004); Jonathan M. Barnett, *Intellectual Property as a Law of Organization*, 84 S. CAL. L. REV. 785, 789 (2011) (arguing that patents enable greater firm specialization); Dan L. Burk & Brett H. McDonnell, *The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm*, 2007 U. ILL. L. REV. 575, 578-82 (arguing that the strength of patent rights can affect transaction costs and thus firm boundaries); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473, 475-76 (2005) (arguing that patent rights can help reduce transaction costs); Tim Wu, *Intellectual Property, Innovation, and Decentralized Decisions*, 92 VA. L. REV. 123, 123 (2006) ("[S]cholarship suggests that the most important economic effects of intellectual property may not be effects on price, but rather on *industry structure*.").

275. Burk & McDonnell, *supra* note 274, at 617 (arguing that too weak or too strong patent rights can also raise transaction costs); Lee, *supra* note 47, at 1440 ("Patents reduce several costs of technology transactions.").

276. Transaction cost economics is one of the primary means by which scholars assess economic activity. For a general overview of transaction cost economics, see Oliver E. Williamson, *Transaction Cost Economics*, *in* 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 135 (Richard Schmalensee & Robert D. Willig eds., 1989).

question.[277] This Part focuses on the former question, with a special focus on patent rights and their possible effects on AI industrial organization and levels of AI innovation.

Before delving specifically into how patent rights may affect transaction costs, some background on the theory of the firm is helpful.[278] In a seminal article, Ronald Coase famously argued that transaction cost levels in an industry can affect industrial organization by influencing the so-called "make or buy" decision.[279] This decision is not a single event, but instead represents the type of decision firms repeatedly face in a given industry.[280] The decision boils down to this: Should a firm in need of a good or service secure that product from a third-party provider on the market (the so-called buy decision) or should the firm make the product itself (the so-called make decision)?[281]

If the transaction costs associated with obtaining products on the market are relatively high, a firm is more likely to "vertical[ly] integrat[e]" production, that is, make the product itself.[282] This integration occurs, the theory goes, because making the product is more economically efficient than securing it from a third-party supplier on the market.[283] That "make" decision can result in hiring additional employees to develop the products, acquiring a third-party provider of various inputs, or some combination of both.[284] Indeed, by making a market-based deal less likely, high transaction costs similarly affect potential third-party suppliers of products by making it more likely that potential trade partners will simply acquire them.[285] Hence, as firms elect to make products themselves

277. *See supra* Part I.

278. *See* R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386, 394-96 (1937) (setting forth the classic articulation of the make or buy decision).

279. *Id.*

280. *See id.* at 396.

281. *See id.* at 395.

282. *See* Coase, *supra* note 278, at 397-98 & n.5; *see also* Dan L. Burk, *Intellectual Property and the Firm*, 71 U. CHI. L. REV. 3, 5 (2004); Lee, *supra* note 47, at 1440 (indicating that higher transaction costs encourage vertical integration).

283. Burk, *supra* note 282, at 6.

284. *See id.*

285. *See id.* at 6-7.

rather than secure them from third-party suppliers, industry consolidation intensifies.[286]

On the other hand, when the transaction costs associated with obtaining products on the market are low relative to producing the same thing internally, firms are more likely to buy that product from a third-party supplier.[287] The reason for this "buy" decision is the mirror image of the "make" rationale: the relatively low costs associated with a market-based transaction mean that it is more economically efficient to secure that product from the third-party supplier than making the same product in-house.[288] As a result, merger and acquisition activity becomes less likely due to the benefits of economic specialization.[289] Hence, lower transaction costs can contribute to less consolidation in an industry, as specialized firms are better able to sell their products to interested buyers as part of a disaggregated supply chain.[290]

Patents may reduce transaction costs and thus encourage industrial disaggregation in a number of ways. For instance, if a party wishes to engage third parties in commercial discussions about its inventive activities, patents can lower that party's risk of those third parties taking and using information about its inventive activities without compensation.[291] Relatedly, patents can be a useful mechanism for "codifying" inventive ideas, thereby facilitating licensing and sales activities relating to those inventive ideas[292] and better enabling innovators to capture the value of their innovations.[293] By enhancing remedial options, patents can also reduce transaction costs by providing patent owners with safeguards

286. *See generally* Graeme K. Deans et al., *The Consolidation Curve*, HARV. BUS. REV. (Dec. 2002), https://hbr.org/2002/12/the-consolidation-curve [https://perma.cc/4FZU-VVL7] (discussing the phases of consolidation that industries typically experience).

287. *See* Coase, *supra* note 278, at 395.

288. *See id.*

289. *See id.*; *see also* Robert P. Merges, *Autonomy and Independence: The Normative Face of Transaction Costs*, 53 ARIZ. L. REV. 145, 148-49 (2011) (arguing in favor of economic specialization both in terms of efficiency and the benefits of autonomy).

290. *See* Merges, *supra* note 289, at 149-50.

291. Arrow, *supra* note 232, at 617; Merges, *supra* note 57, at 1503.

292. Arora & Merges, *supra* note 274, at 455 (indicating that strong intellectual property rights enhance firms' capabilities of appropriating the value of their inventions).

293. *See* Teece, *supra* note 45, at 296 (arguing that weak appropriability regimes may contribute to vertical integration as a means to better capture the value of innovations).

against third parties that may otherwise take advantage of contractual incompleteness.[294]

On the other hand, insufficient patent rights may raise transaction costs and thus encourage industry consolidation in several ways.[295] For example, weak or ineffective patent protection may lead parties to invest in excessive, inefficient self-help measures, including expensive physical and personnel safeguards, in an attempt to protect the value of their inventive information.[296] Weak patent rights may also result in higher transaction costs as parties seek to overcompensate for that weakness—and the risks of uncompensated appropriation by third parties—through extreme contractual protections.[297] Ineffective patent protections may contribute to higher transaction costs by enhancing the likelihood of costly and drawn-out litigation.[298] Overall, ineffective patent protection may thus raise transaction costs as innovators encounter greater difficulties in capturing the value of their innovations.[299] And one possible response to those relatively high transaction costs is industry consolidation as parties make, rather than buy, inputs on the market.

The resulting industrial organization, in turn, can influence whether an industry innovates at optimal levels.[300] For instance, a

---

294. Merges, *supra* note 57, at 1486.

295. Burk & McDonnell, *supra* note 274, at 617.

296. *See* Christopher Buccafusco & Jonathan S. Masur, *Innovation and Incarceration: An Economic Analysis of Criminal Intellectual Property Law*, 87 S. CAL. L. REV. 275, 292 (2014) (describing the types of expensive measures parties may take to protect their property should patent rights prove ineffective). The preceding citation suggests that property owners take these types of self-help measures when they are protecting their property as trade secrets. *See id.* But parties may and often do undertake such precautions even when they plan to patent their inventions, since for the first eighteen months of a patent application's existence, it is not disclosed to the public. *USPTO Will Begin Publishing Patent Applications*, USPTO (Nov. 27, 2000), https://www.uspto.gov/about-us/news-updates/uspto-will-begin-publishing-patent-applications [https://perma.cc/DP4A-C473]. Furthermore, even when the application is published, plenty of information relating to the invention may be missing from the application, such that protecting it with safeguards may be warranted. *See* Anderson, *supra* note 124, at 944.

297. *Cf.* Merges, *supra* note 57, at 1486.

298. *See* Kieff, *supra* note 127 (highlighting this phenomenon in Japan, which is characterized by mostly weak patent rights).

299. Teece, *supra* note 45, at 301-02 (indicating that for this reason, parties are more likely to vertically integrate as they seek to capture more effectively the value of their innovations).

300. *See* Lee, *supra* note 47, at 1440-41 nn.19-29 (reviewing some of this literature).

good amount of evidence suggests that industrial disaggregation—not consolidation—is the best means by which to achieve optimal innovation levels in an industry.[301] This may be for several reasons. Smaller firms are typically more nimble and innovative than larger incumbents.[302] Smaller, more specialized firms may also simply have greater incentives to produce high-quality products, because their livelihoods depend on it.[303] Specialization allows for a variety of efficiencies in supply chain economics.[304] Furthermore, economic disaggregation may provide for greater competition among a variety of firms, and adequate competitive forces in an industry are typically indicative of overall industrial economic health.[305] Even outside of economic efficiency considerations, other reasons may exist for favoring specialization over consolidation.[306]

Hence, the types of intellectual property protections available within an industry are important in part because they can affect an industry's organization and, ultimately, whether that industry yields socially beneficial levels.[307] And importantly, intellectual property rights can have these effects regardless of whether patents and other types of intellectual property are necessary to incentivize inventive activities. In the following Section, I examine how these considerations are likely to play out in light of AI's intellectual property realities, as explored in Part I above.

---

301. OLIVER E. WILLIAMSON, MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS: A STUDY IN THE ECONOMICS OF INTERNAL ORGANIZATION 199-203 (1975) (suggesting that larger, more bureaucratic firms lose significant innovative capacity).

302. Lee, *supra* note 47, at 1441.

303. *See* OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM 140-41 (1985) (discussing the high-powered incentives of production in the context of specialized firms compared to the "lower-powered" incentives present in intrafirm production); Merges, *supra* note 289, at 150 (discussing Williamson's identification of specialized firms' "high-powered incentives" to produce higher quality goods and services).

304. Arora & Merges, *supra* note 274, at 470 (discussing some of the benefits of specialization in supply chain economics); Barnett, *supra* note 274, at 814-15 (discussing a variety of benefits of economic specialization, particularly in the context of the semiconductor industry).

305. For this reason, most countries have some form of antitrust law. But for an argument that less integration is not always better for competition purposes, see Paul L. Robertson & Richard N. Langlois, *Innovation, Networks, and Vertical Integration*, 24 RES. POL'Y 543, 550 (1995).

306. Merges, *supra* note 289, at 150 (discussing considerations beyond economic efficiency that may favor economic specialization).

307. *See id.*

B. AI's Industrial Organization

The AI industry's boundaries can be difficult to pinpoint because so many companies have begun to use AI in their daily business practices.[308] Indeed, "AI as a Service" allows companies with little AI expertise to utilize AI technologies in their everyday operations.[309] But consuming AI does not make a company part of the AI industry.[310] Instead, this Article focuses on the set of companies that actively develop and deploy AI products.[311]

That AI industry is growing and is only expected to continue to do so.[312] Venture funding for AI start-ups has "turned into a torrent," and the industry has experienced "exponential growth" recently in the overall number of AI start-ups.[313] AI-related merger and acquisition activity, and fierce competitions over available AI talent, have also heated up.[314] This Section examines how intellectual property rights may affect that growth by influencing how the industry ultimately organizes itself.

---

308. Louis Columbus, *80% of Enterprises Are Investing in AI Today*, FORBES (Oct. 16, 2017, 6:41 PM), https://www.forbes.com/sites/louiscolumbus/2017/10/16/80-of-enterprises-are-investing-in-ai-today/ [https://perma.cc/XCB6-XFFY] (discussing the widespread use of AI in modern-day enterprises).

309. *See* MSV, *supra* note 201.

310. Sriram Subramanian, *Modern AI Stack & AI as a Service Consumption Models*, MEDIUM (Mar. 2, 2018), https://medium.com/clouddon/modern-ai-stack-ai-service-consumption-models-f9957dce7b25 [https://perma.cc/FL4R-ZAX4] (discussing AI as a service, where consumers simply use AI without otherwise implementing any of the technologies).

311. For some different approaches to tackling this issue, see Daniel Faggella, *Artificial Intelligence Industry—An Overview by Segment*, EMERJ (Apr. 25, 2019), https://emerj.com/ai-sector-overviews/artificial-intelligence-industry-an-overview-by-segment/ [https://perma.cc/QUL2-Z22K].

312. *Artificial Intelligence Market Size Is Projected to Be Around US $191 Billion by 2024*, MARKETWATCH (Aug. 8, 2018, 12:25 AM), https://www.marketwatch.com/press-release/artificial-intelligence-market-size-is-projected-to-be-around-us-191-billion-by-2024-2018-08-08 [https://perma.cc/ZA75-UMKW].

313. Joe McKendrick, *How Fast Is Artificial Intelligence Growing? Look at the Key Bellwethers*, FORBES (Dec. 19, 2018, 12:26 AM), https://www.forbes.com/sites/joemckendrick/2018/12/19/how-fast-is-artificial-intelligence-growing-look-at-the-key-bellwethers/ [https://perma.cc/2GRB-SPKY] (quoting Yoav Shoham et al., *The Artificial Intelligence Index: 2018 Annual Report*, AI INDEX STEERING COMMITTEE 31 (Dec. 2018), http://cdn.aiindex.org/2018/AI%20Index%202018%20Annual%20Report.pdf).

314. *See The Race for AI: Here Are the Tech Giants Rushing to Snap Up Artificial Intelligence Startups*, CBINSIGHTS (Sept. 17, 2019), https://www.cbinsights.com/research/top-acquirers-ai-startups-ma-timeline/ [https://perma.cc/PP44-EMBY] (discussing acquisition trends amongst large technology companies).

1. AI's Intellectual Property Conundrum

As discussed in Part I, patenting AI-related innovations can present a number of challenges, such that patent protection in the AI space is in some respects weaker than ideal.[315] Furthermore, trade secrecy presents a number of advantages for many AI innovators.[316] And copyright, when combined with trade secrecy, may increasingly help make up for whatever patent shortfalls exist.[317]

How have these realities affected patenting in the AI industry? Some data suggest they may not have affected AI patenting much at all.[318] For instance, a recent study shows that AI-related patenting has steadily grown, particularly since 2012, when improvements in computational power dramatically increased the ability to use long-standing AI technologies in a variety of new settings.[319]

Yet the fact that parties continue to seek and obtain AI-related patents is not indicative of effective patent protection for the covered AI technologies.[320] As discussed earlier, large, well-capitalized parties are likely to continue seeking and obtaining many AI patents, irrespective of the state of AI patenting standards, as they build expansive patent portfolios; the value of patenting for such entities lies in the portfolio, not the strength of individual patents.[321] Furthermore, such patent seekers are often able to "browbeat" the

315. *See also* Prange & Lawson, *supra* note 173, at 37 (discussing challenges and benefits of protecting with patents and trade secrets).

316. *Id.*

317. *See* Samuelson, *supra* note 255, at 294.

318. *See, e.g.*, Webb et al., *supra* note 161, at 6 (showing the rise of AI-related patenting in recent years).

319. *Id.*; *see* Dario Amodei & Danny Hernandez, *AI and Compute*, OPENAI (May 16, 2018), https://openai.com/blog/ai-and-compute/ [https://perma.cc/U9QN-9EUA].

320. *See* Lemley, *supra* note 158, at 14 (discussing how changes in patent law that have both strengthened and weakened patent rights do not appear to affect overall patent-related behavior).

321. *See* Alfonso Gambardella et al., *The Economic Value of Patent Portfolios*, 26 J. ECON. & MGMT. STRATEGY 735, 751 (2017) (highlighting empirical analysis showing that building large patent portfolios yields more value to a company than redirecting resources into obtaining fewer but higher value patents); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 31-32 (2005) (highlighting reasons why companies build large patent portfolios, even when the expected value of any given patent is relatively low).

patent office into granting their patent applications,[322] even in cases where courts are likely to invalidate those same patents later on.[323]

Start-ups may also continue patenting some of their AI innovations, regardless of whether obtaining the patents is costly or the resulting patents are ineffective or otherwise weak.[324] For instance, some evidence suggests that start-up companies frequently obtain patents as a means by which to attract capital or otherwise communicate information about themselves to various markets.[325] Hence, start-ups may continue to obtain AI-related patents, even if the companies never foresee being able to enforce those same patents, because that was not their primary purpose in obtaining the patents.[326]

Thus, the fact that companies both large and small continue to patent at least some of their AI innovations is a separate question from whether those patents provide their owners with effective patent protection. Based on this Article's earlier analysis, it would appear that even granted AI patents are often highly susceptible to invalidation in the courts due to issues with subject matter eligibility, novelty, and nonobviousness.[327] Or, even if the patents are otherwise valid, they may often be quite narrow in light of the AI prior art, meaning competitors have an easier time avoiding the patents.[328] Hence, robust AI patenting is consistent with patent law developments that render those same patents weak or largely ineffective as enforcement tools.[329] And with the AI market flooded with such weak patent protections, parties wishing to strike an

322. *See supra* notes 147-49 and accompanying text.

323. *See* Key, *supra* note 119 (discussing shortcomings of patent protection).

324. *See id.* (describing shortfalls and benefits of patenting innovations).

325. *See* J. Jonas Anderson, *Nontechnical Disclosure*, 69 VAND. L. REV. 1573, 1575 (2016) (arguing that patents often disclose nontechnical information to the world that is sometimes more valuable than the patent's technical details); Asay, *supra* note 58, at 265 (discussing how parties use patents to signal information to capital, labor, and product markets); Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 653 (2002) (arguing that parties often obtain patents in order to signal to capital markets that they are innovative and thus worthy of investing in).

326. *See, e.g.*, Long, *supra* note 325, at 679.

327. *See supra* Parts I.A.1, I.A.3.

328. *See supra* Part I.A.3.

329. *Cf.* Lemley, *supra* note 158, at 42 (pointing to consistent patenting behavior, despite fluctuations in the strength of patent rights).

arms-length deal are more likely to face relatively high transaction costs in doing so.[330]

What is more, aggregate patenting data may often mask the reality that smaller companies are, in fact, decreasing their AI patenting relative to their larger counterparts.[331] Indeed, at least some of the recent AI patenting studies suggest that the vast majority of AI-related patenting is happening in the halls of technology monoliths such as Google, Amazon, IBM, Intel, and others.[332] Such patenting discrepancies, too, can lead to higher industry transaction costs as start-ups more frequently rely on trade secrecy.[333]

Finally, the fact remains that for many AI innovations, patenting remains a suboptimal intellectual property strategy because of patent law's disclosure requirements.[334] Trade secrecy, in contrast, provides some legal protections without the need to share with the world a party's AI details.[335] And though trade secrecy may provide such advantages, it is also typically associated with higher transaction costs as parties undertake extensive, costly measures to guard that secrecy.[336]

2. Theory of the AI Firm

Weak patent protection, and often an outright preference for trade secrecy, may thus increase the transaction costs associated with buying an AI input on the market relative to the costs of making the input internally.[337] Those relatively high transaction costs, in turn, can push more parties to vertically integrate,[338]

---

330. *See, e.g.*, Parchomovsky & Wagner, *supra* note 321, at 62 (describing transaction costs with patent portfolios).

331. *See* Asay, *supra* note 77, at 56-57.

332. Webb et al., *supra* note 161, at 17-18.

333. *See* Levine & Sichelman, *supra* note 211, at 779-80 (discussing small and medium sized parties' preference for trade secrecy).

334. *See* Prange & Lawson, *supra* note 173, at 37.

335. *Id.* at 38.

336. *See* Buccafusco & Masur, *supra* note 296, at 323 (discussing costs of secrecy).

337. *Cf.* Levy, *supra* note 44, at 439 (explaining that parties' decisions to integrate vertically are influenced by costs of transacting and internal production).

338. *See id.*

thereby resulting in significant AI industry consolidation and thus suboptimal levels of AI innovation.

For instance, start-up companies, when reaching a certain level of maturation, principally exit the market in one of two ways.[339] Either they make an initial public offering (IPO), in which they become a public company and raise additional capital to finance their ongoing operations through the stock market. Or, they are acquired by or merge with another company, typically a larger incumbent in the same industry.[340] Start-up companies that have greater difficulty in protecting their innovations through patent protection seem more likely to view acquisition by a larger industry incumbent as their best exit strategy.[341] Among other reasons, this is because the transaction costs associated with protecting their innovations, either through secrecy or even in drawn-out patent litigation, are simply too high.[342]

Large incumbents may similarly favor acquisition, rather than a market-based transaction, for a number of reasons. A veil of secrecy undertaken by the start-up, for instance, may make an arm's length transaction too difficult and costly.[343] An acquisition, on the other hand, increases transparency and thus access to the start-up company's AI-related innovations[344] (as well as, importantly, the talented personnel behind them and their tacit knowledge relating to the AI inventions).[345] Furthermore, in many cases large incumbents prefer maintaining secrecy relating to their AI-related

339. Martin Zwilling, *Five Smart Exit Strategies*, BUS. INSIDER (Jan. 5, 2011, 10:30 AM), https://www.businessinsider.com/startup-exits-should-be-positive-and-planned-early-2011-1 [https://perma.cc/XVK2-PGN2] (discussing common exit strategies and listing a merger and acquisition or an initial public offering as the most popular).

340. *Id.*

341. *See* Barnett, *supra* note 274, at 816 (discussing how adequate patent protection enables firm specialization).

342. *See supra* Part II.A.

343. *See* Barnett, *supra* note 274, at 799-800 (describing how uncertainty caused by trade secrets can complicate deals and deter investments).

344. *Cf.* Arrow, *supra* note 232, at 615 (discussing demand for information).

345. *See* Natalie Gagliordi, *Box Acqui-Hires Team from Machine Learning Startup Butter.ai*, ZDNET (July 10, 2018, 12:10 PM), https://www.zdnet.com/article/box-acqui-hires-team-from-machine-learning-startup-butter-ai/ [https://perma.cc/CK45-X374] (discussing one such recent acquisition whose purpose largely aimed at acquiring the AI talent associated with the start-up).

developments, such that acquiring the AI start-up outright makes preserving that overall secrecy that much easier.[346]

To further illustrate these points, consider a highly stylized situation between an AI start-up and a larger AI incumbent. Suppose that the start-up company, like many start-ups, has a relatively modest patent portfolio.[347] Furthermore, because of the perceived weakness of AI patents, the start-up has more frequently relied on trade secrecy to protect its AI innovations than it otherwise might have.[348] The result is a mix of trade secrecy, a smattering of relatively weak AI patents, and possibly copyright protection for certain elements of their AI systems.[349]

Now consider the incumbent. The incumbent has protected many of its AI innovations with patents in an attempt to build a large patent portfolio.[350] Nonetheless, similar to the start-up, its AI-related patents are relatively weak and narrow, even if numerous. Furthermore, in many cases the incumbent prefers to rely on trade secrecy, all in order to avoid patent law's increasingly demanding disclosure requirements.[351]

If the incumbent becomes interested in the start-up's AI technologies, the different intellectual property profiles of the two parties are likely to affect their ultimate relationship.[352] For instance, from the start-up company's perspective, the lack of effective patent protection makes it riskier to engage with the incumbent in an arm's length deal.[353] Contractual solutions are notoriously weak;[354] the patents the party does own are likely to be narrow or otherwise ineffective;[355] and trade secrecy comes with its own problems, including difficulties of policing and enforcement.[356] All of these

346. *See* PASQUALE, *supra* note 18, at 7-8.

347. *See* Levine & Sichelman, *supra* note 211, at 761-62 (discussing why start-up companies might decide against filing for patents).

348. *Cf. id.*

349. Asay, *supra* note 77, at 7.

350. *See* Parchomovsky & Wagner, *supra* note 321, at 53-55 (discussing how large firms often rely on large patent portfolios in deriving value from patenting).

351. *See supra* Part I.A-B.

352. *See* Parchomovsky & Wagner, *supra* note 321, at 8, 10 (describing relationships between large and small companies with different intellectual property profiles).

353. *See id.*

354. *See* Barnett, *supra* note 274, at 798.

355. *See* Prange & Lawson, *supra* note 173, at 37.

356. *See* Peter S. Menell, *An Analysis of the Scope of Copyright Protection for Application*

factors ultimately mean that transacting with the incumbent is likely to entail significant costs, which the start-up may not be in a position to bear.[357]

These costs, in fact, are likely to be exacerbated in light of the incumbent's intellectual property profile. The incumbent's vast patent portfolio means the relative ineffectiveness of any given AI patent doesn't really matter; it can wield that portfolio against the start-up collectively.[358] That leverage is amplified in light of the small set of weak patents the start-up possesses.[359] The incumbent's preference for trade secrecy in some cases also is likely to increase the difficulties in transactions between the parties, as in some cases neither party may be willing to share everything that is necessary to actually strike an arm's length deal.[360] Hence, the result is that, if both parties want to reach a deal, that deal is more likely to be in the form of a merger or acquisition, not an arm's length contractual relationship. Indeed, the high transaction costs associated with weak patent protections, unequal bargaining leverages, and a clear preference for trade secrecy in many cases make this integration choice a natural one.[361]

In fact, the evidence we have suggests this type of consolidation has quickly become the norm in the AI industry, with some arguing that consolidation in the AI industry has happened faster than is typical in other industries.[362] In 2017, for instance, of the 120 AI start-up companies that exited the market, 115 did so through

---

Programs, 41 STAN. L. REV. 1046, 1077-78 (1989) (discussing some of the difficulties in establishing and enforcing trade secret protection in the context of certain software technologies).

357. *See, e.g.*, Parchomovsky & Wagner, *supra* note 321, at 62 (describing transaction costs with patent portfolios).

358. *Id.* at 53-55.

359. *Id.* at 55.

360. *See* Andreas Panagopoulos & In-Uck Park, *Patenting vs. Secrecy for Startups and the Trade of Patents as Negotiating Assets* 6 (Univ. of Crete, Dep't of Econ., Working Paper No. 1610, 2015), http://economics.soc.uoc.gr/wpa/docs/1610.pdf [https://perma.cc/J6WT-THJM] (discussing how trade secrecy is often an inferior mechanism for encouraging disclosure).

361. *See, e.g.*, Parchomovsky & Wagner, *supra* note 321, at 50-51 (describing strategy of acquiring rather than licensing to grow patent portfolios).

362. Vinod Iyengar, *Why AI Consolidation Will Create the Worst Monopoly in US History*, TECHCRUNCH (Aug. 24, 2016, 9:00 PM), https://techcrunch.com/2016/08/24/why-ai-consolidation-will-create-the-worst-monopoly-in-us-history/ [https://perma.cc/UBM8-8FA7] (arguing on the basis of recent merger and acquisition activity in the AI industry that the industry has consolidated faster than is typical).

acquisition by a larger incumbent such as Google, Amazon, or IBM.[363] AI start-up acquisition activity has also significantly accelerated, particularly since 2012, as the large technology behemoths race to gobble up as many promising AI start-up companies as possible.[364] This acquisition activity is also occurring fairly early in the life-cycle of many of these acquisition targets, meaning that industry consolidation is happening before these companies can even develop and offer their own AI products.[365] And while a generally cooling IPO market almost undoubtedly has something to do with these trends,[366] intellectual property considerations would also seem to bear on these developments, for the reasons discussed above.[367]

Industry consolidation manifests itself in other ways as well. For instance, Amazon, Google, Microsoft, IBM, and others offer comprehensive AI services on demand, which require little to no engineering expertise for third parties to use.[368] In certain fields such as generalized image, video, speech and text AI tools, in fact, venture capitalists are reluctant to fund companies wishing to offer related services because the technology monoliths' lead and relative advantages are so significant.[369] These companies have been able to build these "full-stack" AI solutions in part because of their frequent acquisitions of available AI technology and talent.[370] Hence, in a number of important AI product markets, industry consolidation is

363. Vorhies, *supra* note 46.

364. *See, e.g.*, Holden Page, *AI Startups Take the Money and Run as Big Tech Comes Acquiring*, CRUNCHBASE NEWS (Aug. 9, 2017), https://news.crunchbase.com/news/ai-startups-take-money-run-big-tech-comes-acquiring/ [https://perma.cc/E2NF-CHV5] (discussing acceleration of acquisition since 2012); *see also* McKendrick, *supra* note 313 (discussing growth of AI start-ups relative to all start-ups).

365. Iyengar, *supra* note 362.

366. *See* Frank Partnoy, *The Death of the IPO*, ATLANTIC (Nov. 2018), https://www.theatlantic.com/magazine/archive/2018/11/private-inequity/570808/ [https://perma.cc/LL7T-9ZXW] (discussing declining numbers of IPOs generally).

367. *See supra* Part II.B.1.

368. *See* Vorhies, *supra* note 46 (discussing how large technology companies often offer full-stack AI solutions on demand, which makes competing with them difficult for a number of reasons).

369. *See id.*

370. *See id.*

so deep that finding someone to fund a competitive start-up has become nearly impossible.[371]

That industry consolidation, in turn, is a recipe for suboptimal AI innovation. Of course, AI industry consolidation in the hands of a few may offer any number of benefits, including the ability for third parties to quickly access and use, without significant AI expertise, the full-stack AI solutions that many technology giants offer.[372] Be that as it may, a good amount of evidence suggests that heavy industry consolidation can result in poor innovation levels in an industry, as competitive forces wane and the technology monoliths, burdened as they are with multiple layers of bureaucracy, struggle to innovate as they once did.[373] The result, in the end, may be a form of ongoing artificial stupidity, rather than the promised general AI that continues to elude society.[374]

Of course, it is worth repeating that intellectual property protections are certainly not the only factor influencing consolidation in the AI industry. AI innovation heavily depends on complementary assets such as access to large amounts of data and computational power, assets that large incumbents have an easier time accumulating.[375] Hence, much of the consolidation may be occurring because larger firms are in a more realistic position to engage in AI innovation due to their access to such assets. Significant economic risk more generally may also be pushing start-up companies to jump into the relatively safe embrace of a larger incumbent more frequently than they otherwise would.[376] Yet weak appropriability regimes, such as ineffective patent protection, exacerbate these factors, making consolidation more likely. And though large firms may be in the most realistic position to engage in AI innovation, that does not mean they are in the best position to do so.

---

371. *See id.*

372. *Id.*

373. *See* Lee, *supra* note 47, at 1490.

374. *See* Jordan, *supra* note 1 (discussing the general lack of innovation in the AI space, and the failure to realize general AI).

375. Teece, *supra* note 45.

376. Nguyen Huy Kham, *Economic Storm Clouds*, WORLD ECON. F., https://reports.weforum.org/global-risks-2018/economic-storm-clouds/ [https://perma.cc/XA2P-KE64] (discussing ongoing world-wide economic risk factors).

III. IMPLICATIONS

Having considered how the intellectual property protections available to AI innovators are likely to affect AI industrial organization and the industry's overall levels of innovation, this final Part briefly examines some possible solutions to these issues.

A. Strengthening AI Patents

One possibility for addressing some of the issues discussed above is to strengthen AI patent rights. Strengthening AI-related patent rights could theoretically incentivize parties to undertake more far-reaching AI innovation,[377] as well as enable greater economic specialization by helping reduce market-based transaction costs.[378] That greater economic specialization, in turn, could help the AI industry disaggregate, thereby increasing competitive forces therein and thus improving overall levels of AI innovation.[379]

The most obvious route to strengthening patents in the AI space lies in reforming the patentable subject matter requirement. In fact, Congress is currently investigating such a solution.[380] Furthermore, the current USPTO director has also recently attempted to provide clearer patentable subject matter guidance so that parties seeking patents may face fewer patentable subject matter hurdles.[381]

The main thrust of such changes seems to center on making patentable subject matter more expansive, perhaps even returning the state of the law back to what it was before the Supreme Court most recently intervened.[382] Yet while such a change may make AI

377. *See* Lemley, *supra* note 158, at 52 (articulating that the theory underlying patent rights is to incentivize parties to pursue innovation that they would otherwise forego).

378. *See* Barnett, *supra* note 274, at 811.

379. *See* Lee, *supra* note 47, at 1435, 1490.

380. Kirk M. Hartung, *Congress Considers a Patent Eligibility Overhaul*, MCKEE, VORHEES & SEASE, PLC (Feb. 27, 2019), https://www.filewrapper.com/filewrapper/congress-considers-patent-eligibility-overhaul [https://perma.cc/AE9M-HXS7].

381. Benjamin T. Hemmelgarn & Adriana L. Burgy, *Error 101: Director Iancu Wants to Clarify Patentable Subject Matter*, PROSECUTION FIRST BLOG (Oct. 25, 2018), https://www.finnegan.com/en/insights/blogs/prosecution-first/error-101-director-iancu-wants-to-clarify-patentable-subject-matter.html [https://perma.cc/3NMA-LY9B].

382. *See, e.g.*, Kevin A. Rieffel, *What Is Director Iancu Proposing the USPTO Do for § 101*

patenting more feasible and the resulting patents more valuable, that change may reintroduce many of the problems the Supreme Court sought to address in joining the patentable subject matter discussion in the first place.

For instance, as previously mentioned, prior to the Supreme Court's decisions, software patent owners often drafted their patent claims so as to cover broad functions rather than specific technological improvements.[383] This meant that the software marketplace was burdened with many overbroad patents that implicated technologies already in use for some time.[384] The Supreme Court's decisions were meant at least in part to push back against this trend by strengthening the exceptions to the patentable subject matter requirement.[385] And while the Court may have expanded those exceptions too far, as some claim,[386] it remains dubious that returning back to the state of things prior to the Court's decisions is a better way forward.

Indeed, the state of software patenting prior to the Supreme Court's patentable subject matter decisions had significantly contributed to the rise of so-called patent trolls, or parties that do not practice their patents, instead suing others that do.[387] While there is certainly debate about whether such parties provide any

Analysis?, IPWATCHDOG (Sept. 25, 2018), https://www.ipwatchdog.com/2018/09/25/director-iancu-proposing-uspto-§101-analysis/id=101682/ [https://perma.cc/46HS-4CRM] (discussing Director Iancu's desire to focus the inquiry on all relevant Supreme Court precedent, not just the most recent decisions).

383. *See* Lemley, *supra* note 91, at 907-08.

384. *Id.* at 930-31.

385. *See* Timothy B. Lee, *Why a 40-Year-Old SCOTUS Ruling Against Software Patents Still Matters Today*, ARS TECHNICA (June 21, 2018, 4:15 PM), https://arstechnica.com/features/2018/06/why-the-supreme-courts-software-patent-ban-didnt-last/ [https://perma.cc/8KUZ-9J2D].

386. *See, e.g.*, Gene Quinn, *Did the Supreme Court Intentionally Destroy the U.S. Patent System?*, IPWATCHDOG (May 22, 2018), http://www.ipwatchdog.com/2018/05/22/did-the-supreme-court-intentionally-destroy-the-u-s-patent-system/id=97514/ [https://perma.cc/C7D9-BSJV].

387. *See* Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2118-20, 2123 (2013) (discussing patent trolls and their prevalence in the software industry).

social value,[388] there is a good amount of evidence suggesting that in the net they impose an overall tax on innovating parties.[389]

Since the Court's patentable subject matter decisions, the uproar over patent trolls has died down some.[390] Patent trolling has become less pronounced, and whatever ills it entails seem to have lessened.[391] While a number of legal changes account for this state of affairs,[392] the Supreme Court's patentable subject matter decisions, by making broad software patents more difficult to obtain and enforce, almost certainly had something to do with it.[393]

Hence, returning the state of patentable subject matter law to how it was prior to the Supreme Court's decisions would run the risk of reinvigorating the patent troll market, particularly in the AI space. Indeed, as AI continues to envelop every sector of society, the number of possible patent troll targets would increase exponentially.[394] And by raising the overall costs of carrying out AI research and development without providing a clear, offsetting benefit, such a development would arguably impede AI innovation, not promote it.

It is also the case that in many AI contexts, parties simply prefer trade secrecy over patent protection.[395] In such scenarios, it would thus seem that strengthening AI patents would have little to no

388. *See, e.g.*, Stephen H. Haber & Seth H. Werfel, *Patent Trolls as Financial Intermediaries? Experimental Evidence*, 149 ECON. LETTERS 64, 65-66 (2016) (presenting some evidence supporting the argument that patent trolls serve useful roles).

389. *See, e.g.*, James Bessen, *The Evidence Is In: Patent Trolls Do Hurt Innovation*, HARV. BUS. REV. (Nov. 2014), https://hbr.org/2014/07/the-evidence-is-in-patent-trolls-do-hurt-innovation [https://perma.cc/SX9H-3K7P] (summarizing evidence pointing to the harms that patent trolls impose).

390. *See* Eduardo Porter, *Patent 'Trolls' Recede as Threat to Innovation. Will Justices Change That?*, N.Y. TIMES (Nov. 21, 2017), https://www.nytimes.com/2017/11/21/business/economy/patents-trolls-supreme-court.html [https://perma.cc/664C-TLQ3].

391. *See id.*

392. *See, e.g.*, Larry Downes, *The U.S. Supreme Court Is Reining in Patent Trolls, Which Is a Win for Innovation*, HARV. BUS. REV. (June 2, 2017), https://hbr.org/2017/06/the-u-s-supreme-court-is-reining-in-patent-trolls-which-is-a-win-for-innovation [https://perma.cc/NXD6-AB85]; Mike Montgomery, *SCOTUS Smacks Down Patent Trolls*, FORBES (June 2, 2017, 4:50 PM), https://www.forbes.com/sites/mikemontgomery/2017/06/02/scotus-smack-down-patent-trolls/ [https://perma.cc/J674-5BSM].

393. *See* Quinn, *supra* note 386.

394. For concerns that AI patenting may already be getting in the way of AI innovation, see, for example, Gillula & Nazer, *supra* note 146 (reviewing some recently issued AI patents and their potential overbreadth).

395. *See* Fromer, *supra* note 41, at 728-30.

effect on the parties' intellectual property choices. That preference for trade secrecy, in turn, is likely to continue to push the industry towards consolidation in many cases, regardless of the relative strength of AI patents. This is so for the reasons discussed above: trade secrecy tends to increase transaction costs relative to patent protection, meaning that vertical integration becomes the more economically efficient means of producing the AI solution, even if it falls short of being the most innovative one.[396]

Indeed, this point is buttressed by the fact that important parts of AI systems are either not protectable under patent law (e.g., the training data) or only barely so because of the existing AI prior art.[397] And as discussed above, some of those complementary assets are more feasible to access when the industry is consolidated. Hence, strengthening AI patents by expanding patent eligibility is not a panacea for the AI industry. Indeed, doing so may actively harm AI innovation by reviving an AI patent troll market. Instead, the real solution may lie outside of intellectual property rights altogether.

B. Strengthening Antitrust Laws

A natural candidate for reducing industry consolidation, and thereby potentially increasing levels of AI innovation, is antitrust law. In general, antitrust laws are meant to "promote vigorous competition and protect consumers from anticompetitive mergers and business practices."[398] To that end, both the Federal Trade Commission and the Department of Justice enforce federal antitrust laws in an effort to protect consumer welfare, including by way of limiting industry consolidation that is deemed to undermine socially beneficial innovation.[399] Hence, antitrust is one possible means by

396. *See supra* Part II.A (discussing ways in which trade secrecy may increase transaction costs, and thus promote industry consolidation, relative to patent rights).

397. *See supra* Parts I.A-B (discussing these AI patenting considerations in detail).

398. *Guide to Antitrust Laws*, FTC, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws [https://perma.cc/JT6V-56NR].

399. *Competitive Effects*, FTC, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/mergers/competitive-effects [https://perma.cc/4G26-UF67]; *The Enforcers*, FTC, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/enforcers [https://perma.cc/77PD-UBV7].

which to thwart AI industry consolidation if that consolidation's effect is to impede valuable AI innovation.

Yet relying on antitrust law to upend artificial stupidity seems dubious for several reasons. For starters, in general leading scholars often view U.S. antitrust law as rather anemic,[400] particularly when compared to more robust conceptions of antitrust law found in Europe and elsewhere.[401] Hence, U.S. antitrust authorities have typically been reluctant to intervene unless a clear harm to consumer welfare is evident.[402]

But AI industry consolidation, it can be argued, provides benefits to consumers, not harms, in the form of relatively cheap, full-stack AI solutions.[403] Indeed, at least some evidence suggests that consolidation can lead to improved levels of innovation, thereby benefiting consumers, in at least two ways. First, market power can theoretically provide firms with greater security and capital "in the pursuit of ambitious and long-term-oriented" research and development activities.[404] And those long-term research and development efforts may very well bring consumers some benefits, at least ultimately.

Second, some recent evidence suggests that consolidation can and often does lead to technological "synergies" that contribute to innovation.[405] Those synergies, too, can benefit consumers. For these and other reasons, U.S. antitrust authorities seem unlikely to successfully intervene as AI consolidation occurs and, in fact, have

400. *See generally* HERBERT HOVENKAMP, THE ANTITRUST ENTERPRISE: PRINCIPLE AND EXECUTION 1-7 (2005) (discussing the history of antitrust law in the United States, its retreat to a single focus on consumer welfare, and a lack of recent Supreme Court oversight).

401. *See* Sean Heather, *Five Things European Antitrust Gets Wrong*, U.S. CHAMBER COM. (July 20, 2018, 9:00 AM), https://www.uschamber.com/series/above-the-fold/five-things-european-antitrust-gets-wrong [https://perma.cc/86N6-YWVD] (arguing that European antitrust law goes too far in a number of ways); Sanford M. Pastroff & Tilman Kuhn, *Antitrust Law in the United States and European Union: Key Differences*, A.B.A., https://www.americanbar.org/groups/young_lawyers/publications/tyl/topics/antitrust/antitrust-law-the-united-states-and-european-union-key-differences/ [https://perma.cc/66MD-H9GC] (discussing some of the differences between U.S. and European antitrust laws).

402. *See* HOVENKAMP, *supra* note 400, at 7.

403. *See supra* notes 356-60 and accompanying text.

404. Merges, *supra* note 47, at 52.

405. Jan Bena & Kai Li, *Corporate Innovations and Mergers and Acquisitions*, 69 J. FIN. 1923, 1931 1949-55 (2014) (studying 1762 mergers from 1984 to 2006 and finding that technological synergies resulting from those mergers often resulted in higher levels of innovation).

been reluctant to bring antitrust investigations against the main AI behemoths in the past.[406]

Furthermore, while some may envision a more robust future role for U.S. antitrust law,[407] vast changes to those laws do not appear imminent.[408] Hence, unlike patent law's patentable subject matter requirement, which may very well receive a makeover in the near term,[409] the basic U.S. approach to antitrust enforcement seems unlikely to change anytime soon in a way that would effectively limit AI industry consolidation.

Consequently, absent other solutions, AI industry consolidation seems to promise continuing artificial stupidity. Indeed, despite providing enough possible consumer benefits to stave off antitrust oversight, industry consolidation is typically considered a major hurdle, if not outright impediment, to radical, far-reaching innovation.[410] As Robert Merges has noted, "[L]arge companies rarely succeed in paradigm-shifting innovations."[411] Yet this type of innovation is precisely what is needed in the AI field, as many experts attest.[412] With intellectual property and antitrust laws providing little, if any, promise on this front, the next Section looks to a possibly more promising source of radical AI innovation.

C. Government AI

One of history's important lessons is that dramatic, far-reaching innovation often requires significant backing from state actors.[413] A

406. *See* Brian Fung, *Amazon, Facebook and Google Are All Being Looked at for Antitrust Violations, Trump Says*, WASH. POST (Nov. 5, 2018, 9:15 AM), https://www.washingtonpost.com/technology/2018/11/05/amazon-facebook-google-are-all-being-looked-antitrust-violations-trump-says/ [https://perma.cc/6QKB-UBQR] (discussing some recent antitrust overtures from President Trump that to date have gone nowhere, at least in the United States).

407. *See, e.g.*, Reza Dibadj, *A Modest Enterprise*, 10 LEWIS & CLARK L. REV. 415, 416 (2006).

408. Jay Levine & Devan Flahive, *Is It Time to Change the Focus of the Antitrust Laws? The Debate Is Heating Up*, ANTITRUST L. SOURCE (Sept. 19, 2017), https://www.antitrustlawsource.com/2017/09/is-it-time-to-change-the-focus-of-the-antitrust-laws-the-debate-is-heating-up/ [https://perma.cc/T7NE-Q9SC] (discussing several reasons why the current U.S. approach to antitrust has lasted for four decades and is unlikely to change anytime soon).

409. *See* Hartung, *supra* note 380.

410. *See* Merges, *supra* note 47, at 52, 59.

411. *Id.* at 51.

412. *See, e.g.*, Jordan, *supra* note 1.

413. Mariana Mazzucato, *State of Innovation: Busting the Private-Sector Myth*, NEW

version of the Internet, for instance, was first developed by the U.S. Department of Defense before making its commercial debut in the 1980s.[414] Heavy government funding and applied research are also largely responsible for significant innovations in GPS, aviation technologies, space technologies, cellular technologies, nuclear power, nanotechnology, infant formula, bar codes, vehicle tires, microchips, touch screens, vaccines, wind turbines, and many more.[415] In the pharmaceutical sector, government backing is said to be "responsible for 75 per cent of the most innovative new drugs annually."[416]

The reason behind this is at least somewhat intuitive: "[T]ruly radical innovation needs patient, long-term, committed finance. This type of finance is hard to find in the short-termist private sector."[417] Hence, traditional banks, venture capitalists, and other sources of potential funding are often reluctant to invest in innovations that only promise returns, if at all, after a long period of risky trial and error.[418] In part for this reason, commentators often criticize venture capitalists for primarily investing in projects that promise oversized returns in the near or immediate future.[419] And while such an approach may sometimes prove profitable, it makes it difficult for innovative start-up companies to obtain financing for the type of long-term innovation capable of yielding radical discoveries.

SCIENTIST (Aug. 21, 2013), https://www.newscientist.com/article/mg21929310-200-state-of-innovation-busting-the-private-sector-myth/ [https://perma.cc/BSD8-98CF] (discussing the state's role in a number of important historical innovations).

414. *See* Evan Andrews, *Who Invented the Internet?*, HISTORY (Dec. 18, 2013), https://www.history.com/news/who-invented-the-internet [https://perma.cc/C2HH-BBN3].

415. *10 World-Changing Inventions from Government Funding*, FISCAL TIMES (Mar. 7, 2013), http://www.thefiscaltimes.com/Media/Slideshow/2013/03/07/10-government-funded-inventions [https://perma.cc/L7HM-FJGD]; Liz Jacobs, *GPS, Lithium Batteries, the Internet, Cellular Technology, Airbags: A Q&A About How Governments Often Fuel Innovation*, TEDBLOG (Oct. 28, 2013, 11:34 AM), https://blog.ted.com/qa-mariana-mazzucato-governments-often-fuel-innovation/ [https://perma.cc/M58W-3Z52].

416. Mazzucato, *supra* note 413.

417. Jacobs, *supra* note 415.

418. Mazzucato, *supra* note 413.

419. *See, e.g.*, Eric Paley, *Toxic VC and the Marginal-Dollar Problem*, TECHCRUNCH (Oct. 26, 2017, 5:00 PM), https://techcrunch.com/2017/10/26/toxic-vc-and-the-marginal-dollar-problem/ [https://perma.cc/8GLC-TVXT] (discussing the problems arising from such an approach).

Admittedly, the public-private sector debate—that is, whether the government should lead the way, or instead defer to private entrepreneurs, who are often viewed as more capable of innovative activity[420]—is an enormous one that this Article cannot hope to settle. Nor need it. Instead, the point here is simply that for truly radical innovation—such as general AI—often both sides are necessary. Hence, we should view government involvement in promoting such radical AI innovation as an important complement to private sector activity, rather than a competitor to or outright replacement for it.

Indeed, a recent review of economic history suggests that for many significant, disruptive innovations, early government support was crucial because clear commercial possibilities were not yet ripe during those early stages of development.[421] Consequently, neither investors nor private sector companies were willing to take on the financial risks necessary to spur on the relevant innovation.[422] By ensuring that the innovations got off the ground, the government thus played a critical role in the early phases of many significant innovations.[423] Later, when commercial applications of the innovations became clearer, the private sector often took the reins, contributing much to the further development of these technologies.[424] Indeed, many of the foundational technologies underlying innovations such as Apple's iPhone may have never seen the light of day without early government involvement.[425] Apple's later refinements of those technologies certainly provided a number of socially beneficial innovations.[426] But without early government

420. *See, e.g.*, Jeff Madrick, *Innovation: The Government Was Crucial After All*, N.Y. REV. BOOKS (Apr. 24, 2014), https://www.nybooks.com/articles/2014/04/24/innovation-government-was-crucial-after-all/ [https://perma.cc/7JHV-53VS].

421. *See* MARIANNA MAZZUCATO, THE ENTREPRENEURIAL STATE: DEBUNKING PUBLIC VS. PRIVATE SECTOR MYTHS 5-7 (2014).

422. *See id.*

423. *See id.* at 21.

424. *See id.* at 20-21.

425. *See id.* at 87-88; *see also* WILLIAM H. JANEWAY, DOING CAPITALISM IN THE INNOVATION ECONOMY: RECONFIGURING THE THREE-PLAYER GAME BETWEEN MARKETS, SPECULATORS AND THE STATE 294 (2d ed. 2018) (discussing the important role of the state in helping to foster the development of many important technologies).

426. MAZZUCATO, *supra* note 421, at 87-88.

involvement, society may have never experienced those later contributions.[427]

The U.S. government, and governments across the world, remain a significant source of funding for basic research.[428] In fact, most of today's AI innovations initially started out in universities.[429] Yet the U.S. government's share of that funding has fallen precipitously in recent years.[430] What is more, its absolute level of funding has also flattened in the last decade, even as basic research needs grow.[431] And constant threats to cut additional funding mean that flattening could eventually nosedive.[432] The lessons of history suggest that if we are to avoid enduring artificial stupidity and make real breakthroughs in achieving general AI, government backing is necessary, and preferably in large doses.[433] This does not mean that private sector entrepreneurs will have no role to play in achieving general AI—they certainly will, and undoubtedly will have much to contribute. But as the history of many significant innovations teaches, often their breakthroughs will only come on the shoulders of governmental involvement.[434] Or in other words, the private sector's

427. *Id.*

428. *What Is the Optimal Balance Between Basic and Applied Research?*, UNESCO (Feb. 16, 2017), http://www.unesco.org/new/en/media-services/single-view/news/what_is_the_optimal_balance_between_basic_and_applied_resear [https://perma.cc/GAP8-XHZG].

429. Nick Jennings, *Universities Must Stay at the Heart of the AI Revolution. Here's Why*, WORLD ECON. F. (Apr. 5, 2018), https://www.weforum.org/agenda/2018/04/universities-must-stay-at-the-heart-of-the-ai-revolution-heres-why/ [https://perma.cc/X4KJ-XU6X].

430. Jeffrey Mervis, *Data Check: U.S. Government Share of Basic Research Funding Falls Below 50%*, SCIENCE (Mar. 9, 2017, 1:15 PM), https://www.sciencemag.org/news/2017/03/data-check-us-government-share-basic-research-funding-falls-below-50 [https://perma.cc/E2PT-4JAL].

431. *See id.*

432. *See, e.g.*, Joel Achenbach & Lena H. Sun, *Trump Budget Seeks Huge Cuts to Science and Medical Research, Disease Prevention*, WASH. POST (May 23, 2017, 4:15 PM), https://www.washingtonpost.com/news/to-your-health/wp/2017/05/22/trump-budget-seeks-huge-cuts-to-disease-prevention-and-medical-research-departments/ [https://perma.cc/9UUM-HLW6] (discussing some recent threats by the Trump administration to cut federal funding for science and medical research).

433. The Trump Administration did recently issue an Executive Order backing federal support of AI research, but, notably, that Executive Order failed to allocate any additional funds toward the effort. *See* Jadzia Pierce & B.J. Altvater, *President Trump Signs Executive Order on Artificial Intelligence*, INSIDE PRIVACY (Feb. 11, 2019), https://www.insideprivacy.com/data-privacy/president-trump-signs-executive-order-on-artificial-intelligence/ [https://perma.cc/A6DG-D6TJ].

434. Greg Satell, *4 Government Programs that Drive Innovation*, FORBES (July 2, 2013, 8:56 AM), https://www.forbes.com/sites/gregsatell/2013/07/02/4-government-programs-that-drive-

contributions will only be possible by "building on top of [the] technological infrastructure built by the public sector."[435]

Furthermore, the public sector needs greater space to innovate before commercial interests enter the fray. For instance, universities have become so enamored with trying to commercialize their innovations that that commercialization impulse often directs what types of AI innovation university researchers pursue.[436] Often, those commercial interests push for narrower, immediately useful forms of AI rather than more general, less predictable ones.[437] Hence, greater government funding, with at least some distance from the immediate need to commercialize the funded research activities, seems to be the best way forward to realizing more radical forms of AI innovation.

CONCLUSION

If achieving true AI remains a worthy pursuit, then U.S. innovation policy is in need of a reboot. As this Article has examined, intellectual property rights, particularly patents, are a poor fit for many types of AI development.[438] Indeed, for many AI innovators, trade secrecy is often a better choice.[439] These intellectual property realities, furthermore, have industrial organization repercussions, as they are likely to contribute to heavy AI industry consolidation.[440] That consolidation, in turn, is likely to contribute to enduring artificial stupidity.

But neither strengthening patent rights, nor relying on other forms of law such as antitrust, seem to hold much promise as solutions. Strengthening patent rights is likely to reintroduce a

---

innovation/ [https://perma.cc/H6EL-QJ2M].

435. *Id.*

436. Robert E. Litan et al., *Commercializing University Innovations: A Better Way*, BROOKINGS INST. (May 2007), https://www.brookings.edu/wp-content/uploads/2016/06/05_innovations_litan.pdf [https://perma.cc/UX4W-86WW] (discussing the formation of technology transfer offices at many universities in the wake of the Baye-Dohl Act and how these offices often play a negative role in affecting university research and the commercialization process).

437. Remarks at 2018 Berkeley Ctr. for Law & Tech. (Sept. 6, 2018) (discussing, anonymously, the impact of commercial interests on AI).

438. *See supra* Part I.A.

439. *See supra* Part I.B.

440. *See supra* Part II.

number of unintended problems in the AI marketplace that would ultimately tax AI innovators more than help them.[441] And antitrust law, with its strict focus on consumer welfare, is unlikely to have much teeth in the AI context.[442] Instead, as with many radical innovations before it, achieving general AI will require significant government backing that goes beyond mere lip service.[443] Otherwise, artificial stupidity, though valuable in many contexts, may remain our reality for some time to come.

441. *See supra* Part III.A.
442. *See supra* Part III.B.
443. *See supra* Part III.C.