WHILE AI BUYS TIME TO CURE COVID-19, UNRESOLVED AI ISSUES LOOM LARGE ON THE HORIZON

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INTRODUCTION

For every individual infection of coronavirus (COVID-19), recent estimates show that, on average, four new infections occur.[1] This reproduction rate can be reduced, through appropriate measures, down to around 1.1.[2] Within the U.S., COVID-19 has a death rate of 1.3 percent of infected individuals.[3] The coronavirus is deadly and spreads quickly; scientists can find a cure in due time, but that time costs lives.[4] Artificial Intelligence (AI) is being used in various ways to buy that time back. This commentary explores various methods in which AI is employed to create a shortened timeline to reach a treatment or a cure.

I. USES OF AI IN THE AGE OF COVID-19

The first usage of AI in this infectious disease space is contact tracing. This is the process whereby a trained worker interviews an infected patient to determine exposed persons, either by remembered contact with certain persons or by cataloging locations visited.[5] People exposed to the positive patient are then contacted to be tested and isolated, as necessary. Traditionally, this interview method takes three days *per person*.[6] The spread of the

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[1] Thomas V. Ingelsby, *Public Health Measures and the Reproduction Number of SARS-CoV-2*, JAMA NETWORK (May 1, 2020), https://jamanetwork.com/journals/jama/fullarticle/2765665.
[2] *Id.*
[3] *Id.*
[4] AFP, *Full coronavirus vaccine unlikely by next year: expert*, FRANCE24 (July 12, 2020), https://www.france24.com/en/20200712-full-coronavirus-vaccine-unlikely-by-next-year-expert.
[5] Sherryn Groch & Zach Hope, *Contact tracing: How disease detectives are closing in on COVID-19 in Australia*, SYDNEY MORNING HERALD (Apr. 16, 2020), https://www.smh.com.au/national/contact-tracing-how-disease-detectives-are-closing-in-on-covid-19-in-australia-20200410-p54itv.html.
[6] Sharon Begly, *Covid-19 spreads too fast for traditional contact tracing. New digital tools could help*, STAT (Apr. 2, 2020), https://www.statnews.com/2020/04/02/coronavirus-spreads-too-fast-for-contact-tracing-digital-tools-could-help/. *But see* Matt Richtel, *Contact Tracing With Your Phone: It's Easier but There Are Tradeoffs*, N.Y. TIMES (Jun. 17, 2020), https://www.nytimes.com/2020/06/03/health/coronavirus-contact-tracing-apps.html (stating that each case only takes 90 minutes).

disease so severely outpaces those efforts that traditional contact tracing is hopelessly ineffective.[7]

AI, on the other hand, can continually process vast amounts of data, then find and return the relevant and useful information faster than any human; for such a widespread and fast-spreading virus, tracing the virus's spread is a superhuman feat, almost tailor made for AI. It is only hamstrung by internet speed, nearly eliminating the three-day time period.[8] Contact tracing apps use AI to constantly handle the equivalent of the traditional process in their background operations, preserving contact tracing's effectiveness.[9]

There are two popular, differing methods: Bluetooth or geolocation.[10] The former is a joint project from Apple and Google.[11] Their method assigns smartphones rolling, unique Bluetooth keys that are broadcast to other contact tracing app users in the vicinity.[12] In the event of an infection, a user can choose to notify the app, which will then upload the list of unique keys assigned to this person's phone to a central server.[13] All participating phones keep a list of received Bluetooth keys and periodically download the infected list from the central server for cross referencing by the app's AI.[14] The latter method, using geolocation, collects data on when and where a phone was, with that data held on a central server.[15] Following a participant informing the app of an infection, a comparison between that person's geolocation data and the data of others is made, with potentially exposed persons being notified.[16]

Contact tracing through smartphones faces problems, both technically and legally.[17] In the U.S., there is no over-arching,

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[7] Barry B. Sookman, *COVID-19 and privacy: Artificial intelligence and contact tracing in combatting the pandemic*, LEXOLOGY (Apr. 14, 2020), https://www.lexology.com/library/detail.aspx?g=0d657003-bccc-44c1-8bb9-351ab28b3d04.
[8] *Id.*
[9] Luca Ferretti et al., *Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing*, 368 SCIENCE 619 (2020).
[10] Richtel, *supra* note 6.
[11] *Id.*
[12] Sookman, *supra* note 7.
[13] *Id.*
[14] *Id.*
[15] Richtel, *supra* note 6.
[16] *Id.*
[17] Sookman, *supra* note 7.

federally-recommended contact tracing app.[18] Rather, the apps are state efforts.[19] This raises the technical issue of compatibility.[20] The Bluetooth and geolocation methods are not compatible.[21] They collect different data with different collection methodologies.[22] Neighboring states that do not use the same method will not be able to account for the interactions between their respective citizens, willing cooperation or not, because the cross-referencing done by each system depends on data that the other has not collected and cannot provide.[23]

Both methods allow users to choose to inform the app, but issues of consent and privacy remain.[24] The collected data can be used for more than contact tracing, but it is unlikely that users consented to those other uses, especially when those uses cannot be elucidated at the time of consent.[25] Even putting the efficacy of consent aside, we must ask whether there should be limitations on the use of this collected data.[26] On an international scale, different world regions approach privacy in vastly different ways. For instance, in South Korea, the government collected detailed accounts of patient movements and then released this data to the public, with each case being identifiable because of the detail in the collected data.[27] But disclosures like this are highly unlikely to

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[18] Andy Greenberg, *State-Based Contact Tracing Apps Could Be a Mess*, WIRED (May 27, 2020), https://www.wired.com/story/covid-19-contact-tracing-app-fragmentation/.
[19] *Id.*
[20] *Id.*
[21] *Id.*
[22] *Id*; *see* Richtel, *supra* note 6.
[23] Greenberg, *supra* note 18; Richtel, *supra* note 6.
[24] *See* Sookman, *supra* note 7; *State of Utah Releases "Healthy Together" Beta App*, UTAH.GOV (Apr. 22, 2020), https://coronavirus.utah.gov/state-of-utah-releases-healthy-together-beta-app/.
[25] Solon Barocas & Helen Nissenbaum, *Big Data's End Run Around Anonymity and Consent*, *in* PRIVACY, BIG DATA, AND THE PUBLIC GOOD 44, 59, 60–61 (Julia Lane et al. eds., 2014), https://nissenbaum.tech.cornell.edu/papers/Big%20Datas%20End%20Run%20Around%20Consent%20and%20Anonymity.pdf. Google and Apple have expressly designed the system to answer this concern. *Exposure Notification Frequently Asked Questions*, APPLE (May 2020), https://covid19-static.cdn-apple.com/applications/covid19/current/static/contact-tracing/pdf/ExposureNotification-FAQv1.1.pdf. But not all contact tracing apps using Bluetooth use this model. Kif Leswing, *Utah has rejected the Apple-Google approach to tracing coronavirus, and is using an app made by a social media start-up instead*, CNBC (May 13, 2020), https://www.cnbc.com/2020/05/13/utah-contact-tracing-healthy-together-app.html.
[26] Barocas & Nissenbaum, *supra* note 25.
[27] *See* Groch & Hope, *supra* note 5.

comply with European privacy laws like the GDPR,[28] or the California Consumer Privacy Act (CCPA).[29] Despite these problems, contact tracing with AI might be the best way to overcome inadequate traditional methods.[30]

The second usage of AI is active testing and treatment of COVID-19 patients.[31] Using AI in active medical practice is not new,[32] but COVID-19-specific predictive models are being used to determine which patients will need intensive care, allowing early allocation of resources.[33] AI could also fulfill an important predictive role with respect to testing. A cheaper testing model is to pool testing.[34] A pool with a negative result only needs the one test.[35] If the pool has a positive result, specific testing would determine who in the pool is infected.[36] AI could then be used to model social networks, showing who else would have been exposed within the pool and marking them for further testing, rather than retesting the whole pool.[37] Similarly, AI can be used to determine who is susceptible to COVID infection, and fast track them for testing.[38]

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[28] *See* Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 Apr. 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation), 2016 O.J. (L 119/1).

[29] *See* California Consumer Protection Act (CCPA), CAL. CIV. CODE §§ 1798.100–1798.199 (Deering 2019).

[30] Greenberg, *supra* note 18.

[31] Lee Tiedrich & James Ermilio, *Recent AI Developments in the Fight Against COVID-19*, COVINGTON (May 20, 2020), https://www.covingtondigitalhealth.com/2020/05/recent-ai-developments-in-the-fight-against-covid-19/?_lrsc=3d62c3ad-8b18-41cc-8015-90d7bd1bb2af&utm_source=linkedin&utm_medium=social&utm_campaign=elevate.

[32] AI has been used as a diagnostic tool for diabetic retinopathy and for recommending cancer treatments. W. Nicholson Price II, *Medical AI & Contextual Bias*, 33 HARV. J.L. & TECH. 65, 75–76 (2019). Watson handles live calls from consumers for Humana. *Expertise on Call*, IBM, https://www.ibm.com/watson/stories/humana (last visited July 20, 2020).

[33] Price, *supra* note 32; *see* Ryan Abbott, *Everything is Obvious*, 66 UCLA L. REV. 2, 24–25 (2018) [hereinafter Abbott, *Everything is Obvious*]..

[34] Ziad Obermeyer, Ned Augenblick, & Jonathan Kolstad, *Here's one way to make daily covid-19 testing feasible on a mass scale*, MIT TECH. REV. (Jul. 22, 2020), https://www.technologyreview.com/2020/07/22/1005524/pooled-testing-covid-coronavirus-machine-learning-reopening/.

[35] *Id.*

[36] *Id.*

[37] *Id.*

[38] Tiedrich & Ermilio, *supra* note 31.

Lastly, AI is being used extensively to research the virus.[39] For instance, scientists are using AI to examine the proteins that coronavirus targets.[40] Examining all possible folding configurations of a protein—the physical process by which proteins become biologically functional[41]—would take longer than the age of the known universe.[42] AI makes predicting a protein folding configuration feasible, resource and time wise, and has done so with important COVID-related proteins.[43] AI can also help determine which research avenues are worth pursuing. This use of the technology is making the now copious amounts of COVID research more accessible, so overlapping research is less likely to occur, and less time is wasted.[44]

Similarly, AI is being used to explore known, existing drugs to see if they can be repurposed for COVID treatment. AI systems have been tasked with combing through the medical corpus to determine if old drugs might work to treat the virus—a method which has borne fruit with a recent study of dexamethasone, a medication typically used for the treatment of ailments like arthritis and immune system disorders (among others).[45] Additionally, clinical trials are set to begin with another old drug that BenevolentAI[46] suggests would be an effective COVID-19 treatment, called Baricitinib.[47] And while work is being done to

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[39] *See* Jonathan Block, *COVID-19 Puts Spotlight on Artificial Intelligence*, GENETIC ENGINEERING & BIOTECHNOLOGY NEWS (May 11, 2020), https://www.genengnews.com/gen-edge/covid-19-puts-spotlight-on-artificial-intelligence/.

[40] *Id.*

[41] Kerry Geiler, *Protein Folding: The Good, the Bad, and the Ugly*, SCIENCE IN THE NEWS (Feb. 28, 2010), http://sitn.hms.harvard.edu/flash/2010/issue65/.

[42] Oren Etzioni, *AI Can Help Scientists Find a COVID-19 Vaccine*, WIRED (Mar. 28, 2020), https://www.wired.com/story/opinion-ai-can-help-find-scientists-find-a-covid-19-vaccine/.

[43] Block, *supra* note 39. AI protein prediction can be done from a laptop, so the computing power is also manageable. Zhao Qin et al., *Artificial intelligence method to design and fold alpha-helical structural proteins from the primary amino acid sequence*, 36 EXTREME MECHANICS LETTERS 1, 5 (2020).

[44] Block, *supra* note 39.

[45] *Dexamethasone*, WEBMD, https://www.webmd.com/drugs/2/drug-1027-5021/dexamethasone-oral/dexamethasone-oral/details (last visited Jul. 10, 2020).

[46] *About Us*, BENEVOLENTAI, https://www.benevolent.com/about-us (last visited Jul. 10, 2020).

[47] Block, *supra* note 39; Michelle Roberts, *Coronavirus: Dexamethasone proves first life-saving drug*, BBC (Jun. 16, 2020), https://www.bbc.com/news/health-53061281; *Lilly Begins a Phase 3 Clinical Trial with Baricitinib for Hospitalized COVID-19 Patients*, LILLY (Jun. 15, 2020), https://investor.lilly.com/news-releases/news-release-details/lilly-begins-phase-3-clinical-trial-baricitinib-hospitalized.

revamp existing medications for coronavirus treatment, AI is also helping to identify new drugs that could treat COVID-19 patients.[48] It is being leveraged to discover new, patentable antiviral treatments with the understanding that AI can shorten a three- to five-year preclinical-to-clinical testing process down to just a few months.[49]

This last use of AI, discovering a patentable cure for COVID-19, comes with known yet unanswered problems. Such a patent could be worth a substantial amount of money. By way of comparison, there are two different types of polio vaccines, neither of which were patented.[50] But if they had been, the value of the two patents combined is estimated to have been worth, roughly, $7 to 7.5 billion.[51] As an added business incentive, President Trump's administration will not impose price controls for COVID-19 treatments in order to promote private-sector interest in finding the cure, nor will it guarantee the vaccine to all Americans.[52] The theoretical historical value of the polio vaccine shows how valuable such a patent for COVID-19 treatment might be. The problem is that when researchers rely on AI, there are outstanding questions regarding the produced patent and who benefits.

II. AI & PATENTS

The purpose of patent law is to reward inventiveness and scientific advancement by offering a temporary monopoly on the ability to create, produce, and sell inventions, or monetize certain

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[48] Tiedrich & Ermilio, *supra* note 31.

[49] Block, *supra* note 39.

[50] Brian Palmer, *Jonas Salk: Good at Virology, Bad at Economics*, SLATE (Apr. 13, 2014), https://slate.com/technology/2014/04/the-real-reasons-jonas-salk-didnt-patent-the-polio-vaccine.html; *How Much Money Did Jonas Salk Potentially Forfeit By Not Patenting The Polio Vaccine?*, FORBES (Aug. 9, 2012), https://www.forbes.com/sites/quora/2012/08/09/how-much-money-did-jonas-salk-potentially-forfeit-by-not-patenting-the-polio-vaccine/#262eca7869b8 [hereinafter *Not Patenting The Polio Vaccine*].

[51] *Not Patenting The Polio Vaccine*, *supra* note 50. Comparatively, look at the 7-year 500 percent price increase of Epipen. *Mylan CEO on EpiPen drug price controversy: "I get the outrage"*, CBS NEWS (Jan. 27, 2020), https://www.cbsnews.com/news/epipen-price-hike-controversy-mylan-ceo-heather-bresch-speaks-out/.

[52] Deborah Levine, *The case for a free or inexpensive coronavirus vaccine*, WASH. POST (Mar. 2, 2020), https://www.washingtonpost.com/outlook/2020/03/02/case-free-or-inexpensive-coronavirus-vaccine/. The effect of this policy is already seen in the drug remdesiver and the price point set by Gilead. Hannah Denham, Yasmeen Abutaleb & Christopher Rowland, *Gilead sets price of coronavirus drug remdesivir at $3,120 as Trump administration secures supply for 500,000 patients*, WASH. POST (Jun. 29, 2020), https://www.washingtonpost.com/business/2020/06/29/gilead-sciences-remdesivir-cost-coronavirus/.

discoveries.[53] The polio vaccine example shows how lucrative patents can be. But the application process can be quite complicated.[54] There are rigid rules that patent examiners must follow before granting a patent, and therefore strict specifications to which applicants must also adhere.[55]

Pursuant to 35 U.S.C. §115(a), a patent application must identify the inventor(s), or the patent can be invalidated.[56] AI involvement in the inventive process for patents inevitably raises the question of who can be claimed as inventor. The core questions that must be explored are the extent to which the AI itself has to be listed as an inventor or co-inventor, and if not the AI, who should be listed as the inventor instead. Additionally, there is the question of whether AI-involved inventions should be patentable under a different standard, or at all.

The question of AI inventorship regarding patents has recently been put to rest, at least for the foreseeable future.[57] On April 27, 2020, the United States Patent and Trademark Office (USPTO) published a decision involving two patent applications that listed an AI as the sole inventor.[58] The USPTO found that an AI could not be an inventor because the AI is not a natural person.[59] The decision states that 35 U.S.C. §101 implies "inventors" are limited to natural persons by use of the word "whoever."[60] Further, conception—the mental portion of inventorship where the complete invention is formed as it will be reduced to practice—is defined in the Patent Act with terms that implicitly limit conception, and thus inventorship, to natural persons.[61] Therefore, even if an AI system

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[53] U.S. CONST., art. 1, § 8, cl. 8.
[54] *See generally* MPEP (9th ed. Rev. 10, Jun. 2020).
[55] *See generally id.*
[56] "An application for patent […] shall include, or be amended to include, the name of the inventor for any invention claimed in the application." 35 U.S.C.A. § 115(a) (West); *see* Abbott, *Everything is Obvious*, *supra* note 33, at 6.
[57] *In Re Application of Application No. 16/524,350*, 2020 Dec. Comm'r Pat. LEXIS *3.
[58] Kaelyn R. Knutson, Comment, *Anything You Can do, AI Can't do Better: An Analysis of Conception as Requirement for Patent Inventorship and a Rationale for Excluding AI Inventors*, 11 CYBARIS: AN INTELL. PROP. L. REV. 1, 17–18 (2020).
[59] *Id.* at 18; *In Re Application of Application No. 16/524,350*, at *8.
[60] "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor." 35 U.S.C.A. § 101 (West); 2020 Dec. Comm'r Pat. LEXIS *3, at *4.
[61] *In Re Application of Application No. 16/524,350,* at *6.

were able to autonomously invent a vaccine, it would not be an "inventor" for the purposes of current U.S. patent law.

The question of who *can* be listed as an inventor, instead of an AI, is still unresolved, but now paramount—AI is already capable of both finding the structure of targeted proteins and designing targeting molecules. With a potential patent likely worth billions of dollars, understanding who an inventor can be is a lucrative question, and not just for the listed inventor. Inventorship and ownership are not the same,[62] even though the same individual may be listed in both capacities on a patent application.[63] Inventors working within a corporation can (and often do) assign their ownership of a patent to their employer, but remain listed as the inventors.[64] The question of who an inventor can be matters because it can heavily influence who or what is likely to be assigned patent ownership.[65]

Extreme situations can occur because, after the USPTO decision in April, AI inventorship is now impossible.[66] For instance, an unskilled person, a serendipitous observer, might be able to claim inventorship over a curative chemical compound that they could not have created or discovered for lack of knowledge or skill.[67] Imagine an AI system, having found some anti-COVID-19 drug, pushes the results to a computer monitor in an empty laboratory. Imagine our unskilled observer is the first person to see the result produced by the AI, which states the formula for the drug, a synthesis path, and what the drug does.[68] Since the AI cannot conceive of an invention

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[62] *Israel Bio-Engineering Project v. Amgen, Inc.*, 475 F.3d 1256, 1263 (Fed. Cir. 2007) (citing *Beech Aircraft Corp. v. EDO Corp.*, 990 F.2d 1237, 1248 (Fed. Cir. 1984)). Owners, not inventors, of patents are granted the rights previously enumerated. 35 U.S.C.A. §§ 261–62 (West).

[63] *See Israel Bio-Engineering Project*, 475 F.3d at 1263 (quoting *Teets v. Chromalloy Gas Turbine Corp.*, 83 F.3d 405, 406 (Fed. Cir. 1996)).

[64] Christopher McDavid, *I Want a Piece of That! How the Current Joint Inventorship Laws Deal with Minor Contributions to Inventions*, 115 PENN ST. L. REV. 449, 455 (2010).

[65] *See id.*

[66] *See* Erica Fraser, *Computers as Inventors – Legal and Policy Implications of Artificial Intelligence on Patent Law*, 13 SCRIPTED 305, 330 (2016).

[67] *See id.*; Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1098 (2016) [hereinafter Abbott, *I Think Therefore I Invent*].

[68] An invention must satisfy three subject matter requirements to qualify for a patent: usefulness, novelty, and nonobviousness. 35 U.S.C.A §§ 101–03. Presume that our hypothetical drug satisfies these requirements.

in the legal sense, the drug might instead be discoverable,[69] and therefore potentially be patentable.

Conception, for chemical compounds, is knowing how to make the compound and having an idea of its structure.[70] To measure usefulness or utility of such compounds, typically conception must occur simultaneously with reduction to practice, because the utility of a drug is usually impossible to determine without rigorous testing.[71] But if an AI can create or find a targeted drug, it would likely be capable of predicting what other proteins are susceptible to it, and thus be able to determine the utility and usefulness of a drug without the drug being fully manufactured.

Returning to the hypothetical from above, let us say our AI has provided all the information required for constructive reduction to practice on the computer monitor. The observer then becomes the first instance of conception for this invention because, again, the AI cannot conceive of ideas.[72] This process should not be surprising; the observer here could be the researcher working with the AI to develop the drug. But the observer does not need the researcher's knowledge in the field for them to conceive of this invention.[73] The computer monitor is providing all the information required for an observer to appreciate the impact of the drug. Patents do not require an inventor to understand how to reduce an idea to practice, merely that they have a method to do so.[74] A researcher may be able to conceive of an easier chemical sequence for the reduction to practice, but everything needed for an invention has been provided on the monitor. Suddenly, a patent that is likely worth billions of dollars may no longer fall into the researching company's lap through assignment because their researcher is no longer the inventor.[75]

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[69] A simple distinction between discovery and invention is that discovery is finding what already exists, while invention is creating something new. Stephen McKenna, *Patentable Discovery?,* 33 SAN DIEGO L. REV. 1241, 1247 (1996). Discovery is a valid alternative to invention regarding patent claims. *See generally id.* This also precludes derivation, where an individual files for a patent after reducing an invention to practice but does so based on another's conception of the invention, because an AI cannot conceive of an invention. *See Chamberlain v. Kleist,* 112 F.2d 846, 848 (C.C.P.A. 1940).

[70] *Oka v. Youssefyeh*, 849 F.2d 581, 583 (Fed. Cir. 1988).

[71] *Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1206 (Fed. Cir. 1991).

[72] *See In Re Application of Application No. 16/524,350*, 2020 Dec. Comm'r Pat. LEXIS 3, at *6.

[73] Fraser, *supra* note 66.

[74] *See id.*

[75] *See* McDavid, *supra* note 64, at 455.

The inventorship question—or, which *human* can claim they invented a thing—is unresolved. AI operates on a Multiplayer Model.[76] The nature of AI systems means that there are several different entities involved in AI-assisted invention.[77] This includes the software programmer, the data suppliers, the AI trainers, the AI owner, the AI operator, and the AI investor.[78] Not to mention any contributions that may be from open-sourced code.[79] Two of these options stand out as potential "inventors": the AI owner and the AI operator.

For the AI owner-as-inventor route, Professor Ryan Abbott considers the nature of contractually-provided AI systems.[80] IBM's Watson[81] is available to users other than IBM, even though IBM has retained ownership over the AI system.[82] IBM can, theoretically, provide Watson in this manner an infinite number of times.[83] If these Watson clones and their interactions with users lead to patentable inventions, or are capable of that result, giving IBM inventorship on subsequent patent applications could create a positive feedback cycle: more interaction between Watson and users will lead to more patents, which will encourage IBM to promote the use of Watson.[84] Conversely, if Watson users are given inventorship of patentable creations, despite IBM still owning Watson, IBM would be disincentivized from allowing continued access to Watson.[85] A Watson end-user could negotiate for the ownership of the patents flowing from his use of the AI.[86] And defaulting patent ownership to IBM could promote innovation by encouraging access to a powerful AI for a fee, which is a cheaper and more efficient option than developing a new AI comparable to Watson.[87] This could lead to a consolidation of patents in the hands of, in this example, IBM—

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[76] Shlomit Yanisky Ravid & Xiaoqiong Liu*, When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era*, 39 CARDOZO L. REV. 2215, 2231 (2018).
[77] *See id.*
[78] *Id.* at 2231–33.
[79] Complications that may arise due to the use of open source code in the creation of AI systems are not addressed in this Comment.
[80] Abbott, *I Think Therefore I Invent, supra* note 67, at 1115.
[81] "Watson is IBM's suite of enterprise ready AI services, applications, and tooling." *Enterprise-ready AI*, IBM, https://www.ibm.com/watson/about (last visited Jul. 10, 2020).
[82] Abbott, *I Think Therefore I Invent*, *supra* note 67, at 1115.
[83] *Id.*
[84] *See id.*
[85] *Id.*
[86] *Id.*
[87] *See id.*

a consolidation that many may find undesirable.[88] However, this negative consolidation is presumably outweighed by the public benefit of the inventions for which Watson assisted or was responsible.[89] Likely, the absence of Watson would mean the absence of the invention, and therefore IBM's intellectual property consolidation would be the price of advancement.[90]

For the AI operator/user-as-inventor path, W. Michael Schuster approaches the question of inventorship as one of ownership using the Coase Theorem.[91] Again, inventorship and ownership are not the same.[92] But ownership is used because the Coase Theorem applies to property rights and assignment of patents to employers is standard practice.[93] The inventor for this path—the researcher—likely has in his/her employee agreement a clause assigning ownership rights to all patents that they are the inventor of during their employment to their employer.[94]

Under the Coase Theorem, a property right should go to the interested party who places the greatest value on the right.[95] A vaccine patent would have value to a pharmaceutical company in immediate cash flow, but the patent would also show a strong Research and Development department and could encourage business partnerships such as investments.[96] Following the Theorem, the pharmaceutical company—the direct market participant for the vaccine patent—would get the most value out of the patent and should therefore have ownership.[97] The software company (equivalent to IBM above) would be a costly and inefficient choice for a default AI-invention patent owner.[98] IBM, presumably, lacks institutional knowledge of pharmaceutical patenting, and what kind of inventions would be most profitable under normal circumstances.[99] To make up for this, IBM would have to either spend substantial money to acquire knowledge of the pharmaceutical field from experts, or end up generating useless

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[88] *Id.* at 1119–20.
[89] *Id.*
[90] *Id.*
[91] W. Michael Schuster, *Artificial Intelligence and Patent Ownership*, 75 WASH. & LEE L. REV. 1945, 1987 (2018).
[92] *See supra* note 62 and accompanying text.
[93] *See* Schuster, *supra* note 91, at 1987; McDavid, *supra* note 64, at 455.
[94] *See* McDavid, *supra* note 64, at 455.
[95] Schuster, *supra* note 91, at 1971.
[96] *See id.* at 1982–85.
[97] *See id.* at 1988.
[98] *See id.* at 2001.
[99] *See id.* at 1994.

patent applications.[100] Or, IBM could license Watson in some form to persons with knowledge in the field for their use.[101] In the final case, IBM would then have to further police its various Watson users to ensure the company's patent ownership rights were not being violated.[102] Such policing would be a resource-intensive pursuit and is directly contrary to the Coase Theorem: IBM is not interested in the vaccine patent per se, but is paying a substantial amount to secure the patent anyway, whereas the pharmaceutical company, the AI operator/user, is directly interested in the patent.[103]

The two options are not antithetical. The Coase Theorem seeks the best net profit between two parties.[104] This could be satisfied by presuming that the AI owner—here, IBM—owns the produced patent(s), with a standard of practice where the ownership rights are assigned to the AI user through contract. This mirrors the current standard practice between researchers and employers.[105] AI owners presumptively owning patents would still encourage access to sophisticated AI because of the contractual reassignment of ownership to end-users. This would replace the sunk costs the AI owner would be required to invest before benefitting from a patent with compensation, leading to a better net profit than no contract and no invention. Further, an AI owner that refuses to contractually assign these patents to AI end-users could suffer. Competitors with less powerful AI may agree to such assignments, and thereby secure contracts and funding to close the respective AI gap.

However, the presumption that the AI owner owns the patent by default does not account for training done with proprietary data set(s) owned by the AI operator. Since AI is, in one way, only as good as the data it relies on,[106] the AI owner would stand to gain not only any prospective patent, but also an AI improved by the value of the incorporated, and now less than proprietary, data. The AI operator could be paying a licensing fee only to lose a competitive

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[100] *See id.* at 1995.
[101] *See id*.
[102] *See id.* at 2000.
[103] *See id*. IBM may not feel compelled to negotiate regarding inventorship because there could be an extreme disparity in bargaining power, varying from industry to industry. While this issue is not explicitly addressed here, the support for IBM as presumptive owner indicates an acceptance of resulting patent consolidation implicitly addressing this question. Further, a market competitor, open to such negotiation, may force IBM's hand.
[104] *Id.* at 1971.
[105] *See* Schuster, *supra* note 91, at 1987; McDavid, *supra* note 64, at 455.
[106] *See* Amanda Levendowski, *How Copyright Law can Fix AI's Implicit Bias Problem*, 93 WASH. L. REV. 579, 585 (2018).

advantage when a competitor contracts to use the new and improved AI, negating the presumption's net gain.

Currently, as shared above, an invention must be novel, useful, and nonobvious to qualify for a patent.[107] Of the three, nonobviousness is the most important and requires the most complex analysis.[108] Obviousness is determined by using a standard theoretical person, a Person Having Ordinary Skill in the Art (PHOSITA); if the invention would have been obvious to the PHOSITA at the time of filing, then the invention is not patentable.[109] Consider an example: a segmented and mechanized cover for trucks.[110] Some previous patents, or "prior art," include segmented covers for ease of repair, while others describe mechanized covers for ease of opening.[111] The combination of these two elements would be obvious as a natural next step in innovation to a PHOSITA, and therefore unpatentable.[112]

There is a dearth of case law explaining how a court would determine a PHOSITA, but six factors have been identified: "(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field."[113] AI involvement in invention raises the question of whether the theoretical PHOSITA must change to account for the use of such a sophisticated tool.[114]

Samore argues that if the use of a type of AI is common in a field, such that a typical researcher looking for a vaccine would task AI with finding what molecule(s) can bind to a protein, then a molecule found by an AI that binds the protein would be obvious.[115] It would not matter that prior to the widespread use of AI the discovery would have been patentable, because now it is obvious to

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[107] William Samore, *Artificial Intelligence and the Patent System: Can a New Tool Render a Once Patentable Idea Obvious?*, 29 SYRACUSE J. SCI. & TECH. L. 113, 116 (2013).
[108] Fraser, *supra* note 66, at 320.
[109] Samore, *supra* note 107, at 117–18.
[110] *2143 Examples of Basic Requirements of a Prima Facie Case of Obviousness [R-10.2019]*, USPTO (Jun. 25, 2020), https://www.uspto.gov/web/offices/pac/mpep/s2143.html.
[111] *Id.*
[112] *See id.*
[113] Samore, *supra* note 107, at 121.
[114] *See, e.g.*, Fraser, *supra* note 66; Samore, *supra* note 107, at 129; Abbott, *I Think Therefore I Invent*, *supra* note 67, at 1125.
[115] *See* Samore, *supra* note 107, at 129.

the PHOSITA that the AI should be able to produce that molecule.[116] Or, if not that molecule, then it is a given that the AI would be able to return a different molecule that serves the same function.[117] A competitor could then create a functionally identical product that is not covered by the patent as it is a new invention, and would therefore instantly negate the exclusionary purpose of patents.[118] An AI-based PHOSITA would also have an expanded library of prior art, which would raise the bar on combination patents.[119]

But we must also consider what happens when the use of AI is not ubiquitous. Fraser suggests that the PHOSITA should change, even if researchers that lack AI are disadvantaged.[120] The central justification for patents is incentivization.[121] An AI program does not need incentives, but AI operators and owners can still be incentivized.[122] By raising the bar as to what constitutes as the PHOSITA, AI operators and owners are encouraged to still innovate, rather than coasting off of their existing advantage.[123] Fraser does attempt to level the playing field by suggesting the PHOSITA should change in proportion with the amount of computing power used for the invention.[124] Some inventions might only exist because AI can handle data of greater complexity and size than a human can, but others might exist because an AI used brute force to find a solution.[125] However, a changing PHOSITA means also changing what we tell juries.[126] What, exactly, an AI-based PHOSITA jury instruction would be is unclear at best.[127]

There is also the option to entirely exempt any inventions that used AI from the patent regime (in its current form), instead of amending the PHOSITA standard to account for AI use.[128] Ravid believes that non-patented AI inventions could be promoted simply

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[116] *Id.*
[117] *See id.* at 131.
[118] *See id.*
[119] Abbott, *I Think Therefore I Invent*, *supra* note 67, at 1125. Combination patents and AI involvement also bring up questions about AI infringing on prior art, such as the question of liability (who or what is liable) and that of subsequent damages (are the damages forward-facing because the AI will continually use the infringed knowledge); but these questions are outside the scope of this Comment.
[120] Fraser, *supra* note 66, at 320.
[121] *Id.* at 325.
[122] *Id.* at 326
[123] *Id.*
[124] *Id.* at 321.
[125] *Id.* at 326.
[126] Abbott, *I Think Therefore I Invent*, *supra* note 67, at 1125.
[127] *Id.*
[128] Ravid & Liu, *supra* note 76, at 2252–53 (2018).

through first-mover, or first-to-market, advantages, which would present a consumer loyalty, monopoly-like status, and the ability to force out rivals by undercutting the price.[129] Monopoly-like status would exist because consumers have no alternative to the first-mover's product.[130] The first mover can then occupy the entire market share, or as much as they choose to occupy, and set their own price point.[131] First access to the entire market share means that the first-mover can occupy the most advantageous portions and benefit from larger economics of scale, despite sunk investment costs.[132] A competitor entering the market would do so in less advantageous portions and would need to compete without the benefit of the larger scale production processes, while also losing initial investment costs the first-mover has already recovered.[133]

But even if a competitor entered this market space, the first mover has established its product as the one to buy.[134] Consumers would buy what they know works, and therefore remain loyal to the first mover, which could also cut the cost to block competitors.[135] In the case of a coronavirus vaccine, the first-mover advantage of an effective and safe vaccine is immediately obvious. Any such company would have as much of the market as it could produce for and, barring the release of a better product, consumer loyalty and gratitude towards the company that can solve the pandemic.[136] If the company moves quickly, entry of competitors might not even be a concern.[137] The first mover would probably see myriad other benefits besides those listed above, such as ballooning stock value, simply because the desire for the product is so high, and interest in the first-mover would likely follow.

However, there are already questions about whether patent filings are being truthful about the use of AI in the inventive process.[138] Exempting AI inventions from patent law protections does not seem likely to change this behavior, which is practiced for

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[129] *Id.*
[130] *Id.* at 2253.
[131] *Id.*
[132] *Id.*
[133] *See id.*
[134] *Id.* at 2253–54.
[135] *Id.*
[136] *See id.* at 2253–54.
[137] A vaccine would eliminate the market entirely, rendering competition moot. Even a drug treatment, distributed widely and quickly, could eliminate the market.
[138] The USPTO should be seeing much greater numbers of AI involved inventions but is not. Abbott, *I Think Therefore I Invent*, supra note 67, at 1097.

the express purpose of gaining those protections.[139] First-mover "protections" might stall innovation as companies hold out on releasing a product, trying to wait for a perfect storm of consumer interest and buying power and production capacity, even if there are competing companies. A COVID-19 vaccine would not have a consumer demand issue but could have a production one that would encourage a company to hold off on selling their vaccine in order to secure as much profit as possible.

CONCLUSION

Coronavirus is fast-spreading and deadly. While science will catch up and find a cure and preventative treatments, the nature of the virus means that time costs lives. AI is being employed to make up the difference, to great effect.[140] But using AI to find a cure highlights existing questions about AI and patent law.[141] While AI inventorship has recently been addressed,[142] there are outstanding questions, such as whether AI involvement in an invention means a different standard should be required for non-obviousness, or who should be listed as an inventor on an AI-involved patent.[143] These questions are directly relevant to any AI-developed targeted drug, and the closer AI gets to finding such a drug, the less time is left to decide the answers to these questions.

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[139] *See id.* at 1097–98.
[140] *See supra* Part I.
[141] *See supra* Part II.
[142] *In Re Application of Application No. 16/524,350*, 2020 Dec. Comm'r Pat. LEXIS *3.
[143] *See supra* Part II.