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ARTICLES

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Machine learning has entered the world of the professions with differential impacts. Automation will have huge impacts on the nature of work and society. Engineering, architecture, and medicine are early and enthusiastic adopters of automation. Other professions, especially law, are late and, in some cases, reluctant adopters.[1] This Article examines the effects of artificial intelligence ("AI") and Blockchain on professions and their knowledge bases. We start by examining the nature of expertise in general and the function

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[1] Within professions and occupations there are differential rates of adoption and diffusion of technology. According to William Henderson, the early adopters in law are small in number, one sixth, but ambitious, and can set the future road forward for the remainder. William D. Henderson, *Innovation Diffusion in the Legal Industry*, 122 DICK. L. REV. 395, 402–03 (2018). Henderson adopts the Rogers Diffusion Curve, which he argues applies as much to lawyers as it does to farmers. *See id.* at 403, 448–49.

of expertise in law. Using examples from law, such as Gulati and Scott's analysis of how lawyers create (or don't create) legal agreements, we show that even non-routine and complex legal work is potentially susceptible to automation.[2] *However, professions are different from other occupational groups because they include both indeterminate and technical elements that make pure automation difficult to achieve. We consider the future prospects of AI and Blockchain on professions and hypothesize that as the technologies mature, they will incorporate more human work through neural networks and Blockchain applications, such as the distributed autonomous organization ("DAO"). We argue that in the law and the legal profession, the role of lawyer as trusted advisor will again emerge as the central point of value.*

INTRODUCTION: THE NATURE OF THE PROBLEM

Automation in the guise of machine learning, robots, and Blockchain has a significant impact on global economy and society.[3] The prediction of Moore's Law has proved accurate over the past half-century, as processing power has doubled and price has halved every two years.[4] A modern smart phone is now more powerful than the

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[2] *See* MITU GULATI & ROBERT E. SCOTT, THE THREE AND A HALF MINUTE TRANSACTION: BOILERPLATE AND THE LIMITS OF CONTRACT DESIGN (2013).

[3] *See* Michael Chui et al., *Four Fundamentals of Workplace Automation*, MCKINSEY Q., Nov. 2015, at 1, 1–2, https://roubler.com/au/wp-content/uploads/sites/9/2016/11/Four-fundamentals-of-workplace-automation.pdf.

[4] Lee Bell, *What Is Moore's Law? WIRED Explains the Theory That Defined the Tech Industry*, WIRED (Aug. 28, 2016), https://www.wired.co.uk/article/wired-explains-moores-law. For a further explanation of Moore's Law, see

computers used to guide the Apollo missions to the moon in the 1960s and 1970s.[5]

For professionals—lawyers, doctors, engineers, and managers—the cozy world of delivering expertise appears somewhat more brittle and tenuous than it used to. While automation is creating new work, it is also causing more and more people to either lose their jobs or find themselves in increasingly precarious jobs.[6] If we accept Nick Bostrom's prediction—that within the next 100 hundred years, artificial intelligence ("AI") will likely be on a parity with human intelligence before AI eventually outstrips it[7]—we see how the potential for productive work within society will diminish as machines become capable of doing the work cheaper than humans can and for longer periods of time.[8]

This raises a number of issues, particularly normative ones, about how society will be ordered in such a future. Law, at present, is predicated on a traditional Anglo-American model of property rights, employment rights, intellectual property rights and the like, which emerge from economic activity and ventures entered into by

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Thomas N. Theis & H.-S. Philip Wong, *The End of Moore's Law: A New Beginning for Information Technology*, COMPUTING SCI. & ENGINEERING, March/April 2017, at 41, 41–43.

[5] David Grossman, *How Do NASA's Apollo Computers Stack Up to an iPhone?*, POPULAR MECHANICS (Mar. 13, 2017), https://www.popularmechanics.com/space/moon-mars/a25655/nasa-computer-iphone-comparison/; David R. Williams, *The Apollo Program (1963-1972)*, NASA SPACE SCI. DATA COORDINATED ARCHIVE, https://nssdc.gsfc.nasa.gov/planetary/lunar/apollo.html (last updated Sept. 16, 2013).

[6] Adair Turner, Capitalism in the Age of Robots: Work, Income and Wealth in the 21st-Century 9 (Apr. 10, 2018) (unpublished manuscript), https://www.ineteconomics.org/uploads/papers/Paper-Turner-Capitalism-in-the-Age-of-Robots.pdf [hereinafter Turner, Manuscript]; *see also* Adair Turner, *Capitalism in an Age of Robots*, INST. FOR NEW ECON. THINKING (Apr. 10, 2018), https://www.ineteconomics.org/uploads/papers/Slides-Turner-Capitalism-in-the-Age-of-Robots.pdf [hereinafter Turner, PowerPoint] (PowerPoint presentation including Exhibits 6–14 referenced in Turner, Manuscript).

[7] NICK BOSTROM, SUPERINTELLIGENCE: PATHS, DANGERS, STRATEGIES 22–25 (2014).

[8] *See* Turner, Manuscript, *supra* note 6, at 5–10. Turner argues that the Solow paradox is at play when computerization is accompanied by a decrease in overall productivity. *See id.* at 5–19. As a smaller proportion of people are required to carry out the automation processes, the laborers displaced by automation find themselves in less remunerative and lower productivity jobs, leading to an overall decline in productivity. *See id.*

people.[9] We construe the terms economic activity and ventures broadly to include such arrangements as marital partnerships and inheritance of property, as well as business arrangements and transactions. While it is common for lawyers to speak of real property and tangible personal property, as we enter the digital age, property itself is becoming increasingly digital or incorporeal.[10] The most common manifestation of this is intellectual property, which creates rents for its owners for a number of years.[11] These rents make the intellectual property excludable, so that only those who can afford the product can legally enjoy the benefits.[12] However, while conceptions of intellectual property can be traced to the Statute of Anne in 1709,[13] our current incorporeal property issues are significantly more contemporary.

The aim of this Article is to examine the effects of machine learning on society, professions, and economic activity. To do this, we look at how AI is intruding into most economic activity and changing human relationships and engagement. Specifically, we focus on AI in law, the extent to which AI is displacing lawyers, and how far that process can be expected to travel. A key contemporary use of broadly defined machine learning is Blockchain: an application we seek to analyze in an attempt to redress some of the consequences of AI. We are posed with the question of AI's inevitability: will it truly diminish human intelligence and thereby colonize the professions?

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[9] *See* R.H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1, 14 (1959) (property rights); Christine Jolls, *Law and the Labor Market*, 2 ANN. REV. L. & SOC. SCI. 359, 360 (2006) (employment rights); Andreas Rahmatian, *A Fundamental Critique of the Law-and-Economics Analysis of Intellectual Property Rights*, 17 MARQ. INTELL. PROP. L. REV. 191, 201–02 (2013) (intellectual property rights).

[10] *See, e.g.*, Matthew Crain, *The Limits of Transparency: Data Brokers and Commodification*, 20 NEW MEDIA & SOC'Y 88, 90 (2018) (analyzing how data brokers commodify and monetize consumer data as an informational good).

[11] Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337, 361 (2008).

[12] MARTIN SKLADANY, BIG COPYRIGHT VERSUS THE PEOPLE: HOW MAJOR CONTENT PROVIDERS ARE DESTROYING CREATIVITY AND HOW TO STOP THEM 153–54 (2018).

[13] Oren Bracha, *The Adventures of the Statute of Anne in the Land of Unlimited Possibilities: The Life of a Legal Transplant*, 25 BERKELEY TECH. L.J. 1427, 1450–53 (2010).

One underlying theme of our examination is how best to reward expertise in the future. Other questions arise, of course, such as, what will constitute expertise? Will it be worth educating and training people to be experts in the future? If work becomes redundant, can we reward people for other kinds of activities? And, if technology is the cause of these problems, are there ways for it to provide solutions? There is an assumption within this that needs unpacking. Humans and machines are often counterposed as elements in competition in a particular status hierarchy, which privileges the human over the machine.[14] This may be a form of technophobia, or an inability to come to terms with other forms of existence.[15] Some approaches, like actor network theory, posit that both animate and inanimate, human and non-human subjects have their own agency.[16] In the formation of networks, nodes play various roles and whether a node is human or otherwise is irrelevant to the actual role that the node plays.[17] Thus, algorithms and Blockchains are actors that are as effective as humans themselves.[18]

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[14] Roberto Saracco, *Humans vs Machines: Who's Winning?*, TECHTALKS (Aug. 30, 2018), https://bdtechtalks.com/2018/08/30/race-between-humans-and-artificial-intelligence/.

[15] Cari Romm, *Americans Are More Afraid of Robots than Death*, ATLANTIC (Oct. 16, 2015), https://www.theatlantic.com/technology/archive/2015/10/americans-are-more-afraid-of-robots-than-death/410929/; Gary Shapiro, Opinion, *Many Fear Artificial Intelligence as the Road to Robots Taking over the World—Are They Right?*, FOX NEWS (July 17, 2018), https://www.foxnews.com/opinion/many-fear-artificial-intelligence-as-the-road-to-robots-taking-over-the-world-are-they-right.

[16] Steve Smithson & Prodromos Tsiavos, *Re-constructing Information Systems Evaluation*, *in* THE SOCIAL STUDY OF INFORMATION AND COMMUNICATION TECHNOLOGY: INNOVATION, ACTORS, AND CONTEXTS 212, 214 (Chrisanthi Avgerou et al. eds., 2004); Bruno Latour, *On Using ANT for Studying Information Systems: A (Somewhat) Socratic Dialogue*, *in* THE SOCIAL STUDY OF INFORMATION AND COMMUNICATION TECHNOLOGY: INNOVATION, ACTORS, AND CONTEXTS 62, 63 (Chrisanthi Avgerou et al. eds., 2004); Michel Callon, *Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay*, *in* TECHNOSCIENCE: THE POLITICS OF INTERVENTIONS 57, 60 (Kristin Asdal et al. eds., 2007).

[17] *See, e.g.*, Callon, *supra* note 16, at 59–72.

[18] To experience the effects of algorithms' capacity to act, note the phenomena of the market "flash crash" when algorithms precipitated volatile activity in high speed trading systems. BOSTROM, *supra* note 7, at 20–21.

With this understanding, we seek to navigate through the following questions: What is the nature of expertise? What is the relationship between machine learning and the professions? More precisely, what is the relationship between machine learning and the law? And finally, what will be the impact of Blockchain on professions and society?

I. NATURE OF EXPERTISE

In order to discuss the nature of expertise we must examine professions—particularly, the legal profession—since professions embody expertise and knowledge by virtue of how they represent themselves and by the content of their education and training. Sida Liu posits that knowledge in professions emerges from jurisdictional battles either within or across professions as they attempt to monopolize their areas of expertise.[19] Jurisdiction battles are conflicts between the process of yoking things together and the establishment of boundaries.[20] On the whole, lawyers have adeptly marked out boundaries and created monopolies of their knowledge by invoking the assistance of the state in credentialing and licensing.[21]

Law is, in one sense, a "soft" profession.[22] In "hard" professions—like medicine, architecture, or engineering—the state has a strong interest in ensuring that expertise is applied to the benefit of

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[19] Sida Liu, *Boundaries and Professions: Towards a Processual Theory of Action*, 5 J. PROFESSIONS & ORG. 45, 46–47 (2018).

[20] Andrew Abbott, *Things of Boundaries*, 62 SOC. RES. 857, 860, 871–72 (1995).

[21] Benjamin Hoorn Barton, *Why Do We Regulate Lawyers?: An Economic Analysis of the Justifications for Entry and Conduct Regulation*, 33 ARIZ. ST. L.J. 429, 434–35, 434 n.16, 453, 453 n.100 (2001) (discussing the role of the several states in setting standards for bar admission in the United States and the interplay between regulation and establishment as a profession).

[22] WILLIAM TWINING, BLACKSTONE'S TOWER: THE ENGLISH LAW SCHOOL 65–66 (1994) (defining law as a "soft-applied" discipline); *cf.* Dennis R. Laker & Jimmy L. Powell, *The Differences Between Hard and Soft Skills and Their Relative Impact on Training Transfer*, 22 HUM. RESOURCE DEV. Q. 111, 112 (2011) ("[W]e differentiate between hard skills (technical skills that involve working with equipment, data, software, etc.) and soft skills (intrapersonal skills such as one's ability to manage oneself as well as interpersonal skills such as how one handles one's interactions with others.)").

the public.[23] Failure in these fields is potentially catastrophic. The professional expertise of "hard" professions produces tangible products—restored bodies, upright buildings, and stable bridges. However, failure in these fields produces catastrophic effects, like death, collapsed apartment buildings, and twisted bridges.[24] Of course, law can have potentially catastrophic effects as well. The distinction is that, in "hard" professions the effects are direct, and in law they tend to be indirect, for example, the award of triple damages in an antitrust case.[25]

Within this, we can also see how the "soft" profession of law supports the "hard" professions: the lawyers draw up and advise on the contracts and indemnities, which are often imperative to the catastrophic deaths, collapses, and twists. Initial legal outcomes are certainly important—the client is invested, quite literally, in her case; the new state's continued existence and stability are a function of the success of its new constitution—yet the law also includes remedial processes, like appeals or amendments, which create barriers, exemptions, and protections to and from the results of legal decision making and, especially, errors. Perhaps the most salient way of distinguishing law from "hard" professions is that law relies on discourse, language, and the relating of narratives. For example, while the engineer builds the bridge, the lawyer creates the narrative that enables the engineer to bring the bridge into existence. This particular way of articulating law—in other words, demonstrating its facility in discourse—has great relevance for the ideas of interactional expertise, which we explore below.

It is also worth looking at expertise as it is found within professionals and professions. Regulating bodies of professions are involved in the collection and reproduction of knowledge intended to be used by the entire body of professionals.[26] In other words, this is

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[23] TWINING, *supra* note 22, at 64–65; *cf.* Laker & Powell, *supra* note 22, at 112.

[24] PAUL VIRILIO, THE ORIGINAL ACCIDENT 10 (Julie Rose trans., Polity Press 2007) (2005).

[25] 15 U.S.C. § 15(a) (2012).

[26] *See, e.g.*, *About Us*, A.B.A., https://www.americanbar.org/about_the_aba/ (last visited Nov. 11, 2018) (listing, as part of the mission of the ABA, to "[p]romote the best quality legal education, promote competence, ethical conduct and professionalism, and promote pro bono and public service by the legal profession").

a cycle of professionals producing, through education and training, the future generation of professionals. Often, education and training require prospective members of the profession to obtain a minimum level of competence before entering the "real" world of the profession.[27] For the Legal Education and Training Review in England, it depends on the "day one" learning requirements lawyers must achieve before entering practice.[28] Law is fortunate as it has hundreds of years of doctrine underlying its field, placing a significant value on consistency that is rare in most other fields.[29]

As Liu notes, there is little settled opinion on what constitutes expertise among professionals.[30] For example, in law, there is a body of work, although small, on what lawyers actually do.[31] Addi-

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[27] TWINING, *supra* note 22, at 128–30; Barton, *supra* note 21, at 441.

[28] JULIAN WEBB ET AL., LEGAL EDUC. & TRAINING REVIEW, SETTING STANDARDS: THE FUTURE OF LEGAL SERVICES EDUCATION AND TRAINING REGULATION IN ENGLAND AND WALES, at xiii (2013). In the United States, the National Conference of Bar Examiners studied which competencies lawyers should possess by looking at knowledge domains, skills and abilities, general tasks, and specific practice area tasks. Susan M. Case, *The NCBE Job Analysis: A Study of the Newly Licensed Lawyer*, B. EXAMINER, Mar. 2013, at 52, 52–53. Future bar questions should attempt to incorporate these results.

[29] *See generally* Charles W. Collier, *Precedent and Legal Authority: A Critical History*, 1988 WIS. L. REV. 771. Although not relevant to our discussion of expertise, there have been attempts to re-engineer law—for example, Langdell's case method or Warwick's law in context—but these have more to do with pedagogy than substance. *See generally* ROBERT STEVENS, LAW SCHOOL: LEGAL EDUCATION IN AMERICA FROM THE 1850S TO THE 1980S, at 52–56 (1983) (discussing Langdell's case method); *School of Law: About Us*, U. WARWICK, https://warwick.ac.uk/fac/soc/law/aboutus/ (last updated Feb. 21, 2018) (discussing Warwick's law). The more interesting focus for our purposes is the expertise of professionals.

[30] *See* Liu, *supra* note 19, at 49–51.

[31] *See, e.g.*, JOHN FLOOD, WHAT DO LAWYERS DO?: AN ETHNOGRAPHY OF A CORPORATE LAW FIRM 91–98 (2d ed. 2013); JACK KATZ, POOR PEOPLE'S LAWYERS IN TRANSITION 123–26 (1982); MILTON C. REGAN, JR., EAT WHAT YOU KILL: THE FALL OF A WALL STREET LAWYER 7–8 (2004); AUSTIN SARAT & WILLIAM L. F. FELSTINER, DIVORCE LAWYERS AND THEIR CLIENTS: POWER AND MEANING IN THE LEGAL PROCESS 96–97 (1995).

tionally, while sociologists have examined careers and the acquisition of status, power, and authority,[32] it has been mainly left to psychologists to analyze the components of expertise and its accumulation.[33]

There are a number of common features that emerge from the literature on knowledge and expertise. Networks are vital to knowledge and expertise, and neither are acquired by solitary meditation.[34] The role of another is important for measurement, reinforcement, and critique.[35] There must be a pre-existing body of knowledge on which to base one's performance—otherwise known as "standing on the shoulders of a [g]iant."[36] As an individual attains the status of expert, some form of encapsulation of knowledge and analysis occurs, enabling professional experts to arrive at diagnoses, decisions, and conclusions rapidly. Dreyfus and Dreyfus use the examples of two skills—learning to drive and becoming a chess grandmaster—to illustrate the acquisition of expertise.[37] They argue that expertise is acquired in ways opposite to what we normally expect.[38] The traditional approach, according to Dreyfus and Dreyfus, is that knowledge is learned from specific cases and as the learner gains more experience, the rules are interiorized and abstracted so they can be applied to any case or situation.[39] This is the type of process that Cravath expected his associates to go through in order to become competent lawyers. The associates at Cravath's firm would be placed under the tutelage of a senior lawyer who would take complex cases and divide them into simple components on which the associate would then focus.[40] Upon completion, the senior

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[32] Liu, *supra* note 19, at 50–51.

[33] *See* Harry Collins, Three Dimensions of Expertise 1 (Aug. 24, 2010) (unpublished manuscript), http://sites.cardiff.ac.uk/harrycollins/draft-papers/ [hereinafter Collins, Three Dimensions of Expertise].

[34] Liu, *supra* note 19, at 52.

[35] *Id.* at 52–53.

[36] JAMES GLEICK, ISAAC NEWTON 15 (2003).

[37] Hubert L. Dreyfus & Stuart E. Dreyfus, *Peripheral Vision: Expertise in Real World Contexts*, 26 ORG. STUD. 779, 782 (2005).

[38] *Id.* at 782.

[39] *Id.*

[40] ROBERT T. SWAINE, THE CRAVATH FIRM AND ITS PREDECESSORS 1819–1948, at 4–5 (1948).

lawyer would then reassemble the case to show the associates how everything fits together.[41]

According to Dreyfus and Dreyfus, the traditional approach is wrong; in fact, they note that learners may acquire new skills by starting with abstract rules and arriving at particular cases, which is the opposite direction of the traditional approach.[42] They demonstrate this thesis by showing how someone learns to drive a car: "Normally, the instruction process begins with the instructor decomposing the task environment into context-free features that the beginner can recognize without the desired skill. The beginner is then given rules for determining actions on the basis of these features, like a computer following a program."[43]

The learner needs classroom instruction to further understand how different signals—here, engine sound and speed—indicate that actions need to be taken.[44] In practical settings, learners apply these understandings and develop into a situational learner knowing what an engine sounds like when it is necessary to change gears.[45] However, as a learner becomes competent, the potential array of actions and maneuvers a driver can take becomes overwhelming and the driver starts to pare back actions into a set of trusted actions.[46] Drivers seek rules to govern situations, such as what actions are appropriate when leaving a motorway.[47] In addition, drivers make emotional investments in the actions they take; they need, instead of analyzing actions, to "let them sink in."[48] As drivers become proficient, they can begin to recognize situations, but they must decide which action is the correct action to take in a situation; thus, mental computations are always occurring.[49] As Dreyfus and Dreyfus note,

> [t]he *proficient performer*, immersed in the world of skillful activity, *sees* what needs to be done, but *decides* how to do it. The expert [driver, however,] not

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41 *See id.*
42 Dreyfus & Dreyfus, *supra* note 37, at 782.
43 *Id.*
44 *Id.* at 782–83.
45 *Id.* at 783.
46 *Id.* at 783–84.
47 *Id.* at 784.
48 *Id.* at 786.
49 *Id.* at 787.

> only sees what needs to be achieved; thanks to a vast repertoire of situational discriminations, he or she also sees immediately how to achieve the goal.[50]

This is the point where one's brain and emotions work together, resulting in an "immediate intuitive situational response that is characteristic of expertise."[51]

In the field of chess, the work of de Groot[52] and Chase and Simon[53] explore how similar thought processes are discerned in masters and grandmasters. Using pattern recognition and intuition, rather than conscious calculation and evaluation, chess masters arrive at their next move much more rapidly than novice and intermediate players.[54] Chase and Simon found that the chess master "only recall[ed] about 16 pieces out of 24 or 25 pieces in the middle games, whereas de Groot's [m]asters were getting 23 and 24 out of 25 pieces."[55] Chase and Simon further found that a chess master thought in chunks, or configurations of pieces, which were larger than those of other players.[56] They further estimated that achieving master status took around 30,000 hours of practice compared to the 3,000 hours it took to reach Class A level.[57]

Professionals behave similarly to drivers and chess players. Schmidt and Rikers discussed the acquisition of medical diagnostic expertise and referred to knowledge encapsulation as a key attribute

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[50] *Id.*

[51] *Id.*

[52] *See* ADRIAAN D. DE GROOT, THOUGHT AND CHOICE IN CHESS 316–17 (1978).

[53] *See* William G. Chase & Herbert A. Simon, *Perception in Chess*, 4 COGNITIVE PSYCHOL. 55 (1973) [hereinafter Chase & Simon, *Perception*].

[54] *Id.* at 55–56.

[55] William G. Chase & Herbert A. Simon, *The Mind's Eye in Chess*, *in* VISUAL INFORMATION PROCESSING 215, 222 (William G. Chase ed., 1973) [hereinafter Chase & Simon, *Mind's Eye*].

[56] Chase & Simon, *Perception*, *supra* note 53, at 77.

[57] *See* Chase & Simon, *Mind's Eye*, *supra* note 55, at 219 ("By a rough estimate, the amount of time each player has spent playing chess, studying chess, and otherwise staring at chess positions is perhaps 10,000 to 50,000 hours for the Master; 1,000 to 5,000 hours for the Class A player; and less than 100 hours for the beginner."). Chase and Simon define a Class A player as a "[g]ood amateur." Herbert A. Simon & William G. Chase, *Skill in Chess*, 61 AM. SCIENTIST 394, 395 (1973).

of expertise development.[58] Rather than following hypothetico-deduction, experts already have a wide range of diagnostic material in their memory which fits the clinical experience.[59] Similar to a chess player's chunks, these encapsulations give rise to "illness scripts," which allow expert doctors to exclude conditions that are not relevant to the symptoms or syndromes at hand.[60] Flood has shown how corporate lawyers are frequently called upon to arrive at solutions to problems presented by clients, often at a moment's notice.[61] Expertise denotes performative attributes as part of its arsenal: one must *be seen* to be an expert as well as *be* an expert,[62] or to "'act like a savant' even when he does not actually feel sure."[63] Since we cannot see how consciousness works, at least not in a full sense—in other words, we can see how the brain responds to stimuli, but not know how or if that equates to consciousness—we must assume, like Michael Polanyi, that within us, there is a tacit knowledge that is not clearly articulated, but to which we can appeal.[64]

Whether expertise is only an internal phenomenon within the brain is something we cannot yet answer. But, for professionals, as for other experts, expertise and knowledge are not acquired in isolation.[65] The role of networks is vital in extending the knowledge and

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[58] Henk G. Schmidt & Remy M. J. P. Rikers, *How Expertise Develops in Medicine: Knowledge Encapsulation and Illness Script Formation*, 41 MED. EDUC. 1133, 1133–35 (2007).

[59] *Id.* at 1133.

[60] *Id.* at 1135.

[61] FLOOD, *supra* note 31, at 96.

[62] *See* K. Anders Ericsson et al., *The Making of an Expert*, HARV. BUS. REV., July–Aug. 2007, at 114, 117; Dorie Clark, *Get People to Listen to You when You're Not Seen as an Expert*, HARV. BUS. REV. (May 13, 2015), https://hbr.org/2015/05/get-people-to-listen-to-you-when-youre-not-seen-as-an-expert; Michael Hyatt, *How to Be Perceived as an Expert in Your Field: 5 Steps to Boosting Your Influence and Authority*, MICHAEL HYATT (Oct. 5, 2016), https://michaelhyatt.com/how-to-be-perceived-as-an-expert-in-your-field/.

[63] Renée C. Fox, *Training for Uncertainty*, *in* THE STUDENT-PHYSICIAN: INTRODUCTORY STUDIES IN THE SOCIOLOGY OF MEDICAL EDUCATION 207, 227 (Robert K. Merton et al. eds., 1957).

[64] *See* MICHAEL POLANYI, THE TACIT DIMENSION 22–23 (1966). Tacit knowledge enables us to overcome Meno's paradox—"that to search for the solution to a problem is an absurdity; for either you know what you are looking for, and then there is not problem; or you do not know what you are looking for, and then you cannot expect to find anything." *Id.* at 22.

[65] Liu, *supra* note 19, at 52.

expertise of individuals and groups.[66] For some, this might manifest itself in communities of practice ("COPs"), which somewhat resemble guilds with leaders and conveners but do not have all the formal trappings.[67] Some COPs are created, while others emerge from situations that require action.[68] Additionally, Edwards shows how common knowledge and expertise can be formed at the boundaries of different groups through relational agency.[69] Callon demonstrated how knowledge could be an artifact of networks in his analysis of the exploitation of scallops at St. Brieuc Bay.[70] This analysis explored how the scallop population is declining due to overfishing and predators.[71] Scientists studying scallops know very little, especially if the larvae anchor themselves.[72] To constitute a new knowledge of scallops, the scientists had to form alliances and "enroll" the other actors in the project.[73] This could not be taken for granted, as interests could shift out of alignment from the project.[74] Unlike COPs, which appear to come together and stay together,[75] Callon's groups are far more contingent on how they produce

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[66] *Id.*

[67] WILLIAM M. SNYDER & XAVIER DE SOUSA BRIGGS, IBM CTR. FOR THE BUS. OF GOV'T, COMMUNITIES OF PRACTICE: A NEW TOOL FOR GOVERNMENT MANAGERS 7–8 (2003); Michael A. Fontaine & David R. Millen, *Understanding the Benefits and Impact of Communities of Practice*, *in* KNOWLEDGE NETWORKS: INNOVATION THROUGH COMMUNITIES OF PRACTICE 1, 4–7 (Paul M. Hildreth & Chris Kimble eds., 2004).

[68] *See* SNYDER & DE SOUSA BRIGGS, *supra* note 67, at 10–13.

[69] *See* Anne Edwards, *Building Common Knowledge at the Boundaries Between Professional Practices: Relational Agency and Relational Expertise in Systems of Distributed Expertise*, 50 INT'L J. EDUC. RES. 33 (2011); *cf.* Arthur Bakker, *Designing for Communication at Work: A Case for Technology-Enhanced Boundary Objects*, 50 INT'L J. OF EDUC. RES. 26, 26 (2011) ("The literature not only focuses on problems due to differences across boundaries, but also claims a learning potential *at* the boundary between communities of practice or activity systems." (citation omitted)). The Association of International Law Firm Networks is trying to create COPs through law firm networks. *See* AILFN, https://ailfn.wordpress.com/ (last visited Nov. 8, 2018).

[70] *See* Callon, *supra* note 16, at 57–61 (discussing how three series of actors—fishermen, scallops, and scientific colleagues—formed an interconnected web that produced knowledge related to a single research question).

[71] *Id.* at 57–58, 61.

[72] *Id.* at 58–59, 65.

[73] *Id*. at 62–66.

[74] *Id.* at 62–64.

[75] *See* SNYDER & DE SOUSA BRIGGS, *supra* note 67, at 7.

knowledge and their social relations that create knowledge are fragile.[76] What is present here, according to Eyal, is a type of co-production that constitutes networks of expertise, populated by professional and lay experts who work together to create the expertise.[77]

Even if we assume networks are necessary for the production of professionals' knowledge, there remains an element of mystery. A profession was, in the eighteenth century, a "vocation"[78]—something which professions still like to claim.[79] During this time, professions had exclusive access to special knowledge, turning them into a "mystery," which "was further sustained by an appropriate demeanour and clothing."[80] "The long-term growth of the professions therefore depended upon favourable cultural dynamics as well as upon economic opportunity."[81] It was essential for professions to exercise their expertise in social contexts; their knowledge could not be merely academic—that is, knowledge for the sake of knowledge—it had to have meaning and that meaning came through exchange.[82] The question that would then arise was, to what extent could professionals control such an exchange?

According to Collins and Evans, expertise comes in various guises from ubiquitous to specialist.[83] Ubiquitous expertise belongs to all members of society and, by its own nature, is not esoteric.[84] Collins and Evans also draw distinctions between knowledge gained by individual pursuit and knowledge absorbed by virtue of being

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[76] *See* Callon, *supra* note 16, at 62–64.

[77] Gil Eyal, *For a Sociology of Expertise: The Social Origins of the Autism Epidemic*, 118 AM. J. SOC. 863, 876 (2013).

[78] PENELOPE J. CORFIELD, POWER AND THE PROFESSIONS IN BRITAIN 1700–1850, at 20 (1995).

[79] RICHARD SUSSKIND & DANIEL SUSSKIND, THE FUTURE OF THE PROFESSIONS: HOW TECHNOLOGY WILL TRANSFORM THE WORK OF HUMAN EXPERTS 10 (2015) ("Beyond their social and economic significance, being a professional, for many practitioners, is seen to be a labour of love and not simply labour for a wage. It is considerably more than holding down a job. Many of the most fulfilled professionals refer to their daily activities as a calling or vocation: not so much a job as a way of life.").

[80] CORFIELD, *supra* note 78, at 20–21.

[81] *Id.* at 23.

[82] *Id.* at 23–24.

[83] HARRY COLLINS & ROBERT EVANS, RETHINKING EXPERTISE 13–14 (2007).

[84] *Id.* at 13–23.

part of groups.[85] The former tends to be "primary source knowledge," derived from books, journals, and other literature,[86] while the latter is social in nature and cannot be learned on one's own.[87] The latter, following Polanyi, is "collective tacit knowledge."[88] There are two aspects of importance here: the first is the development of contributory expertise, or the ability to function in the field as one who produces outputs;[89] the second is interactional expertise, which is the development of facility with the field's discourse.[90]

The earlier example of chess playing can be interpreted through the lens of contributory and interactional expertise. Learning chess moves is the acquisition of primary source knowledge, achieved alone or in groups; but, to elevate oneself to grandmaster level, one must combine interactional and contributory expertise.[91] A chess player must immerse herself in the milieu of chess, play with expert players, and become fluent and conversant with the field to be accepted as a member.[92] Such a process would be similar for expertise in professional fields, like law, medicine, and accounting. To achieve expertise in their prospective fields, lawyers train with senior lawyers,[93] doctors complete rounds with attending physicians,[94] and accountants join teams for audits,[95] illustrating how full admission and entry into the professions is necessarily social and interactional.[96] Acquiring specialist expertise, therefore, is a social activity,

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[85] *Id.* at 17–18.

[86] *Id.* at 22–23.

[87] *Id.* at 27.

[88] *See* HARRY COLLINS, TACIT AND EXPLICIT KNOWLEDGE 119–38 (2010); COLLINS & EVANS, *supra* note 83, at 26–27; Harry Collins, *Bicycling on the Moon: Collective Tacit Knowledge and Somatic-Limit Tacit Knowledge*, 28 ORG. STUD. 257, 258–61 (2007).

[89] COLLINS & EVANS, *supra* note 83, at 24.

[90] *Id.* at 28, 30.

[91] *See* Chase & Simon, *Perception*, *supra* note 53, at 55–56; DE GROOT, *supra* note 52, at 316–17.

[92] *See* Ericsson et al., *supra* note 62, at 117; Clark, *supra* note 62; Hyatt, *supra* note 62.

[93] *E.g.*, SWAINE, *supra* note 40, at 4–5.

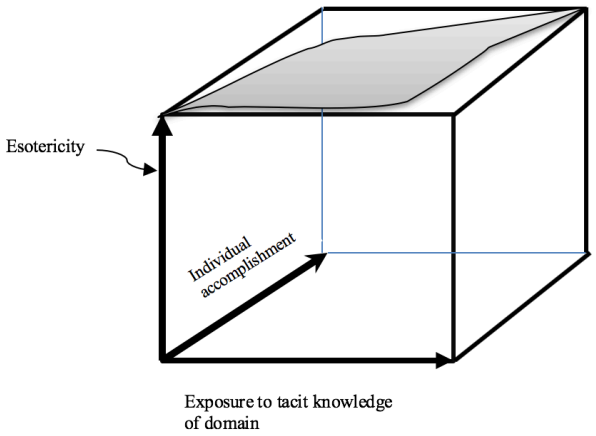
[94] *See* Dreyfus & Dreyfus, *supra* note 37, at 789–90.

[95] Holly R. Rudolph & Robert B. Welker, *The Effects of Organizational Structure on Communication Within Audit Teams*, AUDITING, Fall 1998, at 1, 1.

[96] COLLINS & EVANS, *supra* note 83, at 14; Liu, *supra* note 19, at 52–53.

and would be extremely difficult—if not impossible—to achieve alone.[97] In Collins and Evans's terms, "'[e]nculturation' is the only way to master an expertise which is deeply laden with tacit knowledge because it is only through common practice with others that the rules that cannot be written down can come to be understood."[98] Figure 1 is a reproduction of Collins's diagram, which illustrates how expertise is a combination of individual and social forms of knowledge. [99]

Figure 1: A three-dimensional model of the acquisition of professional knowledge.



[97] COLLINS & EVANS, *supra* note 83, at 7 ("[Most levels of expertise] are learned through social interaction and they are maintained through social interaction. . . . [C]oming to 'know what you are talking about' implies *successful* embedding within the social group that embodies the expertise.").

[98] *Id.* at 24. This also applies to our example of learning to drive, which universally is a ubiquitous expertise of little esoteric value. Collins, Three Dimensions of Expertise, *supra* note 33, at 12; *see also* Dreyfus & Dreyfus, *supra* note 37, at 782–88. However, a Formula One driver is imbued with highly esoteric skills vastly different from ordinary drivers. Collins, Three Dimensions of Expertise, *supra* note 33, at 12. And those racing skills can only be improved by the gaining of tacit knowledge. *See id.*

[99] Collins, Three Dimensions of Expertise, *supra* note 33, at 6, 9.

The knowledge and expertise of a specialist professional—here, a lawyer—starts as a novice lawyer, already in possession of esoteric knowledge acquired in law school.[100] For this reason, the professional is at the top of the esotericity axis instead of at zero.[101] By moving from the front-top-left corner to the rear-top-left corner, the individual acquires greater knowledge, but can never be totally competent unless the individual acquires tacit knowledge by moving rightward.[102] According to this model, the most expert lawyer will be located at the rear-top-right corner, indicating that they have reached the maximal combination of tacit and esoteric knowledge.[103] The white space in the diagram at the top left- and right-hand sides are purposely left blank because an individual cannot go beyond certain limits alone—tacit knowledge is necessary in order to move beyond competence and acquire true expertise.[104] Collins calls this left-side empty space the "epistemological void."[105] "The front right hand empty space, called the 'sociological void', is there because if one has some exposure to the tacit knowledge of the domain but fails to make progress one is likely to be expelled from the community of those who have it."[106] Thus, to maintain a position within a profession, interaction with other members is required.

To see how these different kinds of expertise play out in the legal professional sphere, thus demonstrating Collins and Evans's thesis, we present a story by Gulati and Scott of how sovereign debt contracts are written, which illustrates how contingent and interactional professional knowledge can be.[107] For this type of work involving large law firm lawyers[108] drafting contracts for sovereign countries, the context is in big corporate law firms.[109] These firms have many

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100 Collins, Three Dimensions of Expertise, *supra* note 33, at 9 (using gravitational wave physics to explain an esoteric domain).

101 *Id.*

102 *Id.* at 9–10.

103 *Id.*

104 *Id.*

105 *Id.* at 10.

106 *Id.*

107 *See* GULATI & SCOTT, *supra* note 2, at 9–32.

108 Please note that the authors use the terms "large" and "elite" interchangeably to indicate the same classification of law firm.

109 GULATI & SCOTT, *supra* note 2, at 17.

precedents and contract templates stored in their computer drives.[110] While this firm-specific knowledge might appear impressive, Ribstein argued there is little research and development performed to create new knowledge or improve the status of existing knowledge.[111] Law firms do not innovate because the returns from investment are low.[112] In an interview with the late Harvey Miller, the doyen of bankruptcy lawyers in New York,[113] Miller told Flood that whenever he created some new legal strategy or tactic, it would have a half-life of about three days before everyone else used it.[114] Of course, clients knew and respected Miller's creativity and rewarded it, no matter how short-lived it was.[115]

One example of the lack of research and development in law firms is evident in the discussion of *pari passu* clauses.[116] According

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[110] *Id.* at 9.

[111] *See* Larry E. Ribstein, *The Death of Big Law*, 2010 WIS. L. REV. 749, 785.

[112] *See* Henderson, *supra* note 1, at 421 (describing how innovation is very much a social process and lawyers operate within a pack mentality, so the issue of returns might be due to perception rather than actual economics).

[113] Michael J. de la Merced, *Harvey R. Miller, Renowned Bankruptcy Lawyer, Dies at 82*, N.Y. TIMES (Apr. 27, 2015), https://www.nytimes.com/2015/04/28/business/harvey-r-miller-renowned-bankruptcy-lawyer-dies-at-82.html.

[114] *See* John Flood, *Harvey Miller RIP*, JOHN FLOOD BLOG (Apr. 27, 2015, 10:41 PM), http://johnflood.blogspot.com/2015/04/harvey-miller-rip.html#links. The interview, conducted in 1996 for a project on the Maxwell bankruptcy, is on file with Flood.

[115] *See id.*

[116] *See* GULATI & SCOTT, *supra* note 2, at 13–17. In Latin, *pari passu* means "in equal step." *Id.*

> In the context of unsecured corporate debt, this language has a recognized meaning. The clause ensures that the debt will have the same priority as all the borrower's other unsecured debt in the event of a liquidation. In a corporate bankruptcy, for example, an equal share of the proceeds of any liquidation will be distributed among all holders of *pari-passu*-ranking debts (after higher priority creditors are paid). However, sovereign borrowers do not go into bankruptcy and cannot be liquidated. When a sovereign defaults, no judicial officer supervises the distribution of sovereign assets in accordance with creditors' respective priorities. In the context of sovereign lending, then, it is fair to say that no one really knows what the *pari passu* clause means, something that even eminent practitioners have long acknowledged.

Mark Weidemaier, Robert Scott & Mitu Gulati, *Origin Myths, Contracts, and the Hunt for* Pari Passu, 38 LAW & SOC. INQUIRY 72, 74 (2013) (internal citations

to Gulati and Scott, sovereign debt contracts always contain *pari passu* clauses, even though it can be difficult to sue sovereigns.[117] When Elliott Associates, a hedge fund, successfully sued to have the plain meaning of the clause applied, the decision shocked those who drafted the contracts as they did not expect this interpretation.[118] Did this lawsuit result in these elite lawyers redrafting their contracts? On the whole, no.[119] Gulati and Scott delved deeper to find the reasons for this clause's existence.[120] It seemed no one could really explain why or how this clause had been inserted in the first place or why it endured.[121] Indeed, one of their interviewees told them that it took about "[t]hree and a half minutes" to produce such a contract,[122] but another stated that no one knows what the clause means.[123] We do know that it can be important to obtain the imprimatur of an elite, large law firm for the business community to accept the validity of the transaction, otherwise there can be doubt,[124] but does that mean we can be secure in the knowledge encapsulated in the agreement? That is difficult to answer definitively.

If we see this type of arcane knowledge as being intelligible only to the priesthood, then, in this field of law, it is hard to see how Eyal's idea of the collaborative and extensive nature of expertise—that is, one that is formed by intra- and extra-professional sources—holds.[125] The very constitution of this idea is an internal matter

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omitted) (explaining the mystery of *pari passu* in the context of sovereign debt contracts).

[117] GULATI & SCOTT, *supra* note 2, at 13; Weidemaier, Scott & Gulati, *supra* note 116, at 74.

[118] *See* GULATI & SCOTT, *supra* note 2, at 12–16; William W. Bratton, Pari Passu *and a Distressed Sovereign's Rational Choices*, 53 EMORY L.J. 823, 823–24 (2004).

[119] GULATI & SCOTT, *supra* note 2, at 16.

[120] *See id.* at 109–38.

[121] *See id.* at 109–18.

[122] *Id.* at 6.

[123] *Id.* at 51–52.

[124] John Flood, *Lawyers as Sanctifiers: The Role of Elite Law Firms in International Business Transactions*, 14 IND. J. GLOBAL LEGAL STUD. 35, 38 (2007) [hereinafter Flood, *Lawyers as Sanctifiers*].

[125] Eyal, *supra* note 77, at 872–73, 875–77.

> Power then consists in exactly the opposite of monopoly and autonomy, namely, "generosity" and "co-production." By "generosity" I mean, following Rose, the opposite of monopoly, namely, that a network of expertise, as distinct from the experts,

based on tacit knowledge with little apparent regard to the outside world, until the outside world intrudes by the gathering pace of court decisions.[126] The constituents of the network are the elite lawyers and law firms and the histories of their documents along with their banking clients, which represent a world confined to them and their mystery. Even though they analyzed many sovereign debt contracts,[127] Gulati and Scott were unable to discover why their form persisted for so long without change.[128] Studies, in both law and other fields, suggest this case may be an outlier.[129] Contract drafting is increasingly outsourced to legal process outsourcing companies who use machine learning to streamline the document creation process.[130] In the next Part, we build upon these ideas of professions and explore ways in which machine learning affects the formation and distribution of information within concepts of professions—particularly, in law.

> becomes more powerful and influential by virtue of its capacity to craft and package its concepts, its discourse, its modes of seeing, doing, and judging, so they can be grafted onto what others are doing, thus linking them to the network and eliciting their cooperation. . . . By "co-production" I mean, following Rabeharisoa and Callon, the opposite of autonomy, namely, that a network of expertise becomes more powerful and influential by virtue of involving multiple parties—including clients and patients—in shaping the aims and development of expert knowledge.

Id. at 875–76 (internal citations omitted).

[126] We could argue that the *pari passu* network eventually included, but not by choice, the plaintiffs, Elliott Associates. *See* Robin Wigglesworth & Benedict Mander, *Argentina on the Cusp of Peace with Creditors*, FIN. TIMES (Feb. 16, 2016), https://www.ft.com/content/9766ee16-d31f-11e5-8887-98e7feb46f27.

[127] *See* GULATI & SCOTT, *supra* note 2, at 18–30.

[128] *See id.* at 33–34.

[129] *See, e.g.*, YVES DEZALAY & BRYANT G. GARTH, DEALING IN VIRTUE: INTERNATIONAL COMMERCIAL ARBITRATION AND THE CONSTRUCTION OF A TRANSNATIONAL LEGAL ORDER 5–8 (1966) (discussing the reasoning behind and the importance of arbitration); Flood, *Lawyers as Sanctifiers*, *supra* note 124, at 38, 47; Liu, *supra* note 19, at 52–53.

[130] *See* Stewart Macaulay, *Notes on the Margins of Lawyering, in Three and a Half Minutes*, 40 HOFSTRA L. REV. 25, 28 (2011).

II. MACHINE LEARNING AND THE PROFESSIONS

The impact of machine learning cannot be underestimated in modern society. Frey and Osborne found that close to fifty percent (50%) of all jobs are at risk of automation.[131] While one may think law is impervious to this kind of change, the reverse is true. As we saw from the *pari passu* story, much of what lawyers do is repetitive.[132] If it takes all of three and a half minutes to prepare a sovereign debt contract, then others cannot be far behind.[133] Standardizing and optimizing the creation of contracts removes the element of negotiating each contract from scratch each time.[134] Additionally, when a corporation may be involved in hundreds or thousands of contracts each year, automation seems inevitable. In fact, companies, such as Radiant Law, use technology to assist businesses in managing high volumes of contracting across areas like licensing, non-disclosure agreements, and procurement.[135]

Machine learning is a technology that enables computers learn directly from data.[136] According to a report written by The Royal Society, there are three branches of machine learning:

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[131] Carl B. Frey & Michael A. Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerisation?*, 114 TECHNOLOGICAL FORECASTING & SOC. CHANGE 254, 265 (2017) ("According to our estimate, 47% of total US employment is in the high risk category, meaning that associated occupations are potentially automatable over some unspecified number of years, perhaps a decade or two.").

[132] *See* GULATI & SCOTT, *supra* note 2, at 9; *supra* text accompanying notes 116–23.

[133] GULATI & SCOTT, *supra* note 2, at 9.

[134] *The In-House Guide to Legal Document Automation*, RADIANT L., https://radiantlaw.com/uploads/files/Radiant%20Law%20In-House%20Guide%20to%20Legal%20Document%20Automation.pdf (last visited Dec. 13, 2018) [hereinafter *In-House Guide*] ("Document automation allows you to ensure that users are always going to the right place to create their contracts. This means that you can keep updating the template as you identify improvements that are coming out of negotiations or as the business changes its products and needs. These iterative improvements allow you to 'knock the edges' off your contracts, getting rid of needless negotiation and having a far greater impact on the end-to-end speed to enter into contracts than just speeding up the drafting stage.").

[135] *Id.*

[136] THE ROYAL SOC'Y, MACHINE LEARNING: THE POWER AND PROMISE OF COMPUTERS THAT LEARN BY EXAMPLE 5 (2017).

1. Supervised learning, where the system learns with labeled data;
2. Unsupervised learning, where one "learn[s] without labels" by, for example, creating clusters to which data is assigned; and
3. Reinforcement learning, where agents in the system use previous experiences to learn the consequences of their decisions so that they can maximize their rewards.[137]

Some typical applications of machine learning include recommender systems, as used by Amazon and Netflix, that offer products and films based on interests and prior purchases.[138] Spam filters also use machine learning to sort out junk email by training the system to detect words commonly found in spam emails.[139] Further, voice recognition systems, like Apple's Siri or Amazon's Alexa, use machine learning to answer commands and questions.[140]

The progression of machine learning can be understood and illustrated through the development of the relationship between board games and AI,[141] which resonates with Dreyfus and Dreyfus's study of expertise and learning to play chess.[142] An IBM researcher in the 1950s and 1960s "wrote a machine learning program that could play checkers" and learn from its moves—both the good and the bad.[143] Although the program did not achieve the level of expert, it played above average.[144] In 1997, IBM's Deep Blue beat Garry Kasparov, a chess grandmaster, at chess.[145] Deep Blue was able to "process over 200 million moves per second" to find the best move.[146] Because chess and checkers are played on eight-by-eight boards, such computations are feasible.[147] In 2016, Google DeepMind's AlphaGo played a series of matches against a reigning Go player, Lee

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137 *Id.* at 20.
138 *Id.* at 22.
139 *Id.*
140 *Id.* at 22–23.
141 *Id.* at 26.
142 *See* Dreyfus & Dreyfus, *supra* note 37, at 782–88.
143 THE ROYAL SOC'Y, *supra* note 136, at 26.
144 *Id.*
145 *Id.*
146 *Id.*
147 *See id.*

Sedol.[148] Over two thousand years old, Go "is a game with relatively simple rules . . . but it is incredibly complex, due to the huge number of potential moves."[149] Go is played on a nineteen-by-nineteen board, making it harder than chess: "After the first two moves of a Chess game, there are 400 possible next moves," while "there are close to 130,000" in Go.[150] For both humans and machines, attempting to compute all possible moves in Go would make it potentially take years to finish one game.[151] Because of this, humans use intuition to play Go.[152] Researchers, using neural networks, "trained AlphaGo on 30 million moves from games played by humans," then "used reinforcement learning to allow AlphaGo to learn from thousands of games it played against itself."[153] The matches against Sedol resulted in AlphaGo winning four games out of the five played.[154] One year later, AlphaGo surpassed that level and its only realistic competitor was itself.[155]

Generally, with the improvement in machine learning and automation, the need for unskilled labor declines.[156] Because particular roles can be easily automated, we can outrun our capacity to create new roles.[157] In fact, it is anticipated that up to forty-seven percent (47%) of total employment in the United States is at high risk of automation.[158] The Royal Society report on machine learning also confirms that significant proportions of jobs around the world, such as those in the United Kingdom, are susceptible to automation in the

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148 *Id.* at 27.

149 *Id.*

150 Danielle Muoio, *Why Go Is So Much Harder for AI to Beat than Chess*, BUS. INSIDER (Mar. 20, 2016, 1:32 PM), https://www.businessinsider.com/why-google-ai-game-go-is-harder-than-chess-2016-3/?r=AU&IR=T.

151 *See id.*

152 *Id.*

153 THE ROYAL SOC'Y, *supra* note 136, at 27.

154 *Id.*

155 James Vincent, *DeepMind's Go-Playing AI Doesn't Need Human Help to Beat Us Anymore*, VERGE (Oct. 18, 2017, 1:00 PM), https://www.theverge.com/2017/10/18/16495548/deepmind-ai-go-alphago-zero-self-taught.

156 Frey & Osborne, *supra* note 131, at 254 ("Indeed, over the past decades, computers have substituted for a number of jobs, including the functions of bookkeepers, cashiers and telephone operators.").

157 *Id.* at 258.

158 *Id.* at 265.

future.[159] Machine learning, however, has brought a new dimension to automation: both routine and non-routine jobs are now capable of being performed by machines.[160] This kind of automation potentially affects professional services.[161]

Before we examine how law and legal services are disrupted by machine learning, we want to add another perspective to professions that connects to the discussion of expertise and tacit knowledge. In a study of French medical practice, Jamous and Peloille showed that medical practitioners faced a dilemma: if they explained the complexity of their work in clear technical terms, it could be captured by others who could predict how the work should be performed, removing the uniqueness and competitive edge of their discovery.[162] The essence of this dilemma is similarly captured by the "theatrics" which accompanied the invention of the obstetrical forceps that revolutionized child-birth. Being a relatively low-technical invention, obstetrical forceps would have been very easy to replicate if anyone had access to them, and that is likely why the Chamberlen family went to extraordinary lengths to protect their invention and professional secrets for more than 100 years.[163] Forceps are typically as small as 23 centimeters, and weigh only 600 grams[164]—and yet, "[the Chamberlens] are said to have arrived at the house of whichever woman it might be in a special carriage."[165] They were accompanied by a huge box, deliberately carried by two men in order to lead witnesses

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159 THE ROYAL SOC'Y, *supra* note 136, at 103–04.

160 *Id.* at 100–02.

161 *Id.* at 67.

162 *See* H. Jamous & B. Peloille, *Professions or Self-perpetuating Systems? Changes in the French University - Hospital System*, *in* 3 SOCIOLOGICAL STUDIES 109, 117 (J.A. Jackson ed., 1970).

163 *See* J. H. AVELING, THE CHAMBERLENS AND THE MIDWIFERY FORCEPS, at viii–ix (1882); HARVEY GRAHAM, ETERNAL EVE: THE HISTORY OF GYNAECOLOGY & OBSTETRICS 188–89 (1951); Peter M. Dunn, *The Chamberlen Family (1560–1728) and Obstetric Forceps*, 81 ARCHIVES DISEASE CHILDHOOD F232, F232 (1999).

164 *See, e.g.*, Sales Listing for Simpson Obstetrical Forceps, MEDICAL-TOOLS.COM, http://www.medical-tools.com/shop/simpson-obstetrics-forceps.html (last visited Oct. 31, 2018).

165 *See* GRAHAM, *supra* note 163, at 188.

> to believe that it contained some massive and highly complicated machine. The labouring woman was blindfolded lest she should see the Secret. Only Chamberlens were allowed in the locked lying-in room, from which the terrified relatives heard peculiar noises, ringing bells, and other sinister sounds as the Secret went to work.[166]

Technicality, therefore, had the negative consequence of reducing barriers to entry. To maintain closure and some mystery, there needed to be an element that was inaccessible to the lay person, something indeterminate, which could be judgment, interpretation, or tacit knowledge. However, if the knowledge base appeared to be entirely indeterminate, then it would be simple for other groups to claim equivalent knowledge as truth claims would be unverifiable. For a profession to succeed as a profession and maintain closure, it would need to find the right position in the indeterminacy/technicality ratio.[167] We can see how professions achieve the right ratio through the manner in which professional experts display their knowledge, almost as a kind of intuition.

A. Machine Learning and Law

Machine learning has, and will continue to have, an enormous impact on the delivery of legal services and the law.[168] Some areas of law, such as parking offenses, are considered so trivial that lawyers ignore them, which leads to a void that is filled by machine learning solutions.[169] For example, DoNotPay is a chatbot based on

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[166] *Id.*

[167] *See* Jamous & Peloille, *supra* note 162, at 112 (discussing the Indetermination/Technicality ratio).

[168] *See generally, e.g.*, John O. McGinnis & Russell G. Pearce, *The Great Disruption: How Machine Intelligence Will Transform the Role of Lawyers in the Delivery of Legal Services*, 82 FORDHAM L. REV. 3041 (2014) (discussing machine learning's impact—both present and future—on aspects of legal practice such as discovery, legal search, document generation, brief and memoranda generation, and prediction of case outcomes). For legal industry expert opinions on what lawyers and firms must do to prepare for the future, see, for example, LINDSAY GRIFFITHS ET AL., HIGHQ, SMARTLAW 2.0: EXPERTS INSIGHTS FOR THE NEW FUTURE OF LAW (2018) (ebook).

[169] For current machine learning solutions in the legal profession, see Edgar Alan Rayo, *AI in Law and Legal Practice – A Comprehensive View of 35 Current*

IBM's Watson that asks questions about parking tickets to find grounds for appealing the tickets.[170] Other areas amenable to AI are legal research and document review.[171] These tasks are typically carried out by junior lawyers and are part of the training that lawyers are supposed to undergo in law firms.[172] ROSS Intelligence, like DoNotPay, uses AI to query big data on legal fields like bankruptcy, intellectual property, and labor law.[173] Both DoNotPay and ROSS use natural language processing, eliminating the need for lawyers to become acquainted with the technicalities of the system because the work is done in text.[174] Ravel Law, another AI-based research tool, moves lawyers into a visually driven dimension.[175] Using visual analytics, Ravel Law allows lawyers to see the relationships between cases based on a variety of research terms.[176] In the area of document analysis, systems like Kira, for example, search for particular

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Applications, EMERGI, https://emerj.com/ai-sector-overviews/ai-in-law-legal-practice-current-applications/ (last updated Sept. 19, 2018).

[170] Dana Remus & Frank Levy, *Can Robots Be Lawyers?: Computers, Lawyers, and the Practice of Law*, 30 GEO. J. LEGAL ETHICS 501, 555 (2017); John Mannes, *DoNotPay Launches 1,000 New Bots to Help You with Your Legal Problems*, TECHCRUNCH, https://techcrunch.com/2017/07/12/donotpay-launches-1000-new-bots-to-help-you-with-your-legal-problems/ (last visited Nov. 10, 2018).

> IBM's 'Watson' uses machine learning in various ways. One of these is natural language processing – the form of machine learning which allows computers to process written or verbal information – which Watson uses to extract information from the vast collection of published research papers and case reports, and use this information to recommend treatment options.

THE ROYAL SOC'Y, *supra* note 136, at 35.

[171] McGinnis & Pearce, *supra* note 168, at 3047–50.

[172] Remus & Levy, *supra* note 170, at 524, 532, 531–32 tbl.3.

[173] *Id.* at 503, n.4, 521–23; *ROSS Coverage*, ROSS, https://rossintelligence.com/ross/coverage/ (last visited Dec. 21, 2018); *see* Rayo, *supra* note 169 (noting BakerHostetler, for example, employed ROSS in its bankruptcy department).

[174] *See* Remus & Levy, *supra* note 170, at 521–23; Mannes, *supra* note 170; Rayo, *supra* note 169.

[175] *See Our Products*, RAVEL L., https://home.ravellaw.com/products (last visited Dec. 14, 2018); Rayo, *supra* note 169.

[176] *Our Products*, *supra* note 175; *see also* Remus & Levy, *supra* note 170, at 524–25.

provisions across repositories of contracts.[177] Similarly, Luminance is an AI system for analyzing documents on a large scale, which has been adopted by a significant number of law firms.[178] All of these machine learning developments demonstrate the rapid progress that is being made, and how the line is often blurred between "undesirable" legal work and "unimportant" legal work.

These are merely a few examples of the kinds of automation appearing in the legal world today. Compared to AI used in other professions—medicine (oncology diagnosis) [179] and engineering (bridge stability)[180]—legal AI is in a simple stage.[181] There are a number of reasons for this. Law has responded slowly to technological changes over its existence; it is not immune from change. For example, the printing press, the telephone, and the word processor changed the production and organization of law and legal practice.[182] Machine learning is simply a continuation—albeit a more radical one. We argue, however, that law is slow to adopt new technologies because it lacks a scientific base from which to analyze its needs with respect to technology.[183] As Jamous and Peloille point

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[177] *How It Works*, KIRA SYS., https://www.kirasystems.com/how-it-works/ (last visited Dec. 14, 2018); *see also* Remus & Levy, *supra* note 170, at 514.

[178] *See* LUMINANCE, https://www.luminance.com (last visited Dec. 14, 2018); *Technology*, LUMINANCE, https://www.luminance.com/technology.html (last visited Dec. 14, 2018).

[179] *See* Chelsea Whyte, *How an AI Expert's Cancer Diagnosis May Lead to a Treatment Revolution*, NEWSCIENTIST (July 18, 2018), https://www.newscientist.com/article/mg23931871-200-how-an-ai-experts-cancer-diagnosis-may-lead-to-a-treatment-revolution/.

[180] Ignacio Gonzalez & Raid Karoumi, *BWIM Aided Damage Detection in Bridges Using Machine Learning*, 5 J. CIV. STRUCTURAL HEALTH MONITORING 715, 723–725 (2015).

[181] McGinnis & Pearce, *supra* note 168, at 3046, 3065.

[182] Richard L. Marcus, *The Impact of Computers on the Legal Profession: Evolution or Revolution?*, 102 NW. U. L. REV. 1827, 1853–54 (2008) ("The telephone, in particular, 'completely revolutionized' the methods of transacting legal business."); David. D. Swett, *Word Processing: What Is It? How It Can Help You*, A.B.A. J., Jan. 1974, at 55, 58 (discussing how the word processor can help law firm efficiency); *The Printing Press, the Internet and Lawyers*, N.Z. L. SOC'Y (Mar. 27, 2015), https://www.lawsociety.org.nz/lawtalk/lawtalk-archives/issue-861/the-printing-press,-the-internet-and-lawyers (discussing the impact of the printing press on law).

[183] The Association of Corporate Counsel is setting benchmarks for technology, cybersecurity, and the like. Press Release, Ass'n of Corp. Counsel, Cybersecurity Role, Spend on the Rise for Corp. Legal, ACC Found. Cybersecurity Report

out, the first teaching hospitals in France appeared at the beginning of the nineteenth century,[184] whereas law had no equivalent institution that engaged in scientific research or development at that time.[185] Law schools focused on academic pursuits, while only a few established connections with legal practice.[186] Even continuing professional development was separate from the academy.[187] Admittedly, some lawyers in early twentieth century New York tried to depict law as scientifically based[188] following tenuously from Dean Langdell's attempt to scientize the legal curriculum at Harvard Law School by cloning the model of the "chemistry laboratory" in the 1870s.[189] The nearest institutional equivalent arguably might be the large law firm, especially as envisaged in the Cravath system, but, at best, that is tenuous.[190] Cravath created his law firm as a training institution different from other law firms at the time.[191] Junior lawyers would receive training and, if proficient after a number of years, could be elected to partnership.[192] The law firm thus had two ranks: partners and associates.[193] While it built up skills in young lawyers,

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Finds (May 1, 2018), https://www.acc.com/aboutacc/newsroom/pressreleases/2018cybersecurityreport.cfm; Press Release, Ass'n of Corp. Counsel, ACC Expands Custom Benchmarking Servs. (May 23, 2018), https://www.acc.com/aboutacc/newsroom/pressreleases/acc-expands-custom-benchmarking.cfm.

184 Jamous & Peloille, *supra* note 162, at 127–31 (discussing the rise of the French teaching hospital).

185 *See* Robert W. Gordon, *Legal Thought and Legal Practice in the Age of American Enterprise: 1870–1920*, *in* PROFESSIONS AND PROFESSIONAL IDEOLOGIES IN AMERICA 70, 72–76 (Gerald L. Gieson ed., 1983); STEVENS, *supra* note 29, at 51–57.

186 *See* Gordon, *supra* note 185, at 72–76; STEVENS, *supra* note 29, at 51–57.

187 *See* STEVENS, *supra* note 29, at 51.

188 *See* Gordon, *supra* note 185, at 72–73, 75–76.

189 STEVENS, *supra* note 29, at 35–36, 52–53 (noting that Langdell saw law as a science, to be learned in a library, like a chemist learns in a laboratory).

190 SWAINE, *supra* note 40, at 4–5.

191 *See id.* at 1–12 (detailing the "Cravath system," which "[did] not follow the practice of many other offices of leaving small routine matters entirely to young men fresh from law school without much supervision, on the theory that a man best learns how to handle cases by actually handling them").

192 *Id.* at 4–5, 7–8.

193 *Id.*

the system as a whole no longer sustains wholesale training of novice lawyers.[194] This structural change to the profession is something in which Deloitte has voiced a series of predictions. In the face of the drive towards adopting technology, Deloitte predicted that the concept of "law firms" in the United Kingdom would transform into organizations composed of a small number of equity partners with larger groups of long-term and short-term employees.[195] Moreover, Deloitte also predicts that up to thirty-nine percent (39%) of legal jobs could be automated.[196] The preceding argument shows that law has lacked the established scientific base of other disciplines, and thus, with no internal forces to push it towards a research and development frame of thinking, law has essentially been subject to external forces compelling it to change.[197]

Machine learning has the potential to alter perceptions of expertise in the professions. In some cases, professionals will be replaced by machines, and in others, the professionals' expertise will be augmented by AI. Figure 2 revisits the Expertise-Space Diagram and shows that, as with AlphaGo, machine learning—here, called "algorithm"—is outside the three-dimensional box because machine learning cannot yet acquire tacit knowledge as it has no interactional expertise in the sense that it is not part of a community.[198] But, as

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194 David B. Wilkins & G. Mitu Gulati, *Reconceiving the Tournament of Lawyers: Tracking, Seeding, and Information Control in the Internal Labor Markets of Elite Law Firms*, 84 VA. L. REV. 1581, 1611 (1998).

195 DELOITTE, DEVELOPING LEGAL TALENT: STEPPING INTO THE FUTURE LAW FIRM 12–14 (2016), https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/audit/deloitte-uk-developing-legal-talent-2016.pdf.

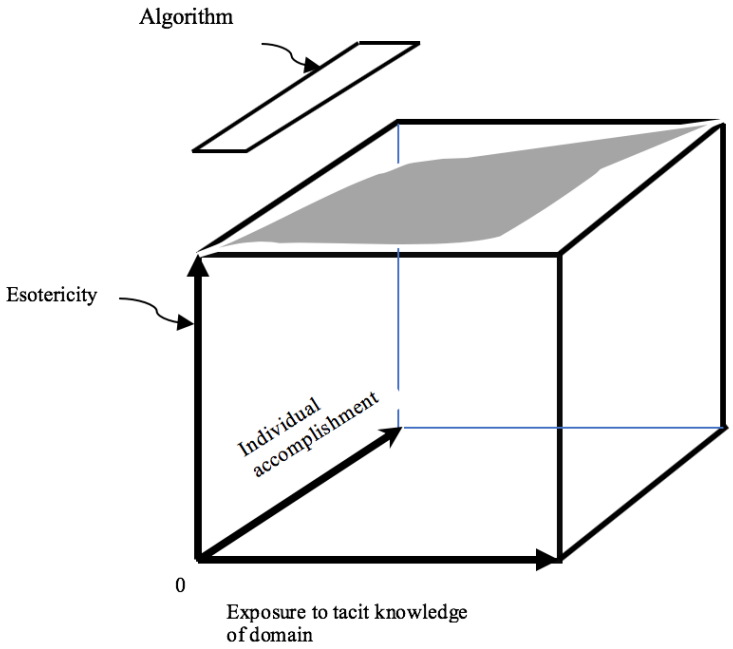
196 Jane Croft, *Artificial Intelligence Closes In on the Work of Junior Lawyers*, FIN. TIMES (May 4, 2017), https://www.ft.com/content/f809870c-26a1-11e7-8691-d5f7e0cd0a16 (discussing DELOITTE, *supra* note 195).

197 *See, e.g.*, David B. Wilkins & Maria J. Esteban Ferrer, *The Integration of Law into Global Business Solutions: The Rise, Transformation, and Potential Future of the Big Four Accountancy Networks in the Global Legal Services Market*, 43 LAW & SOC. INQUIRY 981, 996–97 (2018) (discussing law's threat from the accounting firms).

198 At a theoretical level, we could equate this lack of interactional expertise to what occurs in the Turing Test, which is when a computer convinces human interrogators that the machine is, in fact, human. Gary Marcus, *What Comes After the Turing Test?*, NEW YORKER (June 9, 2014), https://www.newyorker.com/tech/annals-of-technology/what-comes-after-the-turing-test?reload=true. Machines do this through pattern recognition, just as AI already does. *See id.* According to Marcus, most programs usually fail when the "conversations" stray further away

Collins demonstrates with chess machines, the algorithm is not constrained by the rear wall in its knowledge expansion.[199]

Figure 2: Expertise-Space Diagram of professional expertise augmented by machine learning.[200]



Although machine learning has radical potential for disruption,[201] other technologies will add to that disruption, which will further redefine professions and knowledge. The next Section discusses the impact of a newer technology: Blockchain.

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from their database. *See id.* Meaning, there are strict limits to their potential for interactional expertise.

[199] Collins, Three Dimensions of Expertise, *supra* note 33, at 19–21. Another way of looking at this is the distinction between mimeomorphic and polimorphic actions. Mimeomorphic actions are based on imitating repetitive behaviors, whereas polimorphic actions depend on social understanding of changing circumstances. COLLINS & EVANS, *supra* note 83, at 27. Machines are ideally suited for the former but incompetent at the latter. *Id.* Actions within the three-dimensional box are polimorphic, while those outside the three-dimensional box are mimeomorphic. *See id.*

[200] Collins, Three Dimensions of Expertise, *supra* note 33, at 19.

[201] Here, the view of disruption derives from Clayton Christensen on sustaining and disruptive innovation. *See* Clayton M. Christensen, Michael Raynor &

B. *Blockchain, Professions, and Society*

Compared to copyright, chess, driving tests, forceps, and the concept of AI, Blockchain is a new technological structure, which has been created within the last ten years, and its applications have been exponentially expanding over the past few years.[202] Blockchain is the technical and theoretical structure that Bitcoin, cryptocurrencies, and other token-driven technologies operate upon.[203] It was Satoshi Nakamoto who put forward the thesis for Bitcoin, a peer-to-peer system for transactions that would be distributed and immutable.[204] Nakamoto's ideas focused around cryptocurrencies that would transmit value independently of fiat currencies.[205] The central ideas are that the Blockchain (a ledger) recording transactions would be decentralized so that everyone using the Blockchain would have a copy.[206] To prevent double spending and other attempts at fraud, the system would necessitate a cryptographic conundrum that would need to be solved by the community.[207] This "proof-of-work" system had to be complex enough to make it redundant for hackers to try a brute-force approach, but still easily solved to entice the community to try and solve the conundrum.[208] Once the conundrum is solved and recorded in the Blockchain, the record is permanent and unchangeable.[209] Solving it would also reward the solver with Bitcoin and the results would be distributed to the community, thus creating consensus.[210] Furthermore, the system contained its own incentives to promote good and productive behavior.[211]

Rory McDonald, *What Is Disruptive Innovation?*, HARV. BUS. REV., Dec. 2015, at 44, 46.

202 Robert Hackett, *Why Big Business Is Racing to Build Blockchains*, FORTUNE (Aug. 22, 2017), http://fortune.com/2017/08/22/bitcoin-ethereum-blockchain-cryptocurrency/.

203 *Id.*

204 *See* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, SATOSHI NAKAMOTO INST. (Oct. 31, 2008), https://nakamotoinstitute.org/static/docs/bitcoin.pdf.

205 *Id.* at 1.

206 *Id.* at 5.

207 *Id.* at 1–2, 5.

208 *Id.* at 3–4.

209 *See id.* at 3.

210 *See id.* at 3–4.

211 *See id.* at 4.

The Bitcoin Blockchain is limited in its aims, which has stimulated others to create new kinds of Blockchain that carry out different tasks.[212] For example, Vitalik Buterin created the Ethereum Blockchain in 2013, which launched in 2015, as a globally distributed computer platform that would run smart contracts (distributed applications) without intervention from, or need for, from third parties.[213] Ethereum enables the possible construction of immediate contract implementation as well as the possibility of distributed autonomous organizations ("DAOs").[214] Wüst and Gervais define a DAO as follows:

> A Decentralized Autonomous Organization (DAO) is an organization that is run autonomously through a set of smart contracts. In contrast to traditional organizations or companies, there is no central control or management. Instead, a DAO is defined by a set of rules encoded in smart contracts that define how the DAO behaves and how it evolves. Typically, a DAO has many investors that then decide by voting how the funds of the DAO should be invested. As the goal of such an organization is to be governed in a completely decentralized way and the investors gen-

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[212] *See, e.g.*, Ray King, *Ethereum vs Bitcoin: Is Ethereum a Better Bitcoin Alternative?*, BITDEGREE, https://www.bitdegree.org/tutorials/ethereum-vs-bitcoin/ (last updated May 3, 2018); Prableen Bajpai, *Bitcoin vs Ethereum: Driven by Different Purposes*, INVESTOPEDIA, https://www.investopedia.com/articles/investing/031416/bitcoin-vs-ethereum-driven-different-purposes.asp (last updated Oct. 12, 2018).

[213] Bajpai, *supra* note 212; ETHEREUM, https://www.ethereum.org/ (last visited Nov. 13, 2018) ("Ethereum is a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third-party interference."); Bernard Marr, *Blockchain: A Very Short History of Ethereum Everyone Should Read*, FORBES (Feb. 2, 2018, 12:28 AM), https://www.forbes.com/sites/bernardmarr/2018/02/02/blockchain-a-very-short-history-of-ethereum-everyone-should-read/#44f30ffd1e89. Ethereum is believed by some to be the best investment opportunity. Zoë Bernard, *Insiders Say They Think Ethereum Is a Better Investment than Bitcoin*, BUS. INSIDER AUSTL. (July 10, 2018, 6:06 AM), https://www.businessinsider.com.au/ethereum-better-investment-than-bitcoin-insiders-2018-7?r=US&IR=T.

[214] Bajpai, *supra* note 212.

> erally don't know or trust each other, a permissionless blockchain is naturally a good fit for such a design . . . .[215]

Smart contracts are code that executes a set of instructions without intervention as long as certain conditions are met.[216] Consider a smart contract that entails the delivery of goods by ship from one part of the world to another. The smart contract could be set up to make payments along the delivery route—assuming the GPS records appropriate distances and the temperature gauges record correct temperatures and humidity readings—such that, by the time of final delivery, the contract will have been completely executed.[217]

As this point, the distributed applications ("Dapps"), or the software that runs on Blockchain, are still in their infancy and relatively few projects have been brought to fruition.[218] There are, however, fascinating and encouraging projects in the works. The Chicago real estate title transfer pilot project, for instance, successfully transfers a title peer-to-peer on the Bitcoin Blockchain using a colored coin.[219] The title is recorded immutably in the Blockchain, effectively preventing fraudsters from attempting to overlay a fake title

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[215] Karl Wüst & Arthur Gervais, *Do You Need a Blockchain?*, *in* 2018 CRYPTO VALLEY CONFERENCE ON BLOCKCHAIN TECHNOLOGY (CVCBT 2018) 45, 52 (2018). There are, however, many difficulties and problems with the governance of DAOs. *See* Josh Stark, *Making Sense of Blockchain Governance Applications*, COINDESK (Nov. 20, 2016, 9:53 AM), https://www.coindesk.com/making-sense-blockchain-governance-applications; Stephen D. Palley, *How to Sue a Decentralized Autonomous Organization*, COINDESK (Mar. 20, 2016, 10:17 AM), https://www.coindesk.com/how-to-sue-a-decentralized-autonomous-organization.

[216] *How Blockchain Is Revolutionizing the World of Transportation and Logistics*, WINNESOTA, https://www.winnesota.com/blockchain (last visited Nov. 3, 2018) [hereinafter *Blockchain Revolutionizing World*].

[217] *See* MARKUS KÜCKELHAUS ET AL., DHL CUSTOMER SOLS. & INNOVATION, BLOCKCHAIN IN LOGISTICS: PERSPECTIVES ON THE UPCOMING IMPACT OF BLOCKCHAIN TECHNOLOGY AND USE CASES FOR THE LOGISTICS INDUSTRY 12–20 (2018); *Blockchain Revolutionizing World*, *supra* note 216.

[218] Ilmari Kontulainen, *dApps: Why Realtime Data Is the Missing Component*, MEDIUM (Aug. 27, 2018), https://medium.com/streamrblog/dapps-why-the-real time-data-backbone-is-the-missing-component-d2e6f9bb643e. *See generally* Steve Huckle et al., *Internet of Things, Blockchain and Shared Economy Applications*, 98 PROCEDIA COMPUTER SCI. 461 (2016).

[219] Ragnar Lifthrasir, *Permissionless Real Estate Title Transfers on the Bitcoin Blockchain in the USA!–Cook County Blockchain Pilot Program Report*,

on top.[220] Another example is the OpenLaw project, which builds contracts that enclose smart contracts, allowing immediate execution on the Ethereum Blockchain.[221] OpenLaw created a series of legal templates using markup language—that is, contracts are programmed and then stored on the Blockchain using IPFS[222]—making the contracts immutable and secure, and with the capability of executing in real time.[223] Furthermore, there is no need to store these smart contracts on centralized servers such as Amazon or Google because these decentralized structures increase security and privacy.[224]

Although nascent, Blockchain will have an enormous impact on the professions because many repetitive, routine tasks could be organized as smart contracts on the Blockchain to run automatically when required. License or intellectual property renewals could be coded to execute automatically, thereby distributing payments without human intervention unless there is a change to the contract terms.[225] Music contracts could be placed on the Blockchain with

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MEDIUM (June 28, 2017), https://medium.com/@RagnarLifthrasir/permissionless-real-estate-title-transfers-on-the-bitcoin-blockchain-in-the-usa-5d9c39139292. A colored coin is a means of storing data about real assets on the Bitcoin Blockchain. *Id.* Here, the colored coin represents the title. *Id.*

220 *Id.*

221 *Introducing OpenLaw*, CONSENSYS MEDIA (July 25, 2017), https://media.consensys.net/introducing-openlaw-7a2ea410138b.

222 "IPFS stands for Interplanetary File System." Karan Kwatra, *What Is IPFS?*, MEDIUM (Mar. 14, 2018), https://medium.com/wolverineblockchain/what-is-ipfs-b83277597da5. "IPFS is a transport protocol like HTTP, only instead of a client-server model, IPFS connects to a network of distributed nodes to both serve and request data. All files are version controlled and cryptographically authenticated, and websites will load much faster over IPFS than over HTTP." J.M. Porup, *The InterPlanetary File System Wants to Create a Permanent Web*, MOTHERBOARD (Sept. 18, 2015, 2:08 PM), https://motherboard.vice.com/en_us/article/78xgaq/the-interplanetary-file-system-wants-to-create-a-permanent-web. For more information on IPFS, see IPFS, https://ipfs.io/ (last visited Nov. 13, 2018).

223 *Introducing OpenLaw*, *supra* note 221; *see also* IPFS, *supra* note 222.

224 *Introducing OpenLaw*, *supra* note 221.

225 Francois Oustry, *Blockchain Based Solutions for Intellectual Property Management*, MEDIUM (May 21, 2017), https://medium.com/@foustry/blockchain-based-solutions-for-intellectual-property-management-2ba14b51d5f6.

immediate payments, thus removing the necessity for performing rights organizations to collect and distribute royalties.[226]

It is even possible to envisage entire organizations and companies run as a DAO on the Blockchain, making redundant centralized command structures, which typify traditional forms of organization. We could consider a law firm as a distributed entity that rewards work on a peer-to-peer basis without the need for an equity partnership, which could increase efficiency and reduce rent seeking by partners.[227] This raises the question of whether and why one might need a law firm at all, even in the form of a Blockchain partnership. If a law firm is not a formal partnership, it could be a collaborative venture with a different nexus and remuneration system than those of conventional law partnerships. Law firms have the potential to outsource many of the non-law departments—human resources, information technology, and business development—from the firm. If firms were also on a Blockchain, then their services would be on a pay-as-you-go basis through a further set of smart contracts. Voting on future projects and clients could be based on cryptotoken voting according to proportions of tokens held by the members.[228]

Moreover, despite regulation, a law firm as a DAO would have no physical limits, allowing membership to expand around the world. There are already plans to place transport projects on the

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[226] *See, e.g.*, STEPHEN BRETT, INMUSIK WHITE PAPER 19–21 (2d version 2018), https://inmusik.co/wp-content/uploads/2018/08/inmusik-wp-v2.01.pdf; BUSHIDO LAB, LLC, TUNE SOFTWARE: A DEMOCRATIZED ECOSYSTEM FOR THE MUSIC INDUSTRY 6–7, 10 (1.2 version 2018), http://www.tunetoken.io/wp-content/uploads/2018/11/TuneTokenWhitePaperAmerican.pdf.

[227] *See* Nick Jarrett-Kerr, *Large Law Firms and Ponzi Schemes?*, LEXISNEXIS (July 16, 2013), https://blogs.lexisnexis.co.uk/futureoflaw/2013/07/large-law-firms-and-ponzi-schemes/. It is quite reasonable to consider law firms as Ponzi schemes with the equity partners as the original promoters who maintain their positions and payments by recruiting new lawyers who are willing to defer their true immediate rewards in favor of later and greater promised rewards. *See id.* The continued cyclical nature of the organization ensures continuity as long as the market can sustain monopoly rents protected by regulation. *See id.* A DAO run on Blockchain would remove the need for partnership.

[228] *See* Ian Edwards, *Five Blockchain Startups Using Token-Curated Registries*, MEDIUM (Mar. 5, 2018), https://medium.com/@ianedws/5-blockchain-startups-using-token-curated-registries-e2cffd48d4fc.

Blockchain that would supersede companies like Uber or Lyft.[229] A series of smart contracts would organize the company on a peer-to-peer basis and therefore remove the need for the central dispatcher, which can be a system weakness and draw profits away from drivers.[230] With Chasyr, a Blockchain ride share company, drivers invest in Chasyr by purchasing cryptotokens and riders use tokens to pay for rides.[231] The rating system is stored on Blockchain permanently and openly, so that both riders and drivers can see each other's records before accepting the ride.[232] Before Chasyr, Uber was reported as the "disruptive" technology of the day;[233] however, an undeniable truth is the aphorism "changes aren't permanent – But change is."[234] Thus, disruptions will themselves be disrupted, and this is a key role of Blockchain technologies. One of the key potential qualities of

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[229] Andrew Rossow, *Hailing Rides down Crypto Lane: The Future of Ridesharing*, FORBES (July 18, 2018, 7:41 AM), https://www.forbes.com/sites/andrewrossow/2018/07/18/hailing-rides-down-crypto-lane-the-future-of-ridesharing/#16c3745c8cf0 (discussing what Blockchains can do for ridesharing in the future); *see, e.g.*, CHASYR, https://www.chasyr.com/ (last visited Nov. 13, 2018); LA`ZOOZ, http://lazooz.org/ (last visited Nov. 13, 2018); Chuan Tian, *Ridesharing App Founder Wants to Build a Blockchain 'Uber*,*'* COINDESK (May 28, 2018, 1:36 PM), https://www.coindesk.com/chinese-ride-hailing-app-founder-wants-to-build-a-blockchain-uber.

[230] *See* Tony Winchester (@sirwinchester), *Chasyr Combines Uber and Crypto: Take a Ride on the Blockchain!*, STEEMIT, https://steemit.com/cryptocurrency/@sirwinchester/chasyr-combines-uber-and-crypto-take-a-ride-on-the-blockchain (last visited Dec. 19, 2018). With Blockchain and smart contracts, it is feasible to harness other services, like human resources and driver training, as part of the enterprise as needed without being in thrall to a central administration as in most sharing economy businesses. *See* ALEXIS R. ROCAMORE & ARYANIE AMELLINA, BLOCKCHAIN APPLICATIONS AND THE SUSTAINABLE DEVELOPMENT GOALS: ANALYSIS OF BLOCKCHAIN TECHNOLOGY'S POTENTIAL IN CREATING A SUSTAINABLE FUTURE 38–39 (2018).

[231] *Id.*

[232] *Id.*

[233] *E.g.*, Ken Hudson, *What Uber Tells Us About Disruption*, SYDNEY MORNING HERALD (Sept. 5, 2015, 10:53 PM), https://www.smh.com.au/technology/what-uber-tells-us-about-disruption-20150905-gjg0ln.html; Abi Wilkinson, *Uber's 'Disruption' Is Far from Benign – but It's Not Too Big to Ban*, GUARDIAN (Nov. 22, 2017, 6:26 AM), https://www.theguardian.com/commentisfree/2017/nov/22/uber-disruption-ban-london-sadiq-khan; Winchester, *supra* note 230.

[234] RUSH, *Tom Sawyer*, *on* MOVING PICTURES (Mercury Records 1984) (1981).

Blockchain is its ability to democratize the production, use, and reward of data and information, which we are seeing in these conceptions.

Furthermore, the combination of Blockchain and machine learning could lead to substantial and significant changes in the delivery of services, including professional services. Increasing amounts of data are already recorded through the internet of things.[235] Big data collected this way increases the power of machine learning because machine learning is predicated on big data.[236] Blockchain provides the infrastructure, via smart contracts or Dapps, for that data to be paid for by cryptocurrencies and utilized in a decentralized way as the data moves around the system. Through the addition of the Blockchain of things, automation of activities becomes incentivized since there are reasons to capture value through the utilization of one's data.[237] Moreover, the use of smart contracts to run the internet of things should not create problems in terms of contract enforceability because the parties' intent could be incorporated into the smart contract itself.[238]

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[235] LEE RAINIE & JANNA ANDERSON, PEW RESEARCH CTR., THE INTERNET OF THINGS CONNECTIVITY BINGE: WHAT ARE THE IMPLICATIONS? 2 (2017), http://www.pewinternet.org/2017/06/06/the-internet-of-things-connectivity-binge-what-are-the-implications/ (follow "Complete Report PDF" under "Report Materials") (noting that "[i]n 1999, 18 years ago, just 4% of the world's population was online," whereas "[t]oday, 49% of the world's population is connected online and an estimated 8.4 billion connected things are in use worldwide"). The "internet of things" is when everyday objects are attached to the internet in order to transmit and receive data. Jacob Morgan, *A Simple Explanation of 'The Internet of Things,'* FORBES (May 13, 2014, 12:05 AM), https://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/#26b590301d09. For example, a networked refrigerator could order replacement food and inform the manufacturer when it needs servicing or repair. *See id.* Similarly, software and firmware updates could be sent over the internet. *See id.*

[236] THE ROYAL SOC'Y, *supra* note 136, at 5.

[237] Primavera De Filippi & Aaron Wright, *The Blockchain of Things*, SLATE (June 19, 2018, 7:30 AM), https://slate.com/technology/2018/06/blockchain-is-likely-to-advance-the-internet-of-things-and-robot-rights.html?wpsrc=sh_all_dt_tw_ru; *see* Raja Ramachandran, *The Blockchain of Food*, FORBES (Oct. 23, 2017, 1:18 AM), https://www.forbes.com/sites/themixingbowl/2017/10/23/the-blockchain-of-food/#18e70a83775f.

[238] De Filippi & Wright, *supra* note 237. The Law Commission of England and Wales is starting a project on smart contracts in English law. *See Smart Contracts*, L. COMMISSION, https://www.lawcom.gov.uk/project/smart-contracts (last

CONCLUSION: PROSPECTS FOR THE FUTURE

We maintain that, over the long term, centralized forms of organization and coordination will undergo substantial change. In place, decentralized and distributed forms of organization will arise that will function around smart contracts with occasional human input. This will arise through natural development as technologies become more user friendly and established. While Moore's law may be coming to an end,[239] quantum computing will push the pace and scale of computing well beyond our current limits.[240] Developments, such as smart cities and societies where every part of the structure is connected, coordinated, and decentralized will increasingly become commonplace.[241] This will, therefore, make it harder for the abuse of technology at the expense of others, and will reduce unfortunate activities that lead to events like the Facebook/Cambridge Analytica furor, where centralized data collection and user manipulation were used to influence election outcomes in a country where fifty million Facebook users reside.[242]

However, in light of these technological changes and advancements, ultimately, we must be asking, "What effect does this have on professional expertise and knowledge?" Adair Turner, in a pro-

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visited Nov. 13, 2018). Similarly, the Accord Project "works towards a common, universal, implementation for smart legal contracts." ACCORD PROJECT, https://www.accordproject.org/ (last visited Nov. 13, 2018).

[239] *See supra* note 4.

[240] Abigail Beall & Matt Reynolds, *What Are Quantum Computers and How Do They Work? WIRED Explains*, WIRED (Feb. 16, 2018), https://www.wired.co.uk/article/quantum-computing-explained; *see, e.g.*, Richard Waters, *IBM Unveils First Standalone Quantum Computer*, FIN. TIMES (Jan. 8, 2019), https://www.ft.com/content/f0d63c74-12c6-11e9-a581-4ff78404524e.

[241] *See* WILLIAM D. EGGERS & JOHN SKOWRON, DELOITTE CTR. FOR GOV'T INSIGHTS, FORCES OF CHANGE: SMART CITIES 5–7 (2018), https://www2.deloitte.com/content/dam/insights/us/articles/4421_Forces-of-change-Smart-cities/DI_Forces-of-change-Smart-cities.pdf.

[242] *See* Carole Cadwalladr & Emma Graham-Harrison, *Revealed: 50 Million Facebook Profiles Harvested for Cambridge Analytica in Major Data Breach*, GUARDIAN (Mar. 17, 2018, 6:03 PM), https://www.theguardian.com/news/2018/mar/17/cambridge-analytica-facebook-influence-us-election; *Could Blockchain Technology Help Avoid Another Cambridge Analytica?*, CB INSIGHTS (Apr. 3, 2018), https://www.cbinsights.com/research/blockchain-identity-management/.

vocative lecture, argued automation will impact jobs and work adversely.[243] The jobs lost will not be replaced because jobs in manufacturing are so easily automated that the need for human labor will consistently decline.[244] Some services, too, will not be immune from automation.[245] Turner calls some of these service industries "intermediate activities" or "zero-sum activities" because, in and of themselves, they do not add to the gross domestic product, but instead, redistribute resources to other parts of the economy.[246] He includes law in this group.[247] Although there are counterarguments to this approach—for example, Gilson's idea of lawyers as transaction cost engineers who in fact do create value[248]—we, for the moment, subscribe to Turner's view. Significant parts of law are susceptible to disruption by machine learning and Blockchain, which may produce the contracted kind of professional services firm imagined by Deloitte in its report.[249] Such disruptions should reduce the inefficiency that Richard Tromans accuses law firms of having.[250]

Ultimately, what does this leave lawyers with as their main activity? It means that the lawyer as trusted adviser will again emerge as the central type of lawyer. Some are taking this seriously. For example, in its "Strategic Partner Program," Microsoft "asked 13 law firms to co-create solutions within the context of long-term business relationships" and stated that "participants are Microsoft's 'long-term partners' and that Microsoft intends to 'invest in the relationship.'"[251] Lawyers are being prompted by their clients and technological advances to rethink or revisit what the value of being a lawyer is, to themselves and to others. Only this time, the lawyer will not only be imbued with the expertise gained from experience

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243 *See* Turner, Manuscript, *supra* note 6.

244 *Id.* at 13, 34.

245 *Id.* at 10, 13.

246 *Id.* at 10–13.

247 *Id.* at 11–13.

248 *See* Ronald J. Gilson, *Value Creation by Business Lawyers: Legal Skills and Asset Pricing*, 94 YALE L.J. 239, 253–56 (1984).

249 *See* DELOITTE, *supra* note 195, at 4–5.

250 *See* Richard Tromans, *Law Firms Are Inefficiency Factories, Automation Is the Cure*, ARTIFICIAL LAW. (June 11, 2018), https://www.artificiallawyer.com/2018/06/11/law-firms-are-inefficiency-factories-automation-is-the-cure/.

251 Bill Henderson, *Can Microsoft Hit "Refresh" on Client-Law Firm Relations?*, LEGAL EVOLUTION (Sept. 30, 2018), https://www.legalevolution.org/2018/09/can-microsoft-hit-refresh-client-law-firm-relations-068/.

and knowledge—but also augmented with the power of machine learning. Our traditional conception of the lawyer—in a craft based on moral agency[252]—does not disappear but reappears in a stronger form. These types of initiatives can give rise to a new professionalism, built on a much broader and vibrant base, one that incorporates technology, legal knowledge, and a twenty-first century set of values that has a global outlook and is socially aware.[253]

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[252] *See* Elliot D. Cohen, *Pure Legal Advocates and Moral Agents: Two Concepts of a Lawyer in an Adversary System*, 4 CRIM. JUST. ETHICS 38, 45 (1985).

[253] *See generally* Lyn Spillman & Sorcha A. Brophy, *Professionalism as a Cultural Form: Knowledge, Craft, and Moral Agency*, 5 J. PROF. & ORG. 155 (2018).