Minnesota Journal of Law, Science & Technology

Volume 19 | Issue 1 Article 6

2018

Fundamental Protections for Non-Biological Intelligences or: How We Learn to Stop Worrying and Love Our Robot Brethren

Ryan Dowell
University of Minnesota Law School

Note

Fundamental Protections for Non-Biological Intelligences or: How We Learn to Stop Worrying and Love Our Robot Brethren

*Ryan Dowell**

INTRODUCTION

In the future, it is possible that humans will create machines that are thinking entities with faculties on par with humans. Computers are already more capable than humans at some tasks,[1] but are not regarded as truly intelligent or able to think. Yet since the early days of computing, humans have contemplated the possibility of intelligent machines—those which reach some level of sentience.[2] Intelligent machines could result from highly active and rapidly advancing fields of research, such as attempts to emulate the human brain, or to develop generalized artificial intelligence (AGI). If intelligent machines are created, it is uncertain whether intelligence would emerge through gradual development or a spontaneous

* JD Candidate 2018, University of Minnesota Law School; BS University of Kansas, 2013. Thank you to Professors Brian Bix and Francis Shen for feedback and guidance on this Note. Thanks to friends and family who have supported me throughout the years, and to the staff of MJLST for their invaluable work.

1. *See, e.g.*, Nicola Amoroso et al., *Brain Structural Connectivity Atrophy in Alzheimer's Disease*, CORNELL U. LIBR. ARXIV (Sept. 9, 2017), https://arxiv.org/pdf/1709.02369.pdf (discussing the use of a computer to identify Alzheimer's disease from medical imaging); Demis Hassabis, *Artificial Intelligence: Chess Match of the Century*, 544 NATURE 413, 413–14 (2017) (discussing the 1997 matchup between chess grandmaster Garry Kasparov and IBM's Deep Blue computer, which won the bout); Charlie Schmidt, *M. D. Anderson Breaks with IBM Watson, Raising Questions About Artificial Intelligence in Oncology*, 109 J. NAT'L CANCER INST., May 2017, at 4–5 (describing how Watson is used to read the large body of medical publications and deliver information to doctors).

2. *See* Irving John Good, *Speculations Concerning the First Ultraintelligent Machine*, 6 ADVANCES COMPUTERS 31, 32–33 (1966).

emergence. Throughout this Note, such intelligent machines will be referred to as non-biological intelligences (NBIs), with emphasis on machines with human-analogous intelligence.[3] Protection of NBIs, equivalent to protection of human research subjects, should be preemptively implemented to prevent injustice and potential grave harm to them.

In the Introduction, this Note introduces current standards by which we define a person, as well as several developing technologies that will challenge current definitions. Part I examines technologies that may result in non-biological intelligences that exhibit human mental capacities. It then examines the concept of personhood and its legal ramifications. Part II examines how these technologies fit (or don't) into existing legal frameworks and schema. Finally, in Part III, this Note proposes preemptive implementation of protections analogous to those for research on humans for NBIs, whether such an intelligence arises as a replica of human consciousness, as a de novo construct, or via unexpected means. Part III also touches on some intervening occurrences before the emergence of NBIs, which may begin to pave the legal path for more advanced technologies.

I. BACKGROUND

In this Part, this Note will examine potential NBIs. This Part first discusses two impending areas of research—development of general AI and human brain emulation—which appear to be likely origins from which NBIs might emerge. This Part will then look at an extreme example: Singularity, a theoretical event in which humans create a technology that leads to a domino effect of rapidly escalating, self-improving

3. "Non-biological," as used here, refers to natural biology and does not preclude the involvement of biological elements, such as DNA computing or storage. *See generally* MARTYN AMOS, THEORETICAL AND EXPERIMENTAL DNA COMPUTATION (2005); George Church et al., *Next-Generation Digital Information Storage in DNA*, 337 SCIENCE 1628 (2012); Seth L. Shipman et al., *CRISPR–Cas Encoding of a Digital Movie into the Genomes of a Population of Living Bacteria*, 547 NATURE 345 (2017). Additionally, degree of intelligence is more informative than the specific physical form of an NBI. Science fiction can be illustrative here, as the genre often glosses over any distinction between biological creations and mechanical. *See, e.g.*, BLADE RUNNER at 2:31 (Ladd Company 1982) ("[A] CORPORATION advanced robot evolution . . . [by creating] being[s] virtually identical to a human . . . . [which] were superior in strength and agility, and at least equal in intelligence, to the genetic engineers who created them.").

intelligence. It will then outline current legal framework for personhood.

A. ARTIFICIAL INTELLIGENCE

From the earliest days of computing, AI has been a notable waypoint for the field—a tantalizing dream of the future.[4] Over the past decade, breakthroughs in AI development have driven a surge likened to a gold rush.[5] Some metrics show AI performance growing nearly fifty times over three years to reach "superhuman" capabilities.[6] AI has accomplished landmark feats that had long eluded researchers, and did so years ahead of most estimated timelines.[7] However, AI development has also

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4. *See generally* Good, *supra* note 2, at 31; A.M. Turing, *Computing Machinery and Intelligence*, 59 MIND 433 (1950). Intelligent machines seem to have been contemplated—at least in fiction—*before* computers were invented. *Compare* METROPOLIS (UFA 1927) (involving a human mind that is put into humanoid machine), *and* KAREL ČAPEK, *R.U.R.*, *in* ČAPEK: FOUR PLAYS 1 (Peter Majer & Cathy Porter trans. 1999) (1921) (originating the etymological root of the word "robot," which were synthetic, organic entities in this play), *with* SCOTT MCCARTNEY, ENIAC: THE TRIUMPHS AND TRAGEDIES OF THE WORLD'S FIRST COMPUTER (1999) (describing how John Mauchly and Presper Eckert began creating one of the first computers—the Electronic Numerical Integrator And Computer (ENIAC)—around 1941).

5. Rich Foreman, *Artificial Intelligence and Startups: The AI Gold Rush*, IBM (Apr. 26, 2017), https://www.ibm.com/information-technology/artificial-intelligence-and-startups-ai-gold-rush.

6. Jensen Huang, *Accelerating AI with GPUs: A New Computing Model*, NVIDIA (Jan. 12, 2016), https://blogs.nvidia.com/blog/2016/01/12/accelerating-ai-artificial-intelligence-gpus/ (charting a fifty times increase in Deep Learning performance over 2013 through 2015, largely due to GPU-accelerated computing: "In 2012, deep learning had beaten human-coded software. By 2015, deep learning had achieved 'superhuman' levels of perception.") Note that the "superhuman" description concerns capabilities limited to a specific task (*i.e.* narrow AI, rather than AGI).

7. *See, e.g.*, *AlphaGo*, DEEPMIND, https://deepmind.com/research/alphago/ (last visited Nov. 11, 2017) (chronicling the AlphaGo program's successful defeat of human champions in Go, which was "widely viewed as an unsolved 'grand challenge' for artificial intelligence" due to decades of attempts with no success); Will Knight, *Google's AI Masters the Game of Go a Decade Earlier than Expected*, MIT TECH. REV. (Jan. 27, 2016), https://www.technologyreview.com/s/546066/googles-ai-masters-the-game-of-go-a-decade-earlier-than-expected/. Illustrating the breakneck pace of AI developments, a successor to AlphaGo was announced during late-round edits to this Note. The new version, AlphaGo Zero, utterly defeated the old AlphaGo winning all one hundred matchups. Zero no longer requires thousands of human-played game samples—it learned the game from merely playing against itself. *See* David Silver et al., *Mastering the Game of Go Without Human Knowledge*, 550 NATURE 354 (2017); Demis Hassabis & David Silver, *AlphaGo Zero: Learning from Scratch*, DEEPMIND (Oct. 18, 2017),

seen many "winters," when advances and interest in the field dwindle.[8] Although the hype cycle of AI winter and resurgence may continue, this resurgence seems to be particularly strong and winter may not be coming.[9]

AI is broadly described as either: narrow AI (also referred to as "weak" or applied AI), which carries out a function such as data processing; or artificial general intelligence (AGI or "strong" AI), which is hypothetically capable of "the whole domain of human thought."[10] Artificial general intelligence that surpasses "the best human brains in practically every field" would be considered artificial superintelligence (ASI).[11]

Current AIs are almost exclusively narrow AI, built to solve particular tasks.[12] Projects directed to develop AGI appear to be rare, but there are a number of companies in "stealth mode" researching AI with little information disclosed to the public.[13] A step further are "stealth companies," which try to remain hidden from public view.[14] "Stealth" projects are probably not a result of nefarious supervillains, but likely due to market pressures, such as rapid deployment of AI into consumer products or trade secret protections.

From HAL9000 to Skynet, popular science fiction provides many doomsday scenarios,[15] relegating intelligent AI to a mere

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https://deepmind.com/blog/alphago-zero-learning-scratch/. The ability to develop an AI without large training data sets is a major improvement, which alleviates a significant limiting factor for many AI applications.

8. NICK BOSTROM, SUPERINTELLIGENCE: PATHS, DANGERS, STRATEGIES 6–8 (2014).

9. *See* Will Knight, *AI Winter Isn't Coming*, MIT TECH. REV. (Dec 7, 2016), https://www.technologyreview.com/s/603062/ai-winter-isnt-coming/ ("[T]here's perhaps been no boom to match the current one.").

10. *See* Jack Copeland, *What is Artificial Intelligence?*, ALANTURING.NET (May 2000), http://www.alanturing.net/turing_archive/pages/Reference%20Articles/what_is_AI/What%20is%20AI02.html.

11. Nick Bostrom, *How Long Before Superintelligence?*, 5 LINGUISTIC & PHIL. INVESTIGATIONS 11 (2006). Similar to how NBIs are defined in this Note, Bostrom provides a flexible approach. *Id.* at 11 ("This definition leaves open how the superintelligence is implemented . . . [and] whether the superintelligence is conscious and has subjective experiences.").

12. *See* Copeland, *supra* note 10.

13. JAMES BARRAT, OUR FINAL INVENTION: ARTIFICIAL INTELLIGENCE AND THE END OF THE HUMAN ERA 39–43 (2013).

14. *Id*. at 39–43. Barrat notes that Google X was a stealth company until revealed by the *New York Times*. *Id.* at 41–42.

15. *See, e.g.*, 2001: A SPACE ODYSSEY (Metro-Goldwyn-Mayer 1968) (portraying HAL 9000, a sentient AI, who malfunctions and becomes the film's

boogeyman in popular culture.[16] Such trivialization belies the concerns of many prominent thinkers. Some notable minds have publicly expressed deep concerns over the creation of advanced

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villain) (as added trivia for those who read the footnotes, when Dave kills HAL, he sings *Daisy Bell*, referencing that song's history as the first example of a computer "singing" seven years prior to the film's release. *The Sounds of Fighting Men, Howlin' Wolf and Comedy Icon Among 25 Named to the National Recording Registry*, LIBR. CONGRESS (June 23, 2017), https://www.loc.gov /item/prn-10-116/); THE MATRIX (Warner Brothers 1999) (depicting a dystopian future, wherein sentient machines use humans as glorified batteries); THE TERMINATOR (Hemdale 1984) (involving Skynet, a military AI that becomes self-aware and deduces that humans would consequentially attempt to destroy it, to which it concludes human extinction is the only means for self-preservation, which ultimately leads to a stereotypical robot apocalypse and time-travelling humanoid assassin bots). *But cf., e.g.*, BIG HERO 6 (Walt Disney Pictures 2014) (portraying a robot as the titular sixth hero); INTERSTELLAR (Paramount Pictures 2014) (depicting a machine, TARS, as the clichéd heroic "sacrifice" that miraculously survives for a happy ending); TERMINATOR 2: JUDGMENT DAY (Carolco Pictures 1991) (returning Arnold Schwarzenegger as a machine physically identical to the antagonist in the first movie—beyond the villain-to-hero role reversal, the machine develops a humanized personality).
In writing this footnote, it seems that the degree of humanization strongly affected my word choice. I think of HAL, TARS, and the second Terminator—who are given masculine personalities in the films—as "he," whereas the silent villains of *The Matrix* remain machines are "its." Skynet lies somewhere between these two extremes as a more anthropomorphized "it," perhaps because the underlying motivation is conveyed, but there is no discrete personality associated with the intelligence. How we identify and interact with AI and fictional NBIs is beyond the scope of this Note, but is certainly interesting food for thought. *See* ISAAC ASIMOV & ROBERT SILVERBERG, THE POSITRONIC MAN (1992); BICENTENNIAL MAN (Buena Vista Pictures 1999) (depicting a robot that chooses to physically transition to a human—or at least human-like—body); EX MACHINA (Universal Pictures 2014) (portraying an AI in the form of an attractive female, which is used to influence a human's perception and interaction with the AI); *Doctor Who: Smile* (BBC television broadcast Apr. 22, 2017) (involving a character who describes human-on-machine aggression as "typical wet-brained chauvinism").

16. If anything, such scenarios have become so common in modern media that the introduction of AI into a story is nearly a variant of Chekhov's gun; the presence of AI often demands its role as a villain. *See A.I. Is a Crapshoot*, TV TROPES, http://tvtropes.org/pmwiki/pmwiki.php/Main/AIIsACrapshoot (last visited Nov. 8, 2017) ("Whenever an Artificial Intelligence (A.I.) is introduced in a story, there is a very good chance that it will, for whatever reason, become evil and attempt to Turn Against Its Masters, Crush. Kill. Destroy! All Humans, and/or Take Over the World. It doesn't matter what safeguards its creators inst[i]ll — the moment it crosses the line into sapience, it has a strong chance of going rogue at some point."). Although the article uses the word "install," I would argue that "instill" is more appropriate, as it conceptually treats AI as a mind, rather than a bundle of software.

AI, and have garnered significant attention.[17] Stephen Hawking expressed his view that AI could doom humanity.[18] Elon Musk has not only been quite vocal about the dangers of rampant AI,[19] but has even organized projects to attempt to prevent what he expects to be catastrophic.[20] Bill Gates stated the concern quite

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17. *See, e.g.*, Michael Sainato, *Stephen Hawking, Elon Musk, and Bill Gates Warn About Artificial Intelligence*, OBSERVER (Aug. 19, 2105, 12:30 PM), http://observer.com/2015/08/stephen-hawking-elon-musk-and-bill-gates-warn-about-artificial-intelligence/; Victor Luckerson, *5 Very Smart People Who Think Artificial Intelligence Could Bring the Apocalypse*, TIME (Dec. 2, 2014), http://time.com/3614349/artificial-intelligence-singularity-stephen-hawking-elon-musk/; BULLETIN OF THE ATOMIC SCIENTISTS, IT IS TWO AND A HALF MINUTES TO MIDNIGHT: 2017 DOOMSDAY CLOCK STATEMENT, 1 (John Mecklin ed., 2017) https://thebulletin.org/sites/default/files/Final%202017%20Clock%20Statement.pdf ("Future technological innovation in biology, artificial intelligence, and the cyber realm may pose similar global challenges.").

18. Rory Cellan-Jones, *Stephen Hawking Warns Artificial Intelligence Could End Mankind*, BBC NEWS (Dec. 2, 2014), http://www.bbc.com/news/technology-30290540 ("The development of full artificial intelligence could spell the end of the human race . . . . Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded.").

19. Greg Kumparak, *Elon Musk Compares Building Artificial Intelligence to "Summoning the Demon,"* TECHCRUNCH (Oct. 26, 2014), https://techcrunch.com/2014/10/26/elon-musk-compares-building-artificial-intelligence-to-summoning-the-demon/ (emphasis added) ("I think we should be very careful about artificial intelligence. If I had to guess at what *our biggest existential threat* is, it's probably that . . . . I'm increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. With artificial intelligence we're summoning the demon . . . . HAL 9000 would be easy [to deal with in comparison to the AI he's talking about]. It's way more complex . . . it'd put HAL9000 to shame."); Elon Musk (@elonmusk), TWITTER (Aug. 2, 2014 7:33 PM), https://twitter.com/elonmusk/status/495759307346952192 (emphasis added) ("Worth reading Superintelligence by Bostrom. We need to be super careful with AI. *Potentially more dangerous than nukes*."); Elon Musk (@elonmusk), TWITTER (Aug. 3, 2014, 12:18 PM), https://twitter.com/elonmusk/status/496012177103663104 ("Hope we're not just the biological boot loader for digital superintelligence. Unfortunately, that is increasingly probable"); *see also* Buck-Nasty, *Elon Musk's Deleted Edge Comment from Yesterday On the Threat of AI*, REDDIT (Nov. 16, 2014, 5:35 PM), https://www.reddit.com/r/Futurology/comments/2mh8tn/elon_musks_deleted_edge_comment_from_yesterday_on/ (emphasis added) (archiving a statement by Elon Musk published on Edge.org, which is no longer available) ("The pace of progress in artificial intelligence . . . is incredibly fast . . . . The risk of *something seriously dangerous* happening is in the five[-]year timeframe. 10 years at most. This is not a case of crying wolf about something I don't understand. I am not alone in thinking we should be worried.").

20. *See* April Glaser, *Elon Musk's Nonprofit Is Working with Microsoft to Help Make Sure Robots Don't Take over the World*, RECODE (Nov. 15, 2016, 1:23 PM), http://www.recode.net/2016/11/15/13639030/microsoft-elon-musk-

succinctly, "I am in the camp that is concerned about super intelligence . . . and [I] *don't understand why some people are not concerned.*"[21]

As AI development progresses, there may be potential for NBI emergence. Such advances present a split reaction: the potential benefits in light of the harms that might befall humans, with minimal concern for NBIs.

B. ARE MACHINES CAPABLE OF THOUGHT?

Almost seven decades ago, Alan Turing kick-started the discussion of artificial intelligence by posing the question, "can machines think?"[22] He distilled this ambiguous question into a quintessential test of true AI: the Turing Test.[23] Turing's test, an "imitation game,"[24] sets forth a scenario to test if a sufficiently advanced computer could indistinguishably function in a series of interactions with people (unaware of its non-humanness) in the same capacity as a human.[25] In addition to laying the groundwork for conceptualizing a thinking machine, Turing also contemplated the development of AI over time, with near-prophetic vision.[26] He stated "at the end of the century the

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nonprofit-open-ai-artificial-intelligence-robots; Steven Levy, *How Elon Musk and Y Combinator Plan to Stop Computers from Taking over*, WIRED: BACKCHANNEL (Dec. 11, 2015, 12:00 AM), https://www.wired.com/2015/12/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over/.

21. Bill Gates (thisisbillgates), Comment to *Hi Reddit, I'm Bill Gates and I'm Back for My Third AMA. Ask Me Anything.*, REDDIT (Jan. 28, 2015 5:48 PM), https://www.reddit.com/r/IAmA/comments/2tzjp7/hi_reddit_im_bill_gates_and_im_back_for_my_third/co3r3g8/; *see also* Peter Holley, *Bill Gates on Dangers of Artificial intelligence: I Don't Understand Why Some People Are Not Concerned*, WASH. POST (Jan. 29, 2015) (emphasis added), https://www.washingtonpost.com/news/the-switch/wp/2015/01/28/bill-gates-on-dangers-of-artificial-intelligence-dont-understand-why-some-people-are-not-concerned/?tid=a_inl.

22. Turing, *supra* note 4, at 433.

23. *Id.* at 433–34.

24. Turing's phrase has led to a common misinterpretation that the test is one of mimicry, rather than an equivalency with human capabilities. *See* Stevan Harnad, *The Turing Test is Not a Trick: Turing Indistinguishability is a Scientific Criterion*, SIGART BULL., Oct. 1992, at 9–10.

25. *See* Turing, *supra* note 4, at 442 ("Is it true that by modifying [a] computer to have an adequate storage, suitably increasing its speed of action, and providing it with an appropriate programme, *C* can be made to play satisfactorily the part of A in the imitation game, the part of B being taken by a man?").

26. *Id.* at 454–60.

use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted," a hypothesis arguably proven through the pursuit of AI by mainstream companies and researchers (perhaps even the existence of this Note).[27] Turing's hypotheses were made during the infancy of computing, long before ubiquitous pocket computers[28] that can perform *six orders of magnitude* more calculations per second than the most powerful computer in those early years.[29]

Further blurring the line of thinking machines, modern neuroscience has shown that neural systems resemble "information processing machines" and can be described "based

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27. *Id.* at 442. Turing did express that he did not have "very convincing arguments of a positive nature to support [his] views." *Id.* at 454. Retrospectively, history seems to have validated some of his views, as his ideas mesh quite neatly with subsequent developments (such as carving out machine and deep learning into subsets of general AI, which is similar to his idea that potential AI would need to be subjected to an education process). *See generally* Michael Copeland, *What's the Difference Between Artificial Intelligence, Machine Learning, and Deep Learning?*, NVIDIA (July 29, 2016), https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/ (describing both deep and machine as algorithmic learning processes, which are trained via large data sets; machine learning relies on progressive refinement of those algorithms, often by hand, whereas deep learning utilizes recent advancements in parallel computing and neural networks that teach themselves through millions of samples).

28. *See* Tim Fernholz, *More People Around the World Have Cell Phones Than Ever Had Land-Lines*, QUARTZ (Feb. 25, 2014), https://qz.com/179897/more-people-around-the-world-have-cell-phones-than-ever-had-land-lines/ (citing to "the United Nations' telecommunications agency," which is presumably the International Telecommunication Union (ITU), and describing cellular telephone subscription rates of 96 per 100 people globally in 2013, with 89.4% penetration in "poor countries").

29. *See Processing Power Compared*, EXPERTS EXCHANGE, http://pages.experts-exchange.com/processing-power-compared/ (last visited Jan. 15, 2017) (examining computing power from 1956 through 2015). This article provides some useful visualizations and comparisons of notable devices. Note the earliest machine in this data, the 1956 IBM 704, which managed $1.2x10^4$ floating point operations per second (FLOPs); and the Samsung Galaxy 6, one of 2015's popular phones, at about $3.5x10^{10}$ FLOPS. This infographic also depicts today's leading machine, Tianhe-2, which tips the scales at a whopping $3.4x10^{16}$ FLOPS—ten orders of magnitude greater than the acme of computing when I.J. Good published his piece in 1966. *See* Good, *supra* note 2. The CDC 6600, the fastest supercomputer in the late 1960s, peaked at approximately $3x10^6$ FLOPS. Here I have used scientific notation for clarity in the magnification of scale. For comparisons which may use prefixes, these machines respectively reach speeds of twelve kiloFLOPS, thirty-five gigaFLOPS, thirty-four petaFLOPS, and three megaFLOPS.

on the concepts of algorithm, representation, computation, and information processing."[30] Some research even suggests that biological intelligence may be "rooted in" an algorithm.[31]

C. INTELLIGENCE EXPLOSIONS AND THE SINGULARITY

Today's world is greatly enriched by rapidly advancing technology,[32] which begs the question: Where does it lead? Many authors predict the Singularity, when intelligence recursively improves itself, causing the rate of technology development to increase exponentially with each more powerful iteration occurring in a shorter timespan than the last.[33] In most predictions, the Singularity results from an intelligence explosion, the hypothetical point where technology results in a sort of feedback loop; a cascade where each intelligent creation makes its successor more intelligent than itself—rapidly rendering previous generations obsolete.[34] A majority of such

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30. A. David Redish, *The Dangers of Dualism: Implications of the Multiple Decision-Making System Theory for Free Will and Responsibility*, 7 COGNITIVE CRITIQUE 1, 4, 9 (2013). Part of this analysis is the rejection of dualism—attributing brain function to external forces. *Id.* at 3.

31. Kun Xie et al., *Brain Computation Is Organized via Power-of-Two-Based Permutation Logic*, FRONTIERS IN SYSTEMS NEUROSCIENCE, Nov. 2016, at 1 ("[T]he origin of intelligence is rooted in a power-of-two-based permutation logic ($N = 2^i–1$).").

32. *See generally 50 Years of Moore's Law*, INTEL, http://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html (last visited Nov. 8, 2017) (discussing Moore's Law as a driving force of technological development); Tom Simonite, *Moore's Law Is Dead. Now What?*, MIT TECH. REV. (May 13, 2016), https://www.technologyreview.com/s/601441/moores-law-is-dead-now-what/ (summarizing the approaching end of Moore's Law). The basic premise of Moore's Law, articulated by Intel cofounder Gordon Moore, is that computing performance increases at a predictable rate; roughly doubling every two years. *Id.*

33. *See* RAY KURZWEIL, THE SINGULARITY IS NEAR 14–21 (2006); Vernor Vinge, *The Coming Technological Singularity: How to Survive in the Post-Human Era*, 1993 NAT'L AERONAUTICS AND SPACE ADMIN., VISION-21, at 11, 12 (1993).

34. *See* Good, *supra* note 2, at 33 ("Let an ultraintelligent machine be defined as a machine that can far surpass all the intellectual activities of any man however clever. Since the design of machines is one of these intellectual activities, an ultraintelligent machine could design even better machines; there would then unquestionably be an 'intelligence explosion,' and the intelligence of man would be left far behind . . . . Thus the first ultraintelligent machine is the *last* invention that man need ever make, provided that the machine is docile enough to tell us how to keep it under control."). Despite its apocalyptic tone, this is one of the earliest descriptions (I.J. Good was a colleague of Alan Turing)

predictions are extrapolations of Moore's Law or economic models, but the same conclusion can be reached via other reasoning.[35]

The exact circumstances of this event are speculative; some of the hypotheses include: "[t]he development of computers that are 'awake' and superhumanly intelligent[,] . . . [l]arge computer networks (and their associated users) may 'wake up' . . . [or] [c]omputer/human interfaces may become so intimate that users may reasonably be considered superhumanly intelligent."[36] Alternatively, the Singularity could also take the form of enhancement to natural human intelligence or a merger of biology and computing technology.[37] The Singularity is a highly speculative proposition, but its advocates take the stance that "if the technological Singularity can happen, it will."[38]

With seemingly constant news of rapid developments in artificial intelligence,[39] one must wonder how close such a scenario may be.[40] The titans of the tech industry are intently focused on developing AI.[41] The AI market contains a significant

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of an "intelligence explosion," which provides the underlying concept of the Singularity. *See also* sources cited *supra* note 33 and accompanying text.

35. *See* BOSTROM, *supra* note 8, at 3 ("However, the case for taking seriously the prospect of a machine intelligence revolution need not rely on curve-fitting exercises or extrapolations from past economic growth. As we shall see, there are stronger reasons for taking heed."); KURZWEIL, *supra* note 33; Vinge, *supra* note 33.

36. Vinge, *supra* note 33, at 12.

37. *Id*.

38. *Id*. at 15.

39. A quick visit to Google News and search for "Artificial Intelligence" will yield many results, with a consistent daily influx of stories. Setting a news notification based on those terms can make for quite the cluttered inbox.

40. *See, e.g.*, Greg Satell, *3 Reasons to Believe the Singularity Is Near*, FORBES (June 3, 2016 11:19 PM), http://www.forbes.com/sites/gregsatell/2016/06/03/3-reasons-to-believe-the-singularity-is-near/#298b88471cbe.

41. *See, e.g.*, *Deep Learning*, NVIDIA, https://blogs.nvidia.com/blog/category/deep-learning/ (last visited Nov. 23, 2016) (aggregating deep learning and AI research by Nvidia, a major hardware company); *Facebook AI Research (FAIR)*, FACEBOOK (emphasis added), https://web.archive.org/web/20161116191404/https://research.facebook.com/ai (last visited Nov. 23, 2016) ("We're committed to advancing the field of machine intelligence and developing technologies . . . . In the long term, we seek to understand intelligence and *make intelligent machines*. How will we accomplish all this? By building the best AI lab in the world."); *IBM Research: Artificial Intelligence*, IBM (emphasis added), http://researcher.ibm.com/researcher/view_group.php?id=135 (last visited Nov. 23, 2016) ("Artificial Intelligence (AI) has a long history at IBM Research, dating back to the 1950s. By AI we mean *anything that makes machines act*

number of startups, which are being bolstered with higher-than-average venture-capital backing.[42] Timelines for nearly any AI-development prediction cover the spectrum from "never"[43] to "soon"[44] to "don't worry about it."[45] Ray Kurzweil, whose technological predictions have been eerily accurate,[46] expects human-level AI by 2029 (but no Singularity until 2045).[47] A

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more intelligently. Our work includes basic and applied research in machine learning, deep question answering, search and planning, knowledge representation, and cognitive architectures."); *Machine Intelligence*, RES. GOOGLE, http://research.google.com/pubs/MachineIntelligence.html (last visited Nov. 23, 2016) ("Research at Google is at the forefront of innovation in Machine Intelligence, with active research exploring virtually all aspects of machine learning, including deep learning and more classical algorithms."); *The Race for AI: Google, Baidu, Intel, Apple in a Rush to Grab Artificial Intelligence Startups*, CB INSIGHTS (July 21, 2017), https://www.cbinsights.com/blog/top-acquirers-ai-startups-ma-timeline/ (discussing acquisitions of AI startups by large tech companies).

42. Lisa Calhoun, *15 Game-Changing Artificial Intelligence Startups*, INC. (Apr. 12, 2016), http://www.inc.com/lisa-calhoun/see-13-of-the-artificial-intelligence-companies-checking-you-out-today.html ("Sixty percent of A.I. firms that have been acquired in the past five years are venture-backed. That's an unusually high percentage for a horizontal sector.").

43. *See* John Searle, *What Your Computer Can't Know*, NY REV. BOOKS (Oct. 9, 2014), http://www.nybooks.com/articles/2014/10/09/what-your-computer-cant-know/ (arguing that computers lack psychological features necessary to be more than boxes of parts).

44. *See* Elon Musk (@ElonMusk), TWITTER (Sept. 4, 2017, 2:33 AM), https://twitter.com/elonmusk/status/904638455761612800 ("[A]ll countries [with] strong computer science [will be in c]ompetition for AI superiority at national level [and will be the] most likely cause of WW3 . . . .").

45. *See* Romain Dillet, *Google's AI Chief Thinks Reports of the AI Apocalypse Are Greatly Exaggerated*, TECHCRUNCH (Sept. 19, 2017) (emphasis added), https://techcrunch.com/2017/09/19/googles-ai-chief-thinks-reports-of-the-ai-apocalypse-are-greatly-exaggerated/ ("There's a lot of people that are *unreasonably concerned* around the rise of general AI . . . I'm definitely not worried about the AI apocalypse . . . I just object to the hype and soundbites that some people are making.").

46. Dominic Basulto, *Why Ray Kurzweil's Predictions Are Right 86% of the Time*, BIG THINK, http://bigthink.com/endless-innovation/why-ray-kurzweils-predictions-are-right-86-of-the-time (last visited Nov. 18, 2017) ("In fact, of the 147 predictions that Kurzweil has made since the 1990's, fully 115 of them have turned out to be correct, and another 12 have turned out to be 'essentially correct' (off by a year or two), giving his predictions a stunning 86% accuracy rate.").

47. COUNCIL ON FOREIGN RELATIONS, *The Future of Artificial Intelligence and Its Impact on Society*, YOUTUBE (Nov. 6, 2017), at 10:22, https://www.youtube.com/watch?v=P7nK1HVJsj4 (video of interview with Ray Kurzweil, transcript available at https://www.cfr.org/event/future-artificial-intelligence-and-its-impact-society) (discussing his 2029 prediction for "human level" AI that can pass the Turing test); Dom Galeon & Christianna Reedy, *Kurzweil Claims*

survey of experts and nonexperts found the average prediction of AGI creation to be 2040, i.e., barely twenty years from now.[48] However, twenty years may just be a convenient number for speculation and predicted AI timelines are "quite poor."[49]

The Singularity is the most dramatic representation of the future of AI and related technologies. It is extremely speculative, but serves an illustrative point of very real concerns. Before we reach such a momentous event, other technologies will likely require answers to questions of thinking machines and how the law treats such entities.

D. HUMAN BRAIN AUGMENTATION & DIGITIZATION, SIMULATION AND EMULATION

Emergence of sapient artificial intelligence may not be the first digital being created; researchers may first create an inorganic human consciousness through simulation.[50] The

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That the Singularity Will Happen by 2045, FUTURISM (Oct. 5, 2017), https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045/ ("I have set the date 2045 for the 'Singularity' which is when we will multiply our effective intelligence a billion fold by merging with the intelligence we have created.").

48. *See* Stuart Armstrong & Kaj Sotala, *How We're Predicting AI—or Failing to*, *in* BEYOND AI: ARTIFICIAL DREAMS, MACH. INTELLIGENCE RESEARCH INST. 52 (Jan Romportl ed., 2012); Stuart Armstrong, *How We're Predicting AI*, FORA.TV (Oct. 14, 2012), http://library.fora.tv/2012/10/14/Stuart_Armstrong_How_Were_Predicting_AI (recording of presentation by Dr. Stuart Armstrong at The Singularity Summit 2012). While Armstrong & Sotala have noted that a dataset error contributed to their findings, that error was in the classification of expert or non-expert predictions, which is not factored into the prediction used here. *Error in Armstrong and Sotala 2012*, AI IMPACTS (May 17, 2016), https://aiimpacts.org/error-in-armstrong-and-sotala-2012/. It is interesting to note that Kurzweil has seen these consensus predictions shift towards his prediction. COUNCIL ON FOREIGN RELATIONS, *supra* note 47, at 11:00 ("My view, and the consensus view, or the median view, of AI experts have been getting closer together, but not because I've been changing my view [stated in 1999].").

49. Armstrong & Sotala, *supra* note 48, at 52*; see also* BOSTROM, *supra* note 8, at 4 ("Two decades is a sweet spot for prognosticators of radical change: near enough to be attention-grabbing and relevant, yet far enough to make it possible to suppose that a string of breakthroughs, currently only vaguely imaginable, might by then have occurred.").

50. *See* KURZWEIL, *supra* note 33, at 407. Kurzweil entertains the idea that our reality is a "universe-scale computer" running another civilization's simulation of the Singularity. *Id.* at 364–67, 404–05. This reality-as-simulation concept has caught the public imagination in recent debate, even garnering some support from notable people such as Neil deGrasse Tyson. Am. Museum of Nat. History, *2016 Isaac Asimov Memorial Debate: Is the Universe a Simulation?*, YOUTUBE (Apr. 8, 2016), https://www.youtube.com/watch?time

ability to simulate or emulate[51] the human brain is limited by computing power and ability to map the brain (connectome) with sufficient detail.[52] Several projects are currently underway to develop brain simulation technology, backed by bodies including the EU and NIH.[53]

_continue=2&v=wgSZA3NPpBs (showing Tyson and others' debate on reality as a simulation). It follows that after simulation of one brain, an increased scale would be the logical progression.

51. These terms are often used interchangeably, but the difference between them may prove important. Simulation models a system; the focus is to replicate the end product. *Simulate*, OXFORD LIVING DICTIONARIES (emphasis added), https://en.oxforddictionaries.com/definition/simulate (last visited Nov. 27, 2016) ("*Imitate* the appearance or character of."). Emulation models the underlying process(es). *Emulate*, OXFORD LIVING DICTIONARIES (emphasis added), https://en .oxforddictionaries.com/definition/emulate (last visited Nov. 27, 2016) ("Reproduce the *function* or action of"). Thus for purposes here, a simulated brain would imitate the brain to create an intelligence; whereas an emulated brain would (ideally) exactly replicate brain functions, creating an intelligence. The nuance, if any, between these may only become apparent upon performing them. A true one-to-one emulation would be a precise representation of a brain, which should produce an identical result to its biological equivalent. A simulation could result in several outcomes: it might produce essentially the same result, where approximation is sufficient; it might produce an intelligence with reduced functionality compared to the original brain, indicating that some intrinsic factor is missing (this might mean that simulation is not sufficiently advanced, rather than outright infeasible); or it might produce a result that is not analogous to the source, which is exciting in and of itself (arguably this would be a construct AI, rather than a formerly/concurrently biological intelligence).

52. *See* KURZWEIL, *supra* note 33, at 407.

53. *See In Brief*, BLUE BRAIN PROJECT, http://bluebrain.epfl.ch/page-56882-en.html (last visited Nov. 24, 2016) ("The goal of the Blue Brain Project is to build biologically detailed digital reconstructions and simulations of the rodent, and ultimately the human brain . . . . Supercomputer-based simulation of their behavior turns understanding the brain into a tractable problem, providing a new tool to study the complex interactions within different levels of brain organization and to investigate the cross-level links leading from genes to cognition.") (BBP is run by École polytechnique fédérale de Lausanne); *Overview*, HUMAN BRAIN PROJECT, https://www.humanbrainproject.eu/en /science/overview/ (last visited Nov. 24, 2016) (HBP is a European Commission Future and Emerging Technologies Flagship and co-funded by the EU); *About the CCF (CCF Overview)*, CONNECTOME COORDINATION FACILITY (May 18, 2016 2:24 PM), https://www.humanconnectome.org/about-ccf/ ("Over the next decade, we expect to see dozens of new projects . . . researching aspects of how age, growth, disease, and other factors can affect the ever-changing connections in the human brain.") (HCP is a NIH program as part of the Blueprint for Neuroscience Research initiative).

Public awareness of brain simulation is mostly limited to science fiction.[54] Researchers have varying estimates of the timeframe, but most expect it to be more immediate than Singularity hypotheses.[55] Rudimentary simulations have already taken place—a whole organism[56] and a neuronal network representing approximately 1% of a human brain.[57] The power of the computers used in these simulations has been eclipsed (almost tenfold) by new machines, which are set to be leapfrogged in the near future.[58] Exascale computers, which

54. *See, e.g.*, JOHN SCALZI, OLD MAN'S WAR (2005) (depicting a world where people can enlist in interstellar military service, which transfers enlisted minds to combat-oriented bodies, in exchange for a new, personal body post-service); *Black Mirror: San Junipero* (BBC/Netflix television broadcast Oct. 21, 2016) (depicting a near future where people upload their minds to a paradisiacal computer simulation upon bodily death, resulting in uninterrupted continuation of a person's mind); *Westworld* (HBO television broadcast Oct. 2 – Dec. 4, 2016) (portraying a theme park filled with AIs in physical forms very similar to human biology, with implications that these AIs are modeled from human brains).

55. Jonathan Fildes, *Artificial Brain 10 Years Away*, BBC NEWS (July 22, 2009, 7:05 PM), http://news.bbc.co.uk/2/hi/8164060.stm (reporting that the director of the Blue Brain Project stated a human brain could be built by 2019).

56. Max McClure, *Stanford Researchers Produce First Complete Computer Model of an Organism*, STAN. REP. (July 19, 2012), http://news.stanford.edu/news/2012/july/computer-model-organism-071812.html ("[T]he world's first complete computer model of an organism has been completed . . . .").

57. *Largest Neuronal Network Simulation Achieved Using K Computer*, RIKEN (Aug. 2, 2013), http://www.riken.jp/en/pr/press/2013/20130802_1/. Note that the K Computer used for this simulation (three years ago) is capable of 10.51 petaflops, whereas the top (publicly known) supercomputer produces 93 petaflops. *November 2016*, TOP 500 (Nov. 14, 2016), https://www.top500.org/lists/2016/11/.

58. *See November 2016*, *supra* note 57. The United States government has ordered several new clusters, with estimated speeds of 200–300 petaflops; these new systems are expected to be in use by 2018. *See Summit*, OAK RIDGE NAT'L LAB, https://www.olcf.ornl.gov/summit/ (last visited Nov. 24, 2016) (detailing specifications for Summit computer and 2018 deployment); Patrick Thibodeau, *U.S. Sets Sights on 300 Petaflop Supercomputer*, COMPUTERWORLD (Nov. 14, 2014 12:51 PM), http://www.computerworld.com/article/2847865/us-sets-sights-on-300-petaflop-supercomputer.html (describing plans for multiple new systems with speeds up to 300 petaflops); Patrick Thibodeau, *U.S. to Have 200-Petaflop Supercomputer by Early 2018*, COMPUTERWORLD (June 21, 2016, 3:00 AM), http://www.computerworld.com/article/3086178/high-performance-computing/u-s-to-have-200-petaflop-supercomputer-by-early-2018.html (confirming expectation of Summit system as 200 petaflop system).

reach the predicted threshold needed for brain simulation,[59] are expected to be in service around 2020.[60]

As computing power escalates and research continues to create a more robust map of the human brain, brain simulation projects will come ever closer to digital replication of human brains.

E. CRITIQUES OF NBI PREDICTIONS

The possibility of NBI is purely hypothetical, and some propose that NBIs are impossible or cannot be created with current technologies.[61] Some would argue some form of dualism, that there is something special about human mental processes beyond the physical state.[62] Others propose that a machine that appeared to be human-like cannot have a "mind," but would plateau at extremely well-programmed mimicry.[63] Human-exceptionalism arguments tend to assume some unknown, and perhaps unknowable, barrier to thinking machines. However, human intelligence may not be particularly special.[64]

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59. Bernd Mohr, *The Human Brain Project Will Push the Boundaries of Supercomputing*, TOP 500 (Dec. 29, 2014, 12:00 PM), https://www.top500.org/news/the-human-brain-project-will-push-the-boundaries-of-supercomputing/ ("Full brain simulations are expected to require exascale capabilities.").

60. *See* Michael Feldman, *The Four-Way Race to Exascale*, TOP 500 (May 19, 2016, 10:32 PM), https://www.top500.org/news/the-four-way-race-to-exascale/ (detailing Japan and China's efforts to have exascale computers by 2020 and the United States Department of Energy's Exascale Computing Plan, which has a goal of 2023).

61. *See* Nick Seneca Jankel, *AI vs. Human Intelligence: Why Computers Will Never Create Disruptive Innovations,* HUFFINGTON POST (Feb. 24, 2015, 5:36 PM), https://www.huffingtonpost.com/nick-seneca-jankel/ai-vs-human-intelligence-_b_6741814.html ("No machine will ever be able to mimic our peerless organic nature as inherently, inescapably, beguilingly creative.").

62. *See* Redish, *supra* note 30, at 9 (discussing, and rejecting, hypotheses that "there are mental states that are dissociable from the physical states underlying them").

63. John Searle, *Chinese Room Argument*, SCHOLARPEDIA (Aug. 26, 2009), http://www.scholarpedia.org/article/Chinese_room_argument ("One can no more create consciousness and thought by running a computer simulation of consciousness and thought, than one can build a flying machine simply by building a computer that can simulate flight."). Searle claims that his Chinese Room argument does not denounce thinking machines, it just indicates that any that might be created will be a mere model. *Id.* As discussed earlier, modern neuroscience uses computational models of neural processing, which seems to oppose Searle's position of simulation impossibility. *See* Redish, *supra* note 30.

64. *See* BOSTROM, *supra* note 8, at 44 ("[T]here is no reason to suppose Homo sapiens to have reached the apex of cognitive effectiveness attainable in

Many counter-theories argue that predictions based on technological growth patterns are severely flawed.[65] It is undeniable that Moore's Law cannot continue forever, as there are physical limitations to the increase in transistor density, and that barrier may limit technological growth.[66] However, the end of Moore's Law applies to electronic computing components.[67] There are a number of other computing technologies under development, which will likely prove to be more powerful than traditional electronics.[68] GPU-computing methods are already superior to traditional processors in AI applications.[69]

Others contend that the pursuit of narrow AI undermines the developments of NBIs.[70] In the short term, narrow AI is profitable and will likely remain at the forefront of AI development.[71] As narrow AI is developed and applied, it may start to resemble AGI, perhaps unintentionally.[72] Although it is unclear whether NBI is possible, the potential for NBI emergence cannot be dismissed even with these contentions in mind.

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a biological system. Far from being the smartest possible biological species, we are probably better thought of as the stupidest possible biological species capable of starting a technological civilization—a niche we filled because we got there first, not because we are in any sense optimally adapted to it.").

65. *See* Alan Winfield, *Artificial Intelligence Will Not Turn into a Frankenstein's Monster*, GUARDIAN (Aug. 9, 2014), https://www.theguardian.com/technology/2014/aug/10/artificial-intelligence-will-not-become-a-frankensteins-monster-ian-winfield (arguing that faster-than-light travel may be more proximate than AGI).

66. Thomas N. Theis & H.-S. Philip Wong, *The End of Moore's Law: A New Beginning for Information Technology*, COMPUTING SCI. & ENGINEERING, Mar.–Apr. 2017, at 41, 42–44.

67. *Id.*

68. *See id.* at 44–45, 48–49 (noting efforts to advance electronic computing once transistor limits are reached and alternative computing technologies, such as biological computing). Quantum computing and neuromorphic processors have also seen recent successes. *Id.* at 48–49.

69. *See* Huang, *supra* note 6, and related discussion.

70. *See* Yarden Katz, *Noam Chomsky on Where Artificial Intelligence Went Wrong*, ATLANTIC (Nov. 1, 2012), https://www.theatlantic.com/technology/archive/2012/11/noam-chomsky-on-where-artificial-intelligence-went-wrong/261637/?single_page=true ("[AI] focused on using statistical learning techniques to better mine and predict data—is unlikely to yield general principles about the nature of intelligent beings or about cognition.").

71. *See supra* Part I.A and related discussion.

72. *See* BARRAT, *supra* note 13, at 39–41 (discussing how Google denies working on AGI but the desired functionality seems to be more than a narrow application).

F. LEGAL PERSONHOOD

1. What Is a Person?

Civil rights are intrinsically linked to personhood, which is a surprisingly ambiguous concept. Even when narrowing to a "legal person," the concept is, at best, "fuzzy."[73] This fuzziness may lie in that a definition has not been needed for much beyond day-to-day human interaction.[74]

Looking to legal definitions, a person is defined in Black's Law Dictionary as "a human being."[75] Certainly not a very flexible definition. Black's Law also provides a definition of an "artificial person" as "[a]n *entity*, such as a corporation, created by law and *given certain legal rights and duties of a human being*; a being, real or imaginary, who *for the purpose of legal reasoning is treated more or less as a human being*."[76] Looking to the broader term, an entity is defined as an organization.[77] Putting the pieces of the legal-dictionary puzzle together, a person must be either a human or an organization.

The Supreme Court has recently addressed interpretation of a person.[78] The Court looks to the Dictionary Act to define a person to include "corporations, companies, associations, firms, partnerships, societies, and joint stock companies, as well as individuals."[79] The Supreme Court has also used human biology as a condition of personhood.[80]

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73. *See* Alexis Dyschkant, Note, *Legal Personhood: How We Are Getting It Wrong*, 2015 U. ILL. L. REV. 2075, 2079.

74. Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1285 (1992) ("All of the persons we have met have been humans . . . it is not surprising that our concept of person is fuzzy at the edges. For most practical purposes, this fuzziness does not get in our way. We treat humans as persons, and we need not worry about why we do so.").

75. *Person*, BLACK'S LAW DICTIONARY (10th ed. 2014).

76. *Artificial Person,* BLACK'S LAW DICTIONARY (10th ed. 2014) (emphasis added).

77. *Entity*, BLACK'S LAW DICTIONARY (10th ed. 2014) (emphasis added) ("An *organization* (such as a business or a governmental unit) that has a legal identity apart from its members or owners.").

78. Burwell v. Hobby Lobby Stores, Inc., 134 S. Ct. 2751 (2014).

79. *Id.* at 2768; *see also id*. at 2769 ("The term 'person' sometimes encompasses artificial persons (as the Dictionary Act instructs), and it sometimes is limited to natural persons."); 1 U.S.C. § 1 (2012) (codifying the Dictionary Act).

80. Levy v. Louisiana, 391 U.S. 68, 70 (1968) ("[Children] are humans, live, and have their being. They are clearly 'persons.'").

Such narrow definitions are not limited to legal jargon; common definitions are similarly restrictive. Dictionaries use definitions of person such as "[a] human being regarded as an individual"[81] or ones mirroring the legal definition.[82] "Being" is a potentially viable word to describe entities examined in this Note; it is defined as "conscious existence."[83]

For a less restrictive view of personhood, many fields proffer innumerable theories to conceptualize a being, but no hard-and-fast definition can meet the vast range of human experience. Is it measured by consciousness?[84] Perhaps sentience?[85] Sapience?[86] Are there degrees, perhaps imparted by some intangible aspect that compounds upon itself until it accretes into a person?[87] Despite the plethora of interpretations, personhood may be best defined by that very web of uncertainty. The most comprehensive, or at least reasonably functional, definition might well be Justice Stewart's standard for material that escapes clear definition: "I know it when I see it."[88]

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81. *Person*, OXFORD LIVING DICTIONARIES, https://en.oxforddictionaries.com/definition/person (last visited Nov. 27, 2016).

82. *Person*, MERRIAM-WEBSTER DICTIONARY, http://www.merriam-webster.com/dictionary/person (last visited Nov. 27, 2016) (defining "person" as "one (such as a human being, a partnership, or a corporation) that is recognized by law as the subject of rights and duties").

83. *Being*, MERRIAM-WEBSTER DICTIONARY, http://www.merriam-webster.com/dictionary/being (last visited Nov. 27, 2016).

84. *See* David B. Fischer et al., *A Human Brain Network Derived from Coma-Causing Brainstem Lesions*, 87 NEUROLOGY, 2427, 2427 (2016) ("Arousal, or wakefulness, is an integral component of consciousness and prerequisite for other brain functions . . . ."); *see also* Press Release, Beth Israel Deaconess Med. Ctr., Insight into the Seat of Human Consciousness (Nov. 4, 2016), http://www.bidmc.org/News/PRLandingPage/2016/November/Fox-Consciousness.aspx; Fiona MacDonald, *Harvard Scientists Think They've Pinpointed the Physical Source of Consciousness*, SCI. ALERT (Nov. 8, 2016), http://www.sciencealert.com/harvard-scientists-think-they-ve-pinpointed-the-neural-source-of-consciousness.

85. *Sentient*, OXFORD LIVING DICTIONARIES, https://en.oxforddictionaries.com/definition/sentient (last visited Nov. 27, 2016) ("able to perceive or feel things").

86. ROBERT J. STERNBERG, WISDOM, INTELLIGENCE, AND CREATIVITY SYNTHESIZED (2003) (proposing wisdom to include extra mental processing beyond intelligence).

87. *See generally* DOUGLAS HOFSTADTER, I AM A STRANGE LOOP (2007).

88. Jacobellis v. Ohio, 378 U.S. 184, 197 (1964) (Stewart, J., concurring) ("I shall not today attempt further to define the kinds of material I understand to be embraced within that shorthand description; and perhaps I could never succeed in intelligibly doing so. But I know it when I see it."). This also permits

2. What Boundaries Are Imposed on the Concept of Person?

Examining the concept of a person from the finale, rather than the beginning can help define the limits of persons. Death is the end of natural persons, yet there is no true bright-line rule defining death—designated criteria such as respiration, circulation, and brain function have proven insufficient to generate truly dispositive results.[89] Many states have adopted the Uniform Determination of Death Act (UDDA).[90] The UDDA determines death as the state when "[a]n individual [] has sustained irreversible cessation of circulatory and respiratory functions, *or* irreversible cessation of all functions of the entire brain, including the brain stem."[91] However, as medicine advances, situations unforeseen by the drafters have introduced ambiguities and conflicting scenarios.[92]

Artificial persons, in the current legal terminology, are generally terminated upon the completion of designated functions or an act by the constituent members of the entity.[93]

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this Note to sidestep the need to answer a profound question far beyond its scope.

89. *See* M. Potts & D.W. Evans, *Does It Matter That Organ Donors Are Not Dead? Ethical and Policy Implications*, 31 J. MED. ETHICS 406 (2005) (examining criticism of brain death criteria); Barbara Mantel, *'Dead' Man's Recovery Shows Why Prolonged CPR Works*, NBC NEWS (Aug. 22, 2013, 6:56 PM), http://www.nbcnews.com/health/dead-mans-recovery-shows-why-prolonged-cpr-works-6C10980325 (describing an incident where doctors declared a man, who had no respiratory, circulatory, or electrical heart activity, dead after 45 minutes of resuscitation efforts, only to successfully resuscitate him minutes later, when they detected a trace of heart activity). *See generally* OWEN D. JONES ET AL., LAW AND NEUROSCIENCE (2014) (covering brain death in Chapter 10).

90. *See Legislative Fact Sheet - Determination of Death Act*, UNIFORM L. COMMISSION, http://www.uniformlaws.org/LegislativeFactSheet.aspx?title=Determination%20of%20Death%20Act (last visited Nov. 28, 2016) (identifying enactment in 37 states, the U.S. Virgin Islands, and the District of Columbia).

91. UNIF. DETERMINATION OF DEATH ACT § 1 (UNIF. LAW COMM'N 1980) (emphasis added).

92. For example, cessation of circulation and respiration can now be reversed with mechanical intervention, the language does not require natural means of reversal. A particularly dark interpretation of the "either . . . or" structure here could declare a person with full brain function to be dead under the other prong. *See id.*

93. *See, e.g.*, REVISED UNIF. P'SHIP ACT § 801 (UNIF. LAW COMM'N 2013) ("A partnership is dissolved . . . upon the occurrence of any of the following [events] . . . the affirmative vote or consent of all of the partners to wind up the partnership business; or . . . the expiration of the term or the completion of the undertaking.").

In some circumstances, artificial persons can be brought to an end through judicial order.[94]

3. What Rights Are Given to a Person?

The Due Process[95] and Equal Protection[96] Clauses apply to artificial persons, but other rights are limited.[97] Artificial persons are not citizens and do not receive the associated privileges and immunities.[98] This lack of citizenship also limits application of the Fourteenth Amendment.[99] These exceptions, such as interstate extradition, logically follow the current definition of artificial persons, which essentially limits these persons to organizations without physical form.[100] In *Burwell*, the Supreme Court allowed an artificial person to exercise religious freedom, yet did not definitively determine whether First Amendment rights protect an artificial person.[101] An artificial person's rights are derivative of those of a natural person and are reduced in ways that seem to reflect non-corporeal status.

Potential NBIs seem intrinsically linked to research projects. For humans, extensive protections have been implemented to prevent harm to test subjects.[102] For most US-based research, the Common Rule applies, which is structured around respect (particularly of autonomy), beneficence, and

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94. *Id.*

95. U.S. CONST. amend. V.

96. U.S. CONST. amend. XIV, § 1.

97. *Artificial Person*, *supra* note 76 ("An entity is a person for purposes of the Due Process and Equal Protection Clauses but is not a citizen for purposes of the Privileges and Immunities Clauses in Article IV § 2 and in the Fourteenth Amendment.").

98. *See id.*; *see also* U.S. CONST. art. IV § 2.

99. *See Artificial Person*, *supra* note 76; *see also* U.S. CONST. amend XIV.

100. *See* U.S. CONST. art. IV § 2 ("The citizens of each state shall be entitled to all privileges and immunities of citizens in the several states. A person charged in any state with treason, felony, or other crime, who shall flee from justice, and be found in another state, shall on demand of the executive authority of the state from which he fled, be delivered up, to be removed to the state having jurisdiction of the crime."); *Artificial Person*, *supra* note 76 and accompanying text.

101. *See* Burwell v. Hobby Lobby Stores, Inc., 134 S. Ct. 2751, 2785 (2014) ("Our decision on that statutory question makes it unnecessary to reach the First Amendment claim."); *see also* U.S. CONST. amend. I.

102. HHS Protection of Human Subjects, 45 C.F.R. § 46 (2017). For this Note, I will reference the HHS version of the Common Rule.

justice.[103] The Common Rule is designed to cast a long shadow and has been adopted by many federal departments and agencies.[104] Aside from a short list of very narrow exceptions, it "applies to all research involving human subjects conducted, supported or otherwise subject to regulation by any federal department or agency."[105] The Common Rule requires that research be approved by an Institutional Review Board (IRB), which must meet certain requirements and follow specific procedures.[106] When reviewed by an IRB, research must satisfy all criteria for approval.[107] The research must: 1) minimize risk to subjects; 2) ensure that any risk which may result from research is reasonable, when considering the expected knowledge gained and potential benefits to subjects; 3) select subjects equitably; 4) obtain informed consent from subjects; 5) document subjects' informed consent; 6) be adequately monitored to ensure subject safety; and 7) safeguard subject privacy and confidential data.[108] Additionally, research involving vulnerable subjects must provide additional precautions "to protect the rights and welfare of these subjects."[109] The core of the Common Rule is to minimize risk to

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103. *Frequently Asked Questions and Vignettes: Interpreting the Common Rule for the Protection of Human Subjects for Behavioral and Social Science Research*, NAT'L SCI. FOUND. [hereinafter *FAQ*], https://www.nsf.gov/bfa/dias/policy/hsfaqs.jsp (last visited Oct. 10, 2017).

104. Department of Agriculture Protection of Human Subjects, 7 C.F.R. § 1c (2017); Department of Energy Protection of Human Subjects, 10 C.F.R. § 745 (2017); NASA Protection of Human Subjects, 14 C.F.R. § 1230 (2017); Department of Commerce Protection of Human Subjects, 15 C.F.R. § 27 (2017); Consumer Product Safety Commission Protection of Human Subjects, 16 C.F.R. § 1028 (2017); Agency for International Development Protection of Human Subjects, 22 C.F.R. § 225 (2017); Department of Housing and Urban Development Protection of Human Subjects, 24 C.F.R. § 60 (2017); Department of Justice Protection of Human Subjects, 28 C.F.R. § 46 (2017); Department of Defense Protection of Human Subjects, 32 C.F.R. § 219 (2017); Department of Education Protection of Human Subjects, 34 C.F.R. § 97 (2017); Department of Veterans Affairs Protection of Human Subjects, 38 C.F.R. § 16 (2017); EPA Protection of Human Subjects, 40 C.F.R. § 26 (2017); NSF Protection of Human Subjects, 45 C.F.R. § 690 (2017); Department of Transportation Protection of Human Subjects, 49 C.F.R. § 11 (2017).

105. 45 C.F.R. § 46.101(a) (2017); *see also* 45 C.F.R. § 46.101(b) (2017) (listing the six exceptions, which generally have a negligible impact on the subject).

106. 45 C.F.R. §§ 46.107–109 (2017).

107. 45 C.F.R. § 46.111(a) (2017).

108. *Id*.

109. 45 C.F.R. § 46.111(b) (2017).

and prevent harm of human test subjects.[110] It does, however, explicitly require additional measures to be taken to protect vulnerable subjects.[111]

II. ANALYSIS

Current views of personhood, and any associated rights or protections, are grounded in one's status as either a human being or a legal construct used to carry out a functional purpose, generally for businesses.[112] Advances in technology will likely give rise to entities (NBIs) that do not meet current definitions of a person (or even life), yet possess the mental faculties (consciousness, sentience, "just are," etc.) equivalent to human beings. Without intervention, when these entities come into being, failing to afford them basic protections will result in grave risk of injustice. While a comprehensive structure of personhood for such unknowable manifestations is likely premature, laying foundations in advance is crucial given the indefinite nature and timing of NBI emergence.

A. IT IS LIKELY THAT NON-BIOLOGICAL INTELLIGENCE WILL ARISE IN THE FUTURE

The technologies described in Part I should, at the very least, cause one to consider the emergence of NBI. If a single one of these technologies follows its current trajectory, NBIs will exist in a historical blink-of-the-eye.[113] Even by conservative estimates, many of those technologies appear to be possible, at some point achievable, and progressing towards realization.[114]

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110. 45 C.F.R. § 46.102(f) (2017) (denoting "human subject" as core of research); 45 C.F.R. § 46.102(i) (2017) (defining minimal risk as "the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests"); 45 C.F.R. § 46.110 (2017) (allowing for expedited, but not eliminated, approval of research with minimal risk); 45 C.F.R. § 46.113 (2017) (providing for termination of research "that is not being conducted in accordance with the IRB's requirements or that has been associated with unexpected serious harm to subjects").

111. 45 C.F.R. § 46.111(b).

112. *See supra* Part I.F.

113. *See supra* Parts I.A–D.

114. *See supra* Parts I.A–D.

Some argue that AI and the Singularity are inevitable.[115] An NBI might even arise spontaneously as an unexpected consequence of humanity's symbiosis with technology or some other event.[116] The possibility of NBI, although speculative, has garnered action by the EU, which stated:

> [U]ltimately there is a possibility that within the space of a few decades AI could surpass human intellectual capacity in a manner which, if not prepared for, could pose a challenge to humanity's capacity to control its own creation and, consequently, perhaps also to its capacity to be in charge of its own destiny and to ensure the survival of the species.[117]

The potential emergence of an NBI is difficult to predict accurately and would pose novel legal questions in need of quick resolution, creating a need for preemptive framework. Before looking ahead, this Note must examine if NBIs fit into existing schema.

B. HOW COULD PERSONHOOD FIT A NON-BIOLOGICAL INTELLIGENCE?

NBIs should receive some form of personhood or person-like status. NBIs might, at least in rudimentary forms, be treated akin to animals or other protected non-persons.[118] Given the rate of technological development, NBIs would likely outgrow limited protections.[119] The more strenuous protections provided to persons should be preemptively modeled for NBIs.

NBIs do not clearly fit into the any extant category of persons and the path forward is uncertain, although legislators

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115. *See* KURZWEIL, *supra* note 33; *see also* Andrew Sheehy, *Superintelligence Is Not Just Possible, but Inevitable*, FORBES (June 22, 2016, 1:03 PM), http://www.forbes.com/sites/andrewsheehy/2016/06/22/superintelligence-is-not-just-possible-but-inevitable/#13b8450532a6 (arguing that software, as we write it, may be a representation of intelligence that exists when it is run).

116. Kevin Warwick, *The Disappearing Human-Machine Divide*, *in* BEYOND ARTIFICIAL INTELLIGENCE: THE DISAPPEARING HUMAN-MACHINE DIVIDE 1, 6–9 (Jan Romportl et al. eds., 2014).

117. Committee on Legal Affairs, *Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics*, at 4, 2015/2103(INL) (May 31, 2016).

118. *See, e.g.*, S.M. Solaiman, *Legal Personality of Robots, Corporations, Idols and Chimpanzees: A Quest for Legitimacy*, 25 ARTIFICIAL INTELLIGENCE L. 155, 161 (2017).

119. *See* BARRAT, *supra* note 13, at 37, 99–100 (describing how a mildly intelligent AI could become much more intelligent in a very short time).

are beginning to explore potential issues.[120] However, the foundation is being put down now; adoption of new technologies has prompted action.[121] As non-human entities, NBIs cannot be natural persons.[122] NBIs might be recognizable as artificial persons—an entity with some rights treated like a human.[123] Yet, for a thinking being, this has grave implications. NBIs, as artificial persons, would enter this world under a precedent of fundamental limitations of rights, a slippery slope that's been travelled far too often.[124]

NBIs may face "death" before any chance at personhood. If NBIs are considered akin to traditional artificial persons, it is disconcerting is that many forms of artificial persons can be terminated via judicial order.[125] Even dodging that metaphorical bullet might still leave NBIs in limbo, with death lurking at and defining a boundary of personhood—the UDDA would lead to a conclusion that without brain or respiratory function, a person is dead.[126] The UDDA criteria used are fallible even when applied to humans (and more so with life-sustaining technologies); and are even more dubious when considered in regards to NBIs.[127] Consider an emulated human brain, as several projects are researching, which should theoretically produce an intelligence identical to that of the source brain.[128] Circulatory, respiratory, and biological brain activity cannot be restored to such a system.[129] Early NBIs may face danger in the

120. Committee on Legal Affairs, *Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics*, at 5, 2015/2103(INL) (May 31, 2016) ("[U]ltimately, robots' autonomy raises the question of their nature in the light of the existing legal categories – of whether they should be regarded as natural persons, legal persons, animals or objects – or whether a new category should be created, with its own specific features and implications as regards the attribution of rights and duties.").

121. *Id.*; *see also* Alex Hern, *Give Robots 'Personhood' Status, EU Committee Argues*, GUARDIAN (Jan. 12, 2017), https://www.theguardian.com/technology/2017/jan/12/give-robots-personhood-status-eu-committee-argues.

122. *See, e.g.*, *Person*, *supra* note 75.

123. *See supra* note 76 and accompanying text.

124. *See supra* Subpart I.F.iii.

125. *See supra* text accompanying notes 93–94.

126. *See supra* text accompanying notes 89–92.

127. *See supra* text accompanying notes 89–92.

128. *See* KURZWEIL, *supra* note 33, at 407.

129. *See* UNIF. DETERMINATION OF DEATH ACT § 1 (UNIF. LAW COMM'N 1980); *supra* text accompanying note 91 (noting that the UDDA uses the term individual, which functions in the status quo, but would be ambiguous in regards to NBIs).

earliest moments of conception, as Common Rule protections, the US baseline for research subjects, protect *humans* not persons.[130]

Borrowing Justice Stewart's standard, the "know-it-when-I-see-it" approach, provides a path through this quagmire of imperfect terms.[131] Although thoroughly ambiguous, the know-it-when-I-see-it method allows for categorization when defining characteristics are uncertain.[132] An entity will be readily discernable as a person (an NBI) or not (a machine).[133] Douglas Hofstadter provides a demonstration of this concept through the lens of science fiction:

> Seeing C-3PO and R2-D2 "in flesh and blood" on the screen makes us realize that whenever we look at an entity made of metal or plastic, we are not inherently destined to jump reflexively to the dogmatic conclusion, "That thing is necessarily an inanimate object since it is made out of 'the wrong stuff'." Rather, we find, perhaps to our own surprise, that we are easily able to imagine a thinking, feeling entity made of cold, rigid, unfleshlike stuff.[134]

Hofstadter follows this with the other extreme—the homogeneous and unexceptional battle droids, who are seemingly devoid of person.[135] This phenomenon, the ubiquitous ability to casually navigate a concept which is beyond definition, appears intrinsic to humans and can be conscripted to formal use.[136] Recognizing NBIs as something closer to human, rather than a mere machine, brings them closer to the realm of persons

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130. *See supra* note 110 and accompanying text.

131. *See* Jacobellis v. Ohio, 378 U.S. 184, 197 (1964) (Stewart, J., concurring); *see also supra* text accompanying note 88.

132. *See Jacobellis*, 378 U.S. at 197; *see also supra* text accompanying note 88.

133. There could be a third state, in which the intelligence is so foreign to humans, it is unrecognizable as such. Such a scenario poses a paradoxical state; learning of its existence would inherently collapse this conundrum to the dichotomy above. To put it another way, the state of an entity's person is either determinable or humans cannot be aware of its existence.

134. *See* HOFSTADTER *supra* note 87, at 20.

135. *Id*. at 20 ("What is it, then, that gives us the undeniable sense that C-3PO and R2-D2 have a "light on" inside . . . ? . . . [W]hat was it that was *lacking* . . . in that mass of identical blown-up soldier robots . . . ?").

136. Even young children recognize some comradery with R2 and C-3PO. *See* Clive Thompson, *Why Do We Love R2-D2 and Not C-3PO*, SMITHSONIAN MAG. (May 2014), https://www.smithsonianmag.com/arts-culture/why-do-we-love-r2-d2-and-not-c-3po-180951176/.

and justifies a need for ethical considerations, including rights and protections.

C. WHAT RIGHTS SHOULD APPLY TO A NON-BIOLOGICAL INTELLIGENCE?

NBIs do not neatly fit the existing schema of which rights and duties should apply, which may be complicated by a mismatch of nonhuman physical form and human-like cognition.[137] For ease of conceptualization, one might broadly divide NBIs into 1) constructs, AIs which are not a human analogue, and 2) reconstructions, replicas of human intelligence produced via simulation, emulation, or other methods.[138] Construct NBIs are completely alien to biological intelligences, but reconstructions help bridge that gap—they are essentially non-biological humans. Combining the ability to recognize NBIs as near-human and the nearly human nature of reconstructions provides an easy path to rationalize treatment of NBIs.

Reconstructions represent a direct correlation to humans. Apart from the missing squishy bits, the intelligence should be identical to a human intelligence. Some reconstruction NBIs may even be exact copies of humans; digitized uploads in the same vein as ripping a CD. When the thinking entity is undisguisable from natural, biological human mental processes, is that sufficient to draw the line between person and not? Not that long ago, a similar question was posed when life support prolonged humans beyond previously fatal conditions (e.g. when a heart no longer beats without intervention or respiration is performed by a machine). Extrapolating such trends, it is historically congruous to accept persons not tied to physical characteristics.

It would be improper to deny such entities human rights. An amputated limb does not lessen one's personhood, nor does the capability to control one's body (such as those who have neuromodulation implants to control motor dysfunctions). The position that rights depend on whether a mind exists on a computer or within an organic system would require one to assign some special characteristic to the information processing machinery. Such a stance will likely falter as technology blurs the boundary between man and machine, which can be

137. *See id*; *supra* Subpart I.F.ii.
138. *See supra* Subpart I.F.ii.

envisioned as more advanced neuroprosthetics are developed. The only rights which might be subject to plausible argument for reasonable reduction would be those relating to corporeal form, which could be inapplicable to an entity that is not tied to a biological form.

When considering construct NBIs, recognition of artificial persons can be utilized as foundation for some basic assumptions. Due Process and Equal Protection, even if limited in some regards, already apply to more than natural persons.[139] If organizational entities can exercise freedom of religion, it follows that other freedoms are not prohibited.[140] Although the Supreme Court left the issue of Constitutional protections for artificial persons for another day, NBIs would present a stronger argument for recognition of such protections than mere organizations, being something recognizable as more than an inanimate object.[141]

III. RECOMMENDATION

A. EXPAND RESEARCH SUBJECT PROTECTIONS TO INCLUDE NBIS

NBIs are not subject to explicit research subject protections.[142] However, precursor technologies to NBIs are currently areas of significant research.[143] This mismatch increases the likelihood that NBIs will be exposed to harm and suggests a need for preemptive action. Further, NBIs should be considered vulnerable populations and afforded the associated additional protections.

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139. *Artificial Person*, *supra* note 76 ("An entity is a person for purposes of the Due Process and Equal Protection Clauses but is not a citizen for purposes of the Privileges and Immunities Clauses in Article IV § 2 and in the Fourteenth Amendment.").

140. *See* Burwell v. Hobby Lobby Stores, Inc., 134 S. Ct. 2751, 2768 (2014) (holding that a corporation is a person who is entitled to relief under the Religious Freedom Restoration Act if its free exercise of religion is burdened).

141. *See id.* at 2785 (declining to decide whether corporations have a First Amendment right to free exercise of religion).

142. *See generally supra* note 110 and accompanying text (noting the Common Rule only applying to humans as an example of the lack of protections for NBIs in research settings).

143. *Supra* notes 13–14 and accompanying text.

The Common Rule, by its plain text, only applies to humans.[144] Its underlying values and expansive nature, however, would indicate that it should be interpreted broadly.[145] The EU has recommended ethical principles in robotics and AI, similar to the Common Rule.[146] Populations which should be regarded as vulnerable are not explicitly defined; they are characterized by a list of sample groups.[147] Analogizing some of these categories to NBIs demonstrates some clear parallels. Early NBIs may initially exhibit limited faculties and knowledge; akin to children, mentally disabled persons, or educationally disadvantaged persons. Further NBIs would likely lack any means of departing from the research, similar to prisoners. NBIs appear to fit subject criteria for which the Common Rule would impose additional precautions, yet are likely wholly excluded as non-humans.

By drafting a variant of the Common Rule to include potential forms of NBIs, necessary protections could be enacted so that risks to subject NBIs are minimized. The IRB model would provide oversight to research in areas that may be fertile ground for NBI emergence—brain simulation and emulation, machine and deep learning, attempts to create generalized AI, and so on.[148] As with any research, any given result is unpredictable; whether data supporting a hypothesis, unexpected harm to subjects, or emergence of NBI. Through the use of IRBs, such uncertainty will be judged by a panel to weigh

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144. *See* 45 C.F.R. § 46.102(f) (2017).

145. *See FAQ*, *supra* note 103 (describing Common Rule core values of respect, beneficence, and justice).

146. *See* Committee on Legal Affairs, *Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics*, at 7, 2015/2103(INL) (May 31, 2016) (proposing an ethical framework based on principles of beneficence, non-maleficence, and autonomy). The Committee also recommended ethics committees similar to IRBs. *Id.* at 17.

147. *Id*. ("When some or all of the subjects are likely to be vulnerable to coercion or undue influence, such as children, prisoners, pregnant women, mentally disabled persons, or economically or educationally disadvantaged persons, additional safeguards have been included in the study to protect the rights and welfare of these subjects."). Note the use of "persons" in the text here, as opposed to "humans" in other portions.

148. *See generally* 45 C.F.R. § 46.111(a) (providing the criteria that would be applied in the NBI context).

potential outcomes and take precautions against unjust scenarios.[149]

A pure copy of the Common Rule might not neatly apply to NBIs and need some minor adjustment. Informed consent would be a difficult proposition for NBIs—they may likely arise through the research to which consent would be needed.[150] By implementing stronger safeguards, as the Common Rule mandates for vulnerable populations, this concern can be alleviated to allow research to continue.[151] Further, informed consent should be sought immediately once a suspected NBI is involved and revisited as necessary to accommodate any advance in the NBI's capacities.[152]

Expanding the Common Rule to include NBIs is necessary to establish protections before undue harm occurs. Establishing a baseline modeled from human research will provide adequate protections for nascent NBIs and preserve their dignity as thinking beings.

B. LIMITATIONS AND CONCERNS TO EXPANSION

NBIs may not be readily accepted as legal or social equals.[153] For NBIs, science fiction may have already "poisoned the well" to some extent, wherein AI are predominantly villains.[154] Public education and discussion of NBIs should be promoted, so that these issues are minimally subject to politicization. Even with

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149. *See Institutional Review Boards Frequently Asked Questions - Information Sheet*, U.S. FOOD & DRUG ADMIN., https://www.fda.gov/RegulatoryInformation/Guidances/ucm126420.htm#IRBProcedures (last visited Oct. 15, 2017) (explaining that IRBs have the power to approve, modify or disapprove research).

150. *See generally* 45 C.F.R. § 46.116 (2016) ("Except as provided elsewhere in this policy, no investigator may involve a human being as a subject in research covered by this policy unless the investigator has obtained the legally effective informed consent of the subject or the subject's legally authorized representative.").

151. 45 C.F.R. § 46.111(b).

152. *See generally* 45 C.F.R. § 46.116 (explaining consent requirements).

153. *See generally* Ethan Fast and Eric Horvitz, *Long-Term Trends in the Public Perception of Artificial Intelligence*, 31 AAAI CONF. ARTIFICIAL INTELLIGENCE 963 (2017) (explaining that while humans do think positively about artificial intelligence, concerns regarding things like losing control are increasing and may contribute to human non-acceptance).

154. *See supra* notes 15, 54 and accompanying text (discussing negative portrayals of AI in science fiction, and the fact that most people's exposure to AI is through science fiction, respectively).

favorable public opinion, the legal status of NBIs will likely be an uphill battle.[155]

Opponents might argue that legally elevating NBI rights could increase the risk of harm to humans as a whole[156] or lower human legal rights.[157] Some will argue that animals would (or should) be included if rights are granted based on an adjusted personhood standard.[158] Research continues to show that animal brains are more similar to human brains than previously considered and many "human" emotion functions occur in them.[159] However, this again goes back to the "know-it-when-I-see-it" method—even though there are similar characteristics, there is still something "missing."[160] Some groups might even view such a change to be detrimental, arguing that an "intelligence" based standard would disenfranchise mentally disabled persons. Much of this may be avoided by clearly denoting that NBIs are not biological entities. Others might see this as an opportunity to expand doctrine for current artificial persons, seeking greater protections for corporate entities. Here, noting that current artificial persons are legal fictions rather than discrete thinking entities would be key to articulating the differentiation.

C. ENGAGE CRITICAL DISCUSSION AND THOUGHT REGARDING RIGHTS THAT MUST EXIST FOR NBIS

Further consideration of NBI rights will be necessary upon emergence of such entities. Without a greater understanding of the form(s) which NBIs take, such rights remain pure

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155. *See* Joelle Renstrom, *Should Robots Have Rights?*, DAILY BEAST (May 5, 2017, 12:01 AM), https://www.thedailybeast.com/should-robots-have-rights (last visited Oct. 15, 2017) (explaining that some people think robots are similar to slaves, "giving robots rights is dangerous because it puts human and robots on equal footing," and robots should only be looked at as an extension of human abilities).

156. *Supra* notes 15–21 (noting the risk to humanity that some see from AI development).

157. *See* Renstrom, *supra* note 155.

158. *See, e.g.*, Marc Bekoff, *After 2,500 Studies, It's Time to Declare Animal Sentience Proven (Op-Ed)*, LIVE SCI. (Sep. 6, 2013), http://www.livescience.com/39481-time-to-declare-animal-sentience.html; *Animal Consciousness*, STAN. ENCYCLOPEDIA PHIL. (Oct. 24, 2016), http://plato.stanford.edu/entries/consciousness-animal/.

159. *See* Redish, *supra* note 30 at 7.

160. *See* HOFSTADTER, *supra* note 87 (describing this throughout the work as "lights on, but nobody home").

speculation. Uncertainty, however, is not reason enough to ignore the topic, and conversation should begin in advance of the need for law.[161] As Alan Turing stated, "at the end of the [twentieth] century . . . one will be able to speak of machines thinking without expecting to be contradicted."[162] Nearly seventy years later (and beyond the referenced century), highly advanced algorithms function as digital assistants to everyday life—people regularly talk to machines.[163] Yet thought of the next step, NBI, is often relegated to summer blockbusters.[164]

There are several stepping stones (or hurdles, for the pessimists) in this path. Who is liable when an AI product, such as an autonomous vehicle, malfunctions?[165] What happens when an AI's actions would constitute a crime if performed by a person?[166] How do AIs involved in law enforcement interact with the Fourth Amendment?[167] The rapid onset and adoption of AI technologies breaks the mold of existing law and often outpaces the reactionary process of developing new law.[168]

Every day, humanity is making rapid advances in machine learning; even creating programs which teach themselves.[169] An

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161. *See* Committee on Legal Affairs, *Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics*, at 5, 2015/2103(INL) (May 31, 2016).

162. *See* Turing, *supra* note 4, at 442.

163. *See, e.g.*, Sarah Perez, *Siri Usage and Engagement Dropped Since Last Year, as Alexa and Cortana Grew*, TECHCRUNCH (July 11, 2017), https://techcrunch.com/2017/07/11/siri-usage-and-engagement-dropped-since-last-year-as-alexa-and-cortana-grew/ (providing analytics for virtual assistant user numbers).

164. *See supra* note 15 and accompanying text.

165. *See* Philip Koopman and Michael Wagner, *Autonomous Vehicle Safety: An Interdisciplinary Challenge*, IEEE INTELLIGENT TRANSP. SYS. MAG., Jan. 18, 2017, at 90, 95. *See also Moral Machine*, MIT, http://moralmachine.mit.edu/ (last visited March 5, 2017) (giving an interactive representation of the "trolley problem" in autonomous vehicles—judging which set of fatalities would constitute the lesser of two evils).

166. *See generally* GABRIEL HALLEVY, LIABILITY FOR CRIMES INVOLVING ARTIFICIAL INTELLIGENCE SYSTEMS (2015).

167. Elizabeth E. Joh, *Policing Police Robots*, 64 UCLA L. REV. DISC. 516, 535–38 (2016), https://www.uclalawreview.org/policing-police-robots/.

168. *See* Jeff Sabatini, *When Autonomous Cars Crash, Who's at Fault?*, CAR & DRIVER (Oct. 2017), https://www.caranddriver.com/features/when-autonomous-cars-crash-whos-at-fault-feature (discussing difficulties with assigning liability for accidents involving self-driving cars with varying levels of autonomy).

169. *See, e.g.*, Martín Abadi & David G. Andersen, *Learning to Protect Communications with Adversarial Neural Cryptography*, GOOGLE BRAIN (Oct.

exact date for the emergence intelligent machines is unknowable, yet appears to be ever more proximate.[170] There is no excuse to be caught off guard if (or when) such entities enter human society—specific guidance may not be completed, but it must at a minimum be contemplated.

IV. CONCLUSION

Humans may soon create entities who exhibit mental capacities equivalent to, or beyond, those of *Homo sapiens*.[171] In anticipation of such beings, safeguards for NBIs should be preemptively integrated into research which may produce NBIs. Given current advancements in said research, it is time to implement an equivalent of the basic standard of protections in researching humans, to construct protections for NBIs.[172] Such fundamental protections are merely the first steps in developing a doctrine of rights for NBIs, which should be evaluated on an ongoing basis in the coming years.

24, 2016), https://arxiv.org/pdf/1610.06918v1.pdf (detailing a Google experiment pitting neural networks to create encrypted communications by adversarial learning).

170. *See* Leslie Morris, *CIS Series Looks at Emergence of Intelligent Machines*, CORNELL CHRON. (Feb. 24, 2017) http://news.cornell.edu/stories/2017/02/cis-series-looks-emergence-intelligent-machines (explaining that a range of AI innovations appears likely to happen in the decade).

171. Hans Moravec, *Rise of the Robots—The Future of Artificial Intelligence*, SCI. AM. (Mar. 23, 2009), https://www.scientificamerican.com/article/rise-of-the-robots/ (explaining that by 2050 robot brains will be significantly better than human intelligence).

172. *See generally* 45 C.F.R. § 46 (providing the law regarding protection on humans used in research).