Artificial Intelligence, Robotics and the Next Transformative Technology

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Recently, advances in robotics has spurred a discussion among legal scholars as to whether robots represent a new and distinct subject within law and if so, just what a law of robotics might look like. We have been there before. In the early days of the Internet, the ability to digitize information and to transmit it across state and international boundaries motivated a similar discussion, and in seminal papers and court decisions a new cyberlaw began to take shape and emerge. Could the same now be true for robotics? Compared to other emerging technologies, do robots pose such new and distinct legal issues that legislators and legal scholars should take notice and respond with similar debates, provide sui generis protection, or adopt old law to new technology? Answering affirmatively, scholars within the law and robotics community have proposed that robotics is indeed a transformative technology providing distinct legal issues for discussion and adjudication. While I agree that robotics is an emerging technology of importance particularly for automation and for the application of machine learning in general, in this essay I argue that a law of robotics while seductive and challenging for legal institutions, misses the big picture, the true revolution occurring within information technology, and that is artificial intelligence. In this commentary I propose that it is recent advances in artificial intelligence that has given robots the behaviors and capabilities which challenge current legal schemes and that has attracted the attention of legal scholars and institutions. Considering a hierarchy of technology, while the behavior of robots represent an interesting and important aspect of what artificial intelligence can do, artificial intelligence does far more than control the actions of robots and other increasingly smart machines.

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INTRODUCTION

I admit, there is something interesting even compelling about robots, in fact, they once roamed the floor of the lab I directed. The subject of science fiction novels, movies, and numerous scientific papers, robots are beginning to enter the discourse among legal scholars as an “up-and-coming” technology to take notice of.¹

A major proponent of the idea that robots are “an idea whose time has come,” “the next transformative technology after computers and the Internet”² is Ryan Calo who has written extensively on the topic.³ I view his recent Cal. L. Rev. article, *Robotics and the Lessons of Cyberlaw*, as the key guest to the “coming-out” party proclaiming the need for a law of robotics and a new field of study.⁴ Calo is not alone in his enthusiasm for exploring the legal issues associated with robotics. Legal scholars and robotics experts gather yearly at the “We Robots” conference, and First Amendment scholar Jack M. Balkin has recently written on the topic.⁵ In Professor Balkin’s response to Calo’s *Cal. L. Rev.* article he notes: “Calo’s account of the problems that robotics present for law is just terrific, and I believe it is destined to be the starting point for much future research in the area.”⁶

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³ Id. at 528; Ryan Calo, *Open Robotics*, 70 MD. L. REV., 571-613 (2011).
⁴ Calo, *supra* note 2.
⁵ Balkin, *supra* note 1.
⁶ Id., at 45.
enthusiasm? After all, robots are pervasive in society— they star in movies, spot weld on assembly lines, serve as robot pets, and even help surgeons perform surgery. But if we look carefully at the design and features of twenty-first century robots, we begin to see that a particular aspect of their design is the key to understanding the challenges robots pose for the law. That characteristic is not the effectors and actuators which allow the robot to manipulate objects or for that matter any other mechanical feature that “makes a robot a robot;” but instead the key factor raising issues of interest to the law is the capabilities of artificial intelligence which control the actions, thought processes, and output of the machine. In the commentary which follows I discuss some of the defining features of robotics and artificial intelligence which I believe warrants particular attention by legal scholars, and I relate Ryan Calo’s ideas on how the law relates to robotics more directly to the field of artificial intelligence.

The issue of whether robotics is the next transformative technology after computers and the Internet and should therefore be the focus of legal scholars and legislators, is far from settled. In the early days of robotics when computing resources were limited to a few

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7 Two recent examples of movies starring robots are: EX MACHINA (Andrew Macdonald Production 2015); CHAPPIE (Simon Kinberg and Neill Blomkamp Producers 2015).


hundred MIPs and the algorithms controlling the actions of robots were rudimentary, there wasn’t much of an outpouring among legal scholars for a law of robotics. It was only when increases in computational power, improved sensors, and better algorithms gave robots the intelligence to learn rules beyond those meticulously programmed into the machine that the very idea that robots were deserving of close scrutiny by the law began to gain traction.

I view recent articles which describe how robots equipped with artificial intelligence are stressing tort, contract, and criminal law as examples of the momentum currently being generated in the legal academy for a new field of law involving robotics. But taking a contrarian view, I claim that it is artificial intelligence and not robotics per se that is creating the unique issues within law that has caught the attention of legal scholars and other commentators. If the approach advocated in this article is adopted, and we view artificial intelligence as the next transformative technology after computers and the Internet, the resulting paradigm will not ignore or discount the legal issues brought forth by robotics; quite the opposite, as robots are a key technology for the application of artificial intelligence. In fact, Gabriel Hallevy writing about the application of criminal law for artificial intelligence

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intelligence, observed: “An artificial intelligence entity has a variety of applications, including robotics.”

And commenting on the importance of artificial intelligence for the future of technology in general, Tony Tether, former director of DARPA stated: “machine learning is the next Internet.”

Given that artificial intelligence is the “brains” behind increasingly autonomous robots and other smart machines, I suggest that it would be useful for legal scholars and legislators to think of artificial intelligence as a superordinate category in comparison to robotics and other technologies that rely on artificial intelligence to sense and interact with the world.

I.

WHAT MAKES ROBOTS OF INTEREST TO THE LAW?

What distinguishes a robot that is programmed with artificial intelligence from other machines and virtual entities also controlled by the same algorithms and software? I argue- substantively, not much. However, explaining why robotics should be considered the next

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transformative technology and deserving of the attention of legal scholars, Calo describes the essential features of robotics in three main points: (1) their physical presence allows them to sense, navigate, and act upon the world (embodiment); (2) they have the ability to engage in unpredictable useful behavior (emergence), and (3) there is a realization that the experience of robots by humans is more like interacting with a living agent than other technology (social valence).\textsuperscript{13} Examination of these essential “robotic features” indicates that each can be seen as examples of what artificial intelligence affords technology in general, and not specifically to robots. But to be complete, I should point out that Calo emphasizes that it is the combination of embodiment, emergence, and social valence that creates a robotic system, and as such results in unique issues for law.\textsuperscript{14}

What Calo refers to as “emergence,” a specific property of robotics, which he describes as: “unpredictably useful behavior and represents a kind of gold standard among many roboticists…”\textsuperscript{15} is actually a very good description of what artificial intelligence affords a system; in this case, the artificial intelligence is embedded within the body of a robot, although it does not have to be. Regardless of its location, the “form” of artificial intelligence as software and algorithms raises significant issues for law. For example, Professor Balkin notes

\textsuperscript{13} Calo, supra note 2, at 532-549.
\textsuperscript{14} Id. at 532.
\textsuperscript{15} Id. at 532.
that “the problem of emergence is the problem of who will we hold responsible for what code does.”  

I agree, the problem of holding code responsible for the actions it produces, is synonymously the problem which results from the use of artificial intelligence that has the ability to learn and change its behavior as it interacts with the world. A point to make here is that artificial intelligence is more ubiquitous than robots, and when code goes wrong, a robot is not always an actor in the play. Clearly, liability for the actions of artificial intelligence is an area ripe for legal scholarship and state regulation and we see the beginnings of this effort now by the FAA with drones, and state governments with autonomous vehicles.  

However, drones, autonomous vehicles, and robots, are different technologies, although they share in common algorithms and other forms of artificial intelligence. For this reason, legislators would be well advised to focus on general rules which cut across diverse technologies that rely on the same underlying principles of artificial intelligence to act upon the world.

While the physical presence of a robot, and its capacity to harm humans is an important consideration in Calo’s discussion of why robotics is of particular interest to the law, he also discusses how certain virtual objects could influence the world as robots.  

So, in some cases,

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16 Balkin, supra note 1, at 52.
18 Calo, supra note 2, at 531.
the embodiment feature of a robot, can be less important, and Calo accounts for this departure from his main description of a robotic system by stating that each essential element of a robot can be represented by a continuum.\(^{19}\) I have no problems with that thinking, other than to point out that with eight different types of machine combinations that result from Calo’s three essential “robotic elements” (In such a scheme, Ryan’s robotic system occupies the vertices 1, 1, 1 of a cube), a complex set of possibilities is created and I think the law will have some difficulty working out the legal issues for machines which vary across the dimensions of “emergence, embodiment, and social valence.” Now considering artificial intelligence, it is interesting to note that some definitions of the term include robotics as an example of just what the concept means, here’s one example: “the collective attributes of a computer, robot, or other mechanical device programmed to perform functions analogues to learning and decision making.”\(^{20}\) The difficulty of definitions aside, just as digital personal assistants, intelligent virtual avatars, and software agents, are examples of entities dependent on artificial intelligence, so too are robots that are equipped with the same sophisticated algorithms and often for the same purpose. Interestingly, even without a physical presence, virtual entities programmed with

\(^{19}\) Id. at 531.

artificial intelligence can cause harm in the real and virtual world, and be identified as a “cause in fact” in a tort action for negligence.\textsuperscript{21}

While Calo argues that robotics is the next transformative technology after computers and the Internet, Jack Balkin adopts more of the middle road between the fields of artificial intelligence and robotics, commenting, “…I do not distinguish sharply between robot and artificial intelligence (AI) agents.”\textsuperscript{22} Neither do I, although I do argue that the key technology driving the robotics revolution is artificial intelligence, even though I fully acknowledge that impressive advances have been made in the hardware and sensors comprising robots; but algorithms rule the day when it comes to guiding a robot’s performance and are essential for any legal analysis focusing on where to place liability or responsibility for a dispute in tort or contract law.\textsuperscript{23} Just consider an example, artificial intelligence provides a robot’s grippers the right force profile for a particular task. And interestingly, if the robot were to exert too much force and damage a physical object or a human, we can look directly at the robot’s software to gaze into its inner “thought processes.” Thus, artificial intelligence provides a window in

\begin{footnotesize}
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\item Balkin, supra note 1, at 45-46.
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which to look for intent in a contract dispute or *mens rea* for a criminal
action, this is a new development in the law.²⁴

II.

ISSUES OF INTELLIGENCE

At this point in the discussion, it is relevant to take a step back
and ask- what is intelligence as I claim that artificial intelligence is the
key aspect of robotics and other emerging technologies whose
capabilities are now creating tensions in various areas of law such as
torts, contracts, criminal law, constitutional law, and others. Discussing
robot characteristics, Professor F. Patrick Hubbard, in *Sophisticated
Robots, Balancing Liability Regulations and Innovation*, defines
intelligence as “the rate at which the machine can receive, evaluate, use,
and transmit information, and the extent to which it can learn from
experience and use the output of learning to determine future
responses.”²⁵ Hubbard’s definition of machine intelligence is also
similar to Calo’s characterization of a robot which produces “emerging
behavior” and can “sense, process, and act.”²⁶ I should note again that
each of these aspects of robots identified by Calo are made possible by
artificial intelligence. Thus, even though advances in sensor and other

²⁴ *See* Hallevy, *supra* note 11; *Weaver, supra* note 17.
²⁶ Calo, *supra* note 2, at 529.
technologies are leading to “smart machines,” with improving sensors it is still algorithms that process and make sense of the data.

One “form” (or application) of intelligence is machine intelligence and tremendous strides are being made in machine learning techniques which are becoming a feature of robots and other emerging technologies. On this point, UC Berkeley researchers have developed algorithms that enable robots to learn motor tasks through trial-and-error using a process that more closely approximates the way humans actually learn, thus marking an important step forward in the field of artificial intelligence.27 With this artificial intelligence technique, deep learning programs create “neural nets” in which layers of artificial neurons process overlapping raw sensory data, whether it be “sound waves or image pixels.”28 This helps the robot recognize patterns and categories among the data it is receiving. According to Sarah Yang, “people who use Siri on their iPhones, Google’s speech-to-text program or Google Street View have already benefited from the significant advances deep learning has provided in speech and vision recognition.”29 However, the most advanced machine learning software must be trained with large data sets, something that is very energy intensive, and thus motivating work on new types of “neuromorphic”

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28 *Id.*
29 *Id.*
chips modeled from the ideas of neuroscience.\textsuperscript{30} The architecture of such chips receive \textit{sui generis} protection under the Semiconductor Chip Protection Act of 1984, which makes the layouts of an integrated circuit legally protected upon registration.\textsuperscript{31}

So how far along are we towards developing artificial intelligence (or a robot) that will have the intelligence to fully engage our legal system as entities deserving of rights? According to Jack Balkin “we are still a long way from treating robots and AI agents as self-conscious rights-bearing or responsibility-bearing entities.”\textsuperscript{32} For this reason Balkin argues that one of the central issues for robotics is “to allocate rights and duties among human beings when robots and AI entities create benefits or cause harms.”\textsuperscript{33} However, discussing when we might expect even more intelligent robots, Richards and Smart, in an article, “\textit{How Should the Law Think about Robots?}” conclude that [while] robots have not yet reached the levels of complexity the public associates with science fiction … they are surprisingly close.”\textsuperscript{34} Continuing this point, Hubbard notes that “… in the next decade or so, a new class of “sophisticated robots” will emerge by nature of their


\textsuperscript{32} Balkin, supra note 1, at 46.

\textsuperscript{33} Id at 46.

increased autonomy and intelligence.”35 I should note that autonomy and intelligence are both characteristics of what artificial intelligence affords a system, and by Hubbard’s estimation, robots with more autonomous behavior are expected within a decade. Calo seems to go even further in speculating about the use of artificial intelligence for robots when he states: “But the processing capabilities of robots translate to the tantalizing prospect of original action.”36 “Original action” - I know of no other way for “original action” to be a feature of robotics, other than mediated by one form of artificial intelligence or another. But to some extent, I agree with Professor Calo, in that creating software that comes close to mimicking human levels of general intelligence, remains elusive, and unpredictable as to whether it will happen, or when. For artificial intelligence to progress towards human levels of intelligence, of course improvements in algorithms and more robust software will have to be made. Can we expect such improvements to occur within the next few decades? If yes, a law of artificial intelligence as a new field of study and a subject for regulation seems appropriate.

Gordon E. Moore observed as far back as 1965 that computer power was doubling approximately every two years. Fifty years later, China’s Tianhe-2 supercomputer operates at 34 quadrillion cps (34 petaflops); and exaflop computing (i.e., \(10^{18}\)) is just beyond the horizon.

35 Hubbard, supra note 10.
36 Calo, supra note 2, at 532.
In comparison, the raw processing power of the human brain with 100 billion neurons and 100 trillion synapses, with each neuron operating at about 10 b/s, is a petaflop computer.\(^\text{37}\) An interesting aspect of Moore’s law for innovation in general is that advances in artificial intelligence seem to be operating under a feed-back process which creates accelerated returns. With “software robots”, there does seem to be exponential growth, but of course eventually a convergence will occur, so at some point, major innovation will be needed to keep the growth of artificial intelligence continuing. Essentially, this means, greater computational power, improved algorithms, and chips that process information in a similar manner as the human brain.

Even though Calo rightly argues that robots are interesting because they have a physical body which allows them to act directly upon the world, artificial intelligence implicates a greater range of issues than robotics for two main reasons: firstly, as software entities, the code and algorithms of artificial intelligence can be cheaply copied and “implanted” within the “body” of many different kinds of machines, often producing capabilities that are similar to those shown by robots; and secondly, artificial intelligence can “exist” either embedded within the physical body of a machine, or as a virtual representation within cyberspace, this results in a range of issues not directly relevant to a law of robotics. For example, the question of whether a “virtual avatar” is a

form of property, whether strict products liability law applies to algorithms and software, and whether algorithms are patentable intellectual property are just a few issues of concern for a law of artificial intelligence.\footnote{38} There are already some statutes that have relevance at least partially to artificially intelligent entities, such as cyberhacking laws, cyber bulling, and the regulation of electronic agents used for commercial transactions.\footnote{39} As a point to make, the same software and algorithms that contribute to make robots “smart,” similarly works to make other objects within the physical environment and more recently within cyberspace smart.

The fact that artificial intelligence has a foot in both the real and virtual world is, I believe, a huge consideration for what should be considered the next transformative technology and therefore of interest to the legal community. I do not advocate narrowing the scope of the next transformative technology to one particular technology such as robotics, because by doing so we might neglect the important issues raised more generally by artificial intelligence that are independent of the use of a robotic body. I recognize that a law of robotics will solve some problems that are associated with artificial intelligence, but others will remain in need of attention. Therefore, before we are too far invested in a law of robotics, we should strive to make sure that the legal

approach taken for the next transformative technology is inclusive, which I believe can be done by focusing on the legal issues brought forth by the superordinate technology (i.e., artificial intelligence) directing robot behavior and other smart machines.

If a robot is programmed such that it can only move repetitively in predetermined motions, say to attach one machine part to another on an assembly line, then its level of intelligence is low by any accepted definition of intelligence, and the interactions with humans limited to a short list of possibilities that would interest legal scholars. For example, one important issue would be determining liability for harm to a person entering within the boundaries of the robot’s range of motion, this is of course, a legitimate topic of interest for the law and also to the robotics industry which has already proposed safety standards for humans entering robot workplaces.\(^40\) In the event of harm to a worker resulting from the actions of a robot designed to repetitively move an end-effector from one point to another, under current tort law, liability would typically be traced back to the manufacturer or programmer.\(^41\) So far, so good. But with more intelligence provided to the robot by software and algorithms that solve problems in ways not predicted by the human

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\(^41\) Hubbard, supra note 10, at 1819-26.
operator, the range of possibilities for the robot’s end effectors and other moving parts of the machine dramatically increase, and the areas of law impacted by the more intelligent robot likewise increases. Returning to Calo’s use of essentialism as a methodology to map the features of robots to appropriate areas of law, I conclude that listing the essential features of robots is an exercise that consists of mostly listing the behaviors afforded to the robot by artificial intelligence. Therefore, why not a law of artificial intelligence?

III.

SLEEPING ROBOTS AND RULES AGAINST CHEATING

Calo argues that “Little in the literature gives me confidence that artificial intelligence will approximate human intelligence in the foreseeable future.” An interesting and profound comment, but I don’t think it sheds much light on whether artificial intelligence should be considered the next transformative technology. Since several artificially intelligent systems are already equal to humans in cognitive performance in a surprising range of tasks, and I might add are becoming superior to humans in a growing list of skills (once considered beyond the scope of artificial intelligence), possibly, Calo means to say that artificial intelligence will not in the foreseeable future, exhibit across-the-board human levels of intelligence; such is a more defensible

42 Calo, supra note 2, at 528.
position. But of course there is a raging debate among artificial intelligence researchers, philosophers, and scientists as to when, or if, artificial intelligence will equal humans in general intelligence, we will not solve that debate here. Nor will we make a major contribution to another controversial issue within the artificial intelligence community—that of machine sentience. However, returning to the main focus of this commentary, should robotics or artificial intelligence be considered the next transformative technology and therefore of distinct interest to the law, I believe the issue of consciousness for an artificially intelligent machine is a distraction to answering that question. To be considered the next transformative technology, artificial intelligence no more has to “wake up,” than a robot has to wake up, and if artificial intelligence does “wake up,” so too will robots, so consciousness is not a distinguishing issue between artificial intelligence and robots. Further, those who propose that artificial intelligence is improving in leaps-and-bounds, are not cheating when they select a skill once thought solely within the domain of human expertise, then creating an artificially intelligent entity that can do the same task equal to or better than a human.

Rather than “cheating,” this is an example of the incessant

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progress being made in the advancement of artificial intelligence. But even Calo is subject to being “selective” in his examples when he decides to look “…instead at the immediate commercial prospects of robots.”

We’ll its certainly the case that the commercial robots entering society now can sense, process, and act upon the world, which are some of the essential characteristics of a robot identified by Calo. To reiterate, we will not solve the debate about whether artificial intelligence will reach human levels of intelligence here but why not get ahead of the “technological curve,” and start the conversation now? The issues for law and society brought forth by improving artificial intelligence is simply too important to be either put off or set aside in favor of another technology, especially one that is dependent on artificial intelligence for its behavior.

IV.

LACKING ARTIFICIAL INTELLIGENCE

ROBOTS ARE, WITH APOLOGIES, DULL

For robots that work on assembly lines using predetermined logic to perform repetitive tasks, the legal issues implicated if the robot accidently harms a human or damages property, are predominantly within the scope of contract and tort law- nothing too stressful for the law here. In fact, Richards and Smart writing about law and robots

45 Calo, supra note 2, at 529.
argues that robots on assembly lines, or “industrial automatons,” should not even be classified as a robot because robots lack what they term “mental agency.”46 However, when artificial intelligence is embedded within the body of a robot (or accessed through the cloud), this generates a range of actions that the robot may perform in unpredictable ways, and this makes all the difference for many areas of the law and interestingly, also allows mental states such as “intent” or “knowingly,” to become part of the discussion.

It is the case that a robot that lacks the ability to think beyond a few simple rules, is so devoid of intelligence, that no one would assign it responsibility for its actions; nor would anyone consider such a machine to be the next transformative technology after computers and the Internet. Thus, while robots are remarkable technological accomplishments, many of the robots that exist now are rather dull from an intellectual point-of-view. But what does make a robot interesting from a legal perspective? The answer is robots that have capabilities provided by artificial intelligence which allows them to sense the environment, initiate actions, and solve problems using solutions that were originally unknown to the human operator.47 By the way, these are basically the same attributes that make humans interesting for the law; perhaps this is what we mean by “free will.”

46 Richards and Smart, supra note 34, discussing mental agency as the ability to make rational decisions.
47 Calo, supra note 2.
To illustrate the importance of artificial intelligence for the future of law and technology, let me pose a question- Without artificial intelligence controlling the kinematics of a robot and making sense of the information provided to it by a host of sensors, what difference is there between a common consumer appliance such as a vending machine and a robot which unthinkingly moves a servo gun (used for spot welding) from one position to another? Both have been known to harm a human.48 If the gist of this question sounds vaguely familiar, it harkens back to the comments by Judge Frank Easterbrook recalling the story of a former Dean of the U. Chicago law school who argued that there should no more be a law of the computer, as there should be a law of the horse.49 But considering issues of jurisdiction and other issues impacted by the use of the Internet it turned out that there is indeed much to say about a law of cyberspace, just as there is much to say about a law of artificial intelligence.

Discussing the importance of a physical presence for a law of robots, Calo argues that a robot’s ability to sense, navigate, and act upon the world “generally requires a physical presence, and that physical

presence opens up a universe of new possibilities.” 50 In other words, for Calo, intelligence combined with a body seems to make all the difference. This observation follows historical developments in the law. For example, under common law traditions, the law generally needs a body- and robotics provides a body. Assault and battery is normally predicated on an act committed on the person, or in some cases, an extension to the body, 51 in fact, many tort actions are the result of a harm inflicted on a body; and with the exception of the legal personhood fiction established for corporations, historically, contracts are negotiated between people. As a more recent development, discrimination law is built around the concept that people (not inanimate objects) are the subject of discrimination, and so too are hate crimes directed at natural people; numerous other examples could be given. But importantly, while artificial intelligence controls the actions of robots that project a physical presence in the world, artificial intelligence doesn’t need a body either to “exist” or to act on the physical world, this fact alone creates tension in the law beyond those created by robotics. However, just the fact that robots have a body makes it easier for them to be the center of attention and focus of discussion. Looking at algorithms is to most people inherently less interesting than looking at robots, and an algorithm has yet to star in a movie.

50 Calo, supra note 2, at 532.
As we transition into a digital economy and as we spend time in virtual reality, in many cases there is no physical body requirement for the entities we design and interact with, our alter ego may even exist as an artificially intelligent avatar. Yet the same techniques in artificial intelligence that are creating smart robots may lead to legal disputes when intelligent avatars are used as stand-in actors, our digital agents, and as tools for cyberhacking.\textsuperscript{52} Thus, it is the case that unlike a robot, an artificial intelligence may cross the boundaries of the real and the virtual world (e.g., a virtual avatar) and exist as an intelligent entity in either domain, this distinction alone suggests that a law of artificial intelligence will reach more issues creating tensions in the law than robotics.

In my view, to treat robots that exhibit “emergent” behavior as a class distinct from other smart technologies subordinate to artificial intelligence and that also exhibit emerging behavior, is problematic—would each technology controlled by artificial intelligence deserve special attention as well? Or should we develop a scheme which cuts across technologies that have a common thread—specifically those technologies that use artificial intelligence to sense and act upon the world and which interact directly or indirectly with humans? To take a

more comprehensive approach to emerging technologies that have in common the use of artificial intelligence, not only has merit and intuitive appeal, but follows the tradition within the law of developing legal schemes which attempt to unify actors that involve the same technology and legal disputes.

V.
CONCLUSION

To take a conservative view of artificial intelligence, a technology that is moving in the direction of human levels of performance, is to actually limit the scope of the discussion for a law of robotics, especially in the midst of a revolution in the field of machine learning and other techniques in artificial intelligence. Already, one can see robots that are distant relatives to C3PO on factory floors now and performing tasks which require significant levels of intelligence. And the dexterity and general intelligence of robots is moving ahead so rapidly that to be conservative now, is to adopt an approach to a law of robotics that is doomed to lag behind the technological curve. So even though remarkable progress has been made in the design of the mechanical features and structure of robots, we may as well admit that the key technology driving advances in robotics that are of interest to legal institutions and legal scholars is artificial intelligence, simply put, this is where the action is. Therefore, as an open question to legal
academia I ask—why not propose that the next transformative technology after computers and the Internet is the “brains behind the technology,” that is, collectively the heuristics, algorithms, and software which comprises artificial intelligence? Even more so than robotics, after surviving several winters of discontent in which funding temporarily dried up, artificial intelligence is now highly funded and has come of age, artificial intelligence is everywhere and making decisions that impact our daily lives, and its capabilities are stressing the law not only in the field of robotics but in ways beyond those of robotics and as yet to be determined.

So what is the next step to take? As artificial intelligence accelerates quickly into society, according to John McGinnis this creates a need for a response from governments to react to the potential huge effects of disruptive innovations (robotics being one example) being spurred by the use of artificial intelligence across a range of technologies. Let the debate about whether artificial intelligence should be considered the next transformative technology after computers and the Internet begin now while we still have time to chart our future.

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