The robot as cub reporter: law's emerging role in cognitive journalism

Elizabeth A. Kirley

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ABSTRACT

Today's journalist is immersed in news production that no longer treats robot-written news as a mere reference tool. Major news corporations are reshaping the journalism business to reflect the increasingly dominant role of algorithms and its consequent decrease in human curation. With data so integral to today's news storytelling and the arrival of machines that are learning to 'sense, think and act' like their creators, we are called to deliberate on the legitimacy of law to address human risks and responsibilities when humans are harmed physically, socially, financially or professionally. This paper argues that we are entering the age of cognitive journalism that affects the legal personhood question and examines policy initiatives on both sides of the Atlantic for legal norms to inform a law for machines that learn from mistakes and teach other machines. Legal issues raised by driverless cars, human cloning, drones and nanotechnology are examined for what they can offer to an emerging law of the robot. The paper concludes with a call for research that will bring a more nuanced understanding of the legitimate place of law in cognitive journalism.

Keywords: Data journalism; robotics; cognitive journalism; disruptive innovation; human-machine interactions; nanotechnology

INTRODUCTION

Robots are making their mark on the news business. [1] In a 2015 contest between a former White House correspondent and a Wordsmith disembodied robot, American broadcaster National Public Radio (NPR) reported that the creation of a business report took seven minutes for the seasoned human journalist and a mere two minutes for his robotic counterpart (Smith 2015). NPR judged the human article as excelling in style but the robot piece, compiled in almost one third of human time, conveyed the same essential information and quality of analysis. Robotic 'reporters' are also proving their talents in other forms of writing for human consumption, such as academic research (Pitt 2014) [2] and peer review feedback (Bartoli et al. 2016; Grove 2016). [3]

Such robotic story writing within the journalism industry is focused, at present, on business reports and sports contests, functions that require algorithmic scanning of pre-selected data. While the Wordsmith robot uses analytical and natural language functions and therefore meets the definition of Royal and Blasingame's 'data journalist' (2015), it does not display cognitive thinking capabilities because of its strong reliance on human programming and its lack of independent decision making. [4] With the current rate of innovation in robotic news writing, however, the arrival of cognitive journalism is in view. [5]

A principal concern among journalism professionals emerging from that transition is one of public perception: that human reporters will no longer be the definitive source of news (Elkins 2015; Manjoo 2011). That prominence has been eroded considerably by the rise of citizen journalism via blogs, YouTube postings, personal websites and social media, notably Twitter. A more practical concern instigated by robotisation of news writing has been the projected loss of jobs. Such fears are fuelled by research results like a 2013 Oxford study that found 47% of US jobs were at risk of potential automation over the next decade or two (Frey and Osborne, 41) or a Pew Research Center report in 2013 that robots and other digital agents will displace more jobs than they create by 2025. Other sources observe a shift to specialisation within computer-related jobs as robots exhibit enhanced senses, dexterity and capability of performing a broader scope of mechanised labour (MGI 2013).

On the business side of news, Katz (2013) reports that, with growth in computing power and decreases in data storage costs, coupled with significant progress in machine learning and artificial intelligence (AI), white-collar industries are under threat of disruption in much the same manner that process engineering and automation reset the labour-versus-capital tradeoff in blue-collar industries in the 1950s, 60s and 70s (913). Given current newsroom team formations, whether in the name of data journalism (Royal and Blasingame 2015), computational journalism (Katz 2013) or the emerging cognitive journalism, newsroom access to machine-generated data for newswriting has gained acceptance and status within major news industries (Rogers 2011).

That means algorithms for processing big data are now entering domains reliant upon non-repetitive tasks as robots are showing cognitive abilities, such as learning from their experience, interacting with humans using natural (ie human) language and showing the capability of making independent decisions (Noor, 2014). That is particularly the case with embodied or service robots such as drones and other autonomous agents, designed to enter and participate in human-dominated geophysical space. That mobility creates risk for human co-workers, including physical injury and emotional distress.

The added convenience of mobilizing news onto wireless devices from such sources as Facebook NewsFeed [6] and Google News has sparked a new urgency in assembling teams with expertise in computer programming, data science, theoretical physics, stock market analytics, strategic management of social media, and search engine optimization. Those specialists study language, markets, search engine science and the programming of software robots (softbots) to scour the Web, using machine learning, [7] sensors and networks to generate data sets; they then employ predictive analytics to uncover social, political, cultural, business or scientific trends that humans working alone would not have the time or know-how to access. Journalists use those data for evidence-based storytelling rather than 'hanging around in smoky bars' to meet human sources (Moses 2014).

While humans still feature prominently in newswriting, particularly for editing, fact checking and investigative work, their robotic counterparts are tackling functions humans cannot, using big data whose sheer bulk confounds human efforts at organization and sense making. They achieve that by moving away from stochastic or random decisions, the current simulation model, towards models of learning that emphasize cognitive functioning. For a robot journalist, that means its cognitive state changes as it interacts with the information that it encounters (Maxwell and Azzopardi 2016, 731-2). [8] The outcome of such innovation is that robots are becoming human-like in their storytelling and analytical behaviours. That is an important step in automated journalism because it adds realism to robot-engendered stories and moves robotic writers a major step towards autonomous functioning. For journalism, that progress means the robot product gains realism and credibility, necessary features if the news report is to appeal to human readers.

The emergence of what we shall call 'cognitive journalism' is a game changer in one of the oldest of professions, the fourth estate (Stanford University 2010). [9] It brings broader questions regarding the authoritative source of news, the shifting standards of truth versus fact and accountability and control. Katz (2013) explains that today's AI is 'soft AI' in that it attempts to mimic human intelligence in outcomes, but not in its underlying processes. [10] What is unfolding is the possibility of AI surpassing human efforts, what Jones has called removing humans from the loop, by eliminating human propensities to show cognitive limitations when deriving insights from large data sets (2016). Katz enumerates the growing list of human cognitive biases on which robots might improve, such as: the availability heuristic, [11] optimism bias, [12] anchoring, [13] confirmation bias, [14] illusion of validity, [15] and the frequency illusion, [16] (2013, 929, note 102).

University of California law and technology researcher Ryan Calo has observed that, for the first time in human history, we are faced with the combination of the 'promiscuity of data' with the capacity to do physical harm (2015, 515; Mir 2016). With that intensification of robotic potential come larger socio-cultural questions about control, power and social responsibility: when humans are affected by errors in the process we look to law to advance beyond its traditional role as guardian of human rights and defender of the social and political status quo to protect us from anticipated risks created by machines.

This paper assesses the availability of legal models to address risks arising from the emerging cognitive journalism. [17] Those risks involve physical, emotional or financial injury, loss or other threats to the status quo that raise questions about allocation of liability. Recent advances in robotic programming suggest various capabilities of robots that, if unchecked, might lead to such unanticipated conflicts or ambiguities of control. They are already emerging from state of the art achievements: robots overreaching human programming (Smith 2009; Eaton 2015), teaching one other various tasks (Ackerman 2015), learning to disobey (Briggs and Scheutts 2015) and to deceive (Wagner and Arkin 2011), and using cognitive functioning that suggests to some researchers that humans might be edged out of the loop altogether (Willcock and Lacity 2016; Wohlsen 2014; Jones 2016). While there have been key academic contributions to the role of law in automation generally [18] and the emergence of robots in journalism, [19] the study of legal responses to the use of robotics within the journalism frame is relatively new. This paper invites contributions to that study. Given its generic nature and broad scope, it focuses on law in general, not specific legal systems, and aims to consider possible legal responses to data journalism and cognitive journalism, not compile an extensive model or inventory of solutions.

We proceed as follows: Part I introduces the historical and current state of human-machine interactions within journalism; Part II theorizes the robot's role vis-à-vis the disruption versus adaptive evolution debate regarding the progress of human-machine interactions in order to provide a conceptual frame for thinking about how both robot law and cognitive computing might function in an environment of uncertainty; Part III examines current US and EU policies for indicators of the level of preparedness of policymakers for the shape of law to meet robot-induced risk that might affect humans within the journalism frame. Efforts to adapt existing laws of human cloning, driverless vehicles, drones and nanotechnologies suggest legal prototypes; the paper concludes with a call for research that will bring a more nuanced understanding of the legitimate place of law in human-machine interactions.

I. ROBOTS CONTRIBUTE TO JOURNALISM IN INCREASINGLY COGNITIVE WAYS

Robots have been defined as 'autonomous machines able to perform human actions' (Robolaw Guidelines 2014; Smith 2012). [20] Through the integration of AI, machine learning [21] and natural language within robotic functions, we are developing machines that can 'sense, think and act' in progressively human terms (Calo 2016). For news coverage purposes they come in either embodied structures (drones and service robots) or disembodied form (software robots or 'softbots' and sensors). Drones are the principal embodied form currently in use by large media companies for field investigations and other tasks too dirty, dull or dangerous for human reporters (Takayama et al., 2008). [22] Examples outside the journalism frame include mine detection in conflict zones, disposal of nuclear waste, deep-sea mining, underwater equipment repair and potential package delivery for retail outlets.

Although softbots are currently used in journalism for such data-driven functions as information aggregation and predictive analytics, service robots are contemplated for future use in the newsroom to act on such appraisals as that of the European Robotics Association that 'no human being is as precise and fast as a robot' (2012). Outfitted with a wide variety of sensors, service robots can learn about their physical environment and use that information to navigate physical space in the newsroom while making work-related decisions. For example, the Georgia Institute of Technology is developing soft skin for service robots to enable them, among other functions, to respond in socially acceptable ways to sharing cluttered space with their human counterparts (Ackerman 2016). [23] Through awareness of the haptic properties of the objects that a robot is likely to touch, developers can devise intelligent manipulation strategies, such as pushing a hard object with more force than a soft one, or using a lighter touch for contact with a human than a door. Less autonomous robots, such as the Rhombus used to vacuum floors, has no ambient awareness to tell it whether it is bumping into a human leg or a table leg.

Robotics comprises an important science in the 21st century. Its key purpose is to deliver human service via computerized machines that are accurate, speedy and cost effective. Robots are not programmed to tire, complain, lobby for working conditions, contradict their principals, or exhibit bias. [24] According to computer automation researchers Turcu and Turcu (2012), we are currently in the fourth generation of robots: the first models were designed to repeatedly move parts in and out of machines, as in the assembly of automobile components. Second generation robots were programmed to perform tasks in hostile environments such as radioactive laboratories, polluted oceans, battlefields and extra-terrestrial environments; third-generation robots were developed to perform advanced manoeuvres including speech recognition and synthesis capabilities, homing and predator versus prey manoeuvres. Now in the fourth age, millennial programmer-journalists improve on those capabilities using such features as AI, self-assembly, self-replication and nano-sized technology (84).

Legacy news organizations were early adopters of social science fact gathering. [25] In the 1970s media companies looked to computer-assisted reporting for 'precision journalism' or the pursuit of accuracy and objectivity by utilizing databases, surveys and social science (Applegren and Nygren 2014). Philip Meyer, professor emeritus at the University of North Carolina, pioneered the melding of social science quantitative research methods with journalism in his Pulitzer-prize winning coverage of the 1967 Detroit race riots that led to 43 deaths. [26] Meyer shared his belief that 'journalists who report major stories need major tools' with British reporters investigating the 2011 London and Tottenham riots (Meyer 2011; 1991; 1973). Meyer compares journalism in 1967, when information was comparatively scarce and reporters were content to work 'in hunter-gather mode', with today's never ending stream of data that makes paramount a journalist's need to explain. The human component is in making contributions to method, not the machinery, Meyer proposes.

By the first decade of the new millennium, algorithmically compiled data comprised an unquantifiable body of information on just about ever subject imaginable (boyd and Crawford 2012). Robots could access new forms of data to produce stories using human syntax and vocabulary (Carlson 2015). They also provide new sources of information and new techniques for accessing, analysing and disseminating such data, what has been characterized as the 'social shaping of technology' (Dutton 2012).

The sheer quantum of data necessitates robotic assistance. How much data is out there for their use? Big data scholars Kenneth Cukier and Viktor Mayer-Schonberger suggested in 2013 that if all the information collected in the world so far were placed on CDs and stacked in a vertical pile, they would form five separate piles that would each reach the moon. Big data alters traditional statistical methods of sampling and extrapolation with three new ingredients: very, very large amounts of data, the comfort of analysts with messiness rather than the highly curated data statisticians prefer, and the replacement of accuracy with the concept of correlation, a research method at which algorithms are particularly adept. For journalists, that shift refocuses story writing onto how things happen, not why (Cukier and Mayer-Schonberger 2013). For example, when programmers of driverless cars want to teach them the mechanics of street driving, they might feed enough data into the computer to allow its programs to infer the probability that a yellow traffic light means proceed with caution, not stop.

As computers get smarter about their data-gathering capabilities, the next question becomes, how do we sort through that data for meaningfully newswriting? Many are familiar with the observation of American futurist thinker John Naisbitt as early as 1988 that we are drowning in information but starving for knowledge. Young and Hermida (2015) faced that dilemma when examining computationally generated crime news or 'robo-posts' designed to track local homicides at The Los Angeles Times. That assemblage raised questions about how decisions on what to include or exclude were made, whose values those decisions reinforced and what values become 'embedded into the technology' (384). [27] Luciano Floridi reasons that, with their need to interpret the data that computers collect, humans serve as 'semantic engines', transforming computer language so that both machines and humans can collaborate over one project. He notes we still call the arrangement 'human-based computation', however, as long as we continually test for the human factor with such automated programs as the Completely Automated Public Turing test to tell Computers and Humans Apart (CAPTCHA) test (2014, 146).

Robotically compiled data can serve as the source of a story or be the story itself, like the Wordsmith contest. Algorithmically produced news stories might be generated in-house or, increasingly, outsourced to web companies like Automated Insights that developed the Wordsmith model. The output of such companies can be widespread and prodigious. Narrative Science, for example, announced in 2012 that its computers produce a story every 30 seconds. Another news company reports it has been producing news stories since 2014 (Gleyo 2015); notably, Associated Press, a purchaser of such automated stories, advertises its services as 'the definitive source' of news, a distinction reserved in former days for the human journalist (Colford 2014).

Increasingly robots go beyond collaborative tasks: they use sensors to uncover anomalies, to focus on correlations and to make creative associations (Pitt 2014), skills that mimic human perception, memory, spatial abilities and reasoning. [28] Humans contribute new talents as well: developing and programming the robot with natural language software to convert data into stories humans can comprehend; [29] using machine learning to personalize a news feed; editing computer generated drafts; and correcting faulty algorithms (Roso 2016).

On the business side, media organizations might use big data for making financial projections and organizational decisions. None of those activities mimics a traditional news organization: accumulatively they represent a novel approach to 'assumptions about how news and public life intersect' (Ananny and Crawford 2014, 194). The journalism team is evolving into a hybrid work unit that can navigate content and find significant outlier patterns that non-experts do not see. Data journalism, then, is moving increasingly towards 'the process of telling stories with data' (Strikeleather 2013).

There has been much debate over how algorithmic computations fit into the normative notion of journalism as vital to democratic life (Lewis 2015, 869). [30] Hamilton and Turner argue that journalism is still a profession and the human factor is still needed to assist the algorithm in sustaining the societal watchdog function (2009). Collaboration is necessary because algorithms have no social valence, no ability to generate sources or pick up leads where people congregate. Ken Doctor notes that the human factor will always make the big decisions: when trying to sort out the correlation between fake-news on Facebook and Google sites and the Donald Trump win of the 45th US presidential election in November, 2016, he concluded, 'Either you have human beings, a.k.a. editors, making those decisions, or you have algorithms making those decisions. And who writes the algorithms? People (Doctor 2016).'

That message is reinforced by Columbia University's Tow Center for Digital Journalism in its Guide to Automated Journalism (Graefe 2016). It highlights the salient features of automated reporting, suggesting it is most useful in generating routine stories for repetitive topics for which accurate, structured data are available and for generating news faster, at a larger scale, and with fewer errors. Human collaboration is needed, however, to overcome machine limitations such as over-reliance on data; assumptions that might be subject to biases and errors; inability of robots to ask questions, explain new phenomena or establish causality; and the limits of robots to observe society and its behaviours.

II. THEORIZING HUMAN-ROBOT WORK: MORE ADAPTIVE THAN DISRUPTIVE

In theorizing the robot, an important debate emerges: whether the introduction of innovation into human-machine relationships is most accurately described as disruptive and fractious with past realities or as yet another progressive step in a series of evolving changes to which humans must adapt. When we take the 'disruptive' view, in the sense that Harvard Business School academic Clayton Christensen originally promoted, we are reinforcing the idea that novel robotic functions disturb, rather than complement, human objectives. An alternate view would be that gradual or adaptive evolution occurs to incorporate changes into the human-machine collaboration. Making that distinction provides an important indicator of whether exceptionalist arguments prevail and new systems of law must be created or existing sources of law are sufficient to design a legal framework for cognitive journalism.

A. ROBOTS AS DISRUPTIVE INNOVATION

MIT historian Bruce Mazlish promoted the concept of the fourth discontinuity, or man's refusal to understand and accept his own nature as continuous with the tools and machines he constructs. [31] We see an emerging thesis that human-machine relations are complicated by our relentless efforts to humanize the algorithm and to maintain control over its functions. Mazlish admits that 'we cannot think realistically any longer of the human species without a machine,' but identifies ego as the factor that keeps us thinking of ourselves as distinct from, and superior to the machine (1993, 6). Mazlish proposes that once humans overcome pride and the need for dominance over 'thinking machines', we will recognize the continuity of one with the other as seen in the mirroring of the working of the human brain in our machines. Surpassing that impediment, we are able to decide more consciously how we wish to deal with our machines (5).

The term 'disruptive innovation', as introduced by Clayton Christensen and as subsequently applied by others to most major improvements in communications technology, posited that the most well established companies would almost inevitably fail because they miss out on new waves of innovation (1996). Christensen now believes that his core tenets of the disruptive innovation theory he introduced almost 20 years ago are widely misunderstood and misapplied (Christensen et al., 1997, 2015). He has confined his idea of 'disruption' to a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses with an innovative product. It does this by successfully targeting segments of the market that incumbents overlook when they focus on improving their products and services for their more demanding customers. The smaller company delivers more-suitable functionality and, frequently, at a lower price. Incumbents, chasing higher profitability in more-demanding segments, tend not to respond vigorously. Entrants then move up the market to replace the incumbent (2015).

Researchers in today's journalism field are proving that Christensen's perception of being misunderstood is correct in many cases. From drones to Wordsmith, algorithms are being cast as disruptive for their swift displacement of previous allocations of labour and expertise. The variety of application can be seen in one 2016 edition of the peer reviewed journal Digital Journalism where the term is used variously to describe drone use for journalism (Gynnild), the embedding of start-ups in the newsroom (Boyels) and the incorporation by journalists of social media into news dissemination (Chadha and Wells). The term is used to apply to the technological potential to 'disrupt the status quo, alter the way people live and work, and rearrange value pools' (Manyika et al. 2013). It is being used to describe novel analysis of what is trending in real-time, such as Dataminr, a US-based program that analyzes Twitter's full stream of tweets flowing from all over the world (25); and robotic writers used by Forbes or The Los Angeles Times to file short breaking stories such as earthquake tremors or a local bank robbery (Ramos 2014, 26). Through misapplication, the term loses its precision and utility.

Daniel Katz warns we are too quick to assume continuity as well (2013, 919) because the ground is rapidly shifting and 'peril and possibility, as well as disruption, are fundamental features of our times'. [32] Professor David Lane, the founder director for the Edinburgh Centre for Robotics, gives a different reason for our growing confusion over when to correctly apply the term. He suggests we do not know disruptive technology when we see it because 'the technology is going to market to address a set of requirements which may not yet exist', needs the customer might not know they require (Lea 2016). Innovation might be a remarkable detour from what is currently dominating the field, but if it does not garner public acceptance we cannot accurately describe it as 'disruptive' in the Christensen sense. A current example is driverless cars, a technological advancement on which the jury of public opinion is still out regarding its utility to replace people-driven cars.

B. ROBOTS AS CONTINUOUS EVOLUTION

Adaptive evolution involves changes to adjust to specific challenges in the environment, such as survivorship. Alan Turing (1950) made the first proposal that Darwinian selection could produce efficient intelligent machines, capable of adaptation and learning that would have been too difficult to conceive by a human designer (1950). Turing maintained that those machines could be created through an evolutionary process that involved mutations and selective reproduction. The first experiments on the evolution of adaptive behaviours for autonomous robots were done in the early 1990s.

Proponents of the continuity theory of machines include H.G. Wells who referred in the 1930s to the emergence of the computer in the modern world as an answer to our yearnings for a 'world brain'; Vannevar Bush in the 1940s speaking of an 'arithmetical machine of the future'; [33] and the prediction of J.C.R. Licklider in the 1960s of 'man-computer symbiosis'. [34] Those pioneers of modern communications envisioned man-computer cooperation beyond the mere compilation and storage of very large masses of information, what today we unimaginatively label Big Data. Licklider in particular advocated human-machine collaboration that would enable decision-making as problems and variables emerged, not as a pre-set computer function (1960, 4-11). He promoted human-computer symbiosis as an augmentation of human intellect that was relieved from mundane, administrative tasks. As Wells presciently noted, 'The whole human memory can be, and probably in a short time will be, made accessible to every individual.' [35] He envisioned human intelligence developing a 'new world organ for the collection, indexing, summarising and release of knowledge…to pull the mind of the world together.' [36]

One behavioural change ushered in by data journalism is that consumers are becoming more social. That transformation did not occur overnight, but has evolved from the social media industry capturing market share by introducing mobility, attribution and sharing of personal information that was being shared in other ways. Computer scientist Alex Pentland recognizes news ways of sharing in our digital footprints that offer evidence of who we are through 'the little data breadcrumbs that you leave behind you as you move around in the world' (2012). He suggests that that information is more revealing than all our postings on Facebook because it is by studying how we are connected to other people via machines that we can learn about markets, governments and other social structures.

News organizations use that social data for ongoing news personalisation, the machine sorting and collating of all imaginable digital sources to learn which news items would appeal to particular subscribers at any one time (Cassidy 2016). Mark Zuckerberg explains his rationale for introducing personalisation to Facebook Newsfeed: "A squirrel dying in front of your house may be more relevant to your interests right now than people dying in Africa" (LeCompte 2015). What Zuckerberg is not factoring into his explanation is that your neighbour, who might also want to know more about the squirrel, could be receiving a completely different inventory of top news stories, depending on interests gleaned from her search history. Larger repercussions of news personalisation include the diminished scope of news coverage, machine bias and violations of personal data privacy.

Canadian media theorist Marshall McLuhan viewed communications media in the 1960s as continuous with previous discoveries, but also with human physiology. He proposed that all media were extensions of some physical, social, psychological, or intellectual function of humans: automobiles were extensions of our feet, telephones were extensions of our ears, and computers served as extensions of our central nervous system (Bobbitt 2011; McLuhan 1994, 90). Those concepts, while familiar to most Communications Studies students today, were revolutionary in the 1960s.

In the legal context, the theory of adaptive evolution can be seen in our consultation with legal precedent and existing sources of law when devising a regulatory response to the harms to humans perpetuated by robotic reporters.

C. HUMAN-MACHINE COLLABORATIONS: WHAT'S THE HARM?

Journalism robots are not completely autonomous at this point, either the disembodied type or drones. [37] They need humans to minimize their mistakes and thereby engender trust in their collaborations and in the news product. Latar describes the poorer performance when algorithms work alone: although data-mining algorithms discover new connections between many variables with very high statistical significance due to the immense size of data sets, the results can be meaningless and add no real value, or lead to wrong conclusions (2015). False results can be a function of incorrect questions, inaccurate data or faulty procedures.

Machine error can cause alarm and cost money. For example, in May of 2015 earthquake sensors on a computerized detection system misread data from the United States Geological Survey and reported an earthquake with a 5.1 magnitude occurring in Redding California (San Francisco CBS Local 2015). A similar machine error occurred when a Google softbot located an archived report that United Airlines had filed for bankruptcy and disseminated it widely six years later. UAL stocks plummeted as a result (Zetter 2008).

AI developers strive to give an impression of human participation in data journalism in order to instil in the public a sense of confidence and trust in accuracy of the news. Engineers continue to develop programs that not only anthropomorphise the robot but humanise it, for example by enabling it to dream (LaFrance 2015), to compose music (Bentley 2016), and to defeat humans in abstract strategy games (Anthony 2016). Swedish media researcher Christer Clerwall has studied the qualities that would infuse an automated news story with sufficient humanity to generate trust and confidence in a discriminating consumer (2014). He showed students a sports report with text written either by a human journalist or robot-generated text. [38] Participants were asked to characterise the text as human generated or robot-written using 12 descriptors, including 'trustworthy', 'well written', 'boring' and 'coherent' (534). [39] Over a third mistook machine writing for human. Of a further 19 who read a human-authored article, ten thought it was the product of a softbot. Further, the human authored text scored higher on such indicators as coherence, clarity and being 'pleasant to read' but robot-engendered text scored higher on credibility indicators such as trustworthy, objective and accurate (525). Those results suggest that machine-written stories that machine-written stories have reached sufficient sophistication in journalistic style to be used interchangeably with those that are human authored.

Although today's computer code can be opened and inspected for mistakes or the basis for its decisions, big-data analysis using cognitive functioning makes this tracing increasingly challenging for human understanding. Cukier and Mayer-Schonberger (2013) offer an example of the scale of the problem: in a Google search on influenza or 'flu', Google would identify the correlation between a handful of search terms and 'the flu' by testing 450 million mathematical models. Human competencies cannot manage those numbers without computer input; their talents are best used to program machines to do so.

As robots become increasingly common in daily life, there will be a corresponding growth in the rate of mistakes and accidents. Flew et al. (2012) suggest typical software-generated errors include 'statistical anomalies, a lack of sense, misinterpretations, conflicting data standards, incomplete data [and] skewed results (10).' Other mistakes include cases where algorithms are programmed as gatekeepers for accepting or rejecting data for news portals and they accept stories that are out-dated or falsified. Such 'fake news' stories fabricated by social media amateurs and posted on well-known sites were revealed in the aftermath of the US 2016 Presidential elections. False accounts related to both Republicans (announcing that Donald Trump obtained the endorsement of Pope Francis) [40] and Democrats (with stories that a pizzeria had served as a site of child abuse spearheaded by Hillary Clinton). [41] In those cases the robotic error was that algorithms were too non-discriminating as gatekeepers.

The questions for policy thinkers and lawmakers arising from those algorithm-induced errors include: 1) can current laws comfortably incorporate new machines or do we need to create new legal constructions or even new legal persons; and 2) under what conditions could non-human entities be found liable for harm to humans (Koops et al. 2010). The following section considers those questions.

III. LEGAL MODELS AND PROFESSIONAL PRINCIPLES AVAILABLE TO RESPOND TO HARM

As robots grow cognitively more agile, distinguishing human from machine roles becomes a complex task. Assigning liability, or finding fault in a criminal case, raises basic questions about legal personhood, agency, intent and, more broadly, potential shifts in power and social responsibility. If we are to construct a new framework for a law of robotics, it must strike a balance between the need to protect consumers of robot technology and society's need to encourage innovation. If too restrictive, a legal framework deters innovation; if too broad, citizens are exposed to unnecessary risk.

Computational errors in journalism erode public trust in the news as factual and reveal unpredictability in machine functioning that conveys uncertainty. As Surden and Williams make clear, law functions best in a climate of predictability; ironically, law is most needed when unpredictable or unforeseeable events occur (2016). In cyberlaw, Internet law and now technology law, legal actors are often tasked with accommodating new realities while 'proclaiming fidelity to the past' (Sarat et al. 2012). [42] Unlike Internet technology itself, developments in technology law will be most effective if continuous, not disruptive. It then becomes law's role to codify acceptable patterns of behaviour that restore its predictability and hence legitimacy (Surden and Williams 2016, 166).

Richards and Smart (2013) suggest we begin with the basic question, 'How should the law think about robots?' They caution that 1) we should not think in android terms because that focuses on what the robot is not; 2) we need to focus regulation on function rather than form; [43] and 3) we can learn from cyberlaw for what it teaches about applying law to technology.

In both the common law and civil law traditions, legal personhood and hence rights and responsibilities for machines can be assigned depending on the degree of autonomy or independence of action that the machine possesses. Our laws in western democracies have expanded to recognize legal persons as juridical persons, or those entities able to participate in the judicial process as corporations, estates, municipalities, trusts, families, unions and even ships. [44] When assigning personhood to robots, Koops et al. suggest the deciding factor should be 'at what point does it make sense to attribute legal consequence to the entity itself, rather than the human actor behind it?' (2013, 511). For robots, then, we need to assign legal personhood according to 'the conditions under which such [legal] attribution solves problems without creating even greater ones' (512).

Another way to attach legal personhood is to consider the principal and agent model. For example, hypothetically a softbot could be viewed as an agent of a human journalist for purposes of researching and analyzing data, writing up a report and, if the human journalist waives the editing function, delivering the results to a third party. To the extent that robots are recognized as legal persons, the softbot could be sued for breach of contract for any key parts of the assignment left unfulfilled or incorrectly done. If that softbot were then to use more cognition in its functions, defined above as learning from prior mistakes without human intervention, its legal liability would increase. One answer would be to use algorithmic controls that are built-in by design, a situation where code becomes law (Lessig 2000).

Tort law provides another source of legal precedent, if robotic functioning can be attributed a measure of foreseeability. If so, the actions of the robot must not only be negligent but be the proximate cause of the injury. Foreseeability remains a necessary factor even in strict liability cases. There will be situations, particularly as semi-autonomous systems interact with one another in more cognitive ways, where robotic action will surprise the humans involved (Calo 2015, 555). Should those systems prove deeply useful to society, as many envision, some other formulation than foreseeability might be necessary to assign liability. Calo suggests that, with many systems operating together in modern technologies, chances of them responding unpredictably to one another are quite high.

In this section we examine policy initiatives of two leaders in the world of robotic technologies, the EU and the US, for indicators of how robots and other technologies might be controlled by law. The comparison reveals that European legal culture puts value on human dignity and identity in the human-computer interaction. European lawmaking promotes the ideal that restoration of one's dignity can only be achieved by keeping humans in the system. That is a particularly salient lesson for those who promote datafication and commodification of personal data as US technologies are programmed to do. In America, the lack of federal laws on data protection, the patchwork effect produced by various state laws, and the emphasis in policymaking on innovation and co-robotic collaboration produces an entirely different climate for humans in the loop.

A. EUROPEAN INITIATIVES - A UNIFIED APPROACH

I. HUMAN DIGNITY AND IDENTITY ARE PARAMOUNT

The European Commission's RoboLaw project, operating throughout the EU from 2012 to 2014, aimed at providing a comprehensive and unified framework for developing a law of robotics through an examination of existing laws and regulations in the European Union (Robolaw 2014). The overall tone of the project was continuity with past legal principles that also marked the European Commission's approach to robotic technological evolution. Methodology included public surveys, questionnaires, workshops, interviews and consultations with experts. The RoboLaw reports were presented to the European Commission in 2014 for review and referral to the European Parliament on behalf of all EU membership.

While Robolaw prototypes focused on biological needs, it also included robots that are used in the journalism profession. The project reached the following general conclusions: 1) the guiding principle of any robotics law is to protect the dignity and identity of humans; 2) robots are best defined by their function; 3) for certain types of robotics, regulation can be achieved by 'smart' adaptation of existing laws; and 4) prototypes for laws can be found in environmental or product liability law. The authors called for a taxonomy of robots based upon their level of embodiment and autonomy, function, environment, and degree of human-robot interaction. The authors concluded that any regulatory system should be proactive and combine such tools as legal rules, technical norms and standards, codes of conduct and good practices.

Those guidelines focus on 'the human in the loop' as Meg Leta Jones notes, an approach that promotes legal and societal values already contained in several international treaties shared among EU member states and other signatories from the international community (2016, 3). [45] The RoboLaw initiative, then, seeks to perpetuate legal norms already encoded in international law and to maintain the paramount value of human dignity, personhood and data privacy.

The Robolaw report concludes that three factors complicate enforcement of such laws: 1) the technology of robotics dictates transnational efforts, spread over several jurisdictions; 2) conventional legal instruments cannot at all times capture the shifting and transformative nature of robotic innovation; and hence 3) soft law is a preferred method for implementation so compliance must be voluntary. Underscoring all implementation will be the guiding principles of the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights. [46]

Other contributions to European rulemaking for and about robots include guidelines devised in 2011 by two British research agencies, the Engineering and Physical Sciences Research Council (EPSRC) and the Arts and Humanities Research Council. Those agencies show familiarity in their policies with the seminal robot laws advanced by science fiction author Isaac Asimov [47] on human-robot relations in the crafting of their five ethical principles for designers, builders and users of robots: 1) robots should not be designed solely or primarily to kill or harm humans; 2) humans are responsible agents while robots are tools designed to achieve human goals; 3) robots should be designed in ways that assure their safety and security; 4) robots are artefacts; they should not be designed to exploit vulnerable users by evoking an emotional response or dependency; in other words, it should always be possible to tell a robot from a human; and 5) it should always be possible to find out who is legally responsible for a robot (EPSRC Principles). [48]

A consistent theme in both the Robolaw report and the EPSRC report is the reductionist view that robots are tools, not to be viewed in human terms; also stressed is that legal rules are to be directed at robotics, not at robots per se, given their lack of legal personhood. Both reports conclude that regulating innovation poses novel challenges: robots will most assuredly find themselves in circumstances that developers could not have predicted and that current laws do not address, primarily because robotic autonomy brings in the Internet of Things and big data, 'both of which have presented challenges for industry, regulators and privacy advocates,' (ESPRC Report).

II. REGULATING THE RESPONSIBILITY GAP

When robots act independent of humans, there is always a risk that no human will be responsible for what that autonomous actor will do. That has come to be called the responsibility gap by technology scholars (Koops et al. 2010; Naftali and Triger 2013). It is often caused by the lightening speed of technological development that leaves legal policymakers constantly playing catch-up as automated processes march towards self-improvement. As Marchant et al. note with respect to the nanotechnology field, 'It is difficult if not impossible for a slow-moving regulatory apparatus to take aim against such a fast-moving target' (2010, 130).

An example of law being outpaced by technological progress include accounts of law enforcers equivocating over whom to ticket when self-driving cars create traffic snarls (Harris 2016) or Google softbots recycling out-dated bankruptcy news regarding United Airlines, as discussed above (Zetter 2008; *see generally* Marchant et al. 2013). In such cases, legal and moral ethicists have argued that unexpected risks militate against unfettered development of autonomous agents. It is better for assigning liability, so goes the argument, to stick to the reductionist view and assign responsibility and liability to humans. In extreme cases, such as with autonomous war drones, the end point of the argument is that technology cannot be trusted with human life and death decisions (Ben-Mukerki 2016).

III. A SOFT LAW APPROACH IS PREFERRED

Soft law, as proposed by the Robolaw initiative, advocates voluntary and cooperative measures rather than hard law command-and-control terms. It is particularly more flexible when dealing with the uncertain benefits and risks offered by evolving technologies. In areas of rapid technological invention where there is no clear path for traditional regulation, soft law permits the important benefits of experimentation and graduated action (Marchant et al. 2010). As Ian Ayres and John Braithwaite observed almost 25 years ago, the interplay of industry associations, firms, peers and individual consciences 'works to assist or impede the policy problem (1992, 3).'

The Robolaw project called for a different legal perspective on regulation, moving from 'the regulation of the technology to forms of regulating human behavior *with* technology' (van den Berg 2011). An example of 'techno-regulation' would be to infuse driverless car components with regulation by design features such as speed limits, confinement to certain types of terrain or allowing operation only under predetermined ambient light conditions (Robolaw Guidelines 6.2, 49). What soft law might deliver that normal regulation cannot is a legal paradigm focussing not only on regulatory responses invoked in users, but also 'on the ways in which designers (intentionally, but often also tacitly) incorporate values, stereotypes and norms' into their inventions (van den Berg, 2011). Such values can be seen in design choices of engineers and manufacturers that are 'safe', 'efficient', 'sustainable' and 'user-friendly' (van der Poel, 2009). Another mechanism of soft law would be a government sponsored certification regime, as suggested by Marchant et al. (2010).

A softlaw tool for robot journalism might be the establishment of routinized procedures offering human review of machine authored stories prior to publication or the injection into programming elements of algorithms that promote certain word choices or that block certain topics. Criticisms of the soft law approach, directed at the nanotechnology sector in particular, include difficulty in attracting industry buy-in, failure to produce sufficient data on an industry-wide scale to meaningfully assess its potential and a failure to achieve credibility in the eyes of relevant constituencies (Marchant et al 2010, 134).

B. US INITIATIVES - A SECTORAL APPROACH

The US has historically preferred less harmonized lawmaking as adopted with the EU centrist model. There appears to be no discrete federal law or any centralized agency regulating robotic journalism or human-machine interactions on a broader basis, although a federal robotic commission has been vigorously suggested (Bleiberg 2014; Calo 2014). When writing a news story with robotic-compiled data, for example, a human journalist concerned about data privacy is best to consult several statutes, including the Gramm-Leach-Bliley Act [49] for personal data use related to financial products; the Health Insurance Portability and Accountability Act [50] if they want to consult personal health data; the Children's Online Privacy Protection Act [51] for personal data regarding minors; as well as the Cable Communications Policy Act [52] and the Privacy Act of 1974 [53] and state laws such as the California Online Privacy Protection Act. [54] Such an uneven regulatory landscape creates uncertainty of outcome and choice of law and jurisdictional issues. One legitimate concern with such legal sectoralisation is that the government 'lacks expertise in robotics, and because of its piecemeal approach to the subject, it is not accruing that expertise fast enough' (Calo 2014). In calling for the creation of a federal agency to advise on robot regulation, Calo is targeting the lack of dialogue among US authorities on the common legal elements involving drones, driverless cars and other robotic innovations.

An American policy initiative similar in aim to the European RoboLaw program is the National Robotics Initiative (NRI) funded by several US government agencies and administrated by the National Science Foundation. The NRI originally promoted 'co-robotic' activity in 2012 involving one-human-to-one-robot tasks or small group activities where robots would work in 'symbiotic relationships with human partners' that recalls Licklider's man-computer symbiosis theory. [55] Co-robots (collaborative robots) could be distinguished from robots of the past by their improvements in situational understanding and resourcefulness 'due, in part, to the use of real-world data in real time' (NRI Project NSF 12607, Introduction). That focus was modified in 2016 to 'Ubiquitous Collaborative Robots' to reflect the immense scale of human-robotic collaborations offered by emerging innovation (NSF Project #17518). [56] One objective was that robotic design would facilitate a variety of tasks in various environments, with minimal modification to the hardware and software. Robots would be more effective, efficient, and reliable using large pools of information from the Cloud, other robots, and other people (NSF Project #17-518, Summary of Program Requirements). Co-robots would be designed to operate with ever-increasing levels of intelligence, safety and autonomy in unstructured, human-dominated environments and aimed at achieving levels of intelligence and adaptability seen only in animals and humans. Benefits to humans include access to robots that are relatively cheap, easy to operate and readily available.

Unlike the EU Robolaw Initiative, the NRI stresses the effectiveness, affordability and accessibility of the robot, not protection of the human collaborator. Although a concern for maintaining human employment is mentioned in the NRI guidelines, idealistic concerns for human dignity or identity are not.

I. CO-ROBOTS ARE THE FUTURE

Recent additions to the original NRI expand the co-robot theme in terms of the scale and variety of interactions that would be available. Authors of the NRI project are calling for co-robots that would be ubiquitous, commonplace, and integrated into general use of automobiles, computers, and cell phones. The NRI 2.0 program envisions 'teams of humans and co-robots, large and small, reliably and efficiently cooperating on tasks.' That means that robots, both embodied and virtual, need to be personalised and customised to the human collaborator as well as having capabilities for self-diagnosis and self-repair. The goal is to democratise robotics and transform industries, supporting 'a renaissance in American manufacturing' to benefit the individual and (American) society (Program Solicitation, NSF 17-518, Introduction). Jones notes that, while Europeans have put pen to paper regarding what they wish to protect and how to achieve it through technological innovation, Americans are more focused on the 'computable and the computational' as aspiration (2016, 3). [57] She sees the transatlantic divide growing with each new digital device and platform (2015).

II. TRUST IN HUMAN-MACHINE INTERACTIONS IS PRIORITIZED

Research into trust within the human-robot relationship is central to NRI objectives. Researching trust from the following perspectives highlights which aspects of human-robotic interactions are of particular interest to NRI funders: 1) social cues such as humanoid appearance, voice and personality; (2) physical 'embodiment' features versus non-physical features to determine which have the most influence on human trust and performance; (3) human intent and cognitive and affective states, as studied through workload, stress, fatigue and fear; (4) indicators of high-performing human-robot teamwork, as observed from teammate monitoring, shared mental models, coordination and negotiation; (5) investigations into the effectiveness of various models of human-robot interaction, such as delegation and supervisory control; and (6) practical methods for robotic systems to sense and measure human trust and changes in trust over time (NRI II.A.3. Sponsoring Agency Mission-Specific Research).

An update on the NRI initiative was provided in October of 2016 with the U.S. Robotics Roadmap calling for better policy frameworks for integrating new technologies into everyday life in America. Self-driving cars and commercial drones were specifically mentioned as high priority, as was research into using robotics to develop intelligent machines that would 'empower people to stay in their homes as they age.' (University of San Diego 2016).

C. DRONES, CLONES AND AUTOMOBILES: LESSONS FOR ROBOT JOURNALISM

Additional lessons for drafting robot laws can be gleaned from rules devised to regulate recent inventions such as drones, biological clones, driverless cars and nanotechnology. This section will discuss emerging legal norms in those areas for what they can offer a law of robotic technology.

I. DRONE LAWS

Laws addressing technological automation differ according to how the risks to mankind are perceived. For example, drones or small unmanned aircraft systems (sUAS) are regulated by the airline industries in the US and Europe due to the challenges they present to air safety, although their increasing travel across geopolitical borders has initiated discussions on amending international treaties dealing with road safety. [58]

Drones are attracting considerable attention within the news industry, due to the access to developing news stories they offer to human journalists unable to gain entry to particular physical terrain. A certain human urgency to regulate accompanies their market entry because they inhabit human physical space, thereby increasing the likelihood of error and physical threats to human security and privacy.

Other robotic machines are being developed that hold potential to assist newsgathering in various real-time scenarios; for example, researchers at Harvard and MIT have recently build a robot that assembles itself into a complex shape in just four minutes and can quickly crawl away without human intervention (Noor 2014, 83). If that robot were equipped with data gathering components it could evolve into a valuable field reporting tool for eyewitness journalism.

Noor describes the evolution of drones from automated vehicles to cognitive systems. Whereas automated sUAVs have pre-determined behaviour, and are controlled by humans, cognitive sUAVs make decisions that involve non-deterministic, stochastic, and emergent behaviours. Their actions are neither pre-planned nor pre-programmed. That gives them more flexibility of action, which also could translate into safer operations and less risk of human harm (2014, 82). It could also signal greater human danger, however, should cognitive decision making divert actions outside the human safety zone.

In Europe, using drones within European airspace provides an increasingly popular method of surveillance and fact-gathering for news reporters. Initial rules by the European Aviation Safety Agency (EASA) mirrored those in the US in that they regulated drones according to weight and other physical characteristics. They did not distinguish between commercial and personal use drones. With gaps in certain areas of drone regulation due to the rapid pace of technological innovations, laws in each EU member state arose and have produced an uneven regulatory terrain across Europe. The EASA definition of drones is quite wide, as it regulates all remotely piloted and autonomous aircraft weighing over 150 kilograms in the same manner as larger manned aircraft.

Proposed amendments would address 'unmanned aircraft' only, remove weight as a restriction and focus on 'how' and under 'what conditions' the drone is used (EASA 2015, 2). In other words, it categorizes use according to risk to third parties and to property. EASA explains that risk is not always related to weight: a large manned aircraft traversing an ocean is less risk than a smaller drone flying over a populated sports stadium. Data protection and privacy issues regarding the information collected by drones are not addressed because there is a data protection regime already in place.

In America, drone oversight initially operated under the principle that 'everything is permitted unless prohibited,' (Walker 2014). [59] Regulation within the US originally covered three legal regimes: the 1949 Geneva Convention on Road Traffic, regulations enacted by the National Highway Traffic Safety Administration (NHTSA), and the vehicle codes at the state level. Commercial drones, including those used for journalism purposes, came under new Federal Aviation Agency (FAA) authority in June of 2016 as sUAS regulated by weight. [60] Drones must weigh less than 55 pounds, must limit altitude to 400 feet, speed to 100 miles per hour, and operations to daylight hours plus 30 minutes before sunrise and after sunset. Operators of sUAS must also qualify for flying certificates and be at least 16 years of age. Compliance is possible, therefore, for staff of media giants and citizen journalists alike. There are no mandatory insurance requirements for their operation at present and private lawsuits involve human parties only.

II. HUMAN CLONING

Although drone and driverless vehicle laws stimulate thinking about human-machine relations involving what Mazlish called the fourth discontinuity or displacement of human control by scientific discoveries, [61] legal norms involving biological cloning raise more fundamental rights questions. Cloning deals with the 'theoretical inevitability' of the forward march of scientific advancement, either removing the human factor from the loop regarding conception or being forced to define the lawful limits of technological participation in an essential human act of creation (Foley 2009, 44). Through an explication of scientific thinking and practices we are required to justify our ethical and moral lines in the sand. Defining those limits does not produce uniform consensus but can be instrumental in examining what risks arise for humans and how law can provide protections. Robotic use triggers similar questions about how scientific innovation forces decisions with moral, ethical and political implications.

Cloning laws might also assist robot lawmakers in clarifying legal personhood: contentious issues include identifying when a human clone or reproduced organ gains viability and hence human-related identity and determining how to legislate human creation to avoid genetic mistakes and aberrations we are not prepared to live with. Those concerns involve politically controversial ideas often mixed with religious, moral, medical, social, and legal disagreement. This makes it too difficult for the political branches of government to develop an international consensus on regulating assisted reproduction and so regulation around the world varies in kind and degree from one nation to another (Kindregan and McBrien 2011, 31ff). Should policymakers and regulators hedge on establishing clear guidelines, lawyers and judges will be left to clarify those issues through common-law or equitable reasoning and arrive at solutions on a case-by-case basis.

III. DRIVERLESS VEHICLES [62]

It is with driverless cars that we might find the closest affinity to journalism robots, in terms of available legal norms. One commonality is that humans are still present but with a reduced mediation role.

Cars now have at least two levels of automation: they can have automated functions like cruise control, which regulates speed, supervised by the driver who remains in active control; or they can be autonomous meaning that the vehicle itself is making decisions without input from the driver. They can also be fitted for vehicle-to-vehicle and vehicle-to-infrastructure capabilities that have their own potential to reduce the number and severity of accidents (US Department of Transport 2015). [63] For each of those arrangements, policymakers must consider laws that address resultant risk and liability.

While there is no uniform federal US law addressing driverless cars at present except regarding safety features for test driving, at the international level there is a proposed amendment to the 1968 Vienna Convention on Road Traffic to include transborder driverless vehicles in its registration and fitness for transport standards as contained in the US preliminary policy statement on automated vehicles by the National Highway Traffic Safety Administration (NCSL 2016). [64] There is also a similar policy statement by the US Department of Transport. [65] As well, several US states have laws regulating self-driving cars, including California where autonomous vehicles are allowed on the road provided a human driver is behind the wheel and alert. It is that driver that is ticketed for speeding or being impaired while behind the wheel, not the vehicle.

Driverless cars are being promoted as safer than vehicles with humans at the wheel but most journalists report both positive and negative outcomes of test drives (Keating 2015; Hirschauge 2015). [66] While there is general agreement that most models are convenient and generally reliable, they display confusion when making left turns or confronting police officers conducting traffic using hand signals, and are not safe in snow, heavy downpour or icy road conditions. Regulators would applaud such safety features as emergency braking before collisions and lane-departure alerts but have not, as of yet, produced a comprehensive regulatory regime.

Bryant Walker Smith of the University of South Carolina has determined that, in the absence of any federal laws on the subject, traveling in a driverless car under computer directed steering, braking and acceleration is probably legal in the US (2014). It is not the legalities that are keeping humans from endorsing the driverless idea wholeheartedly; it might be the vulnerability they anticipate when in a car they cannot control surrounded by other vehicles with human drivers (Muoio 2016). So, faced with the unpredictability of other human drivers and the unforeseeability of accidents by robotic drivers, regulators have time to decide whether hard law (as with drones), soft law (as with nanotechnology) or no law (as with human cloning in some jurisdictions) is preferable.

Simon Chesterman provides a few creative suggestions to make the driverless car more appealing. He proposes that insuring the vehicles rather than drivers could be an answer, and that strict liability standards be imposed on manufacturers - meaning responsibility for damage without having to demonstrate negligence on their part (2016, 3). He also suggests that a shift in public perception of driverless cars as a service rather than property to be owned could apportion legal liability among others involved in the design and manufacturing process. Chesterman points out the different legal repercussions when a driverless car is speeding due to a mechanical malfunction (in which case US civil laws would apportion compensation) and when information from the passenger's smart watch communicates an error signal to the robotic components in the car that he is having a heart attack. Liability would then become a question of who designed, manufactured or repaired the watch. Issues of agency and the defence of necessity might also come into play.

F. Patrick Hubbard of the University of Southern California notes that robots increasingly enjoy accelerating levels of autonomy, intelligence, and interconnectivity among themselves. He credits US policies for encouraging human-machine collaboration in physically shared spaces, even though it means a likely increase in liability risks. Above all, it will revolutionise manufacturing and introduce a much greater variety of shared tasks (2014). [67]

IV. NANOTECHNOLOGIES

The debate over regulating nanotechnologies carries salience for those looking to define law's role in human-robot interactions. Nanotechnology involves the manipulation and use of materials at the nanoscale; at that size materials tend to show greater activity than they do at the bulk scale. The exploitation of that unique property is 'fueling a frenzy of new products, processes and technologies' for cancer detection, cleaner energy and more efficient computers (Marchant et al 2010, 127). Ironically those benefits also create health and environmental risks that regulatory agencies want addressed.

Given the early stage of nanotechnology discovery, strategic choices must be made on how to approach regulation of the field: the level and scope of regulation; the legal and institutional form it will take; actors that will be involved; and the substantive particulars. Impediments to traditional regulation include 1) a lack of consensus on how to define 'nanotechnology'; 2) the runaway speed of technological advances (again, the regulation gap); 3) the questionable logic of basing regulation on size; and 4) the ongoing debate over whether health and industrial benefits should rule over human safety (131). As a result, although there are various soft law mechanisms for regulating nanotechnologies around the globe, [68] there are few compulsory, discrete laws. Those initiatives engender support within the industry to the extent they show benefits to developers and manufacturers that counterbalance the additional scrutiny soft laws would bring from regulators, journalists, NGOs and possibly plaintiffs' attorneys.

CONCLUSION: EVOLVING LAWS FOR EMERGING TECHNOLOGIES

In 2007, the US National Library of Medicine conservatively characterised robots as 'algorithm-based boxes' (Thilmany, 993). Today, their workings simulate the human brain with an intricate artificial neural network that extracts patterns, finds rules in the data it receives and changes its structure based on that information flow. Cognitive robots are arriving, addressing 'the inherent uncertainty of natural environments by continually learning, reasoning, and sharing their knowledge' (IEEE).'

When mistakes and mishaps occur, damages they can inflict on humans range from physical harm by the embodied forms to emotional and financial harm by softbot error. When harmonized, machine and human interactions can achieve new heights in investigative journalism not possible even a few years ago. As that symbiotic relationship evolves and the world adapts, it makes sense to turn to extant laws and legal principles to bring certainty to a process fraught with unpredictability and nuance.

This paper has examined robot initiatives within the EU (Robolaw) and the US (National Robotics Initiative) for comparative indicators of normative values each society seeks to integrate into human-machine regulation in future. The EU model espouses human identity and personhood, a reductionist approach that perceives the robot as tool and regulatory programs as soft law, highlighting uniform industry standards and voluntary compliance with a centrist system of guidelines. The US, not surprisingly given the predominant number of corporate media giants that are headquartered within the country, promotes innovation, a competitive entrepreneurial climate and a more ad hoc, decentralized and sectoral system of regulation. While calls for agency oversight of robotic invention are frequent, even those suggestions look to light regulation rather than a command-and-control system of laws.

Lessons from common law and civil law systems that could inform evolving robot capabilities require that the robot have legal status; that is fundamental to a finding of liability under civil law (requiring foreseeability) or criminal fault (requiring general or specific intent). Koops et al. (2010) suggest we could take a relative approach, meaning that if we decide upon the preconditions for legal personhood we could then specify its various levels of responsibility with different legal consequences for breach at each level (559). Both EU and US policies contemplate a type of liability similar to that assigned animals or corporations. Thus, a particularly 'smart' robot could gain a restricted form of legal personhood if it could insure itself against liability (560). That capability would reveal some level of cognition but would not grant the attribution of any rights unless the robot were additionally to possess consciousness, intent, feelings, independent goals and capacity for autonomous action. We are not at that point, although we find encouraging the robot's ability to learn from mistakes, improve on human instructions, teach other robots and communicate with humans using natural language.

Once personhood were bestowed, the robot might be recognized as liable for violating private laws of contract, tort or property as we have examined in this paper with various technologies such as autonomous cars, drones, biological cloning and nanotechnology. Regulating those inventions has involved various agencies to standardize transportation or airspace travel, as well as those that oversee the natural sciences. Although activities involving drones and cloning have produced express regulations, they are not uniform in formulation or application in both the US and the EU, nor from state to state within America or among EU member states. Under the support of the United Nations, the International Federation of Robotics continues to monitor accelerating development and interest in robots, primarily for industrial and manufacturing use, but it does not engage in lawmaking.

While there have been seminal discussions about programming ethical considerations into robot algorithms, those debates have 'lost steam' in recent years according to Jones (2015, 28). The fear of having machines make life and death decisions has tempered such debate, although Jones reminds us that even one of the most autonomous services in our daily routine, elevators or escalators, still maintain human input.

Other methods of regulating robotic activities, such as risk aversion by design, are available. In the nanotechnology area, funding policies and decisions often function as ad hoc regulatory systems, allowing some areas of research to flourish while others flounder (Abbot et al. 2012; Marchant et al 2006). Such informal regulation might soon be replaced by stronger regulatory imperatives that accurately measure and contain risks and temper their social and economic impacts. Due to the widespread and accelerating interest in robotic technologies, those regulations might be most effective if transnational in scope, a prospect that calls for intensified research into strategies and tactics that would bring meaningful consensus across the Atlantic and, eventually, among all nations.

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NOTES

Elizabeth Kirley, Associate Professor of Law, Chair of Internet Law, Deakin Law School, Melbourne AU. The author is grateful to reviewers and editors, as well as to the Nathanson Centre for Transnational Human Rights, Crime and Security, Osgoode Hall Law School, York University, Toronto.

[1] 'Robot' is defined herein as a non-biological assistant to humans. The term 'news media' has come to include social media and streaming news feeds as well as citizen journalism and is thus too imprecise for present purposes.

[2] A human-machine contest has been conducted within the university environment, pitting academic researchers against a computer for fastest research results.

[3] Robots have also entered the academic peer review process. *See further,* Bartoli, A, De Lorenzo, A, Medvet , E and Tarlao, F (2016) 'Your Paper has been Accepted, Rejected, or Whatever: Automatic Generation of Scientific Paper Reviews,' Chapter in Availability,

Reliability and Security in Information Systems, vol. 9817, Lecture Notes in Computer Science, 19-28; *see also* Grove, J 'Robot-Written Peer Reviews', Times Higher Education (23 September 2016) as accessed 17 November 2016 at www.timeshighereducation.com; (n=16 human subjects) who were presented with a mix of genuine and machine generated reviews and their ability to actually deceive human judgment was measured.

[4] In the cognitive sciences, there has been a lively debate over whether machine consciousness is possible and how we could detect it. Daniel Dennett endorses a computational understanding of the human mind and sees no inherent barriers to machine consciousness (Dennett, D C 'The Mystery of Consciousness: An Exchange,' New York Review of Books (21 December 1995); *see contra* Searle, J S (1990) *Is the Brain's Mind a Computer Program?* Scientific American, 26. 51. For a collection of essays discussing this and other related issues see Woodruff Smith, D and Thomasson, A L (eds.) (2005) Phenomenology and Philosophy of Mind, Oxford University Press.

[5] Two other terms are 'precision journalism', coined to identify the blend of social science quantitative evidence and investigative reporting used in 1960s America (Meyer 1973; 2011) and 'computational journalism' employed to connote mathematical techniques for the large-scale manipulation of data (Flew et al., 2012). The University of Columbia's Tow Center of Digital Journalism also reports on 'sensor journalism' (Pitt et al. 2014).

[6] Facebook offers Instant Articles and News Feed. It folded its Paper news application in July 2016. *See further,* Newton, C. 'Facebook's Instant Articles arrive to speed up the News Feed,' The Verge (13 May 2015) as accessed 4 December 2016 at http://www.theverge.com/2015/5/13/8595263/facebooks-instant-articles-arrive-to-speed-up-the-news-feed ; and Newton, C. 'Facebook is shutting down its Paper newsreading app on July 29th,' The Verge (30 June 2016) as accessed 4 December 2016 at http://www.theverge.com/2016/6/30/12062124/facebook-paper-shutdown.

[7] Machine learning involves an algorithm that can essentially program itself by finding patterns that lead to good or problematic outcomes. For example, such algorithms can be designed to analyze spam and non-spam emails and detect its telltale patterns. Human programmers have difficulty analyzing the results of machine learning because the computer is often following a highly abstract pattern gleaned from analyzing huge troves of data. *Adapted from* Surden, H and Williams, M A, (2016) 'Technological Opacity, Predictability, And Self-Driving Cars,' Cardozo Law Review 38:121, 148.

[8] Maxwell and Azzopardi, note 3, 739. By comparing robotic behaviour and performance with 48 human subjects under the same conditions, topics, time constraints, costs and search engine, the authors found that 'while naive configurations of simulated users and agents substantially outperform human subjects, their search behaviour is notably different.'

[9] *See further,* Stanford University 'Journalism in the Digital Age' as accessed 7 December 2016 at https://cs.stanford.edu/people/eroberts/cs181/projects/2010-11/Journalism/index7f0d.html?page_id=16 which states: 'In 1841, Thomas Carlyle wrote, "Burke said there were Three Estates in Parliament; but, in the Reporters' Gallery yonder, there sat a Fourth Estate more important far than they all.'

[10] Katz at 918, note 13, citing Mueller, R E, (1990) The Leonardo Paradox: Imagining the Ultimately Creative Computer, 23 Leonardo 427, 427.

[11] The use of examples readily at hand to assist with a decision.

[12] The inclination in some humans to underestimate the probability of negative outcomes.

[13] A human tendency to rely too heavily on the first piece of information offered when making a decision.

[14] A human tendency to look only for what confirms one's beliefs.

[15] A person's conviction that is not altered by facts that argue for the contrary.

[16] The human inclination, when observing a phenomenon, to see it everywhere.

[17] Mir, A 'Robo-journalism: the third threat', Human as Media (1 September 2016) as accessed 1 November 2016 at https://human-as-media.com/2016/09/01/robo-journalism-the-third-threat/ .

[18] Balkin 2015; McIntyre 2015; Zhang and Schmidt 2015; Calo 2015; 2009; Leenes and Lucifero 2014; Koops et al. 2013; Pagalo 2013; Darling 2013; Richards and Smart 2013.

[19] Carlson 2015; Ombelet 2015; Lewis and Westlund 2015; Latar 2015; Splendore et al. 2015; Simonite 2015; Royal and Blasingame 2015; Clerwall 2014; Lewis and Usher 2014; Mair 2014; Ananny and Crawford 2014; Gynnild 2012.

[20] RoboLaw Guidelines on Regulating Robots for the European Commission RoboLaw Project (22 September 2014) as accessed 6 November 2016 at http://www.robolaw.eu/RoboLaw_files/documents/robolaw_d6.2_guidelinesregulatingrobotics_20140922.pdf ; *regarding distinguishing among terms for self-driving (driverless) cars, see* Smith, B W, 'My Other Car Is A ... Robot? Defining Vehicle Automation,' Stanford Center for Internet and Society (19 February 2012) as accessed 2 December 2016 at http://cyberlaw.stanford.edu/blog/2012/02/my-other-car-robot-defining-vehicle-automation.

[21] Both machine learning and AI are integral to the new journalism: machine learning develops methods that can automatically detect patterns in data and then use the uncovered patterns to predict future data; AI is a more umbrella term to describe the capability of a machine to imitate intelligent human behaviour, currently accomplished through such functions as visual perception, speech recognition, decision-making, and translation between languages. *see further,* Murphy, K P, Machine Learning: A Probabilistic Perspective, MIT Press (2012). Deep learning involves software learning to recognize patterns in digital representations of sounds, images, and other data. It mimics human brain activity in the neocortex, the "wrinkly 80 percent of the brain where thinking occurs." Hof, R D 'Deep Learning', MIT Technology Review (nd) as accessed 27 November 2016 at https://www.technologyreview.com/s/513696/deep-learning/.

[22] Takayama, L, Ju, W and Nass, C 'Beyond Dirty, Dangerous and Dull: What Everyday People Think Robots Should Do', Proceedings of HRI (Mar. 12-15, 2008). Web-based public opinion survey, n=250. Selected occupations (n=812) were presented alternatively as being held by "*either* robots *or* people" or by "*both* robots *and* people."

[23] Ackerman, E. 'Robots With Warm Skin Know What They're Touching', IEEE Spectrum (2 November 2016) as accessed 29 November 2016 at http://spectrum.ieee.org/automaton/robotics/robotics-hardware/robots-with-warm-skin-know-what-theyre-touching (discussing sensors as force detectors, informing on the softness, hardness or other tactile information of an object, and thermal detectors, informing on hotness, coldness or ambient temperatures).

[24] Unless programmed to do so.

[25] Also referred to in journalism literature as "traditional," or "mainstream" news organizations (Pew Research Center 2013).

[26] Meyer attributes the term 'precision journalism' to Everett E. Dennis in 1971 when teaching a University of Oregon seminar in 'The New Journalism', later contained in The Magic Writing Machine, University of Oregon School of Journalism 1973.

[27] Young, M L and Hermida, A 'From Mr. and Mrs. Outlier to Central Tendencies: Computational Journalism and Crime Reporting at the Los Angeles Times,' Digital Journalism (May 2015) 3:3, 381-397. Such questions feed into the ongoing perception among certain news personnel that journalists (and possibly their computerized teammates) have a prominent role in a nation's culture wars. As of 2013, eight of the world's top ten Internet companies as measured by audience were based in the United States, though 81 percent of their online visitors were not. *See further* Wasik, B 'Welcome to Digital Imperialism', The New York Times Magazine (4 June 2015) as accessed 12 November 2016 at http://www.nytimes.com/2015/06/07/magazine/welcome-to-the-age-of-digital-imperialism.html.

[28] As early as 2006, intelligent systems could assist humans with big data by fusing large amounts of data into succinct meanings; processing meanings in contextually relative ways; inferring hypotheses that humans are considering; enabling people to have access to the intuitions of others; and presenting information in ways that enhance the tacit knowledge of humans about the subject matter [adapted from Klein, G., Moon, B. and Hoffman, R. R. (2006) 'Making Sense of Sense-Making', IEEE Intelligent Systems 21 (4), 70-73, 72].

[29] 'Natural language' processing combines computer science, artificial intelligence, and computational linguistics to convert data to human languages.

[30] The American Press Institute (2016) credits data journalism with illuminating claims by public figures that form the basis of political or economic decisions. For example, The Guardian wished to investigate UK government claims that a series of riots were unrelated to poverty. Reporters accessed police records to obtain arrestees' home addresses. Journalists marked those addresses on a map and compared them to impoverished areas, which they

obtained through other public data. The interactive map was posted on The Guardian website that helped distinguish those government claims that were true from those that were not. *See further* Rogers, S 'Reading the Riots: Investigating England's summer of disorder', The Guardian (6 December 2011) as accessed 11 October 2016) at https://www.theguardian.com/news/datablog/interactive/2011/aug/16/riots-poverty-map.

[31] The work of Copernicus, Darwin and Freud provided the first three discontinuities or blows to man's ego, according to Mazlish.

[32] *Id.*

[33] Bush, V 'As We May Think,' Atlantic (1 July 1945) as accessed 24 November 2016 at http://www.theAtlantic.com/magazine/archive/1945/07/as-we-may-think/303881/ . Bush was an American engineer, inventor, and head of the US Office of Scientific Research and Development during WW2.

[34] Internet Pioneers, http://www.ibiblio.org/pioneers/licklider.html (describing Licklider as a US computer scientist and psychologist who foresaw the need for networked computers with easy user interfaces, such as point-and-click interfaces, digital libraries, e-commerce, online banking, and software that could migrate to wherever it was needed.

[35] Wells, note 81.

[36] *Id.*

[37] Koops et al. (2010) distinguish among *automatic agents* (the traditional association of automation with mechanical, non- creative applications and in software programs builds on an algorithm that defines the behavior of the program); *autonomic agents* (entities that have the capacity to change their own program in order to better achieve a certain goal) and *autonomous agents* (those having the capacity to determine their own objectives as well as the rules and principles that guide their interactions.)

[38] (n=46)

[39] P. 534. The full list contained 12 descriptors: objective, trustworthy, accurate, boring, interesting, pleasant to read, clear, informative, well written, useable, descriptive, and coherent.

[40] Murphy, W 'Did the Pope endorse Donald Trump?' Quora (2 October 2016) as accessed 2 December 2016 at https://www.quora.com/Did-the-Pope-endorse-Donald-Trump.

[41] Drew, J. and Foreman T. 'DC pizza shop gunman regrets agtions, still believes fake Hillary Clinton child sex ring story' Global News (8 December 2016) as accessed 8 December n2016 at http://globalnews.ca/news/3114831/dc-pizza-shop-gunman-regret-fake-hillary-clinton-child-sex-ring/.

[42] Sarat, A, Douglas, L and Umphrey, MM (eds) (2012) 'Imagining New Legalities: Privacy and its Possibilities in the 21st Century,' Introduction, 2, suggesting law be an instrument of both continuity and change, all the while appearing unsettled, not reassured, by such change.

[43] Richards and Smart give the example of a robot-driven car. Once we install the perception and reasoning in the robot and embed it in the car itself, it is legislated as a car.

[44] Koops note 104, 500; for a discussion of animals as legal entities *see* Hogan, M (2007) 'Standing for Nonhuman Animals: Developing a Guardianship Model from the Dissents in Sierra Club v. Morton', 95 California Law Review 513, 522.

[45] Notably the European Convention on Human Rights, the Universal Declaration of Human Rights, and the International Convention on Civil and Political Rights.

[46] The Charter of Fundamental Rights of the EU brings together in a single document the fundamental rights of all member states of the EU gained upon entry; it is enforced by the European Court of Justice whose mandate is EU integration and harmonization; the European Convention of Human Rights provides minimum human rights protections enforced by the European Court of Human Rights.

[47] Asimov, I. 1995. Runaround, first published 1942, reprinted in Asimov, I. 1995. The Complete Robot (Voyager: McGregor, MN). He devised three Laws of the Robot: 1) A robot may not harm a human being or allow him to come to harm; 2) A robot must obey the orders given to it by human beings, except where such orders would conflict with law (1); and 3) a robot must protect its own existence, as long as such protection does not conflict with law (1) or (2).

[48] EPSRC 'Principles of Robotics,' as accessed 2 May 2016 at https://www.epsrc.ac.uk/research/ourportfolio/themes/engineering/activities/principlesofrobotics/

[49] Pub.L. 106-102 , 113 Stat. 1338 also known as the Financial Modernization Act of 1999.

[50] Pub.L. 104-191 , 110 Stat. 1936 (1999).

[51] Pub.L. 105-277 , 112 Stat. 2681-728 (1998).

[52] 47 U.S.C. ch. 5, subch. V-A (1984).

[53] Pub.L. 93-579 , 88 Stat. 1896.

[54] Cal. Bus. & Prof. Code §§ 22575-22579 (2004).

[55] NRI Project #NSF 12607, Introduction.

[56] National Robotics Initiative NRI 2.0, National Science Foundation, NSF Project #17518 as accessed 1 November 2016 at https://www.nsf.gov/pubs/2017/nsf17518/nsf17518.htm

[57] (Ambrose) Jones, M L, (2016) 'A Right to a Human in the Loop: Legal Constructions of Computer Automation & Personhood from Data Banks to Algorithms,' as accessed 1 December 2016 at http://dx.doi.org/10.2139/ssrn.2758160; (Ambrose) Jones, M L, (2015) 'The Ironies of Automation Law: Tying Policy Knots with Fair Automation Practices Principles', 18 Vanderbilt Journal of Entertainment & Technology Law 77.

[58] For a proposed amendment to the 1968 Vienna Convention on Road Traffic see http://www.unece.org/fileadmin/DAM/trans/doc/2014/wp1/ECE-TRANS-WP1-145e.pdf ; for discussion on amendments to the 1949 Geneva Convention on Road Traffic, see Smith, B W (2014) 'Automated Vehicles Are Probably Legal in the United States' (2014) 1 Texas A&M Law Review 411.

[59] Smith, Automated Vehicles, note 152.

[60] Title 14 of the Code of Federal Regulations (14 CFR) part 107.

[61] Mazlish, note 69.

[62] For greater clarity, cars can have *automated* functions like cruise control, which regulates speed, supervised by the driver, who remains in active control; or they can be a*utonomous* meaning that the vehicle itself is making decisions without input from the driver. For the latter, there is no need for a driver at all.

[63] Federated Automated Vehicles Policy: Accelerating the Next Revolution in Road Safety, US Department of Transport (September 2016) https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf

[64] National Conference of State Legislatures, Autonomous Vehicles, (11 November 2016) as accessed 1 December 2016 at http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx .

[65] Federated Automated Vehicles Policy: Accelerating the Next Revolution in Road Safety, US Department of Transport (September 2016) https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf.

[66] The literature appears to use the terms driverless, autonomous and unmanned vehicles interchangeably.

[67] Hubbard cites: National Institute of Standards & Technology (NIST), Safety of Human-Robot Collaboration Systems Project, available at http://www.nist.gov/el/isd/ps/safhumrobcollsys.cfm [hereinafter NIST, Human-Robot Collaboration]; NIST, Safety of Human-Robot Systems in Flexible Factory Environments (Jan. 8, 2014), as accessed 2 November 2016 at http://www.nist.gov/el/isd/ps/safehumrobsysflexfactenvir.cfm.

[68] For example, the European Commission's Recommendation 2011/696/EU; the proposed EU Classification, Labeling and Packaging Regulation; a EU Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical And Electronic Equipment ; the US Environmental Protection Agency Significant New Use Rule; the U.S. National Institute for Occupational Safety and Health interim guidelines for working with nanomaterials; report of the Food and Drug Administration on Regulation of Nanotechnology Products; and a call by the European Parliament for regulations to require that food containing nanomaterials state that fact on the label .