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Law *as* Information in the Era of Data-Driven Agency

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This contribution introduces the mathematical theory of information that 'informs' computer systems, the internet and all that has been built upon it. The aim of the author is to invite lawyers to reconsider the grammar and alphabet of modern positive law and of the Rule of Law, in the face of the alternative grammar and alphabet of a data-driven society. Instead of either embracing or rejecting the technological transitions that reconfigure the operations of the law, this article argues that lawyers should collaborate with the computer scientists that engineer and design the affordances of our new onlife world. This is crucial if we want to sustain democratic participation in law-making, contestability of legal effect and transparency of how citizens may be manipulated by the invisible computational backbone of our rapidly and radically changing world.

> Three umpires of major league baseball were debating how to call balls and strikes, 'I calls 'em the way they is,' the first said. 'Me,' said the second, 'I calls 'em the way I sees 'em.' 'Naw,' declared the third, who had been around the longest, 'they ain't nothin' till I calls 'em.'
> Marshall Sahlins, 2002[1]

> If men define situations as real, they are real in their consequences.
> Thomas and Thomas, 1928[2]

> If data-driven agents define a situation as real, it is real in its consequences.
> Hildebrandt, 2011[3]

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1 M. Sahlins, *Waiting for Foucault, Still* (Chicago: Prickly Paradigm Press, 2002) 8. The quotation is followed by 'Technically, according to the Cours de gymnastique generale, this is known as the "arbitrary character of the umpires sign"', and can be found under the heading of 'Post-Structuralism'. How ironic that I am not using this quote ironically.

2 W. I. Thomas and D. S. Thomas, *The Child in America* (New York: Knopf, 1928) 572, popularised by R. K. Merton, 'The Self-Fulfilling Prophecy' (1948) 8 *The Antioch Review* 2, 193.

3 A modulation of 'if machines define a situation as real, it is real in its consequences' in M. Hildebrandt, 'Who needs stories if you can get the data? ISPs in the era of big number crunching' (2011) *Philosophy and Technology* 24, 379.

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PREFATORY REMARKS

The Chorley Lecture has provided me with the wonderful opportunity to address the informational nature of the law from the double perspective of both law and information theory. This is not merely an intellectual enterprise. I believe that, as lawyers, we should get our act together. The rapid transformations of both our life world and the systems and institutions that shape us, even as we shape them, are game changers for the grammar of modern law. I am somewhat apprehensive to be addressing these issues as they are in full flux. It is not easy to address a moving target. The only way to make a hit is to anticipate the vector of change, to predict the course of the target and to then move forward and strike. Luckily, this is not my task as I do not intend to strike down the upcoming 'onlife world', the new everyday where anything offline is turned online, while the infrastructures that supposedly make life easy, business more effective and society less vulnerable are saturated with artificial, data-driven agency. Nevertheless, I believe there is an urgent need for lawyers and computer scientists to be on speaking terms, learning enough of each other's language to understand what concerns each of us.

Lawyers have a 'natural' inclination to claim that things are not 'really' different and that current legal techniques are flexible enough to cope with drones, smart fridges, remotely controlled energy usage, and other exotic operations. I beg to disagree. The deep structure of modern law has been built on the affordances of the printing press: on the linearity and sequential processing demands of written text, which evokes the need for interpretation, reflection and contestation. The study and practice of law have thus been focused on establishing the meaning of legal norms and their applicability to relevant human interactions, while establishing the meaning of human action in the light of the applicable legal norms. Data-driven agency builds on an entirely different grammar, its building blocks are information and behaviour, not meaning and action. We need to face the possibility that this will drain the life from the law, turning it into a handmaiden of governance (that fashionable term meaning anything to anybody), devouring the procedural kernel of the Rule of Law that enables people to stand up for their rights against big players, whether governmental or corporate or otherwise. In this article I will test the interface between law and data-driven agency by understanding law *in terms of* information, assuming that we cannot take for granted that law will interact with an artificially intelligent ICT infrastructure (ICTI) in the same way as it has interacted with written and printed text (our previous and current ICTI). By framing law *as* information, I hope to convince the reader that technological infrastructures matter, require our attention and must somehow be brought under the Rule of Law. This will not be business as usual, as it will require rethinking and redesigning the architecture of the Rule of Law.

The first section introduces the issue of law *as* information in the era of data-driven agency. This entails an explanation of what is meant by some of the key terms of the debate, notably data-driven agency, the onlife world and machine learning. The idea of law *as* information in a world that is saturated with artificial intelligence will be discussed under the heading of 'law's new mode of

existence'. Though speaking of law's mode of existence is inspired by Latour's seminal work,[4] my own point here is that the manner in which law exists is not given or immutable but enabled by the information and communication technological infrastructure (ICTI) that mediates its operations in human society.[5] In that sense, modern law has been an affordance of human language, the script and the printing press and we should not take for granted that law-as-we-know-it will be an 'affordance' of the ICTI of data driven-agency.[6]

The second section undertakes to provide an internal – legal – perspective on law as information for outsiders, notably for the architects of our onlife world, that is computer and data scientists and electrical engineers. Providing such a perspective requires us to learn to explain the practice and the study of law in terms that are understandable for those others, without betraying our own – legal – terminology. This section introduces the question of whether law is merely *information about* the legal effect of one's behaviours, or also an *agent that performs* such effect. Must 'to inform' be understood as an intransitive verb (as with 'informing about') or is it a transitive verb (as with 'informing something'). Both senses of information relate to the importance of 'the sources of the law' and to the difference as well as the interrelations between the study of law (foraging information about the law) and the practice of law (seeing to it that law informs human interaction). Indeed, the study of law informs the practice of law and vice versa.

The third section takes the opposite perspective, seeking to provide lawyers with an external perspective on law *as* information, based on some of the central tenets of the mathematical theory of information and cybernetics that has provided the foundations for the rise of the onlife world. Having investigated some of the ingredients of information theory and having indicated some of the reasons for its success, we will move beyond the 'mathematics' to inquire into the differences between law and informatics that make a difference for a proper understanding of law in terms of information.[7] This involves fleshing out the two senses of information introduced in the previous section: information as the object of cognition (as content to be stored, processed or retrieved), and information as an agent that in-forms and thus transforms our cognition. This section ends with a brief discussion of how modern law and its prodigy, the

4 B. Latour, *The Making of Law: An Ethnography of the Conseil d'Etat* (Cambridge: Polity, 2009) *idem*, *An Inquiry into Modes of Existence: An Anthropology of the Moderns* (Cambridge, Mass: Harvard University Press, 2013).

5 The concept of mediation refers to the work of Don Ihde, for example, his *Technology and the lifeworld: from garden to earth* (Bloomington: Indiana University Press, 1990), cf my 'Legal and technological normativity: more (and less) than twin sisters' (2008) 12 *Techné* 169.

6 This should not be confused with technological determinism. 'Affording something' is not equivalent with causing or determining it, rather with making it possible. On the concept of affordance see the work of J. Gibson, *The Ecological Approach to Visual Perception* (New Jersey: Lawrence Erlbaum Associates, 1986) and M. Hildebrandt, *Smart Technologies and the End(s) of Law. Novel Entanglements of Law and Technology* (Cheltenham: Edward Elgar, 2015) 47-56.

7 In the third section I will discuss the close ties between information and difference; in law as in information theory the point is never difference per se but always the ability to detect the difference that makes a difference (in relation to whatever issue that is at stake). cf G. Bateson, *Steps to an Ecology of Mind* (New York: Ballantine, 1972) 135, who defined 'a bit of information' as 'a difference which makes a difference'.

Rule of Law, developed as an affordance of the printing press, arguing that we cannot take for granted that the current mode of existence of law and the Rule of Law are sustainable once the ICTI of data-driven agency takes over. In the final section, we confront the challenges of law in the era of data-driven agency, raising the issue of law as information that has been generated by computer systems capable of 'machine learning'. This evokes epistemological questions as to what we mean when we infer legal knowledge from legal text, but also reconfigures the idea of epistemology itself.

The final section ends with a call for collaboration between lawyers and computer scientists, resisting the urge to stick to one's disciplinary comfort zone, while respecting the domain-specific obligations of the other discipline and remaining loyal to one's own disciplinary requirements. Without in-depth as well as hands-on collaboration between the legal and the technical architects of our shared world the protection of the Rule of Law cannot be sustained nor reinvented.

INTRODUCTION: LAW'S NEW MODE OF EXISTENCE?

The rise of the onlife world

This article investigates the transformative implications of data-driven agency for positive, modern law and for the Rule of Law. It does so by inquiring into the alphabet and grammar of the underlying ICTI, and its theoretical underpinnings in the mathematical theory of information. In this section I will introduce the central notions of data-driven agency, the onlife world and machine learning, while indicating how they challenge some of the core assumptions of law and the Rule of Law.

Data-driven agency refers to a specific type of artificial intelligence, capable of perceiving an environment and acting upon it, based on the processing of massive amounts of digital data. Data-driven agents can be more or less embodied, ranging from robots (drones, self-driving cars or even companion robots) to software bots (search engines, advertising auctions, smart energy grids). They have been envisioned under the heading of Ambient Intelligence or the Internet of Things, accompanied by dystopian as well as utopian narratives of a frictionless world that surreptitiously adjusts the environment to the needs and desires of its users. Currently data-driven agency informs a host of invisible adaptations of our online and 'offline' environment, and the rise of a so-called 'cyber-physical infrastructure' indicates that the distinction between online and offline is becoming increasingly artificial, if not redundant. A cyber-physical infrastructure basically entails turning devices, homes, public and private transport, bridges, hospitals and offices online, to enable persistent monitoring and surreptitious adaptation. Previously, policymakers spoke of the Internet of Things or Ambient Intelligence, which was a vision rather than its actualisation. By now, technicians are actually engineering the cyberphysical scaffolding that puts any thing online, thus interconnecting anything 'everyware'.[8]

8 A. Greenfield, *Everyware. The dawning age of ubiquitous computing* (Berkeley: New Riders, 2006).

For this reason I will speak of an onlife world,[9] when discussing the emerging life world that thrives on mobile, hyper-connected cybernetic systems such as smartphones, online social media, gaming, search engines, health and fitness apps, fraud detection systems and the more. This onlife world has a frontend (the world we see and navigate) and a backend (the largely invisible computational architecture that sustains and informs the frontend). The computational backend is what affords the smooth operations of military drones, robotic surgery, behavioural advertising, automated translation, advances in human genetics, astronomy and smart traffic management.

Most of the infrastructure that gives rise to an onlife world is supported by new techniques of artificial intelligence, notably by those of machine learning (ML). The canonical definition of ML, from Tom Mitchell's Handbook of ML reads:

> A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.[10]

Note the emphasis on experience and the implied feedback loops that define this type of artificial intelligence. Before further exploring the implications of ML for law as information it may help to investigate an example of what it is capable of achieving while highlighting how it may transform our understanding of understanding itself. In 2015, *The Guardian* informed its readers that Google has uncovered what it calls 'thought vectors', in the course of developing ML techniques for computational translation:

> The technique [of thought vectors] works by ascribing each word a set of numbers (or vector) that define its position in a theoretical 'meaning space' or cloud ... The 'thought' serves as a bridge between two languages because it can be transferred into the French version of the meaning space and decoded back into a new path between words ... Hinton [the Google AI researcher who was interviewed] said that the idea that language can be deconstructed with almost mathematical precision is surprising, but true. 'If you take the vector for Paris and subtract the vector for France and add Italy, you get Rome,' he said. 'It's quite remarkable.'

This may be true, but the article continues:

> Some aspects of communication are likely to prove more challenging, Hinton predicted. 'Irony is going to be hard to get,' he said. 'You have to be master of the

9 The concept of an onlife world has been coined by L. Floridi, 'A Look into the Future Impact of ICT on Our Lives' (2007) 23 *The Information Society* 1, 62; further elaborated in the context of the so-called Onlife Initiative at http://ec.europa.eu/digital-agenda/en/onlife-initiative (all URLs last accessed 15 October 2015), which resulted in L. Floridi (ed), *The Onlife Manifesto - Being Human in a Hyperconnected Era* (Dordrecht: Springer, 2014); also Hildebrandt n 6 above, chs 2 and 3.

10 T. Mitchell, *Machine Learning* (New York: McGraw-Hill Education, 1997) 2.

> literal first. But then, Americans don't get irony either. Computers are going to reach the level of Americans before Brits.'[11]

It would be mistaken to conclude from this ironic turn that data-driven agency is capable of replacing the more boring part of human undertakings, while being impotent to compete with our creative skills. Even if we think that computers cannot think if thought is reduced to a vector (a string of numbers), we may be proven wrong in the end. This is not because I think that computers will be able to think, but because the meaning of thought may change beyond recognition. It reminds one of Hannah Arendt, who wrote that '[t]he trouble with modern theories of behaviourism is not that they are wrong but that they could become true'.[12] We will revisit her insights in the final section.

Law's modes of existence

In what follows I hope to explain how and why law can be understood as 'something' that involves creating, storing and retrieving information, without however suggesting that law can be reduced to a computational understanding of creating, storing and retrieving information. The difference concerns law's constitutive relation with justice, legal certainty and purposiveness.[13] The latter aligns with the idea that the concepts of modern positive law and the Rule of Law both depend on law's ability to negotiate the antinomian requirements of proportional and distributive equality, the positivity of the law, and its instrumentality in achieving policy goals. With Radbruch, I believe that the practical incompatibility of these antinomian goals should not be overcome by reducing all of law to either morality, formal positivism or utilitarian instrumentalism. The challenge resides in sustaining the tension between the aims of the law, instead of trying to overcome their antinomian character.[14] With Waldron, I believe that sustaining this tension while still deciding the law is not a matter of getting it right at a high level of abstraction, but of building and sustaining the institutions that allow for contestation.[15] This is where ML and data-driven agency present us with significant novel obstructions. To clarify why this is the case, we shall look into AB testing as one of the most pervasive applications of ML.

At this moment, the better part of our online environment is designed by means of pervasive and re-iterant AB testing.[16] That is to say that online

11 H. Devlin, 'Google a step closer to developing machines with human-like intelligence' *The Guardian* 21 May 2015. See also Y. LeCun, Y. Bengio and G. Hinton, 'Deep Learning' (2015) 521 *Nature* 436.

12 H. Arendt, *The Human Condition* (Chicago, London: University Press of Chicago, 1958) 322.

13 On the tension between justice and legal certainty and the specific role of positive law in Kantian legal philosophy G. Radbruch, 'Legal Philosophy' in *The Legal Philosophies of Lask, Radbruch and Dabin* (Boston & London: Harvard University Press, 2014) 48, more specifically 68-69, 117-119, 184 and Radbruch's critique of Kant at 82-83.

14 On antinomism, based a specific type of relativism, see Radbruch, *ibid*, 55-59. On the antinomian character of the constitutive aims of the law, *ibid*, 107-112. At 112 Radbruch notes: 'We have shown contradictions without being able to resolve them. We consider this no defect of a system. Philosophy is not to relieve one of decisions, but to confront him with decisions.'

15 J. Waldron, 'Kant's Legal Positivism' (1996) 109 *Harvard Law Review* 1535.

16 See, for example, at https://vwo.com/ab-testing/.

applications are increasingly developed by means of a research design that confronts users with two slightly different situations, in this case two versions of a website, version A and version B. The difference may concern the colour or placement of a button, the amount of textual information, the font used, the types of icons employed, or the distribution of text and images. Half of the population to be tested is sent to version A, the other half to version B. Their clickstream behaviours are then tested and whichever version of the site achieves a better response is chosen. Obviously a better response is measured in terms of purchasing behaviours or similar, measurable interactions. Since this process is automated and can be repeated continuously it is possible to test small changes in the site, as well as their interrelations, enabling a pervasive invisible adaptation of our online environment, capable of pre-empting our inferred online behaviours. Once the cyber-physical systems that turn the offline world online become part of our onlife experience, AB testing will surely move to our physical environment – while all the testing as well as the subsequent interventions occur behind our back. Investigating the pre-emptive force of a punishment as well as manipulating voting preferences are just two examples of what this brave new world has in store for us.[17]

The invisibility of potentially undesirable bias and the reduction of our autonomy to fair game for ML algorithms both confront the law with a new type of – mindless and data-driven - agency. The traditional understanding of matter as passive and mind as active does not fit the reality we face. Data-driven agency requires redress if we are to sustain our autonomy and we urgently need to rethink law as capable of addressing such mindless agency. At the same time, this agency will inform the law itself as it will be used to support legal knowledge construction and become a tool for mining, personalising and distributing legal information. Understanding law in terms of information should help to address the data-driven nature of the onlife world, which builds on a particular concept and theory of information that determines both the productive and the reductive dimensions of our new life world. As this new onlife world is not merely the target of law's regulation, but also provides new building blocks for law's articulation, we need to investigate them. To this end I will undertake a risky attempt to see law through the lens of information theory and its twin sister cybernetics, without falling into the trap of developing a cybernetic or mathematical theory of law. The latter would imply a colonisation of modern law's mode of existence by that of other disciplines. Instead, I hope to show that modern positive law has been an early example of a highly successful cybernetic approach to government that may however be on its last legs.[18] I will argue that the surge of data-driven agency that is on the verge of saturating our

17 Imagine using AB testing on convicted criminals to determine the sentence most likely to achieve desirable future behaviours. This is not science fiction, see, for example, A. M. Barry-Jester, B. Casselman and D. Goldstein, 'Should Prison Sentences Be Based On Crimes That Haven't Been Committed Yet?' *FiveThirtyEight* at http://fivethirtyeight.com/features/prison-reform-risk-assessment/. On the manipulability of voting preferences by search engines, see, for example, R. Epstein and R. E. Robertson, 'The Search Engine Manipulation Effect (SEME) and Its Possible Impact on the Outcomes of Elections' (2015) 33 *Proceedings of the National Academy of Sciences* E4512.

18 See below, the section on 'Modern law and the Rule of Law'.

environment poses significant threats to the grammar of law and to the Rule of Law, due to the transformations of the information and communication infrastructure that grounds 'the force of law'.[19]

AN INTERNAL PERSPECTIVE FOR OUTSIDERS: LAW FOR THE ARCHITECTS OF OUR NEW WORLD

Law as agent or information?

Since 2011 I have been teaching law to Masters' students of computer science. These students can be seen as the future architects of our onlife world. For centuries modern written law has provided the architecture for what we now call our offline world, safely grounded in the ICTI of the script and the printing press. As lawyers we must accommodate to the fact that we now share this constructive task with technology developers whose goal may be 'to do no evil' while connecting everybody anywhere with anything everywhere. We cannot assume that the architecture of data-driven artificial intelligence has the same affordances as that of the printing press. Nor can we take for granted that law will remain the primary instrument to guide and sustain legitimate expectations between those who share jurisdiction. Not only because the medium by which law articulates its regulation is being transformed before our very eyes, but also because the playing field itself is reconfigured and we find ourselves at play with previously unknown 'actors' capable of autonomous interventions that we may not be aware of. These actors are the data-driven agents that shape our new world. In the last part of this contribution we will confront the issue of how to address and – if need be - redress the mindless agency that animates our new environment.

When teaching law to computer scientists, we do not aim to turn them into lawyers. It is important, however, to give them a taste of how lawyers think and of what law does. The idea that law *does* things (with words, as Austin would claim) is critical to an adequate understanding of law;[20] legal norms attach legal effect to specific acts, behaviours, states or occurrences. Law indeed shows the salience of the Thomas theorem: 'if men define situations as real, they are real in their consequences' (and this also goes for women).[21] We have the power to generate real consequences by defining legal conditions, and this implies that

19 The force of modern, positive law is based on state authority and the monopoly of violence. Nevertheless, its force cannot be reduced to violence. The mediation of text is pivotal here. On the complexities if not the mystery of the force of law, see J. Derrida, 'Force of Law: The 'Mystical Foundation of Authority'' (1990) 11 *Cardozo Law Review* 920. I would say that the force of law is inherent in the notion of legal effect which is closely related to speech act theory and the notion of institutional facts, and contingent upon the affordances of the prevailing ICTS. This does not imply technological determinism, though it steers free of naive voluntarisms, cf Hildebrandt n 6 above, ch 8.

20 J. L. Austin, *How to Do Things with Words* (Boston, MA: Harvard University Press, 2nd ed, 1975); N. MacCormick and O. Weinberger, *An Institutional Theory of Law: New Approaches to Legal Positivism* (Dordrecht; Boston; Hingham, MA: D. Reidel, 1986).

21 Thomas and Thomas, n 2 above.

law is not merely *information about* such consequences, it also qualifies as an *agent* capable of transforming our reality. Our legal reality is the result of legal construction; it is fundamentally artificial. But, as Dewey once remarked, this does not make it fictitious.[22] As in the case of an artificial lake, which is not an imaginary lake, legal constructs are real insofar as they have real consequences. If specific legal conditions are fulfilled, a couple is married or a person becomes the owner of a house. This is what law does; such examples demonstrate the performative character of the law.[23] The *practice* of law, therefore, cannot be equivalent to information retrieval, even though, to some extent, the *study* of law can be seen as a specific type of information retrieval.[24] Indeed, though lawyers may never even think of law as information,[25] for a computer scientist who is scratching the surface of the law this is likely to be the default approach. For them, to study the law is to acquire, achieve or recombine knowledge of the law - and any methodology that enables such knowledge is welcomed. From a computer science perspective, the point would be to provide them with the relevant documentary sources, preferably integrated in well-designed databases, and various types of tools to retrieve information about the law. This can be information that was stored as such, but it can also be knowledge that is inferred from the data.

In terms of data science such knowledge consists of patterns in the dataset,[26] basically linking relationships between data points by means of mathematical functions. It would probably involve ML as a technique for mining large quantities of legal text.[27] Though machines do not think or reason in our sense of those terms, they have been emancipated from good old-fashioned AI, which was based on mechanical application of preconceived rules, securely aligned with the certainties of logic. ML, quite on the contrary, is about machines capable of perceiving their environment (in this case 'reading' large quantities of text), acting upon this environment (in this case for instance predicting the outcome of new cases),[28] processing the feedback (in this case comparing their predictions with actual outcome) and reconfiguring their program to

22 J. Dewey, 'The Historic Background of Corporate Legal Personality' (1926) 35 *The Yale Law Journal* 655, footnote 1.

23 On the curious fact that Austin actually employs mostly proto-legal examples to demonstrate what he means with a performative speech, act see N. van Dijk, 'The Life and Deaths of a Dispute. An Inquiry into Matters of Law' in K. McGee (ed), *Latour and the Passage of Law* (Edinburgh: Edinburgh University Press, forthcoming 2015).

24 Obviously, the study of law is itself a specific practice, which differs from the study of archaeology, mathematics or astrophysics. Though each of these scientific disciplines are, to some extent, forms of information retrieval, they differ substantially as to assumptions, method, and outcome.

25 With the exception, notably, of H. P. Glenn, *Legal Traditions of the World* (Oxford: OUP, 2007).

26 Data science can be seen as an emerging sub-discipline of both computer science and artificial intelligence, focused on inferring meaningful patterns from data sets, often associated with so-called Big Data (defined by some authors as unstructured data). cf, for example, C. Shan, W. Chen, H. Wang and M. Song (eds), *The Data Science Handbook: Advice and Insights from 25 Amazing Data Scientists* (The Data Science Bookshelf, 2015) at http://www.thedatasciencehandbook.com/.

27 Highly informative, H. Surden, 'Machine Learning and Law' (2014) 89 *Washington Law Review* 87.

28 Admittedly a prediction in itself is, perhaps, not yet an act upon the environment, unless we acknowledge that people will realign their own actions based on such predictions. One can, however, imagine a time when a subset of administrative decisions will be based on this type

improve their performance. ML is based on charting what data scientists call the probability space, it involves abducting and testing patterns in data sets that predict the 'behaviours' of new data.

We should note, however, that the assumption of both types of legal knowledge engineering is that law is equivalent to information that can be 'mined' from the sources of the law. On the one hand we must admit that ML, based on statistical inferences of textual data points, has a computational precision not within the grasp of the human mind. To the extent that such precision delivers adequate predictions of what types of legal arguments fit with a specific case, ML will be a serious 'player' when it comes to mining the content of legal text. I dare predict that within the coming ten years most lawyers will come to depend on it when seeking an overview of relevant legislation, case law and even legal arguments.

On the other hand we should confuse neither ML nor 'thought vectors' with the intricacies of the human mind. Even if some legal scholars have emphasised the crucial role of experience – rather than logic - in 'the life of the law',[29] it is pertinent that we remember the normative foundations of the concept and the Rule of Law. Legal normativity is based on a type of experience that is rooted in the fragility of human self-consciousness, not in computational detachment. In point of fact Holmes did argue for the relevance of statistics as a means to anticipate the outcome of legal cases and this is exactly what ML can do for the law.[30] However, in line with Holmes, this would imply that the legal knowledge engineers who develop the algorithms to delve and further develop legal knowledge should primarily serve those subject to the law, not first and foremost those administering the law. As Kerr has argued, Holmes' concern was that those subject to the law should be capable of anticipating the legal effect of their intended actions. Instead, current applications of ML, for instance on the side of tax and criminal justice authorities, are used to anticipate and potentially to pre-empt the behaviours of legal subjects.[31] Moreover, access to the results

of ML, thus indeed creating some kind of legal effect. Interesting case law is developing, for instance, in the Netherlands where a court of appeal fist decided that an administrative decision taken by automated software (probably not based on ML) without any human intervention did not qualify as a decision taken by the responsible civil servant, even if that servant was supposedly in charge of and therefore responsible for the automated decisions (Court of Appeal Arnhem Leeuwarden, 20 February 2014, ECLI:NL:GHARL:2014:1236). In a similar case, the same court of appeal decided that a similarly automated decision could be qualified as taken by a specific civil servant, reasoning that the decision can be attributed to this civil servant as he was responsible for the system that made the decision. The court's change of heart was based on information provided by the office of the Public Prosecutor (Court of Appeal Arnhem Leeuwarden, 5 June 2014, ECLI:NL:GHARL:2014:4324).

29 O. W. Holmes, *The Common Law* (New York: Dover Publications, 1991) 1.

30 O. W. Holmes, 'The Path of the Law' (1997) 110 *Harvard Law Review* 1001: 'For the rational study of the law the blackletter man may be the man of the present, but the man of the future is the man of statistics and the master of economics'.

31 cf I. Kerr, 'Prediction, Preemption, Presumption: The Path of Law After the Computational Turn' in M. Hildebrandt and K. de Vries (eds), *Privacy, Due Process and the Computational Turn: The Philosophy of Law Meets the Philosophy of Technology* (Abingdon: Routledge, 2013) 91. On the role of legal knowledge engineers from an instrumentalist perspective see, for example, R. Susskind, *The End of Lawyers? Rethinking the Nature of Legal Services* (Oxford: OUP, rev ed, 2010). See the final section below.

of ML should not be restricted to those willing and able to pay the fees of the corporate law firms that have the capital to invest in these sophisticated AI technologies. Even though ML can provide for highly relevant information about the law, it should not be the agent that determines the life of those subject to the law without providing them with effective legal remedies.

Law as information retrieval; information as anticipation

One way of distinguishing the study of law from other types of information retrieval is to emphasise the pragmatic character of the law, which describes neither individual actions nor the regularities that can be detected in our behaviour, but informs us about the consequences of specific types of actions, states or occurrences. It tells us how we should act and how we may not act by clarifying the legal implications, for instance if I register a legal deed regarding the transfer of property I become the owner; if I cause damage I am liable to pay compensation; or, if I cause harm that is qualified as a criminal offence I will be punishable. In Hartian terms, Holmes might have said that law communicates primary norms via secondary norms.[32] The law *informs us about* the legal effects of our actions, it tells us what to expect in terms of, for instance, enforceable duties to pay compensation, or actionable competences to dispose of a particular good. At the same time the *law thus informs the consequences of our actions*, intervening in the temporality and spatiality of the life world we inhabit and depend on. In short, the study of law cannot be understood as equivalent to information retrieval in general, due to the very specific status of the 'sources of the law' that are bound up with coercive authority. It can, nevertheless, be seen as a specific type of information retrieval, as long as we take into account the performative dimension of the practice of law that 'moulds' the contours of the life world we navigate. I will return to the difference between 'informing one about something' and 'informing something' in the section below, on 'Two senses of (law *as*) information'.

If we take the bad man's view it makes sense to retrieve information about the legal effect of our actions before deciding to hack a computer system or to sell sensitive personal data. The information retrieved would give us a fair idea of the consequences of our undertakings, a fair idea of how law as code will rewrite our future, depending on how we act. Holmes, the patron of the bad man's view, indeed, saliently defined the law as '[t]he prophecies of what the courts will do in fact, and nothing more pretentious . . . '[33]

In other words, the information that is to be retrieved takes the form of an anticipation based on a prediction.[34] It clarifies how those endowed with the competence to decide the law in individual cases will most probably interpret relevant legislation, case law and doctrine. This anticipation provides for legal certainty, it enables people to act and to guess how their actions will be qualified

32 cf K. Binding, *Die Normen und ihre Ubertretung. Eine Untersuchung über die rechtmässige Handlung und die Arten des Delikts. Erster Band, Normen und Strafgesetze* (Leipzig: Engelmann, 1890).
33 Holmes, n 29 above, 994.
34 On this particular point, saliently, see Kerr n 31 above.

by others, notably by others with the power to attribute legal effect (legal subjects, the administration, the courts and the legislator).

In that sense the law plays an important role in what Parsons and Luhmann framed as our human condition: our constitutive 'double contingency'.[35] This entails that the meaning of my actions rigorously depends on how I foresee that others will 'read' them, while the same goes for the actions of those others.[36] In the end, our understanding and interpretation of each other's behaviour depend on each other's anticipation of each other's anticipation and so on. This indicates a spiralling circularity in the production of meaningful utterances that grounds an inescapable mutual interdependence as well as the foundational uncertainty that generates new meaning. It makes sure that communication is a successful misunderstanding,[37] built on people masterminding each other without ever gaining total access to the other mind. The uncertainty inherent in our double contingency thus also saves us from being pre-empted by other people and institutions. Even if they were to try, the pre-emptions would be disrupted by the *under*determinacy of human language use that informs the difference between action and behaviour. This, in turn, sustains the uncertainty that is typical of human interaction and the ensuing unreliability that defines us, as underdetermined beings-in-the-flesh.

Double contingency thus generates a persistent subversive kernel that is not only beyond the control of others but also beyond our own. Marx, Nietzsche and Freud – the masters of hermeneutic suspicion – each in his own way foretold the end of an era where the self was seen as a sovereign ruler that knows and directs its subjects (the various parts of the body, and the mind).[38] In point of fact, moral philosophers cherish autonomy in terms of second order desires, meaning that what makes us subjects or agents is our capacity to will not to will something, to reflect on our first order desires and to resist them on the basis of our second order preferences. We pride ourselves in developing the capability of ignoring first order desires because we don't want to be the person who cannot resist smoking or drinking or gaming.[39] This ability to reflect and redress primary desires assumes – and constitutes - a homunculus that navigates and negotiates our mental states. In a sense, law's attribution of liability depends on the 'appointment' of this homunculus, which may indeed be a product of such attributions,[40] enabling us to address and redress our self as the author of our actions. In line with this, the homunculus we 'house' is

35 T. Parsons, *The Social System* (Abingdon: Routledge, 1991) 10, 36, 48, 94; N. Luhmann, *Social Systems* (Stanford: Stanford University Press, 1995) ch 3. The idea of a double contingency is derived from G. H. Mead's 'generalized other', cf. G. H. Mead and C. W. Morris, *Mind, self, and society from the standpoint of a social behaviorist* (Chicago, Il: University of Chicago Press, 1934) 152-164.

36 P. Ricoeur, 'The Model of the Text: Meaningful Action Considered as a Text (1973) 5 *New Literary History* 91; *idem*, *Oneself as Another* (Chicago: University of Chicago Press, 1992).

37 S. Zizek, *Looking awry: an introduction to Jacques Lacan through popular culture* (Cambridge, Mass: MIT Press, 1992) 28.

38 P. Ricoeur, *Freud and Philosophy: An Essay on Interpretation* (New Haven: Yale University Press, 1977) 32.

39 C. Taylor, 'Responsibility for Self' in A. O. Rorty, *The Identities of Persons* (Berkeley, Los Angeles, London: University of California Press, 1976) 285.

40 J. Butler, *Giving an account of oneself* (New York: Fordham University Press, 2005) 11-14.

not a substance but the vanishing point that holds together our fleeting sense of self. It is the unity of place, time and action that we enact when taking the stage in our shared world. In the end, however, we must admit that we can never be entirely sure of our own next move, or of what it will come to mean in the face of the double contingency we confront. This double contingency is part and parcel of the human condition, even if we have found numerous ways to stabilise the incertitude this implies.

One of these stabilisers is the law as we know it today, that is modern positive law. It contributes to mutual agreement on the cusp of mutual incomprehension or even bad faith; it provides legal certainty in the face of an abyss of deliberate or involuntary misunderstandings; and it dictates closure precisely because we have an open mind that is always in flux. The idea is that we should not attempt to overcome the incertitude that is our *conditio humana*. Instead, we need to work hard on sustaining the tension between the indeterminacy that defines our freedom and the determination that defines the necessary ground on which we stand. This tension is like the one that suspends a tightrope, keeping it up in the air to sustain our balancing act between over- and under-determination.[41] Clearly, the emerging confrontation with data-driven artificial agents will be a game changer for this dimension of the human condition, notably because we have no access to their anticipations. We cannot anticipate how they anticipate us. I will return to this point, and to what it does to the law, in the final part of this contribution.

The sources of law: the study and the practice of law

The delicate and often exhausting balancing act on the tightrope of mutual expectations means that the sources of the law cannot be defined as bran tubs filled with rules, principles, relationships or concepts.[42] They cannot even be mastered by divining or constructing an ontology or a data model that correctly describes the interrelationships between the relevant legal rules, principles, relationships or concepts. Although the exercise may be useful in sharpening Occam's razor, the law requires a certain productive redundancy to communicate its censure while respecting our constitutive indeterminacy. Such redundancy allows for shifts in meaning as it provides an excess of information that necessarily allows for a plurality of interpretations. This plurality, nevertheless, does not imply that anything goes. Arbitrary interpretation, for instance based on power asymmetry, is constrained and redressed by the interplay between justice, legal certainty and instrumentality as the formative aims of modern positive law.[43] This obliges the legislator, the courts and the administration to realign these often incompatible aims in the messy environment of concrete

41 I dare say that this balancing act entails that we ground the meaning of our communications in the thin air of the mutual double contingency that defines us, even if some may find this verbose instead of clarifying.

42 Though this is what Glenn, n 25 above, claims, emphasising that information cannot interpret itself, which I think is a valid point.

43 On the critical role of redundancy in the mathematical theory of information see the next section below.

cases, requiring judgement rather than calculation when deciding the law. The acuity needed for such judgement would be obliterated by too much compression of information as this would lead to overly 'rectangular' pruning. The sources of the law are in part defined by the authority they lend to what is retrieved and inferred from them, which provides for the certainty and stability of positive law. At the same time, any information they generate is forever redefined when mined and reconnected with other legal information, whether case law, statutes, legitimate expectations, treaties or even fundamental legal principles that are unwritten even when they have been codified. The temporal aspect that designates our double contingency thus returns in the prognostic nature of legal information that, in turn, underscores the performative nature of legal decision-making.

Based on this analysis, I dare say that the practice of law is identifiable as such by the specific ensemble of constraints that determines what counts as a legally relevant fact,[44] whether a legal act (concluding a contract), a legally relevant act (committing a tort), a legally relevant event (birth) or specific status (being an animal, a corporation or a notary public), coupled with the constraints that determine the legal effect (an obligation to deliver a good, to pay compensation, the status of a legal subject, or, simply the competence to create legal effect). The practice of law thus also identifies a set of professionals that considers itself bound by 'a regime of veridiction' as Latour might say,[45] which qualifies specific facts as legally relevant, while attributing legal effect. *Legal practice* enacts the law;[46] it performs legal effect, rather than telling us 'about' it,[47] building on and adding to the authoritative sources of the law that contain binding legal acts, such as legislation, administrative decisions, judgements, or contracts. In contrast, *legal doctrine* does not generate legal effect, but interprets the content of these sources, taking into account their hierarchical interrelation, thus helping to retrieve information from binding legal texts in anticipation of new cases. *Fundamental legal principles*, finally, generate legal effect by explaining the agonistic coherence of the applicable, binding legal texts – they are not 'about' the legal effect (as legal doctrine) but help the legislator, administration and courts to better 'read' and 'articulate' the conditions for the legal effect that applies in a particular case. Fundamental legal principles are (1) more abstract and transversal than the applicable legal rules and (2) more concrete and situated, as they are often invoked to resolve incompatible legal requirements in a particular case. In a sense such principles seem to have more agency characteristics than legal rules: they are adaptable, more tuned to a specific environment without being bound to it, and capable

44 MacCormick and Weinberger, n 20 above.

45 Latour (2009), n 4 above.

46 'Enact' here refers to the performative action that engages the force of law, notably the acts of legislation, adjudication, administrative decision-making, or even the act of concluding a contract. In the narrow sense 'enact' refers only to the act of the legislator that issues a code or statute.

47 Is an attorney part of the legal practice? When arguing a case she will consider herself bound by the same legal practice as the court and the legislator, but her conclusion does not have legal effect. In that particular sense she does not enact the law. Her interventions may, however, *inform* the enactment of the law, just like those of legal scholars who develop legal doctrine.

of some autonomic developments without losing their identity altogether. They act upon their environment after 'reading' it, in accordance with the relevant legal norms they inform and reconfigure. The sources of the law thus depend on a curious interdependency between the study and the practice of law that nourish each other. They must be distinguished but cannot be separated.

In this contribution I will oscillate between conventional understandings of law and those of information theory. I will assume that in some sense law can indeed be defined as the creation, storage and retrieval of information and that both the practice and the study of law can be articulated, in part, as specific types of information retrieval. When taking this point of view, however, we must remind ourselves that law as information incorporates law as an agent that informs the world we face. To assess what this means in the era of data-driven agency I will now investigate how computer science 'reads' information, before, finally, inquiring what the advent and advance of data-driven agency has in store for law as information.

AN EXTERNAL PERSPECTIVE FOR INSIDERS: INFORMATION THEORY FOR LAWYERS

The mathematical theory of information and cybernetics

Lawyers have a keen eye for analytical rigour. Since legal effect depends on how its conditions are defined we are 'naturally' sensitive to the consequences of extending or restricting the meaning of a legal term. Whether I can be punished for murder or hacking will depend on how my action is qualified and on how murder or hacking is demarcated. For us, meaning is not 'merely' semantics but the heart of the matter. Since the applicability as well as the meaning of legal norms also depends on their position in the relevant legal domain, on their relation with higher or conflicting norms, we have also developed a keen sense of the syntax of legal systems; of how legal norms match, overrule or align with each other - and of how the effects of a change in the meaning of a legal norm will ripple through the system, having potentially undesirable unintended consequences. Together with the performative character of legal practice, which highlights its pragmatic nature, it seems that law is a prime example for the study of semiotics. Semiotics, in both its Peircean and its Saussurian versions, studies signs as agents of signification, in between signifiers and signified.[48] It would therefore be obvious to assess law as information in terms of the semiotic universe, staying close to traditional legal concerns relating

48 A brilliant inquiry into information theory, based on semiotics, pragmatics and systems theory can be found in D. Nauta, *The Meaning of Information* (The Hague, Paris: Mouton, 1972) and *idem*, 'Information - measurement and meaning (1973) 11 *Linguistics* 97. Nauta aims to realign the statistical dimensions of computer-generated meaning with its semantic potential. His work is highly relevant for law *as* information, though I cannot explore it further in the context of this article.

to the nexus of meaning attribution, systematic analysis and the imputation of legal effect.

Instead, I will now turn to the mathematical theory of information and cybernetics, since – in an important sense - they contain the alphabet and the grammar of the onlife world. They set the stage for whatever is performed and both rely more or less on the same concept of information, formulated by Claude Shannon after the Second World War. This will provide us with the 'primitives' of the mathematical theory of information, the discrete digital data that crowd the capillaries of the onlife world. Note that my purpose is not to develop a cybernetic or mathematical theory of law, but – on the contrary – to show the data-driven logic behind the life world that law aims to regulate. It is an attempt to understand how computer scientists think and what computer science does in terms of architecting of our new onlife world. This should not only contribute to a better understanding of the world law aims to inform, but should also provide us with a keen eye for potential transformations of law itself.[49]

It would be difficult to overestimate the affordances of Shannon's concept of information,[50] which he developed in the course of establishing the scientific principles of cryptography (encoding secret messages). Let us first take note that Shannon's interest was 'discrete information', that is 'sequences of symbols, chosen from a finite set, mainly letters of the alphabet but also words of a language and even "quantized speech", voice signals broken into packets with different amplitude levels'.[51] His focus was on transferring such discrete information as fast as possible from point A to point B, hiding the content from unauthorised receivers while making sure the content that is reproduced at B is identical to what was sent from A. Speed, integrity and confidentiality of a set of symbols were his main concerns, not the content of the information itself. Shannon's mathematical information theory, in that sense, is not really concerned with information itself. It is - quite simply - about enabling fast and reliable transmission of 'information', whatever the meaning, while preventing unauthorised detection. In view of this singular objective, to count as

49 Attempts to develop a cybernetic theory of law have been made, cf A. D'Amato, 'International Law, Cybernetics, and Cyberspace' in M. N. Schmitt and B. T. O'Donnell, *Computer Network Attack and International Law* (Newport, Rhode Island: Naval War College Press, 2002). Cybernetic theory is often integrated with system theory as derived from the theory of autopoiesis; notably Luhmann and Teubner have developed a system theoretical articulation of law, as in N. Luhmann, *A Sociological Theory of Law* (Abingdon: Routledge, 2013) and G. Teubner, *Law as an Autopoietic System* (Oxford/Cambridge: Blackwell Publishers, 1993). My own position is closer to, for example, A. Lippucci, 'Cybernetic Legal Analysis and Human Agency' (1998) 4 *Res Publica* 1, 77, because Lippucci takes human agency seriously in a way that most versions of systems theory do not (with the exception of H. R. Maturana and F. J. Varela, *The Tree of Knowledge. The Biological Roots of Human Understanding* (Boston and London: Shambhala, 1998) 198-199.

50 On the concept of an affordance, see n 6 above. An affordance is what a particular environment (or artefact) makes possible in relation to a particular organism.

51 J. Gleick, *The Information: A History, a Theory, a Flood* (New York: Pantheon, 2011) 215 and C. E. Shannon, 'A Mathematical Theory of Communication' (1948) 27 *Bell System Technical Journal* July and October, 379-423, 623-656, who discriminates between discrete, continuous and mixed transmission systems, but builds on the first to develop the others.

information the content that is to be transferred must be quantifiable. Though some might say this rather limits the reach of the theory, the consequences of transforming most of our behaviour into quantifiable data traces (machine readable behaviours) have already been monumental. Therefore, inquiring into Shannon's concept of information is critical to detecting how his theory *informs* the structure and probability space[52] of the onlife world. In this context, 'to inform' is used in its transitive meaning, referring to the (trans)formative impact of whatever informs on whatever is informed, *in casu* the consequences of a highly specific way of framing 'information' for the contours, the shape and the workings of the new life world.[53]

For Shannon, information is measured in terms of uncertainty and surprise. If there is no uncertainty (we all know that if I hit you on the head with an iPad deliberately with no valid justification I will be liable for the harm I caused) there is, paradoxically, no information. If there is random probability (if we have no way of calculating the chance that a court will or will not convict me for smoking in a public place) we have, again paradoxically, maximum information, because whatever the court decides is surprising. Shannon called this random probability (or maximum uncertainty) entropy, a term borrowed from thermodynamics, where it refers to a stable state of complete disorder.[54] In most cases, however, we have more or less information; the higher the probability of a certain outcome the less informative it is, the lower the probability the more informative. This leaves us with a counterintuitive understanding of what counts as information: the better we can anticipate a hidden value (such as whether the CJEU will consider Google to be a data controller) the less information we have (according to Shannon).

Since one of the main concerns of Shannon's theory of information is how to transfer as much information as possible in as short a time as feasible, while taking note of the constraints of the information channel, Shannon concentrated on removing any and all redundant signs from the message to be sent. The fewer signs, the higher the speed (which highlights the physicality of the origins of his mathematical theory). It is precisely Shannon's need to

52 A probability space consists of a sample space (all outcomes that might occur), an event space (outcomes that actually occur) and a probability measure that predicts the distribution of the events over the sample space, cf A. N. Kolmogorov, *Foundations of the Theory of Probability* (New York: Chelsea Pub Co, 1960). Probability space is a theoretical construct that informs the construction of the onlife world that is thus ultimately informed by the theory of information that underlies its cybernetic operations.

53 R. Capurro and B. Hjørland, 'The Concept of Information' (2003) 37 *Annual Review of Information Science and Technology* 343, 350–355 (on the etymology of the term) and 397 (referring to the Oxford English Dictionary of 1989).

54 Note that disorder is not equivalent to uncertainty, though one can argue the connection. On Shannon's concept of entropy see L. Floridi, 'Semantic Conceptions of Information' in E. N. Zalta (ed), *The Stanford Encyclopedia of Philosophy* Spring 2015 at http://plato.stanford.edu/archives/spr2015/entries/information-semantic/, and Gleick, n 51 above, ch 9. On the relevance of negentropy for human individuation, highlighting the relation between technology and negentropy, see B. Stiegler, for example, his 'Net Blues' interview at *Le Monde*, 'Lois des réseaux [Laws of the networks]' 4 February 2015 at http://www.samkinsley.com/2015/02/04/bernard-stiegler-digital-shadows-and-enlightenment/.

get rid of redundancy that defined his issue with uncertainty: any bit that does not contribute to reducing uncertainty can be left out. This is where the mathematics come in, affording significant compression of the data required to convey a certain message. Note that redundancy here does not refer to the meaning of the message, but to the signs used to communicate it. For instance, if I can remove all vowels and all spaces from written language and still convey the same text, I have removed redundancy without jeopardising the content of the message.[55] This is possible because the system can reconstruct the original sentences by means of computation, based on the numerical probability of one letter, word or other data point following another. The content here refers to the signs or discrete data points, not to their meaning, which can be ambiguous, redundant or irrelevant, depending on the intention and the context of the sender, the background and the context of the receiver, and notably the differences between them (they may live in another time, speak another language).

Norbert Wiener, the founding father of cybernetics,[56] in a sense, turned Shannon's theory inside out, claiming that information is negative entropy or order, meaning that the more structure we find the more information we have.[57] This brings us closer to common sense, according to which information is often equated with knowledge (the retention and organisation of information in a particular medium, whether my brain, a stone tablet, a book or a database) rather than news (whatever information is both relevant and unknown). Wiener's concern was different from Shannon's. Instead of focusing on the speed, confidentiality and integrity of messages his interest lay in the control we can exercise over our environment by means of messages. This links information with action and decision-making. Cybernetics derives from the Greek term for navigation, steering and governing, thus connecting information theory with regulation and law. As one can imagine, the capability to detect information, now understood as the prediction of a hidden pattern or value, has enormous potential in terms of controlling the behaviour of a population. If I can somehow foresee how people will behave on the basis of a limited set of data points (behavioural traces) I may be able to manipulate them – especially to the extent that they are not aware of my predictions. If I know that you have a low spending capacity I may be able to induce reduced energy consumption more easily by charging you a higher price, whereas this might not influence those with a high spending capacity. If I know that your behavioural biometrics (for instance your gait, the way you move) matches the onset of Parkinson, or even a genetic propensity to develop Parkinson, I can decide to reject you for a job or for a life insurance policy.

55 Note that various scripts have existed that knew only consonants (so-called abjads) confirming that the vowels could be guessed from the context, cf P. T. Daniels, 'Fundamentals of Grammatology' (1990) 110 *Journal of the American Oriental Society* 727.

56 N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (Cambridge, Mass: MIT Press, 1948) and *idem*, *The Human Use of Human Beings: Cybernetics And Society* (Boston: Da Capo Press, 1988).

57 Though admittedly that also implies that the disclosure of a hidden value will be less informative, which would be Shannon's point.

Beyond the mathematics of information theory

Information is not a thing or a substance, as Wiener wrote: 'Information is information, not matter or energy'.[58] Information is what structures perception and cognition, while being contingent upon the receiving agent and whatever affords or sends the information. It can, for instance, be read off the position of the sun that indicates the hour of day, or sent by an agent to manipulate its environment, like a smell that attracts a prey that is caught when coming close. Mistaking information for its carrier is a category mistake, though believing that the carrier does not make a difference is even more precarious; different carriers have different affordances, changing the speed, accessibility, and actionability of whatever is communicated or 'read off' the environment. Indeed, whereas information is not a substance, once it has been articulated in a certain medium (a book, a silicon chip), it can be commodified as if it were a substance.[59] This can only be done under specific conditions and may require hard work, implementing frictions in the infosphere that render the information temporarily or relatively inaccessible, while under the control of the 'possessor', 'owner' or 'rights-holder'.[60] Think of locked cupboards, closed rooms, encryption keys or the introduction of intellectual property rights. Without such hard work, the relevant information would be non-rivalrous; one person 'having' more of it does not necessarily imply that others 'have' less of it. It would also be non-crowding, as one person making use of it does not necessarily imply that others can make less use of it. The point is, however, that if a person 'consumes' information this will change both the information (most often it will be exhausted after being taken into account, woven into the knowledge-base of the agent) and the person (who will have a more or less different take on her world and her self).[61] Such changes will often transform the value of the information for another person, if only because the original person may have changed her course of action due to the information, or because the value of information resided in gaining a competitive advantage over others who lack such information. This seems to be at odds with the idea that information is non-rivalrous and non-crowding. The latter assumes that information is identical with itself in the course of time and independent from the perceiving agent and from other pieces of information. Though this may be true for an inscription on clay tablets, paper or silicon chips, which is relatively stable and uniform across time, we must not confuse information with its carrier and,

58 Wiener (1948), n 56 above, 132. Similarly, H. von Foerster, *Understanding Understanding* (New York, NY: Springer, 2003) 200-201. I would say, with Ryle, that mistaking information for either matter or energy is a category mistake; information has a different mode of existence than matter or energy. On the category mistake G. Ryle, *The Concept of Mind* (New York: Barnes & Noble, 1949).

59 cf Von Foerster, *ibid*, 200-206 on the impossibility of commodification of knowledge and information (cf n 62 below.

60 We could use the term 'datified' if we define data at the highest level of abstraction, ie support independent, noting that, according to some, 'the actual format, medium and language in which semantic information is encoded is often irrelevant and hence disregardable' (cf Floridi, n 54 above).

61 Interestingly, Beer (an expert in operational research and cybernetics) defined information as 'that which changes us', S. Beer, 'What Is Cybernetics?' (2004) 33 *Kybernetes* 3/4.

in any case, the information that is inscripted clearly depends on a cognising agent. This is so not merely in the obvious sense that something may be new for you whereas I already know it, and therefore it is information to you but not to me. It is also agent dependent in the sense that what counts as relevant depends on the perceiving and cognising agent in the environment that she is enacting. What is informative for a bat may be inaccessible or irrelevant for a human; what is informative for an employer may or may not be informative for an employee (and if so, probably in another sense).

This raises fascinating questions, such as whether the Rosetta Stone contained information before its code was deciphered. Those who wrote the inscription meant to retain information for later use, and those capable of reading the signs gained information. But during the centuries that no information was conveyed, should we deny that the signs 'contained' information, and if so, what does 'contain' mean? This is only an issue, however, if we try to answer the question from an observer's perspective, remaining agnostic about whether the signs can be 'read'. A more interesting perspective takes note that signs do not 'contain' anything, but rather present a potential gain of information, that potential depending on the existence or not of a capability to construct the key to unlock the code.[62] What is gained after decoding is information in the sense of potential meaning, that is contingent upon the integration of the information in the web of knowledge that grounds the cognition of the reading agent. This obviously raises the question of what is knowledge.[63]

For an organism knowledge can be defined as retained information that has been integrated with a body of knowledge previously retained, though some would counter that this confuses knowledge with memory.[64] However, to the extent that knowledge has been retained it is indeed a matter of memory. This not only goes for representational knowledge in the sense of being articulated in symbolic language, but also for knowledge has been articulated into the design of the organism; the body, not merely the brain, remembers how to do things, how to respond to movement or other changes in the environment. Knowledge in this broad sense can even be part of the genetic make-up of the organism (innate behaviour), though we may tend to associate knowledge with what an organism learnt while navigating its environment (learnt interaction).[65] Human beings, however, have a very specific type of memory, since language enables them to recall what happened in the past at a symbolic level and to share this when speaking with one another. External memories – clay tablets, books or databases – make such retention available across time and space between

62 Rosetta Stone (2015), *Encyclopædia Britannica Online* 17 May 2015 at http://www.britannica.com/EBchecked/topic/509988/Rosetta-Stone. One can argue that as long as information is not 'processed', 'integrated' or 'introjected' by a living organism, it is neither information nor knowledge, cf B. Stiegler, 'Die Aufklaerung in the Age of Philosophical Engineering' in M. Hildebrandt, K. O'Hara and M. Waidner (eds), *The Value of Personal Data. Digital Enlightenment Forum Yearbook 2013* (Amsterdam: IOS Press, 2013) 29. Similarly Von Foerster, as discussed at 417, in Gleick, n 51 above.

63 See also Von Foerster, n 58 above, 200-206.

64 On the relationship between knowledge and memory (and logic) P. Rossi, *Logic and the Art of Memory. The quest for a universal language* (Chicago, Il: University of Chicago Press, 2000).

65 Bateson, n 7 above 129-133.

different agents. When people speak of knowledge they generally refer to such symbolic representation, retained in the mind of individual persons, books and libraries.

Two senses of (law *as*) information

This brings me to an important difference between two senses of what is meant by informing someone or something. There is a difference between information as the object or content of a message, and information that acts as a subject or agent upon something else. Capurro and Hjørland note that '[t]he concept of information as we use it in everyday English in the sense [of] *knowledge communicated* plays a central role in today's society [emphasis in the original]'.[66] In contrast, the etymological roots of the term emphasise the action of shaping, forming or moulding something, where the 'in' highlights the impact of the subject of *informare* on its object. The Latin term was, for instance, used in the context of pottery, showing a rather down to earth, material connotation. Cicero and Augustine employed the term *informare* in the sense of mental modelling, explicitly referring to the relation with Greek terms such as *eidos, idea, typos* and *morphe* which had strong ontological and epistemological connotations.[67]

Though Capurro and Hjørland underline that in the context of information and computer science the term has come to refer rather exclusively to the communication of knowledge, I believe that in common sense, in law and in philosophy we still use both meanings of the term. We can say that something stores or communicates *information about* something or posit that one thing *informs* another thing. A doctrinal treatise or scholarly article about the presumption of innocence may contain information about a series of judgements of the European Court of Human Rights; it may also be said to have informed the Opinion of the Advocate General at the Court of Justice of the European Union. It seems that information about something refers to past occurrences, whereas for one thing to inform another thing it must precede that thing. A judgement informing another judgement does not imply causality, though some may understand it as 'influencing', since 'to inform' in this sense is more than 'having provided information about' but less than 'having determined'. I would argue, however, that causality is not the point here, we are rather in the realm of institution or constitution, which is not equivalent to causal influencing. One thing informing another entails that the one has somehow been integrated in the operations of the other, has become part of the other thing.

As to the law, this means that, on the one hand, the law provides information about the consequences of our behaviours, a statement that assumes an external perspective on the law (for instance a bad man's perspective, or a *homo*

66 R. Capurro and B. Hjørland, *The Concept of Information* at http://www.capurro.de/infoconcept.html, under Abstract (pages are not numbered). This is the extended version of *idem*, n 53 above, it includes an interesting section on the Greek and Latin roots of *informare* that is not part of the published chapter.

67 Capurro and Hjørland, *ibid*, under Latin Roots and Greek Origins.

economicus). On the other hand, it also means that law informs our interactions, a statement that assumes an internal perspective. The first perspective enables the calculation of behavioural choices in terms of costs and benefits, evoking Feuerbach's theory on the function of punishment: that the law should inform potential perpetrators about their liability to an amount of punishment that negates the expected benefits of the criminal act they contemplate.[68] The second perspective trades on the idea that people feel obliged to obey the law, for whatever reason, even if they choose not to act in accordance with it. One could say that the law is under their skin, that the obligation to follow the law is part of their identity as citizens of a specific jurisdiction. This could actually constitute a lack of freedom, caused by ignorance about the legal norms followed by way of habit instead of deliberation and appropriation. The internal perspective could pre-empt those subject to the law due to a lack of distance, disabling them from reflecting on their obligations. Indeed, it is the written nature of modern law that enables those it obliges to externalise the legal norms that bind them, thus affording reflection and contestation, alternating between an internal and external point of view. If we cannot but obey the law because we are not aware of the hold it has on us, we are in the realm of discipline, nudging or priming, not in that of the law. This is what Hegel observed in his footnote on treating people like dogs.[69] In point of fact, this is what links written law with the turn from a rule *by* law to a rule *of* law; externalisation of the norms that orient our actions liberates us from their hidden cybernetic effects.

Modern law and the Rule of Law

Modern law, grounded in written legal text (legislation, case law and doctrine) initially provided those living under the rule *by* law with the idea of reliable predictions of how their government will likely respond to their actions. Enacting written legislation enabled a sovereign rule that required or prohibited specific actions under threat of enforcement, thus evoking a measure of legal certainty and societal trust while steering individual and collective action. The subtle but critical transition from rule *by* law to rule *of* law allowed for the consolidation of this trust, based on the reinvention of sovereignty as a system of checks and balances, or countervailing powers. Once the sovereign could be forced to live by its own laws by attributing the power to test its compliance to an independent subdivision of that same sovereign, written law mutated from mere 'information about the law' to 'a law that actually informs the consequences of our actions'. The birth of positive law, with its *res judicata* and *litis finiri oportet,* became an instrument to regulate large populations, but – ultimately and simultaneously – also turned into an instrument to regulate the regulator.

68 Von Feuerbach, *Lehrbuch des gemeinen in Deutschland gültigen Peinlichen Rechts* (Giessen: G. F. Heyers, 1801) 12-20. See T. Hörnle, 'PJA von Feuerbach and his Textbook of the Common Penal Law' in M. D. Dubber, *Foundational Texts in Modern Criminal Law* (Oxford: OUP, 2014) 119 and http://www.law-lib.utoronto.ca/bclc/crimweb/foundation/Feuerbach%20current.pdf.

69 G. W. F. Hegel, A. W. Wood and H. Barr Nisbet, *Elements of the Philosophy of Right* (Cambridge: CUP, 1991) § 99, Addition (H), 125.

If the legislative and executive subdivisions of a sovereign know that their enactments will be interpreted *and* enforced by an independent subdivision they will reconsider their enactments in the light of potential uncertainty of such enactments, as this will boomerang back to their own operations. They will have to anticipate the enforceable expectations raised by their rule-makings. Deciding the law under the Rule of Law is like telling two children who must share a piece of cake that one may cut and the other may choose first; chances are that the cutting edge will be right in the middle. This is not a matter of moral economy or conceptual elaboration but foremost a matter of procedural justice in the sense of *architecting* effective remedies. Across continents and centuries this understanding of the Rule of Law has been developed, defended, explained and inspired by, notably, Montesquieu, Dicey and Waldron (who all three emphasised the central role of independent courts in keeping sovereignty in check).[70]

Once democracy became part of the equation, sovereign rule became self-government, creating and confirming a double form of transparency: (1) people live under rules of their own making (democratic participation), and (2) the application of those rules can be contested in a contradictory procedure capable of opening the black box of their interpretation (the Rule of Law). Modern law has thus been instrumental in establishing one of the most successful cybernetic systems *avant la lettre*, that of constitutional democracy. Note that the checks and balances are achieved by making the success of the control dependent on those who are to be controlled, instituting a pertinent and permanent feedback loop in both directions (between rulers and ruled). This entails that those ruled are not seen as mere objects to be controlled, but subjects participating in self-rule, accountable for their actions to their government and to each other. This is not equivalent with self-regulation per se, but can be defined as a specific cast of self-regulation, that is contingent upon a particular structure that generates iterative reflection on the rules that define the societal probability space.

As I have argued elsewhere, modern law can be seen as an affordance of the printing press,[71] constituting a cybernetic system that informs self, mind and society. Before investigating how the emerging cybernetics of the onlife world informs and reconfigures the relationships between self, mind and society, and how this uproots traditional, modern understandings of law,[72] we need to return to the idea of information beyond its mathematical articulation. Whereas Shannon and Wiener abstracted from the content and meaning of information, we need to balance the relational structure of information-transmission and

70 For theoretical underpinnings of this procedural conception of the Rule of Law, notably moving beyond traditional distinctions between formal and substantive conceptions, see J. Waldron, 'The Concept and the Rule of Law' (2008) 43 *Georgia Law Review* 1 and *idem*, 'The Rule of Law and the Importance of Procedure' *New York University Public Law and Legal Theory Working Papers* 1 October 2010 at http://lsr.nellco.org/nyu_plltwp/234. Also M. Hildebrandt, 'Radbruch's Rechtsstaat and Schmitt's Legal Order: Legalism, Legality, and the Institution of Law' (2015) 2 *Critical Analysis of Law* at http://cal.library.utoronto.ca/index.php/cal/article/view/22514.

71 Hildebrandt, n 6 above, *idem*, 'A Vision of Ambient Law' in R. Brownsword and K. Yeung (eds), *Regulating Technologies* (Oxford: Hart, 2008).

72 Note that in the Western world *modern* conceptions of law are the *traditional* way of understanding law.

storage with keen attention to the message it brings, acknowledging that this message, to be information, concerns a difference that makes a difference.[73]

FINALLY: LAW AND DATA-DRIVEN AGENCY

Information theory as a universal language and the contestability of the law

Let us return to Google's 'thought vector', capable of decoding and encoding the same information in different languages. Note the assumptions inherent in the term 'same', reminiscent of Leibniz' ideal of a universal language that is capable of expressing 'reality' in terms that are 'brief and essential, precise and plain'.[74] The idea of a universal language has close ties with logic and mathematics, cherishing the supposedly translinguistic clarity of mathematical symbols. One can guess that the mathematical theory of information that ultimately informs machine translation has similar attractions for those inclined to a single, universally valid artificial language. It might be that translating anything and everything into machine-readable bits and bytes basically *enacts* a universal language, though based on statistical inferences instead of pure logic.

Depending on how this is done, such a universal language can be highly problematic, if only because the inferences will be contingent on the input (the so-called training set) and on the computational techniques employed to detect the output (patterns, correlations, association rules or clusters in the data set), neither of which can be taken for granted. In the context of computer science, Wolpert has explained that the question of whether data mining techniques provide the right kind of inferences cannot be answered without relying on some form of constitutive bias.[75] Under the heading of his so-called 'no free lunch theorems' Wolpert has 'proven' that the question of whether the algorithm that is used to mine the data comes up with correct, effective or meaningful inferences depends on the distance between the hypotheses it *articulates and tests* in the training set on the one hand and the patterns that inform the 'off-training-set', that is 'the real world'. Enlarging the training set does not solve the problem, as it cannot contain future data. Believing that Big Data will solve all our problems thus re-introduces the inductive fallacy. In that sense Wolpert may be said to have brought some sensible Humean scepticism to data science. In the end he demonstrates how the bias that is necessary to mine the data inevitably co-determines the results. This relates to the fact that the data as well as the hypothesis space that is used to train an algorithm is finite. 'Reality', whatever that is, escapes the reductions inherent in ML; data

73 Bateson, n 7 above. This reframes the earlier position of Carnap, who suggested that information is 'a distinction that make a difference', See Floridi, n 54 above.

74 Rossi, n 64 above, 149, referring to Bacon's quest for a universal language that ensures congruence between words and things.

75 D. H. Wolpert, 'The Lack of A Priori Distinctions Between Learning Algorithms' (1996) 8 *Neural Computation* 1341. D. H. Wolpert and W. G. Macready, 'No Free Lunch Theorems for Optimization' (1997) 1 *IEEE Transactions on Evolutionary Computation* 1.

is not the same as what it refers to or what it is a trace of and the constitution of the hypothesis space is not equivalent with the reality it aims to map.

Even so, the fact that bias informs the choice of algorithms should not be seen as a bad thing. On the contrary, the bias is what makes ML productive, it is the generative process of abductive reasoning, tested by the iterative process of inductive verification and falsification.[76] The bias inherent in ML aligns with the importance of heuristics in cognitive exploration,[77] and to some extent this bias also aligns with Gadamer's hermeneutic philosophy,[78] emphasising that without an implied bias we cannot achieve any kind of perspective on the web of meaning we create while it creates us. However, what saves us from getting things wrong in machine learning, heuristics or hermeneutic understanding is the contestability of the bias, the iteration of testing our frames of reference against the world we need to navigate. Once a bias is taken for granted as a mirror of reality we enter the danger zone, as it makes us blind to whatever escapes the model that has been inferred. Moreover, in law and the Rule of Law this contestability is a normative requirement that safeguards us from being lured into submission to legal norms that may not be valid or correctly applied. The validity of law and its correct application, however, are not given – they require argument and contestation to come alive. They are part of the foundational double contingency that defines us. The problem, therefore, is not in the bias, but in hidden bias and in our inability to test the assumptions and the operations that nourish data-driven agency.

Law informed by data-driven agents

Calling the vector that represents a sentence in natural language a 'thought' vector is in the realm of metaphor, taking a technical term from ML to represent human thought. A vector in point of fact represents a set of data points – whether a sentence, a piece of DNA, an image or spoken language, and it is nothing very new or special within the realm of data science. Nevertheless, the achievements of ML and its impact on nearly all spheres of life, including the sciences, mathematics, the humanities and professional expertise, make for a radical evolution in knowledge, information and memory as well as their mutually constitutive relationships. It appears that layered artificial neural networks enable types of second, third and further order learning that do a

76 C. S. Peirce, *Pragmatism as a principle and method of right thinking* (Albany: SUNY Press, 1997) 225-238. Peirce explains that abduction and deduction generate hypotheses, requiring induction to test their salience. Deduction generates hypotheses that are necessarily true if the theory from which they were derived is valid, whereas abduction generates hypotheses that are not necessarily true but capable of sustaining novel theory, which must therefore be tested empirically (by means of induction).

77 See, for example, G. Gigerenzer, *Adaptive thinking: rationality in the real world* (Oxford: OUP, 2000).

78 H. G. Gadamer, *Truth and Method* (London, New York: Continuum, 2004). Heuristics in cognitive science and hermeneutics should not be depicted as equivalent notions. Heuristics plays out in all living organisms, whereas hermeneutics concerns a theory of interpretation, concerned with meaning. Nevertheless, both emphasise the need for constitutive bias, frames of references, presuppositions, assumptions or – in Gadamer's term, 'Vorurteil'.

pretty good job of simulating, for instance, the usage of human language and thus of generating meaning (which is, of course, attributed by the humans or institutions that engage with these results). Such layered ML is called deep learning (DL). It has been saliently described under the heading of 'How Computers are Changing the Way We Explain the World',[79] pointing out that DL provides for incredibly salient results though always based on 'mere' statistics, leaving causal explanation or understanding in terms of meaning out of the equation (and thus, up to us, the human agents who pick up on the outcome). It seems that the capacity of these machines to simulate expertise reaches far beyond our capability to check the results. However wonderful these results, the gap between their achievements and our ability to understand the outcome is cause for concern – notably also for the law. These systems will soon be able to detect different types of legal argumentation in legal text, while charting the legal domain to which it applies, the kind of case it concerns (asking for an injunction or compensation, charging a defendant), and the legal effect that is at stake.[80] At some point this will lead to an era where 'if data-driven agency defines a situation as real, it will be real in its consequences'[81] and to the extent that such determinations are not contestable by those subjected to their implications, we will have to reinvent such contestation to uphold the Rule of Law.

Though it makes sense to help computers to figure out our concept of a capital city by teaching them to 'take the vector for Paris and subtract the vector for France and add Italy, [such that] you get Rome', this is not what we mean by a thought.[82] Lawyers are well situated to explain why the translation that is programmed here, on the basis of learning algorithms, may be helpful only insofar as we acknowledge that such translations gain something while also losing something. As they say: '*traduction c'est trahison*'; even an excellent translation implies a bit of treason.[83] This is not necessarily a bad thing - García Márquez supposedly told his translator that the English translation of *One Hundred Years of Solitude* was better than the Spanish original[84] – but it testifies to the foundational poly-semantics of human language. Even if information in the mathematical sense can be compressed and transferred, decoded and recoded, when reaching a human person its meaning remains contingent upon the habits and anticipations of her 'reading' of the information, while these habits and anticipations are in turn contingent upon – though not overdetermined

79 M. Nielsen, 'How Computers Are Changing the Way We Explain the World' *Wired Magazine* 8 August 2015 at http://www.wired.com/2015/08/computers-changing-way-explain-world/?.

80 On ML and translation in the context of legal knowledge systems, see Surden n 27 above, 100.

81 Hildebrandt, n 2 and n 3 above.

82 Perhaps it is an artificial thought, in line with Solum's 'artificial meaning', cf L. B. Solum, 'Artificial Meaning' (2014) 89 *Washington Law Review* 69.

83 G. Rabassa, *If This Be Treason: Translation and Its Dyscontents, A Memoir* (New York: New Directions, 2005).

84 As claimed by Rabassa, *ibid*, cf D. O. Pere, '"100 Years Of Solitude" Translator Speaks For First Time About Gabriel García Márquez's Death' Fox News Latino 24 April 2014 at http://latino.foxnews.com/latino/lifestyle/2014/04/24/nobody-writes-translator-gregory-rabassa-speaks-about-gabriel-garcia-marquez/.

by – her cultural, institutional and linguistic settings.[85] Whereas from the perspective of a mathematical theory of information this may be irritating, because it turns straightforward information into something ephemeral such as meaning, for the law this is crucial.

The longstanding debate on comparability in comparative law shows that, on the one hand, common law legal institutions such as the trust can be compared with and differentiated from continental legal figures such as a foundation, though, on the other hand, most lawyers would agree that, based on the comparison, we should acknowledge that in civil law systems the trust as a legal institution with specific legal effect does not exist.[86] The point is to recognise such differences and investigate them in terms of the legal traditions that inform them, without getting carried away to the extent that comparison itself becomes next to impossible, as some 'incomparabilists' would have it.[87] Instead, we should frame the comparison as a productive meeting of different legal traditions,[88] cherishing the existence of different webs of legal relations and precepts that host fundamentally different institutions. The repertoire of different legal constructs enables a debate on what we can learn from each other, including a learning process on what and why solutions that work in one context are unfit for another.

Taking law seriously as a normative enterprise, alternative legal solutions should also enable a comparative perspective on the differential legal protection afforded by these solutions.[89] Cutting all legal traditions down to what can be coded in mathematically precise, machine readable data points will not only decrease the diversity of legal solutions, but might easily erase the fundamental requirement of contestability that typifies the Rule of Law. It is high time that we extend the expertise and experience consolidated in comparative law to

85 It seems to me that Solum, n 82 above, has a curious understanding of what he calls 'natural' meaning, as if this were to be primarily determined by the intention of a singular mind. The meaning of an utterance in natural language, however, always depends on a complex process of signification that involves the author (sender), the relevant interpretive community (bound by the dynamic code it develops, applies and transforms), and the reader (receiver). In that sense the meaning of natural language is 'artificial by nature', in line with one of the tenets held by philosophical anthropologist Helmuth Plessner, whose work is highly relevant for the era of data-driven agency, cf. J. de Mul (ed), *Plessner's Philosophical Anthropology: Perspectives and Prospects* (Amsterdam: Amsterdam University Press, 2015).

86 In his early work on artificial intelligence Solum saliently discussed under what conditions intelligent machines could serve as a trustee, cf L. B. Solum, 'Legal Personhood for Artificial Intelligences' (1992) 70 *North Carolina Law Review* 1231.

87 Pivotal but tending towards incomparability, P. Legrand, 'The same and the different' in P. Legrand and R. Munday (eds), *Comparative Legal Studies: Traditions and Transitions* (Cambridge: CUP, 2003) 240.

88 On the possibility of a meeting of minds between agents who each speak their own language, while still understanding each other: J. van Brakel, 'De-essentialising Across the Board. No Need to Speak the Same Language' (2006) 3 *Netherlands Journal of Legal Philosophy* 263. With great acuity such a meeting of legal minds from outlandishly different legal traditions was initiated by Glenn, n 25 above.

89 I am not proposing a functionalist approach as, for example, developed by K. Zweigert and H. Kötz, *Introduction to Comparative Law* (Oxford: Clarendon Press, 1998), which hinges on the assumptions of functionalist sociology; I rather endorse the strategy of Glenn, n 25 above. cf M. Hildebrandt, 'The Precision of Vagueness, interview with H. Patrick Glenn' (2006) 3 *Netherlands Journal of Legal Philosophy* 346.

the upcoming domain of human law and computer law. Computer law, here, understood as the law that is generated by computer systems, for instance when employed for automatic implementation of administrative decisions or used as a legal knowledge system that sorts, filters and formats legal text to enable what Moretti has coined 'distant reading'.[90] The point is not to resist data mining operations on legal text, but to interrogate the effect of the mining on the meaning of legal text – both in the sense of whether ML will come up with meaning that differs from what a court might have inferred and in the more generic sense of whether the ambiguity that grounds current law will be lost, thus transforming the meaning of meaning in law.

There is no doubt that once they become available these text mining operations will transform the legal profession and disrupt current understandings of law. Richard Susskind, for instance, envisages:

> the emergence of a further grouping of professionals - the legal knowledge engineers. These are highly skilled individuals who will be engaged in the jobs of standardizing, systematizing, and packaging the law. They will be the analysts who reorganize and restructure legal knowledge in a form that can be embodied in advanced systems, whether for use by lawyers, paralegals, or lay people.[91]

Though I agree with Susskind that lawyers are not 'self-evidently entitled to profit from the law',[92] I am not sure that the problems this has generated will be resolved when 'the delivery of legal service ... [is] financed and managed by non-lawyers',[93] at least not when this means that the law becomes 'subject to the normal laws of the marketplace and not some kind of special case, sacred cow, or no-go zone'.[94] Note the use of the term 'laws' in 'the normal laws of the marketplace', suggesting that these are either similar to the laws of nature, or simply better laws. What is at stake here is a purely instrumentalist perspective on law,[95] considered as a tool just like any other, requiring that its operations are tested against other tools in terms of speed, efficiency and effectiveness. I agree that as lawyers we should wake up and foresee that our skills and sources will soon be evaluated in machine-readable terms; we need to develop a vision of the added value of law in the face of a transformed, data-driven market place. In contrast to Susskind, however, I believe we must

90 M. Hildebrandt and J. Gaakeer (eds), *Human Law and Computer Law: Comparative Perspectives* (Dordrecht: Springer Netherlands, 2013). On distant reading, see F. Moretti, *Graphs, Maps, Trees. Abstract Models for a Literary History* (London: Verso, 2005). More specifically in relation to the law, M. Hildebrandt, 'The Meaning and Mining of Legal Texts' in D. M. Berry (ed), *Understanding Digital Humanities: The Computational Turn and New Technology* (London: Palgrave Macmillan, 2011) 145.

91 Susskind, n 31 above, 7.

92 *ibid*, 2.

93 *ibid*, 10.

94 *ibid*, 10.

95 On the difference between an instrumental and an instrumentalist perspective on law, see Hildebrandt, n 6 above, ch 8, based on R. Foqué en A.C. 't Hart, *Instrumentaliteit en rechtsbescherming* (Arnhem Antwerpen: Gouda Quint Kluwer Rechtswetenschappen, 1990). Compare Kant's categorical imperative that prohibits using a rational agent without respecting its autonomy; Kant could be said to condemn instrumentalism, but not instrumentality when it comes to making use of humans or other rational agents.

not fall into the trap of having our 'trade' compressed into the operations of an assumedly neutral, data-driven system that translates the flux of law into its machine-readable fodder, discarding what it cannot recode as such and what it takes to be redundant, ambiguous or indistinct.[96]

Safeguarding human autonomy, enabling contestability

Recalling the practice of AB testing as the most salient reference to the hidden manipulations that pervade the onlife world, we return to Hannah Arendt's *The Human Condition*:

> The last stage of the laboring society, the society of jobholders, demands of its members a sheer automatic functioning, as though individual life had actually been submerged in the over-all life process of the species and the only active decision still required of the individual were to let go, so to speak, to abandon his individuality, the still individually sensed pain and trouble of living, and acquiesce in a dazed, 'tranquilized,' functional type of behavior.[97]

Before taking this depressingly accurate observation to its apotheosis in the era of data-driven agency, I reiterate her subsequent – even more prophetic warning (quoted at the beginning of this article): 'The trouble with modern theories of behaviourism is not that they are wrong but that they could become true'.[98]

Now we can make our point, weaving together the investigations undertaken so far. Data-driven agency refers to the computational cyberphysical environment that not only observes our behaviours but also actively intervenes to pre-empt them. Being data-driven and based on ML, such agency can be a unity of action and perception, capable of learning from its experience with our behaviours. By rigorously abstracting from our conscious intentions, sticking to a statistical anticipation of our inferred intent, data-driven agents can foresee and pre-empt us without any interest in what moves or motivates us, delegating our free will and deliberation to the realm of epiphenomena or redundant information. If I can predict and pre-empt a person without recourse to her reasons for acting one way or another, why bother to inquire about such reasons? Why speak of action, that indeterminate fountain and unregulable resource of our double contingency?

This is what should concern us. This is why law cannot afford to await the actual realisation of an onlife world that thrives on data-driven agency. This

96 Neither Solum, nor Surden, n 27 above, seem to grasp the disruptive character of data-driven 'agency'. Solum believes it will be more accurate and functional in solving human coordination problems than humans ever could. This sounds overly optimistic, notably compared to Surden, who – on the contrary – believes that machine learning will not achieve more than an approximation of human skills in the foreseeable future, though specific tasks may be routinised and delegated to machines. On the dangers of such delegation, see, for example, D. K. Citron, 'Technological Due Process' (2007) 85 *Washington University Law Review* 1249. D. K. Citron and F. Pasquale, 'The Scored Society: Due Process for Automated Predictions' (2014) 89 *Washington Law Review* 1.

97 Arendt, n 12 above, 322.

98 *ibid*, 322.

is why lawyers need to engage with the concepts, operations and grammar of computer science and information theory, collaborating to redesign the upcoming data-driven architectures to accommodate human action, to safeguard the fundamental uncertainty and indeterminacy it assumes, and to protect the pinch of freedom and autonomy that defines us. We need to move beyond merely embracing or critiquing the mathematical theory of information, to an engagement with the assumptions of what turns a data point into an agent of intervention. We must proceed to build contestation into the heart of the upcoming cyberphysical architectures, notably requiring alternative ML algorithms and open source code to make sure that defaults can be contested and reset. We must explain to the architects of the onlife world that law is not just information about the legal effect of our actions, but also the performance of that effect, while demonstrating that the force of law is not equivalent with the effects of computer code.