

Algorithms and Law

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Abstract

The paper moves from the idea that thanks to a technology, which was able to transmit data in a rapid and secure way, and the spread of (personal) computers, a globalised network of data users was created. They started to produce content which was then organized and interconnected.

This essay outlines the role of the law in this process. It notes that the law of states was not interested at first in the regulation of this network, which was at first used only used by its inventors-designers. They created and established the technical norms through which it existed, ie 'the original code'. Little by little, the participants with ownership rights to this technology, and the market, added to these non-legal norms.

In this regard, theory has been elaborated which claims that the network is regulated by the existence of autonomous legal systems which are made 'by communities of choice clustering around shared interests'.

The work criticizes this approach because, in the era of digitalism, not even the most articulated and precise legal system allows to calculate the law, so that, *a fortiori*, also the respect of fundamental human right could be threatened.

The essay also highlights that the obscure nature of legal systems in which norms are formulated by algorithms is amplified by the current function of the data that is being considered somewhat akin to natural resources, as 'data in the wild'. This phenomenon appears in the so-called 'deep learning' phenomenon, in which is not possible to know *ex ante* the data that are the inputs of the algorithmic procedure. Thus, the data are not provided by humans, but they are learned from the algorithm itself.

In conclusion, algorithmic mathematical design needs to be considered in more detail in order to understand its real function. Indeed, it is only through the investigation of this function that the possible regulation of decisions based on algorithms and the role of the law within the machine-internet-web system can be analyzed.

I. From Digital to Digitalism: The Transformation of Human Experience into a Compatible Format (Numbers) Through the Use of Machines

It is not an easy task to define the current era by identifying, all its characterizing elements. Indeed, the constant and rapid evolution of our society makes it impossible to distinguish between what should be included in such definition, and what should not. In the attempt to identify its fundamental

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traits, the extreme rapidity of data circulation clearly emerges.¹

It is necessary to highlight what makes the contemporary age significantly different from the previous ones: it is neither the use, nor the existence of its information itself, but its digital nature, and, accordingly, the possibility to have it used and transmitted differently.

Moreover, the scenario presented to the observer is that the whole human presence has been fragmented and transformed in a format compatible with computerised machines to the point that the digitalisation of the heritage has acquired a normative value.²

Accordingly, the human experience itself has become 'data' and, therefore, an object of calculation. The massive digitalisation that started at the beginning of the 1990s has allowed music, photographs, videos, etc to be dematerialized, giving rise to a real digital world-wide market which, within the European Market perspective, must be unique as well.

The phenomenon of digitalisation has thus revealed its real, greater dimension and it has formatted the whole world in an extension compatible with every computer.³ Consequently, a large amount of data has been produced since then, which has been transformed elaborated and circulated as part of substantially different other data.⁴

The association and complementarity between the aforementioned elements has led to the rise of a technology which is able to reach the greatest part of humans and to interconnect them more significantly. A decisive step forward in this direction can be found in the nomenclature adopted for computers. Stewart Brand in 1974 invented the expression personal computer.⁵ The idea was great: that is to provide everybody with a computer given that, until then, they had been exclusively domain of public entities and big industries.⁶ This aim of Ubiquitous

¹ According to ISO/IEC 2382-1, data are a reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing. Data can be created by persons or be generated by machines/sensors, often in the form of a 'by-product'. Some examples can be found in geospatial, statistical, meteorological, research and other kinds of data.

² UNESCO on 17 October 2003 has adopted the Charter on the preservation of digital heritage. The latter 'consists of unique resources of human knowledge and expression. It embraces cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources. Where resources are "born digital", there is no other format but the digital object'.

³ E. Esposito, 'Artificial Communication? The Production of Contingency by Algorithms' 46(4) *Zeitschrift für Soziologie*, 252 (2017) who highlights that 'the premise is the process of "datification", which allows us to express more and more phenomena in a quantified format that can be analyzed and processed'.

⁴ G. Finocchiaro, 'Introduzione al Regolamento Europeo sulla protezione dei dati' *Nuove leggi civili commentate*, 1-18 (2017).

⁵ S. Brands, *Cybernetic Frontiers* (United States: Random House, 1974). In 1974 TCP/IP standard of transmission (Transmission Control Protocol/Internet Protocol) has been introduced and, from that point on, communication on the web has been named 'the Internet'.

⁶ E. Alpaydin, *Machine Learning. The New AI* (Cambridge, Mass: The MIT Press Essential Knowledge Series, 2016), 8, who says that 'computer-per-person ratio increased very quickly

computing has been undoubtedly reached and, at the same time, overcome with the development of smartphones and of the so-called App(lications).

‘What makes a smartphone special is that it is also a mobile sensing device and, because it is always on our person, it continuously records information about its user, most notably their position, and can make this data available. The smartphone is a mobile sensor that makes us detectable, traceable, recordable’.⁷

II. The Effects of the Machine-Internet-Web System. The Antinomy: Simplicity of Use/(Hidden) Complexity of Procedures as a Mirror of New Sociality

The switch from the digital era to ‘digitalism’ can then be confirmed. From the 1960s on, a new way of thinking started as a natural consequence of that relatively brief process culminated in the spread of smartphones.⁸

The famous quote by Steve Jobs at Stanford University on 12 June 2005 ‘Stay hungry, stay foolish’ is highly representative of this process. Indeed, it was literally taken from a work that was meant to be the Whole Earth Catalogue,⁹ whose author changed the name to the computer making it ‘personal’: ie Stewart Brand.¹⁰

On the other hand, the same idea of cataloguing the entire web is the basis of Google, the most used search engine. Similarly, the Web itself was created with the aim of interconnecting content by means of links. There are many other such examples, from Amazon to Spotify.

The basic idea remains the same: that is, to make everything reachable and available.

To sum up, thanks to a military technology (ie ARPAnet), developed by some American Universities, which was able to transmit data in a rapid and secure way, together with the spread of computers, a globalised network of users was created. They started to produce content to be organised and interconnected as well as transmitted.

The Berlin wall had fallen. The infinite, assuming it still existed, could be

and the personal computer aimed to have one computer for every person’.

⁷ E. Alpaydin, n 6 above, 8.

⁸ ‘You can’t change human nature, but you can change tools, you can change techniques’ and in that way ‘you can change civilisation’. Citation is by S. Brand (C. Cadwalladr, *Stewart Brand’s Whole Earth Catalog, the Book That Changed the World*, available at <https://tinyurl.com/y27han4q> (last visited 28 May 2019).

⁹ ‘It was sort of like Google in paperback form, 35 years before Google came along: it was idealistic, and overflowing with neat tools and great notions’: C. Cadwalladr, n 9 above.

¹⁰ A map of the history of digital insurrection is brilliantly plotted by: A. Baricco, *The Game* (Torino: Einaudi, 2018).

finally enclosed in a beginning and an end. Therefore, it was going to lose any kind of charm.

In this portrait, not only economical relationships,¹¹ but the whole system of human relationships started to change significantly.¹²

Unlike what is usually assumed,¹³ it was not technological innovation that determined a change of pace in the way of conceiving the world but, in fact, it was the other way round.

‘Personal computers (in fact) that were designed for and belonged to single individuals would emerge initially in concert with a counterculture that rejected authority and believed the human spirit would triumph over corporate technology, not be subject to it’.¹⁴

Nevertheless, it cannot be denied that, from the 1960s up to the present, many things have changed and not so much is left of the spirit which animated that cultural (anti)revolution which had started from the Western Coast of America.

Undoubtedly, the current era can be placed in between of a tension, a sort of double binary. On the one hand, the world is becoming extremely complex from a technological point of view. On the other hand, it is incredibly easy to access and it is available to the greatest majority of (western) people.

This ease of the use has contributed to the minimization of the complexity of the underlying structures of the network, up to the point that they appear not to exist. It is possible to interrogate a search engine by a click and immediately receive pages of results; book a holiday; open a bank account etc. Each gesture, accomplished through the machine web-Internet is immediate, able to eliminate

¹¹ From this point of view, the same European Commission expressly qualifies data as the core element for business and economics. Communication from the Commission, *Towards a thriving data-driven economy* (COM (2014) 0442), 4; which in its introduction observes that: ‘We witness a new industrial revolution driven by digital data, computation and automation. Human activities, industrial processes and research all lead to data collection and processing on an unprecedented scale, spurring new products and services as well as new business processes and scientific methodologies’.

¹² C. Perlingieri, *Profili civilistici dei social networks* (Napoli: Edizioni Scientifiche Italiane, 2014), 23, who underlines the ‘radicale mutamento di paradigma delle relazioni sociali’, to an extent that ‘non è più sufficiente tenere esclusivamente conto delle peculiarità dei mezzi informatici’; Ead, ‘Gli accordi tra i siti di *social networks* e gli utenti’, in Ead and L. Ruggeri eds, *Internet e diritto civile* (Napoli: Edizioni Scientifiche Italiane, 2015), 204. Social studies on this regard are also decisive. See V. Karavas, ‘The Force of Code: Law’s Transformation under Information Technological Conditions’ *German Law Journal*, 471 (2009), who writes that ‘we can hardly still argue for the autonomy of the social sphere *vis-à-vis* media; media that under current conditions not only disclose spaces of communicative possibilities, as Luhmann wants it, but in a more radical way pre-determine the content of communications, thus transforming the whole social sphere into a hybrid entity of techno-social character’.

¹³ On the contrary, cf F. Di Ciommo, ‘Il diritto di accesso all’informazione in Internet’, in C. Perlingieri and L. Ruggeri eds, n 12 above, 78.

¹⁴ J. Markoff, *What the Dormouse Said: How the Sixties Counterculture Shaped the Personal Computer Industry* (New York: Penguin, 2005), 15.

space and time of execution. As a consequence, users believe that they need no help anymore from experts such as professors, travel agencies, financial institutions, or other knowledgeable parties.

It was indeed defined as

‘the big promise to dis-intermediate society, to directly connect politicians with voters, producers with customers, to bypass the traditional gatekeepers’.¹⁵

However, the ambiguity of the mechanisms governing the Web-Internet itself – just making everything easy and giving people the illusion of full freedom, which was the core of the anti-revolution – shows the obscure nature of its inner structure.

The already mentioned double binary, in terms of complexity-easiness is mirrored in many other dichotomies such as: freedom of press – right to be forgotten; equality of access – inequality in the exercise of rights and respect of duties.¹⁶

III. The Position of the So-Called Traditional Law in Front of the Machine-Internet-Web System

In spite of these changes, the law, at least national and supranational statutory law remained detached, and in some way alienated from the network, due to its erroneous belief that these changes simply reflected a technological shift involving new, but familiar issues.¹⁷

It does not seem far from truth to claim that this initial indifference shown by the law was not dictated by weakness in regulating technologically complex and transnational phenomena. In the best of the hypotheses, this inaction was the result of an awareness that it was a technological issue to be left to technology itself,¹⁸ as if what was allowed or not in the Web depended upon technological

¹⁵ N. Cristianini, ‘Media and Artificial Intelligence’ *Keynote lecture at Stoa*, European Parliament, 21 November 2017. J. Markoff, n 14 above, 15: ‘The personal computer had the ability to encompass all of the media that had come before it and had the additional benefit of appearing at a time and place where all the old rules were being questioned’.

¹⁶ It is out of the scope of this essay to show the huge implications, also on the legal level, of such a theory. On this regard, reference can be made, among other things, to the question of the ownership and, consequently, to the accessibility to data and its connections with copyright law. Furthermore, another huge question, to some extent opposed to the former one, is that of protection and security of personal data and, more in general, the real respect of fundamental human rights.

¹⁷ L. Lessing, *Code. Version 2.0* (New York: Basic Books, 2006).

¹⁸ In respect of the idea that technic has never been apart from the society that produces it, see below. However, it is important to highlight that starting, from 1987 European Parliament felt in need to create a consulting board (STOA, *Science and Technology Options Assessment*), composed of experts, in order to make it available to members of the Parliament itself neutral evaluations, not depending on scientific options and the related political options. The last report

norms, whereas what was external to it was conditioned by traditional legal norms.¹⁹

In other words, judges and legislators wanted to rely, exclusively, on the already existing abstract rules, even though they were not able to account for the cultural change in progress.²⁰

For too much time, there was a predominance of law over rights, which is in its own nature and culture, not static but dynamic, together with the human being.²¹

Consequently, if national law was not interested at first in the regulation of the network, then the task of creating its norms was left to its inventor-designers. They created and established the technical norms through which it existed, ie 'the original code'. Little by little, the participants with ownership rights to this technology, and the market, added to these norms.²²

Indeed, referring to this system as a 'network' gives this system a planetary dimension, which was ruled by its own supranational and spontaneously formed norms, which became, in essence its own law.²³ Since the so-called traditional law did not take part to the phenomenon of digitalisation, the internal architecture of software and hardware ended up covering a great part of the jurisdiction (ie *lex informatica*),²⁴ too much taken for granted as *lex mercatoria*.²⁵

What is more, the *lex* ruling the cyberspace, ie *lex digitalis*,²⁶ would be even

published by STOA in June 2018 (available at <https://tinyurl.com/y6kmlztl> (last visited 28 May 2019)) highlights that the main event held during 2017 concerned how media and other communication tools are governed and distributed in the era of artificial intelligence.

¹⁹ T. Schultz, 'Carving Up the Internet: Jurisdiction, Legal Orders, and the Private/Public International Law Interface' *The European Journal of International Law*, 802 (2008).

²⁰ E. Opocher, 'Il diritto senza verità', in Id et al eds, *Scritti giuridici in onore di F. Carnelutti*, (Padova: CEDAM, 1950), I, 188.

²¹ 'The debate is never for its own sake, its own glory, but it wants in its different usages to lead to language an experience, a way of living in and being part of the world which precedes it and which needs to be said': P. Ricoeur, 'Du texte à l'action. Essais d'herméneutique', in G. Grampa ed, *Dal testo all'azione. Saggi di ermeneutica* (Milano: Jaca Book, 2004), II, 28.

²² P. Femia, 'Una finestra sul cortile. Internet e il diritto dell'esperienza metastrutturale', in C. Perlingieri and L. Ruggeri eds, n 12 above, 36.

²³ L. Lessing, n 17 above, 48, who highlights the change in functioning: 'the Web as originally built would not be of much use to commerce. But as I've said again and again, the way the Web was is not the way the Web had to be. And so those who were building the infrastructure of the Web quickly began to think through how the web could be "improved" to make it easy for commerce to happen. "Cookies" were the solution'; and 'If commerce is going to define the emerging architectures of cyberspace, isn't the role of government to ensure that those public values that are not in commerce's interest are also built into the architecture?' (77).

²⁴ J.R. Reidenberg, 'Lex Informatica: The Formulation of Information Policy Rules through Technology' *Texas Law Review*, 553 (1998), who defines it as 'the set of rules for informations flows imposed by technology and communications networks'. The Code, according to Lessing.

²⁵ In general, see F. Galgano, 'Lex mercatoria' *Enciclopedia del diritto* (Milano: Giuffrè, 2001), V, 721. *Si vis* E. Giorgini, *Ragionevolezza e autonomia negoziale* (Napoli: Edizioni Scientifiche Italiane, 2010), 185, also for other bibliographical materials.

²⁶ *Lex informatica* would consist in the Code, while *lex digitalis* in norms: H. Lindahl, *Authority and Globalisation of inclusion and exclusion* (Cambridge: Cambridge University Press,

more influential than the *lex mercatoria*, for it applies itself in at least two contexts. In the first context,²⁷ it is not possible to disobey to the *lex digitalis* unless you have no access to the Web. In the second context, this *lex digitalis* is provided with an autonomous system of internal sanctions applied through autonomous decisions.²⁸ Indeed, the concept of the self-application of these norms is based on the existence of autonomous legal systems which are made 'by communities of choice clustering around shared interests'.²⁹

IV. *Drittwirkung* of Fundamental Human Principles in the Transnational Field

This shift from a territorial based jurisdiction to a specific-issue jurisdiction is, on the one hand, animated by social demands and, in this specific case, comes from scientific and technological evolution, which the law must adapt to.³⁰ On the other hand, it is also true that the normative issues emerging from the current fragmentary social needs are, in most of the cases, prompted by commercial and economic issues that need predictable and fast decisions. More precisely, it is necessary to point out that the ability of economic issues and norms to contaminate other social domains, including technology, is of course more pervasive than the contamination that the economic system suffers from other systems. Accordingly, placing every legal system considered as autonomous, in particular the one created by economics and the market, on the same place without a hierarchical order, requires careful consideration. However, this does not mean that the aforementioned economical norms could delay the transitional regulative processes of the fundamental rights of human beings. It is crucial to highlight that this consideration opens the doors to the immense issue of direct applicability human rights at a transnational level, as well as to the role that the so-called

2018), 145.

²⁷ E. Maestri, *Lex informatica. Diritto, persona e potere nell'età del cyberspazio* (Napoli: Edizioni Scientifiche Italiane, 2015), 93.

²⁸ V. Karavas and G. Teubner, 'CompanyNameSucks.com: The Horizontal Effect of Fundamental Rights on 'Private Parties' within Autonomous Internet Law', translated by G. Grappi, *Scienza & Politica*, 117 (2006), exemplifying auto-application in the context of ICANN arbitration proceedings; P. Femia, 'Una finestra sul cortile' n 22 above, 61 construes the relationship between *lex digitalis* and the traditional normative organization in terms of 'exchange of information streams and normative fractions, having different architectures which, nonetheless, belong to one single system'.

²⁹ T. Schultz, n 19 above, 829; V. Karavas and G. Teubner, n 28 above, 1356 'the law is also divided into autonomous transnational legal regimes, which define their jurisdiction along 'issue-specific' rather than territorial lines, and which lay claim to global validity'; A. Fischer-Lescano and G. Teubner, 'Regime-Collisions: The Vain Search for Legal Unity in the Fragmentation of Global Law' *Michigan Journal of International Law*, 1009 (2004).

³⁰ Literature regarding relations between autonomous social systems and the judicial social system, in its strict meaning, is infinite.

traditional law currently plays.³¹

The necessity of the law's intervention in digitalised relationships seems to be recognised,³² at least in Europe, and is based on the assumption that autonomous laws in the Web totally exclude the regulative power based upon the international sovereignty. All in all, this would mean excluding the continuous link between politics (and therefore social needs) and law leaving, in this way, the power to create norms to exclusively economic processes.

We now need to clarify the methods by which the law may intervene in digitalized relationships. Interventional methods. For this perspective, the statement according to which 'different code makes differently regulable networks. Regulability is thus a function of design'³³ has already hit the mark. In this way, this intervention is being imagined happening *ex ante*, through the imposition of a specific set of technical specifications. However, as soon as the attention goes to transnationality, such a model, based uniquely on a programming code, is inevitably going to fail.³⁴

The same criticism also applies with regard to the adoption of a connecting factor between law and digitalized relationships based on the place where the activities carried out on the internet produce their effect.³⁵ So, even though it is true that regulating *ex ante* the Code is of fundamental importance, it is not sufficient in itself. Thus, many feel the need to create procedural infrastructures that with an *ex ante* prospective, would allow autoregulated norms (private ordering) to exercise a 'virtual domestic law'.³⁶

With a rough approximation, such procedural structures should help to normalise the inevitable and also indispensable clashes among the many different parts of the society,³⁷ including the transnational ones. Ruling on these clashes would, draw the boundaries between autonomous norm creating groups of society and would create incompatibility rules which would foster cooperation between systems.³⁸

³¹ Literature on this regard is very wide. The contribution by P. Femia ed, *Drittwirkung: principi costituzionali e rapporti tra privati* (Napoli: Edizioni Scientifiche Italiane, 2018) is really a valuable one. See also M. Zarro, 'L'evoluzione del dibattito sulla Drittwirkung tra Italia e Germania' *Rassegna diritto civile*, 997 (2017), from whom further bibliographic references can be drawn.

³² P. Femia, 'Una finestra sul cortile' n 23 above, 59.

³³ L. Lessing, n 17 above, 34.

³⁴ A useful test is given by the very much debated issue on the so-called right to oblivion. Even if it was admitted as a right, it would be absolutely ineffective. It is, in fact, sufficient to change the domain of the research (from .it to .com) to completely bypass it.

³⁵ As compared to a connection based on the place where servers sending data streams are located.

³⁶ K.H. Ladeur, 'La *Drittwirkung* dei diritti fondamentali nel diritto privato "Diritto privato costituzionale" come diritto delle collisioni', in P. Femia ed, *Drittwirkung* n 31 above, 245.

³⁷ *ibid* 247. Precisely, he writes that: 'il diritto privato costituzionale consiste invece nel nuovo "diritto delle collisioni" che considera i diritti fondamentali quale garanzia della differenziazione dei sottosistemi sociali e della permeabilità reciproca dei regimi che in tale processo prende forma'.

³⁸ G. Teubner, 'Un caso di corruzione strutturale? La fideiussione dei familiari nella collisione

Moreover, a solution based on procedure should not be surprising. Whenever the law is not able to set a specific final rule, in whichever field, it tends to create a number of different norms which should serve to set forth limits that society should not cross.³⁹

This perspective seems to predicate a sort of freedom from something (in a negative, rather than in a positive sense) and clarifies, with some extent of intellectual honesty, the limits of ‘justiciability’ according to the so-called traditional law, based on the sovereignty now of politics, then of the law,⁴⁰ and, what is more, also the limits of a procedural approach in terms of autonomous social spheres. In other words, the best a judicial system could get is no more than a second best.⁴¹

However – even admitting that justiciability of individuals’ claims (rights) does not remain confined within an autonomous social system as self-executing – it needs to be highlighted that, in the era of digitalism, not even an articulated system of rules on clashes can assure a model for calculating norm making nor, much less the respect of fundamental rights.⁴²

As explained in further detail below, innovation in technology in the digital era and its economic functionalization make a rule-making process only operating *ex ante*, or trying at most to monitor compatibility among the different instances of the society, inadequate.

Given that the method for collecting data, as well as for processing and, subsequently, reusing it, may not be under the domain and, thus, the control of any human being, the code is no longer able to predict its result. If this is so, many implications follow. First of all, traditional law cannot abstain from controlling and conforming the hermeneutic result.⁴³

di logiche d’azione incompatibili (BVerfGE 89, 214 ss.)’, in P. Femia ed, *Drittwirkung* n 31 above, 219.

³⁹ It is very useful, for this purpose, at every level, the whole set of laws by the financial market. The best result that the law can obtain is the building of an adequate strategy and not the best negotiation in concrete, admitted that it places at the centre of the law the regulation the best interest of the client.

⁴⁰ G. Teubner, *Nuovi conflitti costituzionali: norme fondamentali dei regimi transnazionali* (Milano: Mondadori, 2012); C. Camardi, *Certeza e incertezza nel diritto privato contemporaneo* (Torino: Giappichelli, 2017), 211.

⁴¹ ‘In the place of an illusory integration of a differentiated global society, law can only, at the very best, offer a kind of damage limitation’: A. Fischer-Lescano and G. Teubner, ‘Regime-Collisions’ n 29 above, 1045.

⁴² It is worth it to cite: G. Teubner, ‘I precari rapporti tra diritto e teoria sociale’, in P. Femia ed, *Drittwirkung* n 31 above, 285, which claims that the effectiveness of fundamental rights in relations between individuals is not guaranteed by the position of individual fundamental rights but only through the protection of the organization and the procedure. These last constitute the premises and structures of the individual positions.

⁴³ P. Perlingieri, ‘«Controllo» e «conformazione» degli atti di autonomia negoziale’ *Rassegna diritto civile*, 216 (2017); P. Femia, ‘Autonomia e autolegislazione’, in S. Mazzamuto and L. Nivarra eds, *Giurisprudenza per principi e autonomia privata* (Torino: Giappichelli, 2016), 5 of the manuscript, where it is read that: ‘non basta la formale riconducibilità dell’agire all’applicazione di una regola che ci si è dati da sé, occorre che questa autonomia sia giusta, nel senso di conforme, adeguata all’oggetto che la produce’ (it is not enough the formal traceability of the action to the

V. Evolution of the Concept of Data: From the Object of what Computers Process to Natural Resources

In such a scenario, trying to fit the network, defined internet-web-machine within the realm of the Rule of Law, we must emphasize that ‘the original code’ had the objective of classifying the whole world and making it available with no substantial limits except for the costs of creating the necessary technology and the costs dealing the agreement with the Internet Service Provider (ISP).⁴⁴ In this phase, data was (simply) objects processed by software. They were, in other words, passive. The real turning point occurred when the question as to what to do with all this data was raised.

‘With this question, data starts to drive the operation; it is not the programmers anymore but the data itself that defines what to do next’.⁴⁵

It follows that the meaning of data to which also EU rules refer, is ontologically different from the one it had before digitalization reached its mature phase.

The true turning point is in fact the idea of data being considered on the same level of natural resources, as ‘data in the wild’. Once again, economic issues have significantly influenced all the other social contexts, including law.

What is radically different in the current consideration of data is the volume, variability and speed of data, as well as the ability to link them one with the other. Indeed, alluvial amounts of data (Big Data),⁴⁶ coming from different sources such as web pages, files from weblogs, forums, social-media, audios, videos, clickstreams, emails, documents and sensor systems automatically implement new data, constituting new assets (*Big Data Economy*).⁴⁷ Such new assets, from a legal point of view, represent ‘new situations, assets mostly in the users’ availability’.⁴⁸

It is now common knowledge, also shared by institutions, that

‘the development of an enormous and increasing amount of data (...) through the analysis and advanced methods of processing gives an

application of a rule that has been given by itself, this autonomy must be right, in the sense of conforming, adequate to the object that produces it).

⁴⁴ At the beginning, however, the service was substantially made by the public institutions where, in fact, the Internet had been implemented.

⁴⁵ E. Alpaydin, n 6 above, 11 that underlines that: ‘With this question the whole direction of computing is reversed’.

⁴⁶ ‘With the expression “big data” it is referred to large amounts of data of different types, produced at high speed, by different types of sources. The management of these dataset at high variability and at real time imposes to resort to new instruments and methodologies, such as for example, powerful processors, software, and algorithms’: declaration Communication by the Commission, *Towards a thriving data-driven economy* (COM(2014)0442).

⁴⁷ It has been pointed out by: P. Perlingieri, ‘Privacy digitale e protezione dei dati personali tra persona e mercato’ *Il Foro napoletano*, 481 (2018); R. Moro Visconti, ‘La valutazione economica dei database (banche dati)’ *Il diritto industriale*, 358 (2017).

⁴⁸ P. Perlingieri, ‘Relazione conclusiva’, in C. Perlingieri and L. Ruggeri eds, n 12 above, 419.

unprecedented picture of human behavior, of private life, as well as of our society'.⁴⁹

This creation of new situations starting from data which have converted human experience to numbers is thus the starting point for analysis. It also becomes essential to consider by a lawyer trying to understand, even though not in details, the origins of a similar shattering phenomenon.

In order to do this, we must go back to the time when the potential *whole* has become, at least theoretically, available to entire collectivities: get back, that is to say, to the time when the first digital calculators were invented and automatic calculation on a big scale commenced. The latter, having numbers as a subject, without any doubt involves mathematical calculations. Indeed, mathematicians believe that the extraordinary force of numbers is a fundamental feature of their field.⁵⁰ The force of numbers is also of a generative nature, ie able to create new things and, for this reason they are inextricably linked to technology.

Sticking to the main argument of this essay, the century which has just passed – in the context of a renewed attention for the foundations of mathematics – has gathered mathematical abstraction and practical reality thanks to the development of automatic calculation on a big scale.⁵¹ The invention of electronic computational machines presupposed, in fact, the use of abstract structures which only pure mathematics would be able to elaborate and, at the same time, could solve any problem of the physical world suitable to a mathematical solution.⁵²

It is not a mere coincidence that, after World War II, a group of scientists was studying how to define at its best of abstract structures able to solve practical problems: the algorithm. There is no need to highlight the position expressed in

⁴⁹ Report on the proposal of resolution of the European Parliament on 20 February 2017, on the implications of Big Data for the fundamental rights: privacy, data protection, non discrimination, security, and activity of (2016/2225(INI)), point C.

⁵⁰ It is highlighted in: P. Zellini, *La matematica degli dei e gli algoritmi degli uomini*, (Milano: Adelphi, 2016), 72. Starting from the analysis of the Greek mathematics, he writes: '*un ente matematico ne produce un altro (dynamis), come se si trattasse di una forza di progressivo ampliamento insita negli stessi enti matematici*' (original quote) (a mathematical entity produces another mathematical entity (dynamis), as if it were a force of progressive expansion inherent in the mathematical entities themselves).

⁵¹ The tribute to A. Turing on the theme of digital computationability cannot be calculated. It must be remembered that A. Turing, during the Second world war, discovered a weakness in the Enigma's application thus contributing decisively to the victory of the war itself. In addition, he publishes for the Journal Mind, in 1950, an article entitled 'Computing Machinery and Intelligence', where he identified a test that was meant to verify when a machine can be considered as intelligent. According to the test by Turing is, in fact, sufficiently intelligent when it is able to provide answers which are not distinguishable from those provided by human beings.

⁵² It is particularly worth it to observe that the development of automatic calculation starts from the theoretical considerations on the critics to the fundamentals of mathematics and, in particular, from the ones by David Hilbert. According to this latter, it was necessary to answer to the question whether mathematical problems do not admit, neither in theory, to be resolved through an algorithm (ie a logical-mathematical procedure).

this essay is not that algorithms have appeared only in the middle of the twentieth century, but that algorithms have always existed.⁵³ According to mathematicians, this change resulted in the need to build and methods of calculation and to make them manifest so that these were certain and effective in a specific place and time.⁵⁴ That was the moment when the science of algorithms, not algorithms per se, turned mathematical operations into a process or procedure.

It has been claimed that the same idea of a process-procedure evokes that of *lógos*,⁵⁵ which can, in light of the semantic studies by Heidegger, be defined as a selection (lay) of what is present in non-concealment or an unveiling. Such manifestations, in simple terms, happen through language (in this specific case, a mathematical one). On the other hand, we should remember that the crisis of the foundation of mathematics, which required the elaboration of methods of calculation that are traceable, certain and effective in a specific time and space, was substantially simultaneous to that philosophy, which saw the being-there in the unveiling. Man became a project. The central argument is therefore the theme of technology.⁵⁶

Within this scenario, the law also not excepted from this ‘antimetaphysic realism’. In fact, a shift from the exegetic to the systematic and dogmatic method occurred during these years.⁵⁷

The role of the jurist is to synthesize, regroup the applicable rules together in an institution, and group of institutions into a unified system.⁵⁸ The Pandectistic

⁵³ P. Zellini, *La dittatura del calcolo* (Milano: Adelphi, 2018), 51, that maintains that the concept of algorithm is pre-euclidean and that was meant to compare, since then, two different measurements.

⁵⁴ Literally, P. Zellini, *La matematica degli dei e gli algoritmi degli uomini* n 50 above, 52.

⁵⁵ Elsewhere (E. Giorgini, *Consulenza finanziaria e sua adeguatezza* (Napoli: Edizioni scientifiche italiane, 2017)), it was referred the logarithms not in a strictly mathematical sense, but in order to shed light to the argumentative profile.

⁵⁶ N. Irti and E. Severino, *Dialogo su diritto e tecnica* (Roma-Bari: Laterza, 2001).

⁵⁷ 1881 is a turning point that starts the shift from the esegetic method to the systematic one thanks to the publication of E. Gianturco, ‘Gli studi di diritto civile e le questioni del metodo in Italia (1881)’, in Id, *Opere giuridiche*, I, (Roma: Libreria dello Stato, 1947), 3 where the necessity of a reform of methodology to be applied at University can be found. On the role of the work by Gianturco for the overcoming of the esegetic school, please, see: P. Perlingieri, ‘Relazione conclusiva’, in Id and A. Tartaglia Polcini eds, *Novecento giuridico: i civilisti* (Napoli: Edizioni scientifiche italiane, 2013), 351. 1881 was also the year of publication of the *Lectio Magistralis* in occasion of the inauguration of the course of Civil Law at the Regale Università di Roma on 26 January by E. Cimbali, ‘Lo studio del diritto civile negli stati moderni’, in Id, *Studi di dottrina e giurisprudenza civile* (Lanciano: Tip R. Carabba Edit, 1889), 5. It has been highlighted that the first generation of Civil Law scholars did not agree with the esegetic methods: ie A. Masi, ‘Il metodo esegetico, le prolusioni e l’inizio del metodo dogmatico’, in P. Perlingieri and A. Tartaglia Polcini eds, n 57 above, 8.

⁵⁸ To address these passages is out of the purpose of the present work. For a summary, see: N. Irti, ‘Diritto civile’ *Digesto delle discipline privatistiche. Sezione civile* (Torino: UTET, 1990), VI, 147; Id, *La cultura del diritto civile* (Torino: UTET, 1990); C. Ghisalberti, *La codificazione del diritto in Italia 1865-1942*, (Roma-Bari: Laterza, 1994), 142; G. Cazzetta, *Scienza giuridica e*

method created ‘a castle perfectly walled by principles and rules’.⁵⁹ The perfection and completeness of this system was due to its ability to address every case, at least from a formal point of view, thanks to the elaboration of categories. The judicial system arising from this process is thus closed, logically closed.⁶⁰

The qualifying product of Pandectistic is the scientific construction of the system which leads to the recognition and statement of the intrinsic connections among every right, in a way as to the concepts hereby expressed assume an organizing function.⁶¹ The enclosure of the system is intimately connected to the possibility of abstracting from the idea of law. Such abstraction is able to materialize principles which can be applied in non-contemplated hypothesis.

Very briefly, mathematics, philosophy and also law, through the construction of procedure (logos), truly had the objective to expel infinity from human reasonings and try to reach stability (in calculations and in decisions) and power to predict.

VI. The Science of Algorithms, Computational Complexity, and Necessary Approximation

If in the mathematical system built by human beings there is no room for the idea of infinite, it needs to be replaced by procedures made of finiteness. In other words, by the science of algorithms, which is developed with the aim of ‘conducting to the finite arithmetical calculation every type of process entailing the concept of infinite’.⁶²

At this point, it is necessary to investigate the purpose and the functioning of the algorithm, since the legal implications of this way of thinking are impressive. It is worth it to highlight from now on, indeed, that the architecture of the functioning system of the digital worlds is based upon the science of algorithms. That is, coding itself is made of algorithms.

Algorithms, through detailed and numerically finite series of instructions,

trasformazioni sociali. Diritto e lavoro in Italia tra Otto e Novecento (Milano: Giuffrè, 2007), 41.

⁵⁹ Are the words of P. Grossi, *Il diritto nella storia dell'Italia unita*, in *www.lincei.it*, 9.

⁶⁰ For a summary see A. Mezzacane, ‘Pandettistica’ *Enciclopedia del diritto* (Milano: Giuffrè, 1981), XXXI, 592.

⁶¹ ‘*Lo scopo della Pandettistica era di creare un sistema positivo, dogmaticamente privo di contraddizione, di un diritto privato generale (c.d. «Harmonistik delle Pandette» dei manuali pandettistici), attraverso il ricorso all'interpretazione (esegesi) delle Pandette giustinianee quale presupposto sovrapositivo di legittimazione*’ (‘The purpose of the Pandettistica was to create a positive system, dogmatically devoid of contradiction, of a general private right (the so-called “Harmonistik delle Pandette” of the pandettistic manuals), thanks to the use of the interpretation (exegesis) of the Justinian Pandects as a superpositive assumption of legitimation’): H. Schlosser, *Grundzüge der Neueren Privatrechtsgeschichte. Rechtsentwicklungen im europäischen Kontext*, (translated by M. Zarro, *Tratti fondamentali della nuova storia del diritto privato. Evoluzioni giuridiche nel contesto europeo* (Napoli: Edizioni Scientifiche Italiane, 2016), 153).

⁶² P. Zellini, *La dittatura del calcolo* n 53 above, 139.

which can be processed in a particular space and time, allows the achievement of a result that represents the solution of the initial problem.

Each set of instructions is an abstract structure derived from pure mathematics such as linear equations, polynomial calculations, matrix calculations etc. The so-called algorithm strategy produces intermediate results, hidden most of the time, that are the result of mathematical calculations entailed by each instruction. That work is the base for the subsequent step. Needless to say, each piece of instruction may also be another algorithm with what follows in terms of extension of the number of calculations to make. The achievement of the solution depends upon the correct execution of the instructions.

It is intuitive that the execution of an algorithm might have an extreme computational complexity which does not affect, at least in theory, its own effectiveness. If it was not executable, the algorithm itself would not exist but it cannot affect its efficiency.

This efficiency, under the mathematical perspective, must be valued in terms of arithmetical cost, that is, in terms of space and time of execution. When the latter are excessive, the ability of the algorithm itself to sort the problems of applied science is questioned, which is same problems for which the algorithm was created. The inefficiency would question the actual effectiveness of the algorithm.

Algorithmic efficiency on a large scale, in the era of digital calculation must face inevitable phenomena such as the production of such great numbers which exceed the space available in memory of a computer. Moreover, the execution of each piece of instruction requires the solution of equations of linear systems and, consequently, of matrix calculations with a different number of variables. The matrix calculations, in turn, require the execution of different arithmetical operations which may require a large amount of time.

In order to deal with problems, mathematics has developed, through the time, models of simplification of calculation that could avoid the growth of the size of the numbers not compatible with the space and time of computers. Accordingly, technological progress permitted the development of more and more powerful engines, provided with more processors and a better memory ability. This evolution, in relation to the models of simplification and reduction as well as to the technical features of computerized engines, however, are not able to prevent the errors during the whole, complex computational process. The increase of the latter, together with the increase of the numbers' size, creates a risk of doubt regarding the correctness of calculation the ability of the algorithm to achieve the purpose for which it was created. Consequently, assuming the resolution of a problem by means of an algorithmic formula, (even one involving substantial computational difficulty) does not necessarily guarantees the actual practicability of the solution. The number produced by the calculation, indeed, may not correspond to the model required by the algorithm.

The only expedient that seems possible is, therefore,

‘to weaken the demand for exactitude (...) resorting either to the approximated algorithms or to procedures the result of which corresponds to the solution found with a significantly high probability’.⁶³

Moreover, the digital calculation on large scale also posits additional critical profiles. First of all, numbers are represented through binary series of figures (ie 0/1).⁶⁴ These series must be finite in order to be inserted in a calculator and, therefore, the digital data, from their first input into the computational system are already approximations. Considering the millions of calculations made by the computer, this approximation increases the serious risk of generating instability of the calculation itself.

At the beginning of the paragraph we already noted that the science of algorithms aims at finiteness, that is, to the mathematical concept of discreteness. The digital calculation, indeed, can only operate in the area of discreteness and not in the continuous (infinite) as happens with the analogical calculations.

VII. Non-Neutrality of the Algorithms: The Necessary Role of Law

The previous discussion notes that the progressive digitalization of human experience, together with the design of computerized engines, allowed the expansion of science in the algorithms, which was rooted in the idea of providing an answer to practical, mathematically resolvable issues throughout finite procedures. In name of this finiteness, the system based on the algorithms renounce the exactness of calculation.

Consequently, as a first conclusion to the current investigation, the code is for its own nature destined to produce approximated results in two ways. On the one hand, the digital binary numerical system requires the constant approximation of the data at each operation. On the other hand, the simplification and reduction aimed at making the algorithm efficient produces errors which are directly proportional to the increasing of the size of the number. All that is aggravated by the fact that the multiple operations of calculation are hidden and, therefore, out of control of the human user.⁶⁵ Thus, assuming that the algorithm ruling the

⁶³ *ibid* 136.

⁶⁴ E. Alpaydin, n 6 above, 2, ‘a computer represents every number as a particular sequence of binary digits (bits) of 0 or 1, and such bit sequences can also represent other types of information. For example, “101100” can be used to represent the decimal 44 and is also the code for the comma; likewise, “1000001” is both 65 and the uppercase letter ‘A’. Depending on the context, the computer program manipulates the sequence according to one of the interpretations’.

⁶⁵ C. O’Neil, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York: Crown Books, 2016), 19; L. Avitabile, ‘Il diritto davanti all’algoritmo’ *Rivista italiana per le scienze giuridiche*, 321 (2017), which highlights that ‘*La produzione di dati, dietro le apparenze semplificate, nasconde un traffico controllato da algoritmi operativi sulla base di stringhe opache o inaccessibili alla totalità*’ (The production of data, behind simplified appearances, hides a traffic controlled by algorithms that operate on the basis of opaque

code is the solution to the practical problem to solve, this solution, as a matter of clarity, is totally approximated, with evident consequences as regards the efficiency of the solution itself. Substituting the infinite of the possible solutions with the digitally calculable (following a finite procedure) first of all, represents the death penalty for the peculiarity of the concrete fact, engendering an evident paradox.

The force of the rules designed in the Code would be based on a choice (economic, most of the time) which, however, appears as if it were truth and as such hard to control, especially as regards the results it produces.

From this point of view, in fact, a large part of the effort of the so-called traditional (supra)national law, despite having made decisive and important steps forward in the matter of personal data processing,⁶⁶ has instead kept in the background the question of controlling the effects of the application of the algorithms.

The regulation, even the most specifically directed to the issue of profiling and the automatic decisions that could be based on it,⁶⁷ remains firmly anchored to the requirement of consent. Indeed, it is so much so that explicit consent is one of the exceptions from the prohibition on automated decision-making and profiling defined in Art 22(1) GDPR and to the Right to be informed by the controller about and, in certain circumstances, a right to object to ‘profiling’, regardless of whether solely automated individual decision-making based on profiling takes place.⁶⁸

The rules of the GDPR that require controllers, in a nutshell, to provide meaningful information about the logic involved and to implement suitable measures to safeguard data subjects’ rights freedoms and legitimate interests cannot seriously guarantee in individual situations that the algorithmic strategy does not violate fundamental rights.⁶⁹ As it has been observed, in fact, ‘*non si può controllare ciò che non si capisce*’ (‘what cannot be understood cannot be

or inaccessible strings to the totality). In the same meaning, see: *Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679*, ‘Profiling processes can be opaque. Individuals might not know that they are being profiled or understand what is involved’.

⁶⁶ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (GDPR). For some bibliographical reference see: B. Goodman and S. Flaxman, ‘European Union Regulations on Algorithmic Decision Making and a ‘Right to Explanation’ *Al Magazine*, 38, 3 (2017).

⁶⁷ According to Art 4(4) GDPR, profiling is ‘any form of automated processing of personal data consisting of the use of personal data to evaluate certain personal aspects relating to a natural person, in particular to analyze or predict aspects concerning that natural person’s performance at work, economic situation, health, personal preferences, interests, reliability, behaviour, location or movements’.

⁶⁸ Literally, *Guidelines* n 65 above, 17.

⁶⁹ It is useful to underline that the normative model based on the correct execution of proceedings is the same that the Community legislator has used in the field of financial market regulation (MiFID I and II). It is sufficient to compare the provisions on conflict of interests or, more recently, those on algorithmic bargaining.

controlled').⁷⁰

VIII. Evolution of Algorithmic Models (Deep Learning). Insufficiency of the Perspective of the Right of Access and/or of that the Comprehensibility of the Logics Underlying the Algorithm

We have already noted that, for long time, mathematics has identified simplification models with the aim of making computation viable. Through these models (kernel function, support vector machines, etc) algorithmic science has undergone a new revolution, a change of paradigm, which could be summarized, in a non-technical and trivializing way, in the ability to make linear (simpler) systems that they aren't.⁷¹ Therefore, the complexity of a function is not an absolute concept but depends on the possibility of it being simplified. Naturally the resulting function is not mathematically exact: for this reason, we have to incorporate ideas from statistical learning theory to rule out meaningless explanations of the data and so it can be possible as generalization performance.

On this generalizing power, in the last decade, a theory of learning machines has emerged and with it the possibility of analyzing existing algorithms and designing new ones that they don't require intelligence but data.⁷² Accordingly, we can say that in any kind of learning algorithm, they adjust the parameters of the model by optimizing a performance criterion defined on the data. This phenomenon is exponential in the so-called 'deep learning' concept, in which is not possible to know *ex ante* the data that are the inputs of the algorithmic procedure. Accordingly, the data is not provided by humans, but it is learned from the algorithm itself.

In short,

'a deep neural network can be trained one layer at a time. The aim of each layer is to extract the salient features in its input, and a method such as the autoencoder can be used for this purpose. There is the extra advantage that we can use unlabeled data – the autoencoder is unsupervised and hence

⁷⁰ P. Domingos, *L'Algoritmo Definitivo. La macchina che impara da sola e il futuro del nostro mondo* (Torino: Bollati Boringhieri, 2016), 16. Moreover, according to the GDPR, the duty of the controller, does not necessarily consist in a complex explanation of the algorithms used or disclosure of the full algorithm.

⁷¹ 'In a way, researchers now have the power of nonlinear function learning together with the conceptual and computational convenience that was, to this point, a characteristic of linear systems': N. Cristianini and B. Schölkopf, 'Support Vector Machines and Kernel Methods The New Generation of Learning Machines' *AI Magazine*, 32 (2002).

⁷² 'This ability of generalization is the basic power of machine learning; it allows going beyond the training instances. Of course, there is no guarantee that a machine learning model generalizes correctly – it depends on how suitable the model is for the task, how much training data there is, and how well the model parameters are optimized – but if it does generalize well, we have a model that is much more than the data': E. Alpaydin, n 6 above, 42.

does not need labeled data. Accordingly, starting from the raw input, we train an autoencoder, and the encoded representation learned in its hidden layer is then used as input to train the next autoencoder, and so on, until we get to the final layer trained in a supervised manner with the labeled data. Once all the layers are trained in this way one by one, they are all assembled one after the other and the whole network of stacked autoencoders can be fine-tuned with the labeled data'.⁷³

We are now back where we started: the whole human experience has become data, deep learning is now able to read all this data and to use them as if they were natural resourced (data in the wild) to train algorithms. The science of algorithms was born to enclose the infinite in the finite and nowadays, thanks to the deep learning, the inability to foresee the levels of transformation (abstraction) of the data entered in the algorithmic procedure reopens the doors to infinity.

Needless to say that this model can grow exponentially, making it clear that the real issue is no longer the accessibility of the Code or the comprehensibility of the logic underlying the algorithm as legislation, at least European, requires. That legislation takes into consideration the opacity of the algorithm or in the meaning of a form of proprietary protection, 'corporate secrecy', or as a problem of readability of the code, but the legislative provisions do not adequately evaluate the opacity as mismatch between mathematical procedures of machine learning algorithms and human interpretation.⁷⁴ It was indeed well highlighted that

'an algorithm can only be explained if the trained model can be articulated and understood by a human. It is reasonable to suppose that any adequate explanation would, at a minimum, provide an account of how input features relate to predictions'.⁷⁵

IX. Initial Conclusions: The Act Based on the Algorithmic Decision Must Always Be Interpreted

At this point, it becomes clear that the functioning of algorithms involving legal effects must be controlled to ensure that they produce outcomes compatible with our legal system. This control must take place through the interpretation of

⁷³ *ibid* 107.

⁷⁴ J. Burrell, 'How the Machine "Thinks": Understanding Opacity in Machine Learning Algorithms' *Big Data & Society*, 3 (2016). She, convincingly, proposes the three meanings of opacity and she argues the 'the opacity of machine learning algorithms is challenging at a more fundamental level. When a computer learns and consequently builds its own representation of a classification decision, it does so without regard for human comprehension. Machine optimizations based on training data do not naturally accord with human semantic explanations'.

⁷⁵ B. Goodman and S. Flaxman, 'European Union regulations on algorithmic decision making' n 66 above, 6.

the act generated by the application of the algorithm. It cannot be sufficient, even if indispensable, to rely on the right to access to the code, or to implement measures to safeguard. It does not even convince the vision, finally pursued by the legislator of the financial markets,⁷⁶ of monitoring the results of the algorithmic application that would subsequently allow to intervene on the construction of the algorithm itself. This approach, in fact, is once again, not only of mere compliance, but explicitly legitimizes the validity of an act incompatible with the principles of the legal system. But there is more. In that process of communicative osmosis, considered by many among the autonomous spheres of the social world, the digital one would irreparably prevail. Or in other words, this would have colonized, even through the provision of legal norms in the strict sense, the law.

⁷⁶ See arts 4(1), no 39 and 17 MiFID II.