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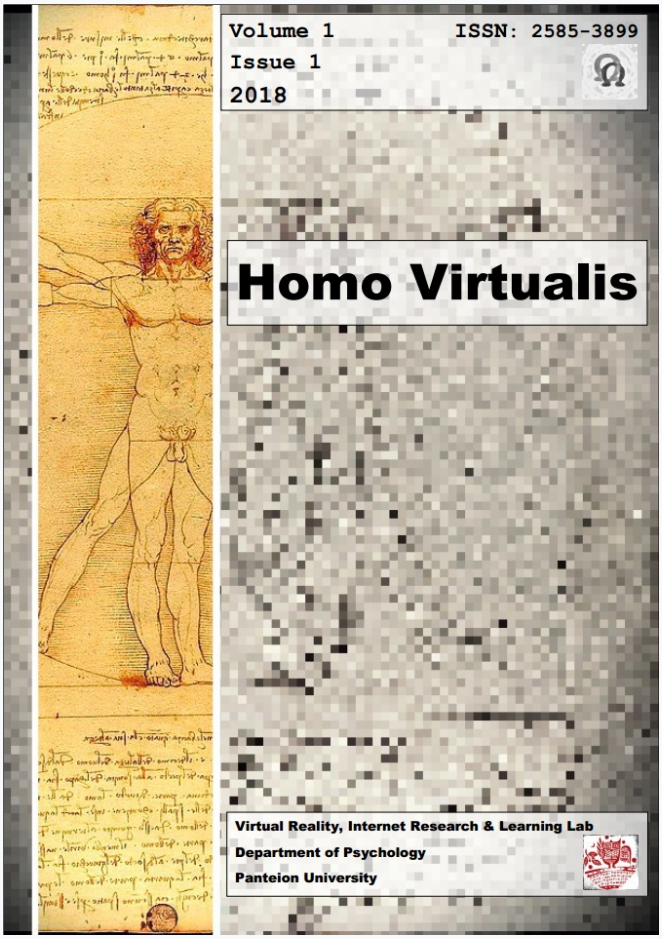


# Industry 4.0 and the digitalisation of society: Curse or cure?

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# Industry 4.0 and the digitalisation of society: Curse or cure?

**Charalambos Tsekeris**[1]

**Abstract:** The central aim of this article is to sketch and outline a brief and critical presentation, overview and assessment of the (radically ambivalent) dynamics of the large family of technological developments pertaining to the Fourth Industrial Revolution (Industry 4.0), as well as of the so-called digitalisation of society. This assessment attempts to comprehensively overcome relevant analytical dualisms and the one-sided "either-or" logic, in favor of a synthetic, open and creative "both-and" framework of interdisciplinary thought.

**Keywords:** *digitalisation, fourth industrial revolution, industry 4.0, internet, singularity*

## Introduction: The Advent of Industry 4.0

We are currently living through an unprecedented revolution, namely, Industry 4.0 (in German, "Industrie 4.0"). Many scholars describe it as the greatest event in human history, while others characterise it as a serious existential threat to the species (see Schwab, 2016b). *Industry 4.0*, commonly referred as the *Fourth Industrial Revolution* (see Figure 1), is an emblematic title for the current trend of automation, scaling and data exchange in manufacturing technologies. It includes artificial intelligence, virtual reality, cloud computing, cognitive computing, the Internet of Things (IoT) and the Internet of Nano Things (IoNT), or the Internet of Everything (IoE), and big data analytics.[2] In addition, the interactive networking of human agents through social media platforms and the generation of big data "is extended to machines so that networks of communicating machines are created. In the most extreme case, industry 4.0 means that a good is fully automatically produced, delivered, used, repaired and recycled without human intervention through the networking of different technologies over the Internet" (Fuchs, 2018, p. 281).

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[2] According to World Economic Forum's recent *Mapping Global Transformations Report* (2018), the Fourth Industrial Revolution represents a fundamental change in the way we live, work and relate to one another (https://toplink.weforum.org/knowledge/insight/a1Gb0000001RIhBEAW/explore/summary). All these exciting developments are expected to radically transform the world by "enhancing the labor productivity, making transport more efficient diminishing the energy needs, supporting dealing more effectively with climate change, as due to electronic means offered by Internet one may usually send and receive data from other devices or from individuals" (Prisecaru, 2016, p. 58).

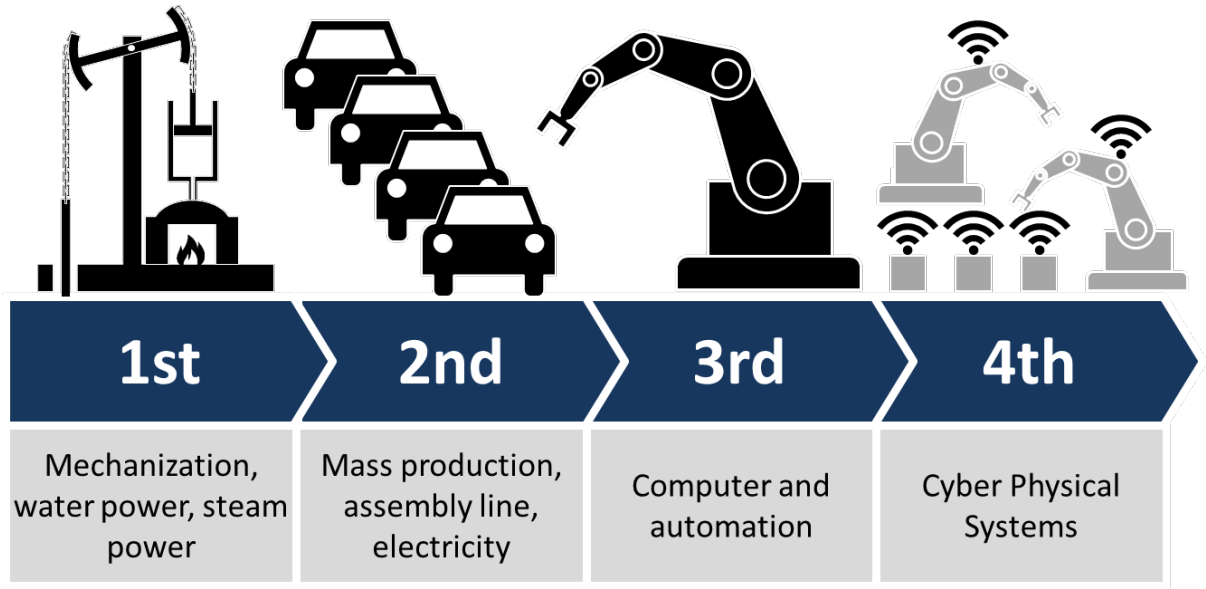


*Figure 1*. The Fourth Industrial Revolution follows on from technological revolutions brought about by water/steam power (industrial revolution 1.0), electricity (industrial revolution 2.0), and computerised automation (industrial revolution 3.0).

(Source: https://en.wikipedia.org/wiki/Industry_4.0)

These scientific and technological developments are driving rapid or "exponential" global change and innovation. According to the conception of "exponential change", socio-technological advances (especially the explosion in data volumes, computer processing power and performance capabilities) is happening at an uncontrollable and constantly increasing pace.[3] For instance,

> [w]e will soon have more devices than people communicating with the Internet. In about 10 years from now, 150 billion (!) "things" will be communicating with the Internet. […] Due to limited communication bandwidth, an even smaller fraction of data can be processed centrally, such that a lot of local information, which is needed to produce good solutions, is ignored by centralized optimization approaches. In other words, attempts to optimize systems in a top-down way will become less and less effective – and cannot be done in real time. Even revolutionary new technologies such as quantum computing are unlikely to change this (Helbing, 2015, p. 75).

**Singularity and blockchain technology**

In such context, the American technology guru, inventor and futurist Ray Kurzweil (2005), now a director of engineering at Google, has famously argued for the so-called "singularity hypothesis", closely linked to the Fourth Industrial Revolution developments. According to Kurzweil's popular book *The Singularity is Near* (2005), this hypothesis pertains to radical future technological prospects, with special emphasis on "the law of accelerating returns",

[3] Additionally, machine learning methods render information systems more intelligent.

which manifests itself as *exponential technological progress*. Actually, the aforementioned "exponential change" is the strong driver or "agent-cause" of singularity.

Kurzweil (2005) plots progress in a wide variety of areas (including computing, communications, and biotechnology), and concludes that a technological singularly is due around the year 2045.[4] Machine intelligence is a leading factor in Kurzweil's forecast. The self-evolving and self-improving artificial intelligence scenario champions over steadily accelerating pace of technological advancement. But this kind of narrative, which arguably pertains to a deterministic conception of technology and a new version of techno-optimism, as well as to a "promising technology" and a "techno-utopia" (Hirsch-Kreinsen, 2016, quoted in Garibaldo & Rebecchi, 2018, p. 299), is quite problematic and doubtful because

> [i]n the longer term, the technology promise of Industry 4.0 will have to pass through a long dark valley of disappointments, and lagging enthusiasm before a new phase can begin in which further advancements in the concept will doubtlessly be attempted. It can be anticipated that such a subsequent developmental phase will be one of more limited and realistic economic and social expectations. Inevitably by that time, the promising technology of Industry 4.0 will probably have lost at least some of its glamour (Hirsch-Kreinsen, 2016, quoted in Garibaldo & Rebecchi, 2018, p. 299).

The waves of technological change are strongly ambiguous and lead to nonlinear and unpredictable economic development and social transformation.[5] Moreover, the World Economic Forum's founder, Klaus Schwab, has perceptively observed that, in the emerging Fourth Industrial Revolution (4IR), a dynamic "fusion of technologies … is blurring the lines between the physical, digital, and biological spheres" (Schwab, 2016a). These technologies include everything from the internet to drone to big data, and their potential applications are rapidly expanding. Accordingly, in his original article "Can Cyber-Physical Systems Reliably Collaborate Within a Blockchain?", Ben van Lier (2017) argues that, in an increasingly networked world comprising of both virtual and physical systems, in which humans collaborate with machines, trust-producing mechanisms like blockchains will become crucial. In particular, blockchain technology is the digital ledger software underlying cryptocurrencies, such as bitcoin (see Figure 2), for the secure transfer of money, assets, and information via the internet without needing a third-party intermediary.[6]

[4] However, most recently, Ray Kurzweil predicted that the exact year Singularity will occur is 2029 (see https://futurism.com/videos/ray-kurzweil-predicts-the-exact-year-singularity-will-occur/).

[5] Technology is now rewriting society's fundamental rules. Indicatively, as Vivek Wadhwa (2016) imaginatively maintains:

i) "Anything that can be digitized will be".

ii) "Your job has a significant chance of being eliminated".

iii) "Life will be so affordable that survival won't necessitate having a job".

iv) "Your fate and destiny will be in your own hands as never before".

v) "Abundance will become a far bigger problem than poverty".

vi) "Distinction between man and machine will become increasingly unclear".

[6] "What remains beyond doubt is the much more stable and predictable nature of gold-backed cryptocurrencies. Thus, the most virtual currency invented to-date acquires the centuries-long proven and secure virtuality of gold as a measure of value, provocatively swimming against the tide of permanent insecurity and emergency" (Dimitrov, 2015, p. 141).

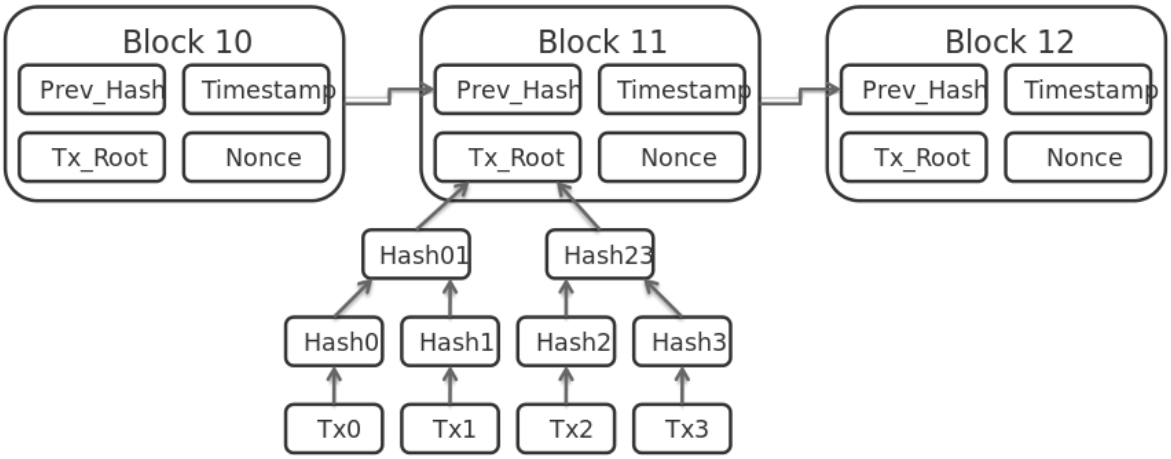


*Figure 2*. An example of a bitcoin network, a peer-to-peer payment network enabled by blockchain technology, which operates on a cryptographic protocol.

(Source: https://en.wikipedia.org/wiki/Bitcoin_network)

Arguably, bitcoin is a useful tool (made possible by the advancement of the internet) that importantly facilitates human cooperation, albeit the emerging, complex cybersecurity needs and the overlapping technological and economic risks. Yet, we should remember that we are fundamentally social beings and collaborative creatures. Therefore, tools like bitcoin are of fundamental human nature, of fundamental sociality, and facilitate our expression of these fundamental portraits.[7] Nowadays, there are ways in which the availability of online data not only gives us new insight to human interaction and to understand our world, but also new opportunities to intervene in the world to make it better (Tsekeris et al., 2018).

**Ambivalent dynamics**

Network science and, in particular, social network analysis indisputably promise a surprising number of such opportunities. But they also enable governmental agencies to gather and evaluate detailed information about millions of people's families, friends, acquaintances, and other contacts, since much of this information is voluntarily made public by the social media users themselves (see Figure 3). Advanced technological systems of massive data collection and storage are currently employed to surveil (and even control) ordinary citizens and their online activities, which become "sucked up as data, quantified and classified, making possible real-time tracking and monitoring" (Lyon, 2014, p. 4). However, not even governments can absolutely control their own data: "data volume grows faster than processing power, implying that a growing share of data will never be processed" (Helbing, 2017, p. 319; see also Tsekeris, 2016).

[7] Despite the coming situation of technological unemployment (Brynjolfsson & McAfee, 2014; Helbing, 2015; Swan, 2017), the rapid proliferation of a "collaborative commons" and the so-called "non-market" and "non-linear" economic activities is making it possible for a more cooperative and just society to emerge (Mason, 2015, pp. 141-145; see also Rifkin, 2014). Nevertheless, no one can easily predict the future and the political economic and cultural dynamics of "gig economy" – in 2016, the US Department of Labor defined a "gig" as "a single projector task for which a worker is hired, often through a digital marketplace, to work on demand", see: https://www.bls.gov/careeroutlook/2016/article/what-is-the-gig-economy.htm.

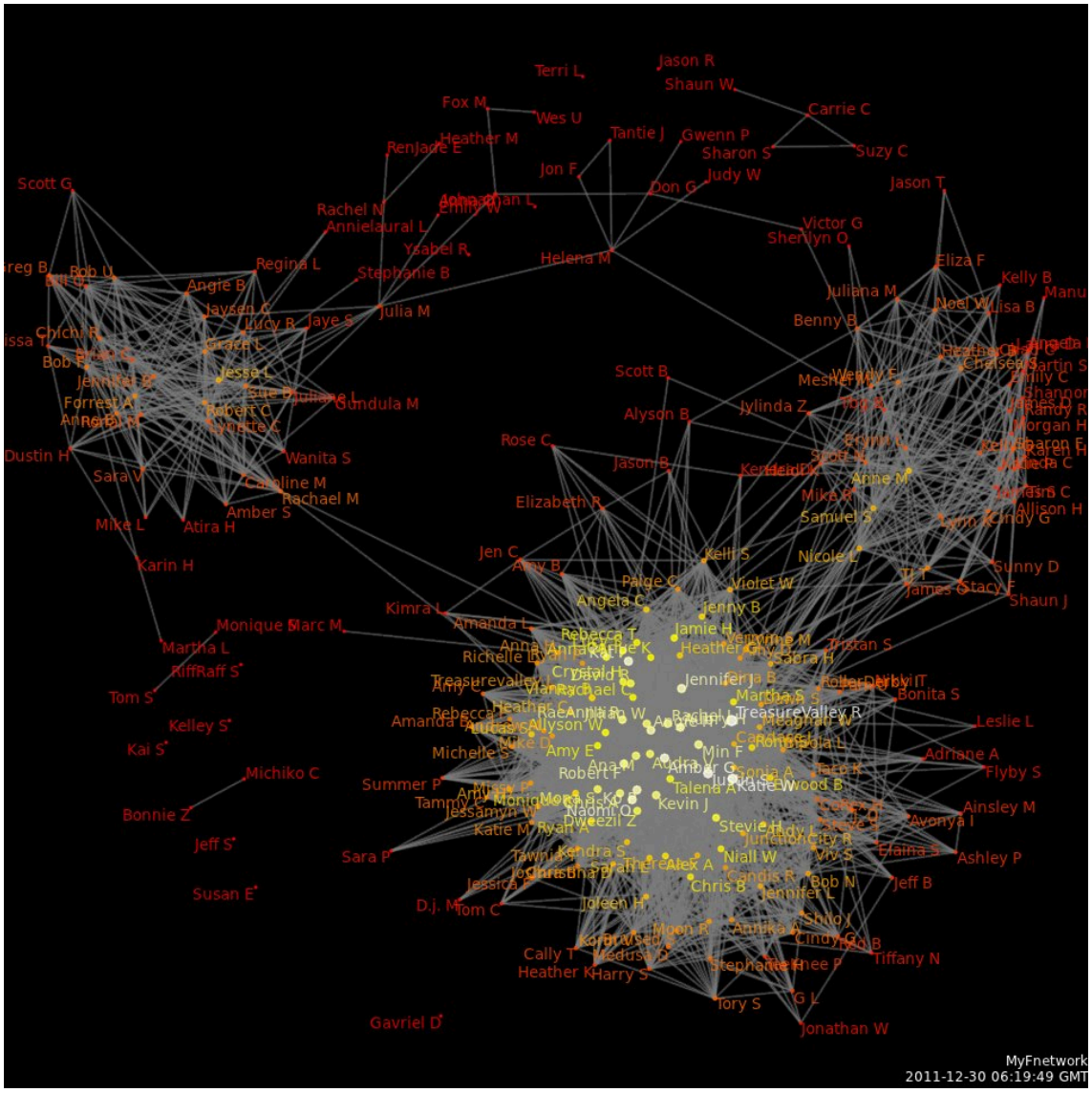


*Figure 3*. An example network graph illustrating the relationships between Facebook users.

(Source: https://en.wikipedia.org/wiki/Surveillance)

Furthermore, new, conflicting (and perhaps incommensurable) types of humanity gradually emerge. One the one hand, *Homo Rationalis*, the hitherto grand symbol of the public sphere, is rapidly metamorphosing to *Homo Granularis*, thus signifying "a newform of humanity in a world of numbers and algorithms" (Kucklick, 2014, p. 15). One the other hand, we witness the appearance of *Homo Virtualis*, who expands the received, old or traditional "ideal human model", "escapes the ideal human proportions, goes beyond the limitations of natural environment by taking advantage of the technological developments and the emerging virtual, cyber environments" (Koskinas, 2018, p. 1).

In the same line drawn by Koskinas (2018), it is acknowledged that virtual reality (VR) "incorporates new modalities, besides fantasy, as mediums of contact with the imaginary world […] fantasy itself gets direct access and even volitional control over the actual physical objectiveness. It really is already enough to wish something so that it happens, as is the case, for example, in some of today's cutting-edge applications of VR in medicine" (Dimitrov,

2015, p. 141). In some sense, this entails the opening of public communication, the democratisation of experience and the emancipation of human fantasy. Therefore, virtual reality should rather be theorised as a symbolic heterogeneous medium, a complex semiotic technological digital environment or ecology (without hierarchy), which "strongly tends to largely replace its actual physical detonates. A semiotic complex technological digital environment, which shows a tendency not only to compete with the immediate physical and social environment, but to assimilate, to control, and to dominate it" (Dimitrov, 2015, p. 142).

Most importantly, virtual spaces are not "spaces of pure representation or imagination, but spaces of Aristotelian potential, spaces to actualize what-might-be" (Tsekeris & Koskinas, 2011; Greene & Joseph, 2015, p. 224), which often follow an enterprise ethic and create new (immaterial) commodities, markets and consumers. Given that virtual reality environments gradually constitute an integral and expanding fraction of our everyday experience, the capability of recording, biometrics, and data mining technologies will grow, making it increasingly feasible to keep track of where people go, whom they meet, what they do, and what goes on inside their bodies (Brin 1998; Lyon, 2014). This inevitably calls for a critical media and technology studies perspective (Fuchs, 2015; 2018), as well as for a critical data science, strategically aiming to discover and uncover power effects and exploitative relationships of any kind (Kitchin, 2014).[8]

No doubt, what is urgently required is a critical assessment of this new "digitalisation paradigm" (including Industry 4.0) and its societal implications, "avoiding the paralysing choices between prophecies of doom and unrealistic and deceiving techno-optimism" (Garibaldo & Rebecchi, 2018, p. 299). Such an assessment arguably needs to follow the reflexive epistemological lines of Ulrich Beck's complexity and multiplicity thinking, as found in his *Reinvention of Politics* (1997) and his *World at Risk* (2009). Following Beck's (1997, 2009) "both-and" integrative conceptual logic, instead of the zero-sum game logic of "either-or", positive and negative aspects (cures and curses) of Industry 4.0 mutually co-exist and co-evolve in the same relational context, thus signifying an analytical transition *from dualism to duality* (Demertzis & Tsekeris, 2018).[9]

This calls for further empirical research and careful scrutiny on complex patterns in our speedy, digitalised and networked world, paving the way for exciting intellectual developments, scientific findings, and interdisciplinary conclusions. Especially now that the "post-Internet", or the "Next Internet", is emerging (from the dynamic convergence of Cloud Computing, Big Data Analytics, and the Internet of Things), new ambivalences, risks and challenges are being energised and posed for the quality of democracy, citizenship, and the political public sphere (Mosco, 2017). The Fourth Industrial Revolution and the digitalisation of society can perhaps provide some good (albeit partial) solutions to many of the problems

[8] In the same line, Vincent Mosco (2015) rightly warns us against highly powerful data politics and digital positivism (data processes of meaning-making are never innocent, neutral, and objective), as well as against the systemic practice to assess patterns in society as the ultimate goal of Big Data, since "they are increasingly used to analyze, model, and forecast human behaviour" (Mosco, 2015, p. 182). Rather than "just following" the data and data scientists, we need a critical reflexive awareness of the complex forms of knowledge being produced, as well as of our own role in that process.

[9] In this regard, Industry 4.0 can be perceived as a site of struggle: "Socio-technical or techno-social ecosystems operate by and for their creators, social relations resample old ones and new ones pro-social or a-social come forth, power relations and power structures exceed their limits and re-shape on neo-primitivistic levels, neo-luddism and the denial of technology struggle with freedom of expression, acceptance of difference and respect of otherness" (Koskinas, 2018, p. 2).

of humanity only if we make sure that a governance system will adequately harness all the possibilities of this revolution, without denying the democratic principle of alternatives possibilities (Garibaldo & Rebecchi, 2018). All in all, one should be sceptical of Industry 4.0 (Pfeiffer 2017; Fuchs, 2018).

## Conclusion

Industry 4.0 and the all-pervasive digitalisation of the contemporary uncertain and precarious world create both huge promise and potential peril, and unpredictably alter the content, nature, character and dynamics of social and human experience. It is therefore offered the relational prospect for both cures *and* curses, empowerment *and* disempowerment, openness *and* closeness. Academic communities and communities of knowledge, in general, still need to find new concepts, meanings, methods, frameworks and radical alternatives, concerning institutional settings and interaction rules, which will allow self-organising (cyber-social) systems to be superior using real-time data to enable adaptive feedback mechanisms, so that those systems behave favorably and in a more stable, resilient, participative and bottom-up way (Helbing, 2015). Having a critical reflexive grasp of both the universal and specific features and processes of Industry 4.0, especially of those associated with huge sets of data (Big Data), is now becoming a significant democratic task, over against the automation of society and the robotisation of humanity. Human societies are in a historic existential crossroad and must arguably take the road to creativity, empathy, reciprocity, diversity, pluralism, trust, solidarity and cooperation, which will be the milestones of success in the coming years.

Let's hope that the Fourth Industrial Revolution will entail a fruitful process of *creative destruction* (Schumpeter 2003/1942, pp. 81-86), where the new and the innovative is displacing the old and the obsolete in a dynamic process. In search of a new meaning of being human (and of being social as well), what we urgently need is to embrace exponential transformation and build a shared digital future in an agreed, reflective, sustainable, inclusive and value-sensitive manner, over against fault lines and rifts: "To solve the world's problems and adapt to environmental, social, economic and technological change, we must increase our problem-solving capacity. We must get more efficient in taking the best ideas on board and combining them, in other words, to catalyze collective intelligence" (Helbing, 2015, p. 77). This seems the only way to survive the hopeless battle against complexity and unpredictability.

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