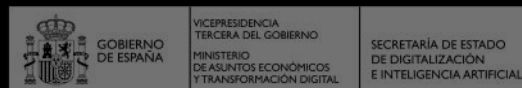


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About Digital Future Society

Digital Future Society is a non-profit transnational initiative that engages policymakers, civic society organisations, academic experts and entrepreneurs from around the world to explore, experiment and explain how technologies can be designed, used and governed in ways that create the conditions for a more inclusive and equitable society. Our aim is to help policymakers identify, understand and prioritise key challenges and opportunities now and in the next ten years in the areas of public innovation, digital trust and equitable growth.

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SECRETARÍA DE ESTADO DE DIGITALIZACIÓN E INTELIGENCIA ARTIFICIAL



00	<div>Pag. 6 - Pag. 13</div> <div>Foreword</div> <div>Pag. 7 - Pag. 9 by Carme Artigas</div> <div>Pag. 10 - Pag. 13 by Carlos Grau</div>
01	<div>Pag. 14 - Pag. 27</div> <div>The Golden Age at our door</div> <div>By Carlota Pérez and Andrés Schäfer</div>
02	<div>Pag. 28 - Pag. 43</div> <div>The new surveillance society: Your data</div> <div>By Jennifer Kite-Powell and Marijke Roosen</div>
03	<div>Pag. 44 - Pag. 55</div> <div>Post-truth, fake news and alternative facts</div> <div>By Aurélie Filippetti and Christian Salmon</div>
04	<div>Pag. 56 - Pag. 75</div> <div>Artificial Intelligence and ethics</div> <div>By Joanna Bryson and Martin Eisenlauer</div>
05	<div>Pag. 76 - Pag. 91</div> <div>The gig economy: exploring competing narratives</div> <div>By Jeremias Adams-Prassl and Tim Wallace</div>

06	<div>Pag. 92 - Pag. 107</div> <div>Towards a digital “Cold War”</div> <div>By Natasha de Teran and Federico Guerrini</div>
07	<div>Pag. 108 - Pag. 127</div> <div>Climbing to the top</div> <div>By Mateo Valero and Robin Wauters</div>
08	<div>Pag. 128 - Pag. 145</div> <div>The role of humans in the digital society</div> <div>By Virginia Dignum and Bennie Mols</div>
09	<div>Pag. 146 - Pag. 165</div> <div>Public value, platform capitalism and digital feudalism</div> <div>By Mariana Mazzucato, Rainer Kattel and Parminder Bahra</div>
10	<div>Pag. 166 - Pag. 185</div> <div>Urban autopia (self-driving vehicles)</div> <div>By Raúl Rojas and Rene Millman</div>

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Foreword

By Carme Artigas and Carlos Grau

Preface 1

by Carme Artigas

This 2020 is a year that will go down in history. The impact of the health crisis caused by the COVID-19 pandemic is generating unprecedented social and economic transformations that will definitively modify our way of understanding the world, of facing up to the challenges we have ahead as a society.

The world has changed, and it has changed forever. The power of the collective experience that we have lived through this year as a community, as a species, places us before a new starting point. An urgent reset to which we have been forced without warning, and which force us as citizens, as a country, to adapt to the new rules of this global scenario.

The lockdown and the new social distancing measures aimed at protecting citizens from the coronavirus have brought an unprecedented shock to the world economy in the last century. Never before in modern history we have experienced a context similar to the present one.

The slow down of the economy and the restrictions of mobility have brought dramatic consequences for millions of people around the world. A collective effort guided by solidarity and the common benefit that requires solutions and new transformative policies in which states will play a key role.

It is time for governments to regain the trust of citizens, to be seen once again as the fundamental instrument for improving people’s living conditions. It is time to build a common future that guarantees a way out of the crisis that leaves no one behind. A collective project that can generate hope and awareness among citizens. That listens to the people, their needs and their concerns, in order to make them come true through a common and solidary effort.

In this task of building a sustainable and inclusive project for the country, with the aim of emerging from this crisis stronger as a country, the Spanish Government has a clear priority: the digital transformation. If we have learnt something from the crisis we have experienced, it is that the digital world is not about the future, but rather a reality of the present that affects and conditions all aspects of our lives.

The pandemic has accelerated the arrival of the digital revolution in our societies in an unimaginable way just some months back. Progress predicted for years to come has become a reality in just a few weeks. Digitalisation is here to stay, changing the way we work, consume, inform ourselves and get in touch with our beloved ones.

The book you are holding in your hands aims to serve as a guide for the reader, to shed some light on the challenges and opportunities that the irruption of this new digital era means for our society. Through a review of the most outstanding aspects of this process of digital transformation and of the disruptive technologies that are leading innovation in this so-called ‘Fourth Industrial Revolution’, the different authors of each chapter try to glimpse the context that in the coming years will determine the scope of the changes to come.

It is a work of reflection and study of the possibilities that technology offers for the construction of a better and more advanced society, but also a look at the ethical aspects and the dangers and challenges that technological development implies, whose depth and speed are unprecedented.

This book has the fundamental objective of drawing a context to the current technological revolution through a detailed and specialised analysis of the areas in which the most transcendental and relevant advances in this new paradigm are being developed. A new paradigm for which we, at the Secretary of State for Digitalisation and Artificial Intelligence, see as a challenge to face from the commitment to the progress of our country. The citizens more than ever demand the response of their governments, and here in Spain we are determined to face up to this renewal of our productive structure and society keeping always the highest standards to protect the fundamental values and rights of citizens and the responsibility towards society and the environment.

There are many uncertainties and unknown threats to come, but there are also new opportunities and spaces for our self-reinvention as a society with a clear priority that must stand out above: putting people right in the core of any advance.

The COVID-19 pandemic has accelerated in an unprecedented and unexpected way the digital transformation of our societies, but also the perpetuation of social gaps that deepen inequality to unprecedented levels.

For this reason, we understand that there can be no way out of the crisis without a reconstruction of a transversal and inclusive economy. An objective for which digitalisation must act as a basic tool that allows the population to access the new opportunities that technology offers on the basis of equal opportunities.

This context has accelerated all the processes related in one way or another to digitalisation. The opening of a digital gap, even deeper than that which already existed months ago, is undoubtedly one of the great problems associated with this acceleration of the technological revolution and its impact on the lives of citizens. A very worrying situation which, if not tackled urgently, could have irrevocable consequences for the progress of our country and our Welfare State.

That is why inequalities derived from asymmetric digitalisation, such as the territorial, educational and gender gaps, must be a priority for the transformation of the productive, economic and social system that we should face. This is the path we must always keep in mind during this process and, therefore, one of the basic points of España Digital 2025 plan, Spain's national strategy for this digital transformation.

Beyond the great advances and innovations at the highest level, which are fundamental for the progress of our companies and institutions, we believe in technology as an instrument to change and make people's lives better. To create spaces to offer new horizons to people who saw technology as something distant and inaccessible. To improve the living conditions of sectors of the population for whom training in digital skills can mean the opportunity they need to develop in a digital environment that is increasingly representing a greater percentage of the GDP of the most developed countries.

The benefits of the digital transformation of our economy and our society that the Spanish Government is betting on will only be possible through an inclusive and sustainable strategy that generates wealth and well-being in all areas of society. We cannot think of real technological advances without taking care of people, and without making this advances accessible to the whole population through the knowledge and skills needed to do so.

We are also facing a revolution on many levels, in which we must value aspects derived from technological development which will be, and already are, of vital importance for our development as a community and respect for a series of fundamental values in societies such as those of today. The analysis of such profound transformations as those we are experiencing these days from an ethical perspective and respect for citizens' rights also means the greatest guarantee to erase the barriers of access of the most vulnerable population to the benefits of technological development.

This book is the best example of the importance of making a reflexive effort in this aspect. A reflection that must cover areas as complex as cybersecurity, the management of Big Data or the fight for citizens' digital rights. All of these are challenges derived from the growing incorporation of new technologies into our lives that we, as a government, have the responsibility to address in order to guarantee that this transformation is materialized with the maximum respect for the democratic values that we represent.

For this reason, works such as this book are a fundamental exercise to face this challenge from the multiple perspectives that such complex phenomena demand. This book is also a valuable reflection on how, from the perspective of our societies in the 21st century, we are absorbing all these changes and incorporating them into our idiosyncrasies and new rules and codes.

The different authors highlight phenomena that today occupy a fundamental part of the government's agenda, and whose penetration into public debate and into the daily lives of all the readers of this manual grows every day.

We are talking about phenomena such as the transformation of the world of information, of the channels of access to knowledge and the transcendental changes in the model of consumption of cultural products and multimedia content, which are increasingly linked to the inexhaustible flow of information that the extension of the Internet has made possible.

Aspects such as privacy on the Internet, respect for the digital rights of citizens, or the right to information and the rigorous control of fake news, are crucial debates we, as society, must face in the near future. That is why the government has launched a participative process to create a Digital Rights Chart for Spain, opening the debate about which rights must be updated and upgraded to protect ourselves in the digital spaces as much as we are protected in our common life.

In this intellectual effort, which governments have the duty and responsibility to support and promote through initiatives that encourage in-depth and restful research work, public-private collaboration and cooperation between the different states will be one of the keys. The work of entities such as the Digital Future Society must be used by institutions and public authorities as a starting point to obtain valuable information that consolidates a comprehensive knowledge of the most important issues with regard to the development of the digital transformation that we need, based on the in-depth analysis of each of the sides of the phenomena that we are facing.

The digital future is already here. It is time to decide how we tackle the enormous challenges that the transformation of all areas of life will force us to face as citizens and part of society. This is a path that we must travel together, leaving no one behind and being aware that technological progress means, above all, social progress.

It is our duty and our responsibility to prepare for this future, and for the present we are already living, being aware of all the resources and tools we have at our disposal to build a sustainable and inclusive digital transformation. A task for which it is essential to generate new spaces for reflection, for collective thinking that will allow us to know, from all possible perspectives, a reality that surpasses everything imaginable until now, and that will connect academic and intellectual work with a clear and determined idea to improve people's lives.

The challenge is exciting, and sharing it is undoubtedly the best way to complete a journey that will mark our lives –and the lives of those to come– forever.



Carme Artigas

*Secretary of State for Digitisation and Artificial Intelligence.
Government of Spain*

Preface 2

by Carlos Grau

The digital emergency is a reality that we must tackle together without further delay. We at Digital Future Society define this concept as the situation that has been generated by an asymmetrical and accelerated digital transformation that requires urgent measures to be taken in order to guarantee equity and inclusion, the protection of human and digital rights, and to reduce the environmental footprint. A reality that demands that the international community, governments, companies and civil society become aware of this crisis, in order to take action before the consequences are irreversible.

The growth rise of disruptive and innovative technologies such as Artificial Intelligence, machine learning, Blockchain, augmented reality, Big Data, the Internet of Things, 3D printers - to mention just a few of the technologies that have most impact on our everyday lives - has contributed to an unprecedented transformation of the world. Technology has revolutionised the global economy, industry and business models; society, its ways of interacting and communicating and such important sectors as health or education, not to mention the impact it has had on the sustainability of planet Earth.

The exponential growth of disruptive technologies, a product of the ‘Fourth Industrial Revolution’, and their impact on the economy and on society have brought major benefits to people, but also many challenges and dilemmas in terms of security, equity, ethics, human rights and the protection of the environment in this new digital era. Although technological advances have not been adopted equally everywhere on the planet, their impacts have however affected humanity as a whole, widening gaps and in certain cases increasing inequalities and exacerbating inequalities in rights and opportunities between citizens of different countries.

Technological advancement is a two-sided coin. On the one hand, or side, it offers a wide range of options as far as opportunities and inclusion are concerned, given that technology entails access to information, science and education, better services, greater productivity, besides promoting transparency and innovation, acting in many cases as an accelerator. But on the other hand, if the appropriate contextual conditions are not established, technology can also bring exclusion and vulnerability in its wake, challenges brought on by a lack of anticipation of and response to the negative impacts it can have in economic, social, ethical and environmental issues.

As I have pointed out, the digital emergency brings with it major great challenges that have to do with the access to and the use, implementation and unequal impact of technology. At Mobile World Capital Barcelona, under the auspices of the Digital Future Society programme, we shed the spotlight on those areas we can influence, putting forward proposals and recommendations with the purpose of finding solutions to the complex questions posed by the digital era, which are also addressed in this book from the perspectives of international experts. Firstly, the digital gaps are found in even the most digitalised societies, as is the case of Europe.

This is a complex social challenge that implies unequal access to and use, impact and knowledge of technology by different groups, essentially the most vulnerable. Gaps that are growing wider due to the lack of economic resources, age, gender, disability, education, location, the lack of skills and understanding, etc.

Disinformation, on the other hand, has proven in recent years to be a serious threat to democracies. It puts the right to quality information and appropriate decision making at risk. Disinformation is being used in areas of our planet as a political weapon, generating polarisation, spreading messages of hate and manipulating public opinion. Although it may seem contradictory, in the information age, the society of ignorance is being purposefully encouraged.

Thirdly, the new forms of employment are showing how current labour regulations, social protection plans and legal frameworks are designed for traditional forms of employment. Once again, legislation is lagging behind reality. Employment with digital platforms is increasing globally at a higher speed than we had anticipated, and in this field we have a marvellous opportunity to formalise labour relationships and distribute risks and responsibilities in a more equal way.

Technology also has a clear impact on the environment. The digital transformation entails, in certain cases, an increase in energy consumption due to the increasing use of devices, distribution networks and data processing centres, but the use of large amounts of data and Artificial Intelligence, and the promotion of new models of sustainable mobility can contribute new technologies that mitigate the negative effects of climate change.

Finally, another key aspect is data governance. In a world that is increasingly more dependent on data-based algorithms that choose and make decisions on behalf of human beings, policy makers must guarantee the existence of appropriate regulatory frameworks and data governance mechanisms, so that professionals and end users of these data can understand, respect and exercise their fundamental human rights. It is in this field that ethical criteria must take precedence when designing and deploying Artificial Intelligence algorithms, which must primarily place the person at the centre, in an inclusive and diverse way.

We are facing global problems, and we must therefore approach them in a transversal and multi-strategic way. Technology is an accelerator that favours greater communication and new experiences, but in these times of accelerated change, the key lies in our not forgetting to place human beings at the centre, and in our anticipating the social impacts brought about by certain changes thanks to the new technologies. We have a road map, set out by the United Nations’ Sustainable Development Goals, and an opportunity to turn new technologies into an instrument that can accelerate wellbeing and can limit and reduce to the minimum the risk of malpractice and also anticipate their social impact by making sure that they are deployed in conjunction with appropriate coverage measures to ensure that no one is left behind.

Technology opens a door to handling crises in a very efficient and preventive manner. The pandemic is a good example. The world is changing at overwhelming speed, and only technology is able to keep pace with it. Public and private administrations and institutions endeavour to adapt to the changes through regulations and transformation plans, but we have always been one step behind. The time has come for us to anticipate the future and to formulate new alliances in the face of the major challenge posed by the digital emergency.

Technology is not an end in itself: it is a tool that can enable us to determine what type of society we want to be. In this scenario of technological revolution, the digital transformation plays a key role in the achievement of these goals, because it is a lever that moves the economy and the society of the 21st century.

According to the OECD, cutting-edge technologies are those that will redefine industry and communications and provide the solutions we urgently need to face global challenges such as climate change, social inequalities generated by digital gaps, or the weakening of democracies due to disinformation, apart from the fact that they have the potential to replace existing processes. Therefore, technology is part of the solution.

An example of this is the positive effect that emerging technologies can have on our achieving the Sustainable Development Goals (SDG) promoted by the United Nations. In relation to the goals of eradicating poverty and hunger, the digital economy is helping many low-income people to access financial services for the first time, a crucial step in order to lift oneself out of poverty. ICT also helps farmers to increase the efficiency of their crops and their commercial productivity. As far as gender equality is concerned, digitisation can give women a greater voice in their environment and around the world, as well as offering new opportunities for their economic empowerment. With regard to health, Big Data and Artificial Intelligence can help us to observe situations, analyse trends and prevent and create projections against the outbreak of diseases and the use of health services, as well as to share knowledge and practices. When it comes to education, mobile devices allow students to access educational resources anywhere and at any time, which helps to eliminate economic barriers, gender gaps, and other differences between rural and urban environments. In order to mitigate the effects of the climate emergency, satellite images are crucial to understanding what state the Earth is in, to sharing climate information, making forecasts and using early alert systems in order to better adapt to the consequences of climate change.

It is our duty, as institutions and citizens, to choose values that are going to allow us to advance towards a completely digital society, but not at any cost. We must build an equitable, sustainable and fair digital society. We must seek a balance between technological advances and humanism: respecting privacy, influencing the progress of society, training all citizens in digital skills, and using technology wisely to improve people's quality of life.

To do so, we must place people at the centre of technological development. This idea, which has been referred to as technological or techno-ethical humanism, is all about endowing the different agents in the ecosystem with the tools they need to ensure that the growth of the new digital society is as inclusive and equitable as possible, in line with the SDG.

If we are to reduce the discrimination caused by the digital emergency, the solution lies in strengthening societies and empowering citizens. Citizen empowerment through media literacy is key to building digital confidence in citizens and to eliminating the inequalities that hinder equitable growth. This means that we must provide citizens with more participation tools that allow them to become more aware and to participate in debates and in the decision-making process.

The digital emergency, just like the climate emergency, is a global phenomenon that affects everyone. In order to face the ethical and social dilemmas found in such issues as privacy, inclusion, and the empowerment of the most vulnerable sectors of society, we must first understand the impact of the digital transformation. That is why this book is giving a voice to key figures in society who represent research and academia, business and technology corporations, international organisms, governments and activists.

A voice that is embodied in 10 chapters that discuss such topics as the future of employment, the phenomenon of post-truth, the ethics of Artificial Intelligence, the expansion of the gig economy, the importance of data, supercomputing, the role of human beings in the digital society, the phenomenon of digital feudalism, or the evolution of cities. Questions that describe our digital reality and that we must tackle if we are to find solutions to the moral issues and the challenges of inclusion and inequality that arise from the digital emergency.

The spirit that must guide us is that of collaborative work, debate and agreements, focusing on innovation,

technology and talent with a proactive attitude that is flexible, adaptable, creative, optimistic, cooperative and supportive. It is vital that we encourage reflection and debate among the main agents involved in the digital agenda who, placing the citizen at the centre of the debate, are working to guarantee a society that is based on sustainability, equality and justice. The gestation of this new social contract requires voices and sectors from all over the world, leaving no one behind, from national policy makers to multilateral organisms, the technology industry, civic organisations, civil society and, of course, academia.

The pandemic that we have experienced has only served to accelerate the digital emergency and to make it more evident, highlighting challenges that we must urgently tackle. Most people have had to push ahead with a decade's worth of digitisation in just six months. This moment is an exceptional opportunity that we cannot afford to miss as a society, and we must address this major challenge with a global public-private collaboration, ensuring that those who have been part of the problem in the past become part of the solution vis-à-vis this new phase of our society. There is no time to waste. That is why this book aspires to generate a plural portrait of where we are now and where we are going as a society. Thanks to the voices of all the authors, sources and everyone involved in the book whether to a greater or lesser extent, we now have in our hands a work that will fuel the debate but that, more than anything else, directly tackles the main challenges posed by technology today with proposals and recommendations that, in this environment of digital emergency, can undoubtedly help us to together build a society that is more humanistic, ethical and, above all else, more inclusive.



Carlos Grau

CEO of Mobile World Capital Barcelona

01

The Golden Age at our doorstep

Smart, Sustainable and Global Growth

By Carlota Pérez and Andrés Schäfer



Preface

Warning to readers

The digital era has captivated human imagination not only with its exploits, but also with the dangers it entails. Dazzled by the brilliance of technology, we find it hard to glimpse its true potential for completely changing everything from our everyday lives to public policy. At some point in every technological revolution, a new paradigm begins to prevail. It is a moment of vertigo.

• Act I
Four (and a half) chapters

The Great Depression of the nineteen-thirties was epitomised in Charlie Chaplin’s film Modern Times (1936). This mischievous comedy recounts the misfortunes of Chaplin’s ‘Tramp’ character along with his companion, the ‘Gamin’ (Paulette Godard), at a time of unemployment, hunger and repression of the poor, against the backdrop of apparent gleam of mass production and automation, with its relentlessness and dehumanisation. In one scene, our two underdogs dream of a bountiful life in a modest suburban home from which they need only to reach their hand out of the window to grab the low hanging fruits of a brave new world. Dreams are, however, just dreams and the outcome of the story remains open. In the end, the two lovers only have each other. They walk hand in hand down a newly paved but deserted road in the middle of nowhere, towards an uncertain future.

Watching a stream of these images under the strict lockdown of the Covid-19 pandemic is unsettling. We are now at a similar moment, marked by great uncertainty about our future. At that time, 25% of wealth was concentrated in the hands of the richest 1% of the United States. That proportion is virtually identical to today’s figure. The International Monetary Fund (IMF) has concluded that we are now facing the worst recession since the Great Depression. But the pandemic makes us overlook the underlying reality. Because this is actually a recurring story and the chapters of this thrilling series are known as Technological Revolutions.

It was the Austro-Hungarian economist Joseph Alois Schumpeter who posited that capitalism evolves in technological leaps that constitute true revolutions. Schumpeter’s hero is not the highly successful businessman doing more of the same old thing, but rather the one that creates disruption. What we call an ‘innovator’. This succession of technological revolutions covers four and a half chapters. In each chapter, a new social group obtains access to the new good life.

The first chapter took place in the United Kingdom under the Industrial Revolution, which elevated a capitalist bourgeoisie and created an industrial proletariat that lived in conditions of exploitation, but would never leave the stage.

The second chapter, from 1829 onwards, led to the Victorian boom of coal, steam, iron and railways and saw the elevation of a cultured, entrepreneurial middle class in the new burgeoning cities.

The third chapter was the era of steel, heavy engineering and transcontinental navigation that led to the first globalisation under the “Pax Britannica”, while the United States and Germany made a leap to the forefront. The good life extended to skilled workers and the world of art, culture and entertainment. This was the Belle Époque of Lautrec, Renoir and Monet.

The fourth chapter kicked off in 1908 with the launch of Henry Ford’s Model T and the era of Mass Production, facilitated by automobiles, hydrocarbons, networks of highways and mass electrification, and shaped by suburbanisation, mass consumption and the Cold War. Now, in the countries of the so-called advanced West, the blue collar workers of the factories at last enjoyed the wellbeing of the post-war Golden Age.

Even though these revolutions are differentiated by their technologies, they all follow a recurring pattern. Each revolution can be divided into two parts: an experimental installation period and a period of deployment throughout the economy. The installation phase is guided by the world of finance and the deployment phase by production. Installation is driven by free-market ideology, as espoused by Reagan, Thatcher and Milton Friedman. Deployment sees renewed belief in the importance of the State in guiding the market and is the moment for people such as Keynes, Roosevelt and Adenauer. These are two mindsets that prevail at two different moments. Both are part of how Technological Revolutions propagate in the market system.

The two parts are separated by an emphatic split: a crisis. This is generally a collapse of the stock market followed by a period of recession acting as the pivoting point from one half to the other, transitioning from a new technological paradigm, towards a new socio-economic and political paradigm or, in other words, a comprehensive change in the entire functioning of society. We are currently at one of these historic moments when we find it hard to imagine a better future.

We forget that for the Tramp and his lover the post-war boom was to come around some twenty years later and that his dream would become true for millions of workers. They would have their dream house with children, and a car to go to work, to the supermarket, to school or to the beach. This was the period of greatest prosperity since the series began.

One day in 1971, the launch of Intel’s first microprocessor was given a low-key report in the press, overlooked by most. That event marked the start of chapter five, the Information and Communications Technology (ICT) revolution. The digital era.

A real chance of Smart, Sustainable and Global Growth lies ahead. A new Golden Age.

• Act II
Creative Destruction, Gilded Age

Another feature of technological revolutions is that while one stage languishes, the other emerges. The current paradigm has saturated its natural markets and introduces changes to lengthen its life. The mass-production revolution reached saturation point at the end of the nineteen-sixties. It was the time of the civil rights movement, followed by the youth rebellion of 1968. The process of demolishing the establishment and seeking new horizons took off. In the nineteen seventies, a new historical moment would appear along with the oil crisis, mass unemployment, inflation, environmentalism, feminism... and the microprocessor. The model of industrialisation by import substitution took parts-assembly to countries in Latin America and Asia in order to reduce costs, open up new markets and postpone the paradigm’s death. Nixon tellingly began opening up to China in 1972. Entire factories were later moved to countries in the Third World. At some point Ronald Reagan stated that “government is the problem”. And so, government started dismantling the western Welfare State and undermining the trade unions. This was when Margaret Thatcher brought the miners’ union to its knees.

Milton Friedman’s dictum became the new era’s maxim: the social responsibility of all business is exclusively to maximize returns to shareholders. The financial system was deregulated, and investment looked for alternatives to a moribund model with decreasing returns. Capital gradually discovered

innovators in places like Palo Alto, fumbling around in their parents’ garages with a technology incomprehensible to their seniors. New technologies replicated and financial capital invested in them increasingly. Accelerating change rendered trades and jobs irrelevant as well as workers, regions and entire countries obsolete. A Gilded Age concealed rampant inequality under the patina of free-market ideology.

It is actually the financial frenzy during bubbles that makes it possible to install the infrastructure necessary for the new paradigm, long before it is profitable, as in the case of laying optical fibre around the planet. It doesn’t take long to reach the point at which there are more investors than good projects. This is when speculative capital detaches from its productive substrate and initiates a self-propagating state of excess. A financial bubble arises and grows rampant until it collapses.

This relentless, ferocious process of replacing one paradigm with another is what Schumpeter refers to as “creative destruction”. The economist and venture capitalist William Janeway sums it up succinctly: “Amazon took 2.2 billion dollars to get to positive cash flow, where it was earning its way. It could never have done that, except in a bubble environment.”



• Act III
Creative Construction, Golden Age

History has consistently shown that capitalism is able to redress the imbalances it has caused, albeit only after major crises: financial collapses, recessions, wars and social unrest. There is extreme resistance to social change. During the Great Depression, F. D. Roosevelt tried to usher in the New Deal and was simultaneously accused of being a fascist and a communist. It took the enormous collective effort of the Second World War for US politics and business to understand the potential of mass production and the advantage of a proactive state. Once peace came, mass production needed mass demand.

How was that to be achieved? Simply flooding the market with money is no solution. The potential of each revolution requires the orientation of the playing field to be established in order to encourage fruitful interactions and to ensure that its benefits reach new strata of the population. Three elements are involved: enabling factors, how the playing field is oriented and dynamic demand.

What enabled that paradigm was the quantitative leap in productivity resulting from mass production, which rested on the low cost of raw materials and energy. This refers particularly to cheap hydrocarbons, which provided the main source for the huge amounts of energy required, as well as derivative products such as plastics and petrochemicals. This paradigm therefore inevitably yielded an enormous amount of waste and environmental damage, not seen as critical then.

Three directions influenced the orientation of the playing field. One, the **Cold War**, which generated a large number of public contracts and innovations that eventually passed into the civil domain (such as computers and Internet), another, the Marshall Plan and post-war reconstruction, and, finally and most importantly, the American Way of Life and suburbanisation. According to J. M. Keynes, housing for the middle and working classes was the path to be followed and he advised Roosevelt “to put most of your eggs in this basket”. Land on the outskirts of towns and cities was very cheap and therefore, when combined with standardised construction, costs were reduced enormously, thus making housing available to large strata. It was a clear opportunity.

Suburban life generated a huge, febrile hive of economic activity that extended its benefits to the majority. This was an entire platform supported by the State so that the market economy could unfold on it. From housing to infrastructures and endless amenities, ranging from shopping centres and services to public schools and hospitals, jobs and businesses grew at an astonishing rate.

Dynamic demand was driven by the **Welfare State** and involved strengthening trade unions, collective bargaining, stable salaries, unemployment benefit, state-aided mortgage loans, consumer credit and free health and education. A mass programme of housing and consumption, for example, was unthinkable without state backup for mortgage loans and unemployment benefits as a bridge in the event of a loss of work. Jobs for life and guaranteed pensions boosted demand.

• Act IV
The Great Confinement

There have been three crises with potential for change in the installation period of the digital revolution. The first was the bursting of the dot-com bubble in the year 2000, the second the burst of the real estate bubble in 2007, which led to the global financial crisis from 2008. Quantitative Easing (QE), which then came to the rescue, led to the hope that everything would return to how it used to be. These funds, however, mainly revived the financial casino and inflated the price of assets, real estate, shares and corporate debt while increasing inequality and social instability. In every respect, it was a balloon ready to pop. The spark came from an unexpected place: the Covid-19 pandemic, which originated in China, the world's new factory.

The global Great Confinement of 2020, the trigger of the financial crash that was already on the verge of happening, is the third of these crises. It shows how the playing field has been rigged in recent decades. Badly-paid jobs have turned out to be essential: health personnel, supermarket employees, couriers, etc. Their wages were slashed during the installation period while financial profit soared. Under the lockdown, these are the two sectors that remain fully operative: vulnerable workers risk their health to keep the world afloat; the financial sector uses current volatility to make huge earnings.

At this point, free-market ideology, which had been instrumental for the installation of the ICT paradigm, has become an obstacle for deploying it to everyone's benefit.

This is similar to what occurred in the post-war period, when there was a need for reconstruction in Europe with a spirit of solidarity and the State as the promoter. Employment instability is revealing the need for a different type of social security network, perhaps a universal basic income and better payment for essential jobs. Austerity policies cannot continue to undermine health systems and essential services and State subsidies to the private sector must be suitably reflected in taxation. All this is being recognised by Klaus Schwab, the convenor of the Davos meetings, calling for a RESET of capitalism post Covid.

The handling of future pandemics and environmental and climatic problems requires global cooperation and a reset of multilateralism. The positive impact of the global lockdown on the quality of air and water (Venice's canals for example) and even on wildlife should be taken into account for the future. It has been shown that it is very possible to work remotely and to videoconference, which reduces the need for travel considerably.

Degrowth economists and environmentalists hold that the current pattern of wasteful economic growth cannot lead us to environmental sustainability. Many orthodox economists, on the contrary, consider that environmental regulations can obstruct development and growth. But neither the ones nor the others acknowledge the huge innovative potential of smart, sustainable and global growth. They are reluctant to believe that innovation enabled by ICTs can allow for growth based on intangible assets and services, enabling significant savings in energy and materials, generating whole new jobs creating sectors in the economy while also protecting the environment.

For finance to find productive options the direction of the playing field must be changed and the platform for the deployment of the innovative power of ICTs be created. Policies must suit the current paradigm just as they suited the previous paradigm during the post-war period. The suburbanisation model was adapted to the main innovation of the time, the car, which allowed easy access for the economic development of the entire territory. It also fitted the mass production of standardized objects with a view to lowering prices and to increasing earnings by volume in a national context.

ICTs, by contrast, with their flexible production methods allow for the segmentation of markets into differentiated products, which offer greater earning margins, in a globalized context. Both the problems inherited from the old paradigm and those generated by the installation of ICTs must be solved using the logic of these new technologies.

• Act V

Revolution 5.0: Smart, Sustainable and Global Growth

Cheap computing and information are the enablers of the current paradigm, just as cheap energy and materials enabled the previous paradigm. It is not just a matter of computers and Internet, but also of Artificial Intelligence, the Internet of Things, Robotics, Satellite Communication, Big Data, Blockchain and a virtually endless series of uses, as digital technology can be implemented from food production to biomaterials, from health to care services, in fact, to all aspects and at all levels. This means a new quantitative and qualitative leap for productivity. As on previous occasions, it is this leap that will enable reincluding the sectors that were displaced during the installation period in the advanced countries plus, possibly this time, the majorities in the developing world.

Any direction established for the new paradigm will only work if demand has the necessary characteristics and volume. For this to happen, a powerful understanding of the current moment is essential. The most obvious direction is Smart, Sustainable and Global Growth.

Initially, public investment in research, development and green enterprises will be necessary to back risk initiatives that produce innovations and new synergies, and attract new investors.

To achieve this, environmental regulations should be designed as incentives. Policies to improve the energy “mix” should lean towards encouraging renewable and non-polluting sources and discouraging fossil fuels. A whole new range of industries, processes and procedures, social habits and methods of political participation will emerge from Smart Sustainable Growth. This is because innovation, investment and production in such a growth model respond to an equivalent consumption. Instead of a linear economy, based on materials for creating products and transporting them to consumers –which will end up as waste–, we could see a “circular” economy where design contemplates durability, maintenance and reuse.

Currently, our objects do not quickly become obsolescent because of the “frantic speed” of technological change, but rather because of a

strategy to stretch out saturated markets. This leads to millions of tons of waste. This obsolescence is “planned” and its cost is socialized. The change to a maintenance economy would mean that extremely high-quality and durable products are manufactured with the best and most environmentally friendly technology possible. They would be targeted at a dynamic national and international lease sector, with processes of maintenance, modernization, disassembly, recycling and reuse, and bring a radical reduction in the consumption of materials while the needs of increasingly large strata of population would be covered. This extensive industry would undertake electronic diagnosis, 3D-print replacement parts, and use and retrain personnel displaced by technology and globalisation. Although a truly modern refrigerator would be more expensive, it would last a hundred years and would be subject to periodic updates and changes of ownership. Towards the end of its useful life it would still allow people emerging from poverty to benefit from renting such an appliance.

The necessary modernisation of infrastructure, including civil engineering and building, to recolonize cities by making them more efficient and ecological, by transforming suburbs into self-contained spaces, and by including new glocal productive vocations, will be a powerful and constant generator of innovation and employment.

Under the paradigm of ICT, the organisational model of many corporations has changed from hierarchical and pyramidal to horizontal and networked. The proliferation of free web services encourages innovation in the creation of communities for sharing access to products and collaborating on creative projects. For some time we have aspired to “democratising access”, as exemplified by software as a service (SaaS), car-sharing and co-working spaces. This means changing from purchasing physical goods to temporary access to them, leasing them or replacing them with intangible services (which is what is increasingly happening with music, film and reading).

In turn, aspiring to a healthier life, with trends such as cycling and extreme sports, keto and paleo diets,

organic and “gourmet” products, “experiences” and the global boom in craft beers, coaching and personal training, as well as wearing sustainable clothing, or driving electric cars, are now common currency among young people and those with higher levels of education or purchasing power. These new values, as in past revolutions, tend to spread to the rest of the population. Jobs in personal care such as physiotherapy and osteopathy, caring for the elderly, primary and preventive medicine, universal access to quality education, as well as training and lifelong re-training in a changing employment panorama are clear indications of where the new type of demand is heading.

This will not, however, solely be restricted to advanced economies. ICTs have shown their adaptability in developing countries: Internet access has incorporated to the global market parts of the world that were unable to fully participate in the previous paradigm because of lack of infrastructure. Smart green development is possible not only in Asia, but also in Africa and Latin America. The “American Way of Life” is no longer economically or environmentally viable on a global scale and must give way to a “Smart Sustainable Way of Life”.

All paradigms need an institutional framework that provides the necessary context for synergies in the market. First, the digital paradigm needs globalisation given that its basic infrastructure is the global internet. Providing finance to developing countries would create markets for redesigned capital goods to be sustainable and suited to the local conditions: engineering, infrastructure and equipment. This would generate dynamic demand and jobs in developed, emerging and developing countries and raise the standard of living of millions, while significantly reducing migratory pressure. Let us not forget that the intangible nature of ICT makes state-of-the-art innovations possible anywhere. In Kenya mobile phones spread rapidly and were turned into digital banks.

Mass production as a system was based on the premise of jobs for life and unemployment insurance in the event of unforeseen circumstances. In the digital era, given the demand for flexibility and resilience, many jobs are

now part of the gig economy and an increasingly large proportion of the working population is self-employed. The uncertainty inherent in this system of labour must be managed. There could be a Universal Basic Income, which everyone receives but to be returned in tax by those who do not need it. It would also be convenient to have a system of banking services that pay or collect interest in accordance with fluctuations in income over a year, thus guaranteeing a monthly fixed income.

Bearing in mind the metamorphosis to which the system is subject with the change of paradigm, a similarly changing taxation policy is necessary.

Instead of taxing work and consumption, transport, resources and polluting energy could be taxed. This would encourage innovation and efficiency in energy and materials, as well as the creation of jobs and the consumption of intangibles, while favouring local production and avoiding long-distance transport. Very short-term stock market operations could be taxed heavily at rates that decrease over time in order to encourage patient long-term investment in the real economy.

This does not mean a confrontation between the State and the markets, but rather a change from obsolete and inadequate policies to others suited to the problems being faced and to the new technological potential. The solution involves establishing a positive-sum game between business and society. This is what leads to the second stage of each Technological Revolution and what we refer to as its Golden Age.



Epilogue

The lost treasure

The ICT paradigm has led to more horizontal organisations and has made relations among people more flexible and streamlined, but neither governments nor citizens appear to fully understand that new technologies imply new kinds of interactions. The State needs to adopt the new agile organisational models in order to offer innovative services that are easily accessed by the public, together with a much more participatory democracy. To paraphrase Tim O'Reilly, the government should become a platform that provides both data and web services that allow citizen participation in order to solve problems: Government 2.0.

This, however, is just part of the story. As happened with previous technological revolutions, national states and multilateral institutions need to adjust to the basic assumptions and the logic of the new paradigm, both with regard to how they function and the design of policies. Our challenges are of a planetary nature: climate change, epidemics, migrations and trade are

global and affect us all. These require a new global governance framework with regulatory and taxing power to make a smart, green, global and fair growth model sustainable and possible.

The digital paradigm is our greatest opportunity now. Its potential for networking and participation contains the chance of citizen emancipation. Its capacity for dematerialising the way we fulfil our needs on a healthy planet is enormous. It is our job to find this lost treasure.



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02

The new surveillance society: Your data

By Jennifer Kite-Powell and Marijke Roosen

In 2017, Pulitzer-prize winning journalist Ronan Farrow tracked down a breadcrumb trail of clues to discover Harvey Weinstein's use of private surveillance to spy on journalists to intimidate, threaten and coerce them to not run unflattering stories on his case.

Farrow's 2020 book and 2019 podcast of the same name, *Catch and Kill*, details the lengths Weinstein and other monied players went to surveil journalists and private citizens.

This kind of private surveillance is dark. It's threatening. You aren't aware of it until you are, or in the most extreme cases, murdered like journalist Javier Valdez Cárdenas who was shot in Mexico outside of his newspaper, *RioDoce*. Valdez Cárdenas covered drug trafficking and organized crime in Mexico.

How big is private surveillance? Big and global. This is the age where a company can sell you 'surveillance in a box' to spy on who you want spied on. The smartphone tracking industry is frightening.

The New York Times' special feature, *One Nation, Tracked*, looked at the digital epidemic of phone tracking in the Privacy Project, which is a dataset of more than 50 billion location pings from the smartphones of more than 12 million Americans as they moved through several major cities. Each ping to the phone shows the precise location of the user, even in the Pentagon. For the record, it's legal to track, collect and sell this information.

Not just in the US but in most of the world as well. It's become a profitable trade to track humans and that activity is both legal and lawless.

In Farrow's podcast, John Scott-Railton, a senior researcher at the Citizen Lab in Toronto called this type of surveillance '[checkbook surveillance](#)' - meaning if you have the money and don't want to be accountable, you can acquire private surveillance.



“There will come a time when it isn’t ‘They’re spying on me through my phone’ anymore. Eventually, it will be ‘My phone is spying on me’.”

Philip K. Dick, Author

I spy

Citizen Lab investigates and researches the tactics which are being used to silence journalists and dissidents. Checkbook surveillance isn't about stopping crimes, it's just about subversive surveillance. In the Weinstein case, the producer hired Israeli private intelligence firm Black Cube to track journalists and suppress their stories. Black Cube calls their line of work, 'creative intelligence.'

Anyone can acquire information now - even the dark forces of an Israeli-based 'creative intelligence agency on US soil like Black Cube. But how far down the rabbit hole have we collectively gone when it comes to data acquisition in today's always-on world? Pretty far.

We are living in a surveillance state where we are all Big Brother now. From your laptop video camera to dashboard cameras in cars and our trusty smart home security devices, not to mention the GPS in your smartphones, surveillance tripped over itself and has become privatized by each of us as individuals.

Us. Them. And you. Surveillance by governments and now by each other on each other.

With an expected 6.4 billion smart home devices in use by the end of 2023, homes will be saturated with smart devices and virtual assistants. And, with Google and Amazon publicly acknowledging, they follow their users' conversations in their homes. Everyone is listening.

The rise of voice and Artificial Intelligence (AI), the Internet of Things (IoT) gives devices like Alexa and Ring the ability to obtain information passively as we open and shut our refrigerator, jog around the block, turn off and on our lights. It can listen silently, see and then send all that data to its corporate masters.

All this connectivity has created a currency. Your data.

We have arrived at the precise point where we are under surveillance physically, and our data is surveilled not for the prevention of crime, but for-profit by big tech and corporations and by governments to eradicate and control policies within their borders.

The research report Data Age 2025 has predicted that data will from 33 to 175 zettabytes by 2025. This goes way past gigabytes, terabytes and petabytes. To put the sheer size of the data into perspective, 175 zettabytes on a DVD would create a stack of DVDS that could circle the Earth 222 times.

We will come back to this later, but first we have to look at how we got here.



Back to the future

In our always-on digital lives, how do we regulate, oversee, or legislate the unerring use of personal data globally? At what point are consumers okay with some data being out there and other data being private?

Let's go back to the 1990s when the first search engine, Archie, began searching FTP sites to create an index of downloadable files, the only result was a listing, not the content of the search due to storage limitations. One year later, Tim Berners Lee set up a virtual library, known as VLib (World Wide Web Virtual Library) which then morphed into Veronica (1992); which searched file names and titles in Gopher index systems; and Jughead in 1993 (which did the same as Veronica but only searched one server at a time).

Jumping to 1994, Yahoo introduced the first iteration of search as we know it today, which was web pages with a human-created description in the URL. From there, web crawlers to Lycos which went live with 54,000 documents to Alta Vista in 1995, which had advanced search capabilities.

Then something happened that brought us where we are today. In 1996, Google created a project called Backrub, a search engine that used backlinks for search. There are two key features of Backrub which paved the way for search as we know it today: one, Backrub ranked pages using citation notation which meant that any mention of a website on another site would count it as a vote toward the mentioned site; and two, a website's "authority" or reliability came from how many people linked to that site, and how trustworthy the linking sites were.

At that time, the other players, Lycos, AOL, AskJeeves and Inktomi Hotbot didn't believe the citation notation model would work. And, it wasn't until 1998, following Microsoft's launch of MSN Search did we see the giant we know today as Google made its way into search.

It was now a race to process and rank information in a world of first-party and third-party cookies which tracked our every move.

We had crossed the Rubicon. It was now a race to process and rank information in a world of first-party and third-party cookies which tracked our every move.

The more the consumer searched, the more information Google and other search engines acquired. Social media sites like Facebook entered the public domain officially in 2007 and short three years later, were already admitting to privacy mistakes within the platform. Now more than a decade later, the company continues to dodge global data and user privacy issues.

“It was now a race to process and rank information in a world of first-party and third-party cookies which tracked our every move.”

Good old fashioned surveillance

Why do we find the world of *1984* so harrowing? Is it because it presents a future where citizens have no personal privacy? Or is it that Orwell's Big Brother world is total control of human's lives by a monolithic, authoritarian state? Is it too close to home to we're collectively experiencing as we live in a digital world?

Defining surveillance in the 21st century is not a straight line. Traditional surveillance has been relegated to closed caption television (CCTV) and electronic identification (e-ID) installed by governments to protect citizens, subdue potential terrorist threats, and maintain civil order. Governmental surveillance is a monolith.

In his book *Broken Homes*, author Ben Aaronovitch said the problem with the surveillance state is that it's hard work trying to track someone's movements using CCTV – especially if they're on foot.

Aaronovitch said part of the problem with CCTV is that the cameras all belong to different people for different reasons.

'Westminster Council has a network for traffic violations, the Oxford Street Trading Association has a huge network aimed at shop-lifters and pickpockets, individual shops have their own systems, as do pubs, clubs and buses. When you walk around London it is important to remember that Big Brother may be watching you, or he could be having a piss, or reading the paper or helping redirect traffic around a car accident or maybe he's just forgotten to turn the bloody thing on.'

With government surveillance, consumers have little or no control over this part of their lives. It's part of being a global citizen. There are no secrets from the government. Research shows that the use of CCTV is often biased according to cultural stereotypes and subjective prejudices. This turns CCTV into a tool for socio-spatial cleansing.

When it comes to most surveilled countries by CCTV cameras installed, the 2019 data showed that China and the US were the top two countries for citizen surveillance. And despite China having four times more CCTV cameras than the United States, the US has the highest number of CCTV cameras per person in the world at 15.28 per 100 people versus China's 14.36 per 100 people.

The same saturation formula applies to Germany and the UK which come in third and fourth respectively with Germany having more CCTV cameras, but less CCTV surveillance per person and the UK having less CCTV cameras but more monitoring per person.

However now, surveillance is more than a CCTV camera.

Shawn Gua, CEO of Umbo Computer Vision which makes an AI-powered video security system in Taiwan said we see cameras at many places like schools, public transit, offices, or in residential communities but most people have no emotional connection with them. And that with so many surveillance cameras, we don't feel more or less secure when we see the cameras and that's a huge disconnect.

Government surveillance has spilled over into information gathering on both consumers and citizens.

In China, CNN reported that leaked Chinese government records showed detailed surveillance reports on Uyghur families and how Beijing's justified their mass detentions. This comes on the heels of the Chinese government's decision to rank the trustworthiness of its citizens through

data on every one of their actions. Chinese authorities create scores on citizens by taking into account how a person crosses a street, political comments on social media, purchasing behavior or where and to where they send their resumes.

A new 2019 law in China now mandates that a citizen who registered a new SIM card must also submit a facial recognition scan.

According to Steven Feldstein with the Carnegie Endowment for International Peace, AI surveillance technology has spread quickly and faster than global experts expected. The research shows that at least 75 out of 176 countries are actively using AI technology for surveillance. The uses include smart city and safe city platforms (56 countries); facial recognition (64 countries), and smart policing (52 countries).

Governments are using AI surveillance to track and control their citizens, even when those citizens don't have access to the cloud. In a disturbing dystopian reality, Linnett Taylor, Associate Professor of Data Ethics, Law and Policy at the Tilburg Institute for Law, Technology, and Society (TILT), noted that even though close to half of the world's population has no or limited access to the Internet, these populations are being targeted by AI surveillance.

“You may not be able to reach the connected world, but it can certainly reach you.”

Case in point, Zimbabwe. In an effort to be a part of the new world order, the Zimbabwean government signed a deal with a Guangzhou-based start-up, Cloudwalk, to provide a mass facial recognition program. All of this data from citizens in Zimbabwe, which has a bleak human rights record, will feed China's Big Brother technology and fuel Zimbabwe's new surveillance state that could target ethnic minorities who present political threats to the government.

In 1984, the destruction of privacy was a means to an end, a tool for enforcing obedience to the dictates of the authorities. But in our global society in 2020, there are global pockets of resistance and rejection of the surveillance state.

In the US, university students from the University of California protested the use of facial recognition for security surveillance on campus in Los Angeles. Fight for the Future, the students and digital rights group coordinating the actions against facial recognition in schools, showed how the facial recognition software misidentified UCLA faculty members and athletes, where mainly people of colour were misidentified.

And, in August 2019, the Swedish Data Protection Authority fined the Skellefteå Education Board of a municipality in northern Sweden 200 000 SEK (approximately 20 000 euros - almost 19 000 dollars) for using facial recognition technology to monitor the attendance of students of their High School, because it violated the GDPR.

The thin end of the surveillance wedge

Our homes are now exposed to big tech and potential criminals who have access to our most intimate information. The rise of voice and AI and IoT has the capacity to obtain information passively as we open and shut our refrigerator, jog around the block, turn off and on our lights. It can just silently listen and see. And here's something disquieting, in December 2019, Amazon Ring sales almost tripled despite the hacks, security breaches and assaults consumers experienced with Ring. In fact, New York Times reporter Brian Chen said that people just don't care that their Ring device is spying on them.

At the start of the new decade, security researchers discovered that Ring's apps contained hidden code which shared customer data with third-party marketers. The Electronic Frontier Foundation (EFF) said Ring had a pattern of behavior that focuses on mitigating exposure to any scrutiny of breachers but still benefited from massive volumes of customer data available to them through the device. In December 2019, hackers hijacked the Ring cameras of multiple families and used the devices' speakers to verbally assault some of them.

William Budington, a technologist for EFF who helped discover the trackers embedded inside Ring's apps said in the New York Times that Ring had done 'precious little to address the broader threats to privacy that their devices enable.'

In California, the Los Angeles Police Department and three other local law enforcement agencies are using automated license plate readers (ALPR). According to the EFF, the California State Auditor's office determined there were fundamental problems with the police ALPR policies including the risk of ALPR data being abused to surveil political rallies or target immigrant populations.

The elephant in the room is choice. As consumers and citizens, do we fight against surveillance when we don't freely choose it? How far are we willing to go in the transfer of their personal data in exchange for apps that simplify our activity personally, professionally and socially?

But, when we do make the choice, are we more willing to give up our privacy if we have the choice versus when the choice is made for us? A slippery slope towards creating a sci-fi dystopian world versus a world where we choose what to share and what not to share.

This is surveillance in a hyper-connected world and another iteration of the global surveillance society we live in.

The new surveillance state

The evolution of surveillance has taken us in several directions in the last three decades - governmental and private surveillance to where we are today, consumer surveillance - . The surveillance triangle and in the middle is our privacy.

It's the new world order where our 24/7 digital lives: computers, smartphones, tablets, wearables and smart appliances gorge on users' information to establish behavioural patterns which are sold and traded. Do we have the right to protect our information online? And if we lose our digital privacy from the consumer surveillance, have we lost our freedom?

Doing business and living online has become second nature to consumers around the world.

In 2020, doing business and living online has become second nature to consumers around the world. We've collectively spent three decades surfing and searching the web with abandon. There was little or no awareness of the digital footprint we were leaving behind which has become just another iteration of the global surveillance society we live in. Privacy was the last thing on our minds.

This violent death of consumer privacy came at the hands of the companies that consumers willingly or unknowingly gave their data to. But, does it mean we've reached our privacy tipping point?

Mike Feibus, principal analyst at Feibus Tech says he's come to the conclusion that there won't be a tipping point at least not in the conventional sense where there's some egregious breach of trust that motivates us to say "enough is enough," and cut off the Internet giants from our lives. Feibus believes that consumers already have plenty of ammunition so if it was going to happen, it would have happened already.

'The services they afford us have changed our lives. And they're engrained. We hate giving them our information, providing yet another glimpse into our lives. But when push comes to shove, and we're late for an appointment, we tell Google via Maps where we're going. And via Gmail, we've probably already told them WHY we're going. [...] There are only two things that will change things: someone will come up with a better way, and we'll migrate to that. Or the government will introduce legislation with teeth, and force the Internet giants to change themselves.'

The 2030 Initiative

In this new surveillance state, how far are citizens willing to go in the transfer of their personal data in exchange for apps that simplify their activities personally, professionally and socially?

The United Nations has laid out its 2030 Initiative and sustainable development goals to transform our world. Some of those goals include promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; and promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

‘Surely, protecting citizens digital rights is part of that recipe to transform our world. Allowing consumers and global citizens to have control over their digital lives is paramount to creating a resilient infrastructure that can create sustainable industry.’

Is the tide turning from the corporate elites? Tim Cook, CEO of Apple has called for stronger privacy regulation in 2019 saying that consumers deserve control over their digital lives. And the New York Times ended the use of ad exchanges and behavioral targeting in Europe after the GDPR came online.

In the power-to-the-people corner, a Dutch district court ruled against an identification scheme called System Risk Indicator (SyRI) because of serious data privacy and human rights concerns.

SyRI is considered a landmark privacy case because the court ruled that it violates the European Convention of Human Rights and had no limit to what data can be used with no transparency on how the data is being used.

But perhaps the most vocal voice of regulating data for citizens is Margrethe Vestager, a Danish social liberal politician and Executive Vice President of the European Commission for a Europe Fit for the Digital Age.

Vestager told Time “This idea of services for free is fiction... people pay quite a lot with their data for the services they get. I would like to have a Facebook in which I pay a fee each month. But I would have no tracking and advertising and the full benefits of privacy.”

Vestager wants to reign in how tech “companies suck up personal data,” which she believes stifles competition. Since international law has only just begun tackling the issue, Vestager has appointed outside advisers to help draft new regulations. This, she says, is now her most urgent work. Vestager says “We are at the end of the beginning of an industrial revolution, tech is changing our entire society.”

Technology affords us the freedom to be a global citizen, but that doesn’t mean citizens should have to give up privacy online. Creating a new equilibrium or balance of power where consumers can choose privacy on their own terms could be the way forward in our digital future.





Jennifer Kite-Powell

Jennifer is an author & senior tech contributor at Forbes. Her first book, Love, Lust, Longing & Truth was published in 2017; her second book, Deluge in a paper cup in May 2020. She covers innovation and technology as it intersects with science, art, health, environment, culture and agriculture. Jennifer moderates creative and VR/AR panels at events and festivals worldwide including Comic-Con and Mobile World Congress. Jennifer’s insistent female voice permeates her poetry and prose. Jennifer is also a contributor to Unseen, a multimedia art installation by NY artist, Chantal Calato which debuts at the Burchfield Penny Museum in 2020.

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03

Post-truth, fake news and alternative facts

By Aurélie Filippetti and Christian Salmon

“Suspicion has now invaded the economy of discourse. The narrator has been discredited. The plot has been exposed.”

The two words “fake news” point to everything bad about our democracies. The expression may seem diagnostic, yet it act as a tremendous screen and something that has become a powerful diversion and an alibi for a state censorship that has obscured the systemic causes of why public expression has fallen into disrepute and its history since the nineteen-nineties.

The term “fake news” was used so much in 2017 that it was officially declared word(s) of the year by the Collins English Dictionary and the American Dialect Society. 2017, however, is not so much the year of “fake news” as the year in which Donald Trump turned it into a weapon against his detractors. He used the term to spread his lies—or “truthful hyperboles” as his ghostwriter calls them—prolifically on the sites of his supporters. With the expression “fake news”, Trump made use of social media’s power to disseminate to set the media on fire. “Every word, twisted in the hands of the spirits”, wrote Franz Kafka, “becomes a spear turned against the speaker”.

Although the mainstream media like to assume the role of news watchdogs, their own credibility is scant.

It is through an act of belief that we trust some and disbelieve other news. Factcheckers are the dupes of fake as they are concerned less with championing pure, indivisible truth than with regaining the margins of credibility that opinion stubbornly denies them. The farce of fake news therefore carries on with their knowing involvement.

Observers of the mainstream media and fact-checkers are unlikely to understand the meaning of such a reversal. What is at stake is not the struggle of truth against lies but the ability to tell them apart. It is not a question of restoring the truth as if there existed a reality devoid of fiction, a truth without ideology, like The Truth coming out of her well in G  r  me’s painting, fully naked and armed with her whip to chastise humankind.

Fake news can obviously be dismissed as a manifestation of what was previously known as disinformation—now in the age of social media—, or posited as a symptom of the transmutation of the democratic system by neoliberal reason, the impact of which is the shutting down of all forms of democratic deliberation.

This dismantlement has not happened overnight but rather in a period of over thirty years and was made possible by the exceptional conjunction of two revolutions: 1. In the sphere of capitalism through the financialisation and globalisation of markets; 2. In the sphere of information and communication technologies through the explosion of the Internet and the emergence of social media. In the nineteen-nineties, neoliberal political regimes took advantage of these exceptional circumstances to gain ground by thwarting criticism of the independent media and by making light of opposition or traditional checks and balances.

From the nineteen-nineties, politics entered the age of enactments. There emerged a never-ending spiral that chained encryption to decryption, hope to disappointment, and image to its deconstruction. Spin was only intended to change perceptions. Audiences, however, were no longer so easily fooled. The Watergate affair had seen to that.

The explosion of the Internet and twenty-four hour news yielded a veritable growth of anecdotes and stories, some more believable than others. Suspicion was the rule.

For a long time image and vision prevailed, yet from Nixon to Reagan images became less believable and their credibility diminished as they multiplied and scattered: seeing was no longer enough, one had to believe a story. This was the first stage in the spiral of discredit: from simple spin to the story, from image to the story, and from delusion to belief.

New digital media appeared in the mid nineteen-nineties. CNN was no longer the only news channel but was joined on the cable network by new channels such as Fox News. Internet became a means of mass communication and television, which is still by far the main source of information for Americans, was gradually absorbed by leisure industry giants such as Disney, Viacom and Time Warner. They would play a dominant role in the packaging of information and coverage of news and scandals. The new system of continuous information favoured an anecdotal version of events, a black and white representation of current affairs, and led to a thitherto unprecedented blurring of reality and fiction.

While the Bush administration did not invent this new media environment, often referred to by the neologism “infotainment”, it was the first administration to take office after its emergence and it made brilliant use thereof. Frank Rich, New York Times columnist, noted that “the chronicle of how a government told and sold its story is also, inevitably, a chronicle of an American culture that was an all-to-easy mark for the flimflam. The synergistic intersection between that culture and the Bush administration’s narrative is a significant piece of the puzzle. Only an overheated 24/7 infotainment culture that had trivialized the very idea of reality (and with it, what once was known as “news”) could be so successfully manipulated by those in power.”

It was to counter this discredit that the Obama campaign launched its core message: the hope of a change that one could believe in. Obama was entrusted with a task to which he was apparently abandoned by Washington politicians in desperation: to bring repute to the presidential office, something would require more than just fancy rhetoric. Obama’s campaign was both a technological and a narrative success. It managed to fulfil four different functions: storyline, framing, timing and networking, or a kind of a magic square. The age of radio with Roosevelt and the era of television with Kennedy were succeeded by Obama as the first candidate of the digital age.

Suspicion has now invaded the economy of discourse. The narrator has been discredited. The plot has been exposed. The term “fake news” not only refers to the proliferation of “fake news” on social media, but is also the object of suspicion itself.

All sources are flawed, all authors —whether political, scientific or religious— are discredited. This is an inexorable process: just as monetary inflation undermines confidence in currency, the proliferation of stories has ruined trust in narratives. The deviation of official accounts from people’s experience, particularly during the 2008 crisis, destroyed the credibility of all official accounts. Faster exchanges on social media and the shortening of messages encourage the logic of confrontation rather than of the story. Noise on social media has given rise to the buzz-maker in place of the mythmaker.

The system of globalized information has reached a point of entropy and now produces only disbelief. It is not so much that lies have become the norm and the truth is prohibited or disregarded, but rather that lies and the truth now cannot usually be told apart. Public debate no longer opposes content or information, but rather the ghosts that seek to convince us they are real. The collapse of confidence in language is no longer due only to the strategic effects of manipulation, but also to the appearance of a new discursive regime that keeps all discourse in belief mode. As Evgeny Morozov states: “an economy ruled by online advertising has produced its own theory of truth: truth is whatever produces most eyeballs”.

No one is spared. All sources of discourse are flawed, all “authors” —whether media, political, or even scientific (climate scepticism)— are discredited. We are all carried away by the spiral of discredit. Just as inflation ruins confidence in currency, data proliferation has ruined the credibility of all narrators.



Covid-19 and crisis of discourse

An example of this may be observed in the discourse at the start of the global Coronavirus crisis. This is the first truly globalized and not just international crisis. Financial crises are in fact crises resulting from the internal dysfunctions of financial capitalism that affect different states and different societies in diverse ways, and during these crises there is ultimately an interest for everyone to adopt individual rather than united strategies, the “stowaway” being whoever emerges better and before the others and is able to take advantage of the impact of the costs assumed by others without paying the price themselves.

The coronavirus crisis, by contrast, is the first –even from an economic perspective– in which solidarity is the condition for a global solution to the pandemic, and the only way out, not only globally but also individually. When faced with a pandemic, it is pointless for one society not to show solidarity with another by taking in the sick, offering materials and expertise, if it is able to do so, and, particularly, by sharing its knowledge, its data and information. Transparency is one of the keys to the world’s success in dealing with the pandemic. It is evident that not only a return to health but also the revival of the economy are solely possible if all countries together have eradicated the virus. The “stowaway” is just as likely to be infected with the virus as anyone who paid for their ticket and, more importantly, as long as there is a stowaway, he or she can spread the virus and infect everyone else.

This pandemic is coupled with a financial crisis, in which discourse is highly significant because what the heads of the financial and economic authorities publicly state is indirectly performative: what governors of central banks and the presidents of the ECB (European Central Bank) and the FED say is literally “worth its weight in gold”. Their comments directly influence the markets and the expectations of stakeholders, which rely on the concept of trust. These markets need to hear a discourse that reassures them even though a reassuring discourse may not necessarily be the most rational. The individual irrationality of everyone’s expectations, however, eventually establishes a kind of collective over-rationality: a good governor of a central bank is someone who knows not to say too much in order not to cause panic, yet to say enough in order to show that he or she is doing something and being firm albeit not too heavy-handed, and how to act (by playing with interest rates for example) without being too interventionist. The importance of what he or she says is not, however, directly performative, as it is not enough to declare that the rates are coming down for markets to react. The speaker’s credibility must not be undermined and what is said should

have a stronger impact than what could have been said. Making no declaration or an apparently benign statement has disastrous consequences: thus, on 12 March 2020, at the start of the Covid-19 crisis, Christine Lagarde did not say the words that the financial markets were expecting. She exacerbated the impending crash. Le Monde therefore entitled one of its editorials: “Christine Lagarde’s professional misconduct”. What did she say? Nothing. Precisely nothing. Although she had held a press conference announcing a series of measures, between the start of her speech and its end, Europe’s stock markets had already lost an additional 4%. The announced measures of support were nonetheless solid and unprecedented and what she proposed was not inherently bad. She was coherent. She did, however, utter the phrase that everyone feared she would say and that one sentence caused a commotion.

Then what was it that she said? “The ECB is not here to close spreads”. This phrase alone had such a significant economic impact on the markets that Lagarde was forced to issue a statement a few hours later to rectify her remarks. As well the ECB took even stronger actions six days later by issuing a declaration indicating explicitly that the ECB would not refrain from massively buying a State’s bonds (to save it), even though normally it would implement a coherent and non-“fractional” policy for member states as a whole.

A fresh look at the catastrophic statement of the 12th of March and the analysis of her abrupt turn caused by a phrase shows that frankly she did not say anything that the markets were not already aware of. Even though she did not announce any action worthy of criticism, she did mention the possibility of a status quo regarding the difference in rates among European countries, which could ultimately lead to a fragmentation of the Eurozone. Faced with the very specific and firm measures announced in the same speech (including the option of banks borrowing at negative rates to finance the economy) and the possibility of ECB non-intervention to prevent divergence among Eurozone countries, the markets’ interpretative capacity worked flat out.

Certainly, it is this machine for interpreting discourse that causes the demise of parrhesia. Christine Lagarde chose the wrong parrhesia and swung from good parrhesia, which at any normal time would involve signalling the inadequacies of the tools of the ECB –the body she heads– in the coordination of Europe, to bad parrhesia: at such a critical moment, simply pointing out the faults of a system is clearly not enough. Lagarde’s initial mistake simply amounted

to stating what is obvious to anyone familiar with the European Union’s defects: it does not have the necessary tools to be a last-resort lender for a member state. This is the main structural flaw of the Eurozone. However, had she acknowledged this at any other time, she would have been considered to be speaking the truth or not beating around the bush. Yet the words of Lagarde–whose competence in finance had been questioned when she was appointed to succeed the supremely expert Mario Draghi– at this precise moment when Europe stood at the threshold of a crisis of tragic gravity, by creating a new horizon of expectation, turned a matter of fact into bad parrhesia.

What the financial markets actually expected was a speech that not only described circumstances as they were with their weaknesses (the intrinsic faults of the Eurozone), but also went beyond the truth with a discourse that would become performative: “we will act to prevent the fragmentation of the Eurozone” (even if the tools to do so do not exist). This is what she achieved on the 18th of March when she explained the reasons why “I overruled the objections from Germany and the Netherlands”. This statement was described as “professional misconduct” because, as Le Monde states, the job of the governor of the ECB is not to be a good financial analyst, but to know how to “communicate”. Communication here did not complement action, but undermines actions established elsewhere. Therefore, it was necessary to quickly supplement the measures of the 12th of March with an unprecedented plan of action on the 18th of March –described by the press as a “bombshell” and “revolutionary”–. Above all with an extremely nuanced communication design to show the ECB’s absolute determination to not abandon any country smitten by the epidemic nor leave “any citizen” in the Eurozone in disregard. Indeed, it does seem that not all truths need to be told and that in democracy there is good and bad parrhesia, as noted by Michel Foucault in his work on this Greek concept of “speaking frankly” or “speaking the truth”. The disastrous declaration of the 12th of March embodies this tension between truth and democracy in a context where the latter is increasingly losing its independence, particularly in the context of how the markets operate. Obviously, at the height of the Covid-19 crisis, it is the pandemic that determines the media and political agenda. It also changes the conditions of parrhesia; it made Lagarde’s speech for the 18th of March listenable to, something of substance, and not just a list of excess. The discourse of truth indeed becomes very important when people feel their survival is threatened.

Within the empire of the Big Five tech giants

The economy follows the economics of discourse and the economics of discourse now follows the laws of the financial markets: volatility, rumour, dramatic turns of events. Polling or electoral derivatives are now linked to this instability of content. This is actually not just a disruption of information, but the disintegration of all space for democratic deliberation

In this postdemocratic space, agora has become empty and fake news glows on Internet like extinct stars that shine long after their deaths. Its influence is a paradoxical indication of the extinction of everything involved in organising and regulating democratic deliberation. The Big Five tech giants deem that by accumulating huge amounts of raw data (stored in rows of servers in depots, or data warehouses) it is possible to build models of behaviour and verify their relevance through the use of algorithms. They claim to be able to use them to predict most social phenomena and human behaviour, not only to control but to neutralize experience completely. To loop whatever is possible. Eric Schmidt, CEO of Google, recently unflinchingly stated: “We know roughly who you are, roughly what you care about, roughly who your friends are. Technology will be so good that it will be very hard for people to watch or consume something that has not in some sense been tailored for them.” This is not just a marketing strategy, but a new social relationship among people mediated by algorithms. What is known as algorithmic governmentality is a new form of power. The Big Five tech giants are a new model of symbolic jail, a new type of prison, the prison of the possible. We are unaware of all of these algorithms that are constantly watching and informing us. They nonetheless accompany us everywhere, watch over us, constantly assist us and, above all, connect us with others. There is, however, a limit to the digitisation of experience as there is a remainder to any division, and

this remainder is explosive. Everything that has been pacified by algorithms resurfaces elsewhere, in wild, chaotic form.

It reveals its spontaneous ideology: to annex and absorb the possible, to master the configuring power of the unconscious, its free association, and its possible creations and recreations. Heidegger distinguished calculative thinking from essential thinking. With the Big Five tech giants and the automation of data processing, the former has prevailed. Over the last ten years, calculative thinking has won over all sectors of activity and of government, one by one, starting with politics, which now draws ever less from deliberation and relies increasingly on methods by calculation intended to produce “optimal” results. The project to control and produce what is possible and not only what is real no longer seems so crazy. This is how a new social environment, constantly self-sustained with its own data, is being created: instead of contact there is connection, instead of relationships there is interaction and instead of experience there is the adding of information.

The Empire of the Big Five tech giants has no borders. It has no armies and no currency of its own, but does have several billion people who speak every existing language. It is unlike any empire known in history yet is not an imaginary place like a lost Atlantis that feeds human imagination. It is real, hyperreal, or, rather, infrareal, like cells in the human body, or neural networks, or a chemical body’s aggregates of atoms. It is neither visible to the naked eye nor sees us. It is a network of black boxes with which we are constantly interacting. It is nameless yet its power comes precisely from its anonymity. It records the data we produce, codifies our behaviour, observes our routine gestures

and files our preferences and our tastes. It also builds a world in our image, a possible world that matches our recorded habits and if we alter them, its world also changes imperceptibly, it modifies its protocols through the magic of “feedback loops” and “deep learning”, processes that allow for automatic modification of models with feedback.

It is not a conquering Empire and is happy to delete territories that are foreign to it. It does not colonize the peoples that it annexes, as it is content to bring them the light of networks, to immerse them in a pool of information, emotions, thoughts, memories, and to allow them to exchange with one another. It is rather like an immersion baptism: a digital baptism, which provides access to the Empire’s knowledge and to community, through a simple act of faith. All you have to do is join its world and open to its applications. They guide you on the path of interaction. If you agree to being geolocated and allowing free access to your data, to your desires and to your thoughts, in return you will be acknowledged and the empire will give in to your most contradictory desires. Now you have a profile. The Empire knows what to do with you and has what you need. In the Empire of the Big Five tech giants, there are no stories, no contacts, no sequences or narrative tension with unpredictable results. Calculation always produces a result and that is compliance. What the Empire has diminished is the very space of uncertainty, the distinction between true and false, reality and fiction, the chance to symbolize and to tell. The Empire has nothing to do with fantasy. Calculation is only interested in calculating —calculating one another’s impulses and transforming them into compulsive purchases—, “profiling” behaviours and establishing continuities and regularities, extrapolating them, predicting developments and looping whatever is possible.



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04

Artificial Intelligence and ethics

The most important question is: How will technology change our society – and what do we have to do to preserve our ability to choose the future that will benefit us all?

By Joanna Bryson and Martin Eisenlauer



Artificial Intelligence (AI) and the idea of thinking machines have fascinated people for a long time. Authors and directors gave the public their vision of thinking and feeling machines, long before engineers did. Science fiction made a deep impact on how Artificial Intelligence is perceived and discussed today. Most of these artistic visions gave the readers and viewers the impression that sentient machines are possible, and something to be feared or at least to be leery of.

So, the public discussion is fueled by unrealistic hopes and expectations, including anxiety and doubt. These are mostly fact-free preconceptions about how our future and the future of AI will look like. In this chapter we will try to take a more factual look at this discussion and to answer some of the most pressing questions around Artificial Intelligence and the ethics-debate surrounding it.

AI – from fiction to fear?

First stories of sentient machines date back to ancient Greece, where Homer describes independently acting creatures that were crafted by the god Hephaestus in his poem “The Iliad”. With the rise of science fiction and the start of the digital revolution stories of robots and Artificial Intelligence became more and more popular. Movies like Metropolis (1927), 2001. A Space Odyssey (1968), Terminator (1999) or The Matrix (1999) drew a dystopian picture of a not so distant future, where humans fell victim to a sentient and malevolent Artificial Intelligence.

“The current non-fiction debate about Artificial Intelligence is sometimes driven by the fear of a future.”

Maybe this is why even the current non-fiction debate about Artificial Intelligence is sometimes driven by the fear of a future, where machines act on their own, and no longer need humans. A group of famous tech-experts including Microsoft-founder Bill Gates and Tesla-CEO Elon Musk have expressed concern about the evolution of Artificial Intelligence and the lack of rules for AI systems. Theoretical physicist Stephen Hawking warned before his death: “The development of full Artificial Intelligence could spell the end of the human race. Once humans develop Artificial Intelligence, it will take off on its own and redesign itself at an ever-increasing rate. Humans, who are limited by slow biological evolution, couldn’t compete and would be superseded”.

Apart from these fears of being subjugated by machines in some distant future, there are also concerns about the short-term effects of the ever-growing efficiency of machines and other autonomous systems. First among them is the fear of losing jobs to machines and AI, and the underlying concern that this development will change the way our society is built, with the current foundation of work being the main source of both income and for many self definition.

A study on customer trust, commissioned by Salesforce in 2018, shows, that over a third of the surveyed persons mistrust Artificial-Intelligence systems. More than half (54 percent) do not believe that companies and institutions using AI act in the best interest of their customers, and 60 percent are concerned that the use of Artificial Intelligence poses a serious risk to the safety of their personal data.



What exactly is AI?

Before we delve to far into this deeply-philosophical discussion, let’s take a look at what we are actually talking about. Wikipedia defines Artificial Intelligence as “intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans or animals”, thus linking the definition of AI to the broader concept of human intelligence, which term is in turn defined as “the ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context”.

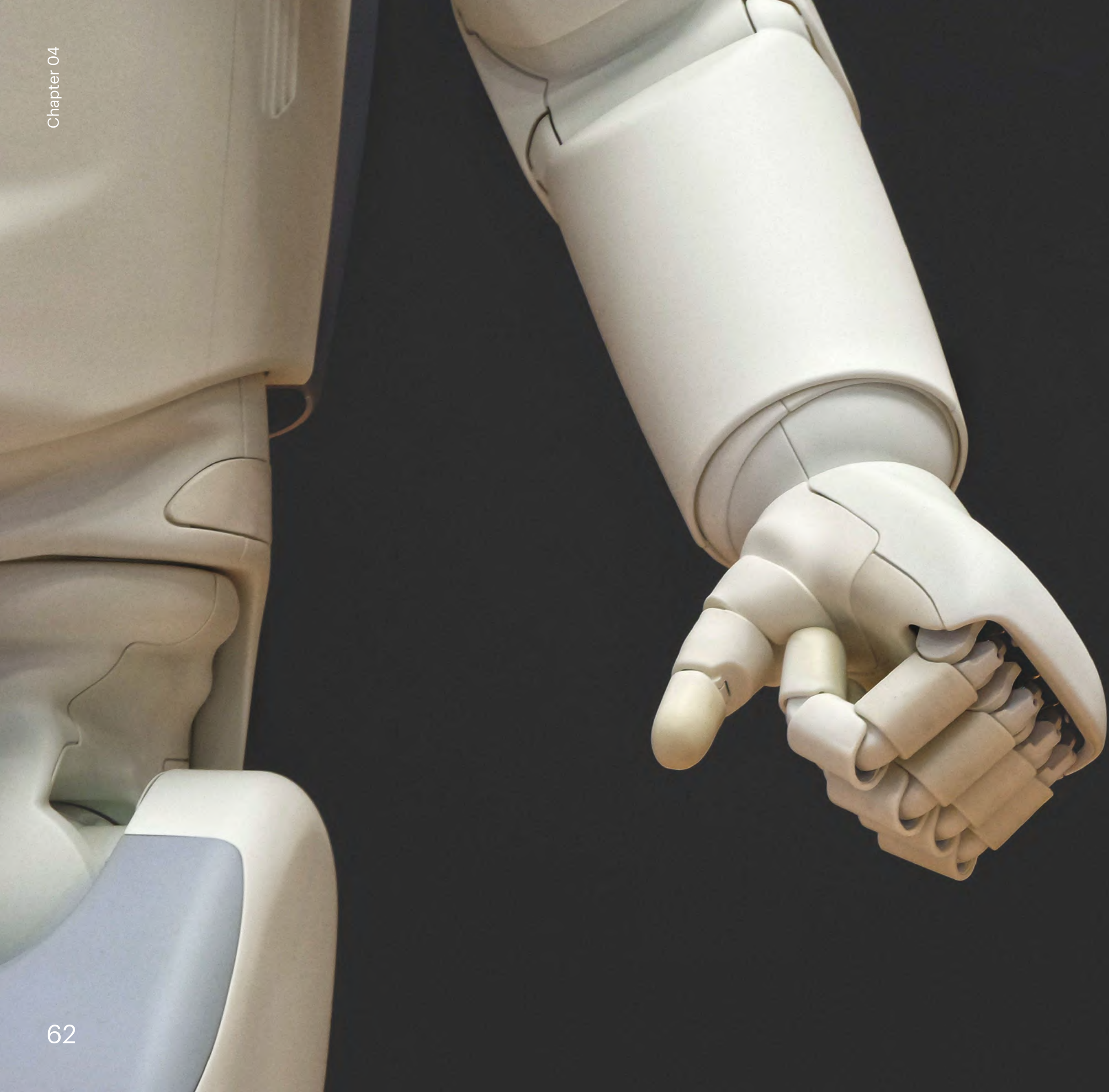
“Artificial Intelligence was first proposed as a scientific endeavour in 1956, and has since been recognised as a scientific field.”

Pool, Macworth and Göbel, authors of Computational Intelligence: A Logical Approach provide the following scientific definition of AI: “Computational intelligence is the study of the design of intelligent agents. An agent is something that acts in an environment—it does something. Agents include worms, dogs, thermostats, airplanes, humans, organisations, and society. An intelligent agent is a system that acts intelligently; What it does is appropriate for its circumstances and its goal. It is flexible to changing environments and changing goals, it learns from experience, and it makes appropriate choices given perceptual limitations and finite computation. The central scientific goal of computational intelligence is to understand the principles that make intelligent behavior possible, in natural or artificial systems. The main hypothesis is that reasoning is computation. The central engineering goal is to specify methods for the design of useful, intelligent artifacts.

The European Union defines AI as: “Systems that display intelligent behavior by analyzing their environment and taking actions—with some degree of autonomy—to achieve specific goals”. It elaborates: “AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)”.

At least one of us -JB- ordinarily defines AI more simply. Intelligence has been defined since the late 19th century as the capacity to choose an appropriate action for a given context, and Artificial Intelligence is simply when the object making that computation is deliberately constructed by a human or an organisation of humans.

Artificial Intelligence was first proposed as a scientific endeavour in 1956, and has since been recognised as a scientific field. That field has experienced several waves of rapid growth followed by sudden setbacks and slowing. Recent technological and scientific advances lead to a boom not only in research but also in marketable products which led to public discussions of the technology behind it. The main drivers of these discussions are systems like Apple’s Siri, IBM’s Watson or Amazon’s Alexa, which are conspicuously human-like in that they use language to communicate, and are all called Artificial Intelligences by their proprietors. Others are motivated by the fact that AI systems have beaten human champions first at chess, then go. Still others are driven by the suggestion that AI has been used to manipulate the outcomes of elections in leading democracies, or has been demonstrated to propagate biases like sexism and racism found in the data used to train the systems.



Humanizing the unhuman

Looking at fiction, the popular assumption is that Artificial Intelligences will soon rival the abilities of the human brain. The assumption is that subsequently Artificial Intelligences will develop consciousness, maybe even personalities and sub-consciousness like the one's humans possess. Following that line of thinking some already call for human rights and/or fundamental rights for these supposed digital persons.

In reality systems containing AI are far removed from the human brain and body, despite in some cases having similar or superior computational or cognitive powers.

Current vendors of AI-solutions like Amazon or Google enforce this trend, by trying to make their products seem as human as possible. Advertisements for products using Artificial Intelligence show these systems to act and behave like humans. From Amazon's Alexa to IBM's Watson – most AI-systems are portrayed as virtual beings living in a computer, who have almost-human characteristics and even quirks. This in turn makes people tend to think of Siri, Alexa or the Google Assistant as humans, or at least something that is very close to human, which in turn profits the vendors of those systems because it increases the attachment between customer and product, and also reduces their obligation towards a product seen to be taking care of itself.

In reality systems containing AI are far removed from the human brain and body, despite in some cases having similar or superior computational or cognitive powers. Comparisons between computers and brains usually are very crude and do not do justice to human thinking. There are extreme differences between the brain and current computers. A study of Stanford University estimates, that a human brain consists of about 200 billion neurons, which would give it a storage capacity of about one petabyte of data. That is about a thousand times as much as even advanced PC-systems use today. The computational power the human brain is estimated to be about one exaflop, which is about ten times the performance of the 122,3 petaflops, that IBM's summit, the world fastest computer reached in June 2018, or about three million times the computing-power of a current i7-CPU from Intel.

Apart from the computational capabilities of the human brain it is also linked to a complex system of hormones and other chemicals that influence its performance, and also the development of the things we call personality, consciousness,

feelings and all the other things which characterise a living organism. All these are not inherently programmed into Artificial Intelligence. It would be impossible to construct AI exactly motivated as an ape, or to generate sensations with mechanical sensors that is as much like a human's experience as a dog's, a cow's or even a rat's. These animals share many of the details of our mental experience with us, yet they cannot master language or tool use like a human. AI is the opposite — we have built language into it, but we cannot give direct animal experience of the world to it. We can however make it appear human-like by training it to mimic the behaviour of humans.

Even though machines will never be or feel human, we have already built systems capable of expressing human fallacies.

AI researcher Rodney Brooks concludes in a blog-post titled "Artificial Intelligence is a tool, not a threat": "I think it is a mistake to be worrying about us developing malevolent AI anytime in the next few hundred years. I think the worry stems from a fundamental error in not distinguishing the difference between the very real recent advances in a particular aspect of AI, and the enormity and complexity of building sentient volitional intelligence".

We would go further. We are not going to build machines that are in themselves human—unless we consider clones to be machines, which doesn't seem right. Clones are animals, and cloning humans is illegal, but a human clone would certainly be a human. On the other hand, even though machines will never be or feel human, we have already built systems capable of expressing human fallacies like prejudice, or human malevolence like ransomware. The important thing to realise is that it is not the machines that we should consider to be expressing these fallacies or malevolence, but rather that machines are a means through which human intentions or human culture can be expressed by the manufacturers, owners, and operators of those machines.

Even though machines will never be or feel human, we have already built systems capable of expressing human fallacies.

Machines are not humans

JB has made a number of arguments against presenting machines as people. In a 2010 book chapter Robots should be slaves she argues that humanizing technology would be immoral, not because of humans, but because of the technology. She argues that given that technological products will be owned by someone, it would be immoral to make them to have human experience even were that to be possible. Her point is, that robots – including those with intelligence – will only show human-like emotions if they are programmed to. Why should a robot be frustrated, if it fails at a task a hundred times? And why should it act emotional because of this frustration, why should we program it to be grouchy or abusive? What seems to be natural is natural, it's a consequence of how we have evolved. But as designers we have conscious choices not available to “The blind watchmaker” of evolution.

In a more recent paper, patiency is not a virtue JB argues that even if we program AI to make moral decisions, we should consider the humans who did the programming or chose to execute it the moral agents — the ones who are responsible. This is for a simple reason. We can hold humans responsible, we can shame them, fine them, or put them in jail, and this will make them want to change their behaviour. With machines, the connection between reward or punishment or action is not the same as it would be for any animal. Again, it is whatever we program it to be. JB concludes: “We are obliged to make robots we are not obliged to... We are obliged not to the robots, but to our society. We are obliged to educate consumers and producers alike to their real obligations with respect to robotics”.

“Joseph Weizenbaum, one of the fathers of modern Artificial Intelligence also saw a distinct separation between human and artificial decision-making in the difference between making a decision and a choice.”

Computer scientist Joseph Weizenbaum, one of the fathers of modern Artificial Intelligence also saw a distinct separation between human and artificial decision-making in the difference between making a decision and a choice. To him a decision is a fact-based, computational activity, whereas a choice is a judgement based on facts and factors like emotions that cannot be quantified. Weizenbaum concluded, that researching AI devalues human life, because it reduces the human mind to nothing more than a very complex computer program. More importantly, he saw that humans were confused by the moral status of such programs. Weizenbaum saw no way out of that dilemma, but given AI research has continued, now we must find one.

Transparency and liability

The main points of regulation, and thus contention, for Artificial Intelligence are not questions of morality or ethics for or by the machines themselves, but transparency, accountability, and liability.

Transparency is mainly about understanding why a system using Artificial Intelligence comes to the results it generates. This can be used to help remove human prejudice from the decisions and mitigates issues of trust, fairness and discrimination. One example of unwanted, and likely unfair results was Apple's practice of give higher credit-volumes to male customers. This very clearly demonstrates why it is important to be able to find out how a system using AI arrives at its decisions. Considering the wide proliferation of AI-based systems throughout all industries; non-transparent decisions could have wide ranging effects on society from healthcare to finances and other socioeconomics. Of course, we aren't always able to predict all the outcomes of human laws or decisions even without AI. But the goal of transparency for AI is to be sure we can find which human is accountable for how the system was built, how much it was tested, when it was deployed, and how it was used and maintained.

Some people are concerned ironically that the push for more transparency in the programming of Artificial Intelligence has led to something that is called the transparency paradox. This describes the problem that the better documented an AI system is, the higher is the chance of the whole system being hacked. Small changes in the parameters could lead to huge changes in the outcome – something particularly dangerous if every part of the decision-making-process is laid open. Others say that open sourcing AI is the only way to ensure that it is reliable and is reliably protected from this kind of abuse, since more eyes would be able to spot errors and vulnerabilities.

These arguments overlook that transparency and accountability are required in many other industries, without these kinds of problems emerging. Transparency doesn't necessarily mean that everyone will know or understand every aspect of how a system works. First, it may only be necessary to have enough information to ensure good practice is followed and that no one has deliberately committed crimes or been neglegant with a system. Secondly, in most industries there is IP. Inspection is only done by trusted third parties, typically the government, when there is a suspicion of wrong doing. This is what happens for example in medicine, pharmaceuticals, and manufacturing.

So the need for transparency in itself is not the biggest ethical question for programmers. Nevertheless, concerns about systems being hacked are well placed.

Digital technology may always be violated if it lacks adequate cybersecurity. If a system is able to learn, it can also be attacked by distorted training data.

There are indications that hackers can take advantage of regularities about how systems like machine vision work, to place tricks and traps for driverless vehicles that human drivers overlook. There is no question that we need to be careful about what kinds of systems we put intelligence into, and what kinds of systems we connect to the Internet where they can be most easily assaulted.

Another problem of transparency (at least a study at Berkley claims) is that it is possible to steal the results of AI research by using the explanations given about how the systems arrives at its conclusion. Without proper regulation, this result may lead companies to be inclined to be very secretive. On the other hand, this is also a problem known in other sectors. The solution may be simply the rule of law, and good defense of intellectual property.

In this context the subject of trustworthy or responsible AI has emerged, meaning systems, that are built with transparency as their main guideline. "Trustworthy AI will be our north star, since human beings will only be able to confidently and fully reap the benefits of AI if they can trust the technology. We must ensure to follow the road that maximizes the benefits of AI while minimizing its risks. To ensure that we stay on the right track, a human-centric approach to AI is needed" explains Pekka Ala-Pietilä, chairman of the High-Level Expert Group on Artificial Intelligence (AI HLG) of the European Union. These claims are slightly ironic, since in fact transparency should ensure that no one needs to trust AI, rather we can see that it is working properly, or not.

In their Guidelines for a Trustworthy AI the HLG defines the following factors for a system to be deemed trustworthy: Human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity and fairness, societal and environmental well-being and accountability. The last of which brings us to the second main ethics problem for Artificial Intelligence – liability.

The parameters for developing, operating and managing AI-based systems differ very much from market to market.

Liability: Who exactly is to blame?

The question with probably the widest-reaching consequences is that of liability, or put more simply: Who is to blame if something goes wrong?

The European Union tries to foster the development of Artificial Intelligence, but also understands that it has to regulate problems arising from its deployment. In a paper titled Liability for Artificial Intelligence and other emerging digital technologies the Union's Expert Group on Liability and New Technologies sum up their efforts: "Artificial Intelligence and other emerging digital technologies, such as the Internet of Things or distributed ledger technologies, have the potential to transform our societies and economies for the better. However, their rollout must come with sufficient safeguards, to minimize the risk of harm these technologies may cause, such as bodily injury or other harm."

This paper includes guidelines for a lot of the possible scenarios in which Artificial Intelligences can cause damage. The Experts follow the view of these systems being tools or machines, that are operated by humans or companies, and liability for any problems lies with these owners, developers, or operators.

The Expert Group puts a lot of extra responsibility on the operators to protect the rights of customers and users of their systems. They stipulate compulsory liability insurance for manufacturers of digital products and suggest logging features that document how an autonomous system or other use of AI arrives at its decisions. Finally, they conclude: "It is not necessary to give devices or autonomous systems a legal personality, as the harm these may cause can and should be attributable to existing persons or bodies".

This complies with the view established in Article 12 of the United Nations Convention on the Use of Electronic Communications in International contracts, which stipulates that the person (whether natural or legal) on whose behalf a computer was programmed should ultimately be responsible for any message generated by the machine.

This view is very consumer-friendly. It might be seen as presuming that there is always only one liable party, but in reality there might be dozens. An example: The responsibility

for the malfunction of an autonomous car may lie with the car-manufacturer, the software-programmers of the AI driving, the proprietor of sensors and mapping services, the company that provides data for the vehicles systems, network-connectivity or even the influence of a hacker. Again this is the same as for any sector, where for example a bank will be held liable for the actions of its bankers and for having cybersecurity. Even though for the consumer there might ultimately be only one party liable under European law, every legal claim may spark a myriad of further legal actions.

Apart from that, there are also markets that apply totally different standards of liability – or none at all. Some markets are woefully under-regulated when it comes to the consequences of digital systems or Artificial Intelligences. Others –or sometimes the same country in different circumstance, like the USA– put very strong penalties on even minor infringements, which makes the operation of critical systems a rather risky venture for companies.

The parameters for developing, operating and managing AI-based systems differ very much from market to market – though the companies offering them often develop these systems for a global rollout.

For this reason, efforts like the General Data Protection Regulation (GDPR) of the EU, although initially seen as a constraint, in fact provide massive benefits to corporations by clearly spelling out a harmonised system of regulations that allow them to do business in many countries with the same products. Such cooperation –both between countries and with companies– is essential for governing technology that so easily transcends borders.

Conclusion: Ethical question are not centered on technology

Artificial Intelligence and ethics are deeply entwined. At least, when you look into a distant future, where machines have learned to think and develop a conscience – which according to some of the world’s leading AI-experts may never come to pass. JB is relatively isolated in arguing that machines are already conscious in that they have explicit memory of events, but that this has less ethical consequence than being human, and subject to human accountability.

Today’s ethical questions surrounding Artificial Intelligence are more centered around legal and technological issues. When you take away the mystique and supernatural thinking of the movies and novels, AI deployment is really every-day technology. An autonomous system is not a sentient being. Even very complicated artefacts like driverless cars, or like corporations and governments, do not and cannot require ethics beyond what humans are able to impose on each other. Our obligation is to ensure enough transparency that we can keep each other safe and sound.

The real ethical questions facing today’s society is how we use the options given to us not by the AI itself but by the power given to us by technology like Big Data, quantification of formerly unquantified events, surveillance and digitisation.

How much influence do we grant organisations using such technology over our personal lives? How much personal freedom do we want to sacrifice in the face of ever more powerful algorithms that promise to predict our future? And how do we incorporate those people who are in danger of being left behind by all this technological change?

Broad discussions about ethics are essential to the success of our future societies. Artificial Intelligence seems exciting, but it is really only a small part of the broad discussions of how to make our societies fair and sustainable. Today’s pressing needs are to learn where to incorporate technology into our every-day-live – and where to keep it out.

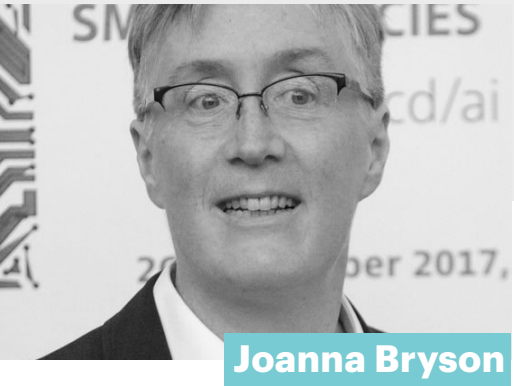
The most current technological question is not whether Artificial Intelligences should be granted basic human rights. Even if such rights were a good way to defend an AI system, building a system that requires such a difficult sort of defense would be a violation of our moral duty to ourselves, and possibly also to such systems. We have the power to make AI safe, secure, well backed up, transparent, and robust. The most important question is: How will technology change our society – and what do we have to do to preserve our ability to choose the future that will benefit us all?

Excursion: AI and War

Today’s weapon systems offer us a chilling glance into the future: Drones can be piloted from a thousand miles away, sensor-systems lock onto objects automatically and weapons track their targets automatically with a precision no human could ever hope to attain. The leap into a future, where autonomous robots are sent into battle, seems imminent.

At first glance, this seems like a good idea – meaning soldiers would not have to die in future wars. But leading military minds like Sir Stuart Peach, Chairman of the NATO Military Committee, do not believe in a clean war. At the Munich Security Conference, he explained: “War remains violent and dangerous. The idea that there is risk-free war is not true and has never been true”. Humans will always experience a war, the question is which ones, and who will stop it?

By the end of February 2020, the US department of defense has given itself a series of so-called ethical principles for the use of systems that involve Artificial Intelligence. Defense-Secretary Dr. Mark T. Esper introduced them: “AI technology will change much about the battlefield of the future, but nothing will change America’s steadfast commitment to responsible and lawful behavior”.



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05

The gig economy: exploring competing narratives

By Jeremias Adams-Prassl and Tim Wallace

The gig economy has exploded into public consciousness over the past decade. Conceptually it is not new - the 'gig' refers to musicians taking their income one show at a time, and can be applied to any number of freelancers and self-employed workers. In the modern sense, however, it typically means workers operating through digital platforms, offering services online to anyone who wants them - locally, in the form of odd jobs, taxis or food delivery, or globally such as web design, survey completion or data handling.

At first glance it appears wildly popular. After all, if nobody had a use for gigs, then the system would not exist.

It seems hard to imagine that Uber, for instance, could have become the multi-billion dollar behemoth of ride hailing less than 10 years after it sold its first trip if it were not popular with, or useful to, investors, customers and drivers alike. The notion of flexibility for workers has caught on with lightning speed - surveys indicated the majority of people now want to work on a different schedule to the 'usual' nine-to-five hours.

The gig economy seems perfectly suited to their needs.

Yet the extraordinary growth of the online model has brought with it important and as yet unresolved questions about the way the system operates.

These questions have only become more pressing as the coronavirus pandemic sweeps the world with dire economic consequences, particularly for workers with limited financial resources and partial or even non-existent labour market protections.

From workers' rights to the nature of competition with incumbents, this chapter explores the rise of the gig economy, the moral and legal quandaries it throws up, and its future as a major component of modern life.

Introduction

Tensions lie across any innovation. Incumbents fear insurgents. Workers must take a leap of faith to work in an upstart business or industry. And consumers have to break with those companies and services they know if they are to try something new. In the gig economy, new technology has introduced competition with exhilarating -or perhaps terrifying- speed. Local markets have become globalised at an unprecedented pace, whilst global players have begun to offer hyper-localised services. The very nature of employment appears to be shifting from formal, regular and disciplined to self-employed, worker-led and highly flexible. These are revolutions which might never be un-done.

Once valuable flexibility has been won -fitting work around family life, say, or enjoying the variety of several different types of employment each week- it could be difficult to persuade workers to go back to long and rigid hours with a more conventional employer. Employers who benefit from no longer having to provide a raft of benefits might be reluctant to return to costly workforce entitlements. The social order could even be overthrown. That, at least, was Daniel Defoe's reaction when his travels around Britain in the 1720s showed him the effects of the boom in the price paid to wool spinners.

Surging demand meant earnings of spinners doubled or tripled in a few years. This type of work could be carried out at home on a schedule to suit the spinner. It was part of the putting out system, in which small tasks which were part of a larger production process could be done by workers at home. Crucially, they were able to take as much or as little work as they wished - very much like the promise held out to workers in the modern gig economy. As a result, Defoe wrote, farmers struggled to find milkmaids or labourers, manufacturers could not tempt hands into the factories, and the rich found servants reluctant to live in with them and work full-time. Cruel, unpleasant or excessively demanding masters found workers could no longer be compelled into work by poverty.

Worst of all, in Defoe's telling, those spinners did not work as hard as before: instead of spinning all day, every day, they would use their new flexibility and higher earnings to take time off. "This prosperity introduces sloth, idleness, drunkenness, and all manner of wickedness," he wrote. His response was to propose more regulation of the labour market, albeit in favour of employers rather than workers, in line with his moral sympathies.

Defoe was writing on the eve of the industrial revolution, just before widespread mechanisation led to the adoption of more modern standardised working days in which factory workers were compelled to match the speed of machines, rather than the patterns of nature, the daily lives of their masters or, in the case of wool spinners, their own preferences between flexible work and financial reward.

But his journals show 'gig work', or something like it, is not a new invention. Indeed, it was not a new idea even in Defoe's era. Evidence exists for this type of work throughout history from ancient Babylon to Japan's Tonya organisations. Nor did it die with industrialisation.

A different variant was seen in dockyards through the 19th century with stevedores hired for half a day at a time to load and unload ships. It meant taking work as and when both the employer and the worker wanted it. The break in the middle of the day allowed the employer to weed out any dock hands deemed to be working poorly -the equivalent to a modern day online ratings system-.

The gig economy is undeniably back. Its new form is radical and has changed industries almost overnight.

But it is not unique to this era, nor an entirely innovative form of work.

Those tensions between employers' demands and employees' desires, between quantity of work and quality of life, and between rights are every bit as pressing today as they were in Defoe's time.



Digital revolution

The gig economy’s latest iteration has taken form amid a global digital revolution. The Internet launched the modern version of gig work. Smartphones supercharged it. Consumer services have been upended with astonishing speed. Uber, Lyft and other ride-hailing services are ubiquitous in cities the world over. Yet Uber offered its first lift in San Francisco less than a decade ago. More than 30,000 Deliveroo cyclists and drivers deliver takeaways across more than 200 cities -exceptional growth for a company founded only in 2013.

It is not only consumer services. Amazon’s Mechanical Turk platform matches workers to ‘tasks’ such as online content moderation, survey participation and data validation across the world.

Highly-paid professionals are also adopting the model. ‘Platform law’ companies such as Keystone Law, Excello Law and gunnercooke have all been described as the ‘gig economy’ for lawyers, operating a model significantly more flexible than the traditional long-hours companies lawyers more usually follow. These disparate forms of employment have four common threads.

Typically they divide jobs into tasks -driving to follow an online map’s instructions, for instance, or delivering a meal rather than preparing, cooking and serving the whole product to the customer. Second, the services are rated by customers to ensure quality. The platforms through which the gig economy operates are not ‘wild west markets’, but tightly curated by tech brands which want to keep quality high. For example, Uber bars poorly rated drivers.

Third, the platforms take a slice of their workers’ pay. Just as a traditional temp agency or headhunter takes a fee for placing workers in jobs or an estate agent takes a commission for selling a property, so these platforms take a cut.

Fourth, the middle men actively shape and guide not just the behaviour of individual workers, but the entire marketplace, for instance in advertising heavily or in subsidising services in a bid to gain scale and market share.

Super-scale, super success?

That scale has become a key feature of the gig revolution sweeping the world economy. Estimates of the number of gig workers globally are difficult to assess, but indicate an extremely substantial share of the workforce is involved.

Gig economy platforms have opened up some markets incredibly successfully.

A study by McKinsey estimated that between 20% and 30% of workers in Europe and the US are involved in the gig economy to some extent. This amounts to up to 162m people. Such scale could indicate a win-win-win situation, with the gig economy matching the needs of workers, consumers and employers. Taxi drivers waste less time seeking a fare while customers gain cheaper rides and a more convenient service. Web designers can list their services on Fiverr access a global market instantly. At the other side of the transaction this enables entrepreneurs to set up shop online without learning design skills or hiring a full-time designer for a one-off job.

It can provide an income for those typically excluded or marginalised from traditional employment, for instance if they have caring responsibilities, or face discrimination, or have criminal convictions. Those new to an industry and with too little experience to gain a full-time job can gain an income by working gigs instead. Older workers seeking part-time work to ease their way into retirement or top up their pension can find gig work more flexible and forgiving than a more permanent employment contract.

That McKinsey study found 64m happy to use gigs as a way to top up their income from other sources, with 49m choosing to earn most of their livings this way. However there is also a sense of desperation among a large number of workers. Another 23m use gig work as their main source of income out of necessity or a lack of choice, while 26m use it to top up incomes for the same reason.

This could still indicate the gig economy serves a useful purpose for those who have no other option - a new safety valve in the jobs market to let those without work find a degree of employment more easily than ever before.

Yet global competition and a lack of long-term contact with an employer can also mean very poor wages, as even skilled workers operating online find it difficult to charge high fees for small tasks. The International Labour Organisation surveyed workers across five platforms performing tasks including transcription, data collection and experiment participation. Typically the workers are well educated - 37% held a bachelor’s degree and 20% a postgraduate degree. Yet “most microtasks are simple and repetitive and do not coincide with the high level of education of crowdworkers.” The pay is commensurately low at an average of \$4.43 per hour worked, or \$3.31 per hour when unpaid work, such as searching for tasks, is included. In the US and Germany, the ILO found average earnings on gig platforms to be below legal minimum hourly wages.

A precarious life

Varied and unpredictable earnings are only one aspect of the sometimes difficult lot of the gig worker. To take the example of a takeaway delivery driver, in the past they were employed by a restaurant to take food to customers, paid per shift. If an unexpectedly low number of customers placed orders, the restaurant suffered even as the worker was paid their usual wage.

Now a gig worker is paid per delivery, they bear the costs of slumping demand in lower earnings. At the same time the flexibility of the gig system may prove illusory if the platforms exert a high degree of control over the work patterns of those providing services.

An investigation by the Work and Pensions Select Committee in the UK Parliament’s House of Commons found Uber drivers were required to “stay on the road for extended periods of time to make a living”, and did “not have the freedom to determine their own working patterns.” Complaints by workers of exploitative conditions, inflexible hours and disappointing earnings are widespread.

Descriptions of gig work as a *digital sweatshop with slave wages which kills your self worth* are not hard to find.

The rights which come with traditional employment are frequently lacking, including holiday pay and sick pay even for those who operate largely or solely through one platform. The Taylor Review of Modern Working Practices in the UK found a great deal of confusion among workers and businesses as to the rights of gig workers. The result can be a financially precarious existence.

A survey by the Chartered Institute of Personnel and Development found almost one-quarter of non-gig workers could afford to keep up with their bills and living expenses for six months if their income disappeared unexpectedly. This was true for only one-in-eight gig workers.

Nor are these issues distinct to the gig economy. The wider labour market has seen a shift in risks away from employers and on to employees. Sometimes this takes the form of extra flexibility in contracts, allowing employers to pay staff only when they are needed, with workers rather than employers suffering from periods of low demand. For instance, almost 1m workers are now employed on zero-hours contracts in the UK. These do not specify the work involved, so employees’ earnings vary week by week or even day by day as their services are required.

Most workers are happy with the arrangement and do not desire extra hours, according to the Office for National Statistics. But a significant minority are unsatisfied. More than one-in-four want either an additional job, more hours in their current job, or a different job with more hours. It has led to calls for major reform of the market. For instance, the Trades Union Congress, which represents 5.5m UK workers, wants zero hours contracts to be banned.

Descriptions of gig work as a *digital sweatshop with slave wages which kills your self worth* are not hard to find.

Gigging in a pandemic

Much of the rise of the digital gig economy has taken place since the financial crisis of 2008-09, in an upturn in the business cycle. Now with the onset of the coronavirus pandemic, the vulnerabilities of gig workers and their lack of legal rights has been brutally exposed. Gig workers face the combination of a health crisis and an economic slump.

They also lack the rights of workers off from a full-time job, such as sick pay, and may struggle to access government support schemes unrolled specifically to combat the coronavirus recession.

Those engaged in face-to-face work suffer as restrictions on movement and human contact hit demand for their work. At the same time even those who work purely online can find their earnings undermined by a general collapse in economic activity.

In one sense their diversity of income sources may be a strength. Even if one employer goes bust or stops hiring the gig worker, others may continue to require their services. A worker familiar with gigging may be experienced with fluctuations in demand, shifting the type of services they offer to match the circumstances of the day.

But they also lack the rights of workers off from a full-time job, such as sick pay, and may struggle to access government support schemes unrolled specifically to combat the coronavirus recession as these are typically targeted either at those in traditional employment, or those with a long history of self-employment. It brings serious health worries, for the individual and wider society.

A survey by the Royal Society for the Encouragement of Arts, Manufactures and Commerce (RSA) in the UK found that financial insecurity would compel more than half of gig workers would to carry on working even if infected with the coronavirus, compared to just over one-third of other workers. That threatens to spread the virus further, undermining efforts to contain its spread, as well as endangering sick workers.

“I do not see how the flexibility can work in favour of these people right now. They are exposed to an incredible amount of risk, because some of them are still doing deliveries and coming into contact with a lot of people while the rest are staying home,” said Jason Moyers Lee, general secretary of the Independent Workers Union of Great Britain, in March 2020 as the COVID-19 outbreak took hold. “They don’t have the basic employment rights protections and most of the schemes the Government is rolling out do not apply to them. I think they are in one of the worst positions you can be in in the country right now.”

Bringing order to chaos

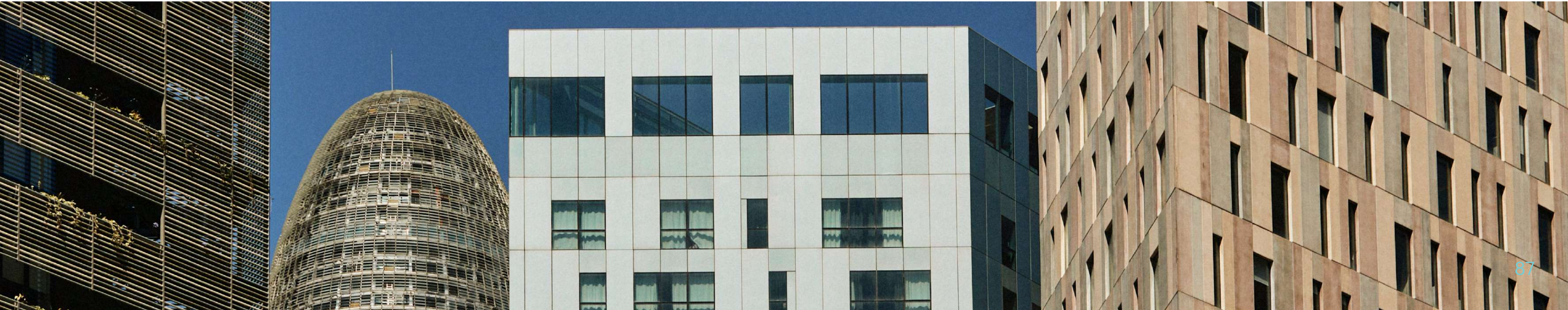
There is clearly demand for reform to the gig economy. Some of its workers face conditions deemed unacceptable in other parts of their countries’ labour markets. At the other end of the income scale, some platforms face allegations that they are close to becoming monopoly powers in their industries, in part because of their reliance on low-paid workers with few rights - effectively competing unfairly with incumbents via a less rigorous legal framework.

Yet the popularity of these near-monopolies with their customers, who benefit from the low prices on offer, can make it difficult to tackle the labour rights issues.

As a result, any regulation must seek to preserve the benefits of the gig economy - lower prices, more efficient use of resources, convenience for workers and customers - while aiming to protect some of the lowest paid workers in society.

Added to that, the wildly varying accounts and experiences of life in the gig economy, as a worker and as a customer, show the complexities involved for anyone trying to regulate, harmonise or improve an extremely heterogenous set of industries.

Partial solutions are already emerging, typically based on the view that if a job looks like employment and is structured like employment, it should be treated as employment. In March 2020 France’s Court of Cassation ruled that Uber drivers are employees, bringing the rights which come with that status.



Towards a sustainable platform economy

At the same time, it must be borne in mind that reforms will create costs, potentially for customers through higher prices, platforms through lower profits, and potentially even workers if improved rights stymie the growth of the platforms on which they rely. Some of these seem bearable - a platform which bases its entire operating model on regulatory arbitrage cannot expect to have a long term future without regulators closing gaps in the law.

Despite the extraordinary progress made in the past decade, the digital gig economy is only just getting started.

Similarly, creating a level playing field will benefit those incumbents which suffer from being undercut by insurgents using holes in the legal framework. Instead of trashing innovation and competition, a more sensible and even-handed system of regulation should encourage platforms to focus on providing the service customers want, rather than the legal arbitrage which lets them offer lower prices, sometimes at workers' expense. Despite the extraordinary progress made in the past decade, the digital gig economy is only just getting started. Smartphones have comprehensively colonised vast swathes of developed market economies, but have yet to reach most of the world's population on any meaningful scale. Likewise reliable Internet access remains the preserve of the rich - at least 3bn people have no online presence at all. Just as the emergence of high speed and mobile Internet access have overhauled industries over the past 10 years, so the continued rapid growth of the global online population could transform more sectors in the coming years as digital innovators get to work on a scale never seen before. More workers, customers and employers will be able to access one another, and serve each others' demands. And just as attitudes towards gig workers have shifted as the market has grown, so might they shift again.

It cannot be taken as read that the current moves to formalise gig work and enhance the rights of those toiling via online platforms will continue forever. Opinions shift, views change.

When Daniel Defoe was writing almost 300 years ago, it seemed clear to him that the sudden change in work conditions and empowerment of the working classes should be met with a crackdown, rather than legal support. "Servants have it too easy and can move jobs at a whim. Masters are in slavery to their servants," he claimed. If anything, he added, the law was too soft on the workers: "Laws have already been made on the servants' side, for their more easy obtaining justice, for the better recovery of wages, and for obliging masters to perform their contracts."

His solution? "New laws therefore seem absolutely necessary to enforce the obedience of servants." In his plan, workers would only find employment if they had good references from prior masters attesting to their good service and honesty, with would-be employers banned from hiring those without the necessary paperwork. The attitude may seem cruel or alien to modern ears. But the solution is very modern - Defoe in effect proposed the strict ratings system used by online platforms.

If the ratings fall too low, the worker is ejected from the system and from future employment through the app.

After 300 years the arguments around gig work look remarkably familiar, despite the gloss applied by the digital age and the exhilaration of its growth and innovation.





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06

Towards a digital 'Cold War'

**How the battle for infrastructure and data will
redefine our future**

By Natasha de Teran and Federico Guerrini



Technology tensions are as old as time: technology both advances wars and can be advanced by war. And then, as some would argue is happening today, technology can be the casus belli itself.

Experts seem to be fairly evenly split on the question of whether we are in, are moving towards, or are quite a way away from a technological Cold War. Some maintain that the major powers have been locked in a technological Cold War pretty much since the end of the Cold War; others that the major powers' technologies are now so interdependent that the term 'Cold War' cannot and should not be used to describe the status quo – however tense it may look at times.

The Economist trod a middle path in March 2019, when its cover story defined the China-US stand-off as "a new kind of Cold War". Not just diplomatic, this was perhaps the most accurate assessment.

In the Cold War, an iron curtain prevented the flow of ideas, industry and innovation; technology in the USSR developed on completely different tracks to the US and vice versa. For the last few decades, these have flowed pretty freely between the US and China – so much so, in fact, that vast parts of the US technology stack are reliant on Chinese-made components. As the supply chain disruptions caused by the then very localised COVID 19 outbreak in China in early 2020 demonstrated, many of the major US tech manufacturers are hugely reliant on Chinese manufacturing. Apple’s ability to sell iPhones and iPads in Detroit depends on factories working in Zhengzhou. China meanwhile looks to the US consumer and US companies for jobs, semiconductors and 5G network components.

If the embrace was always a tense one it has become downright uncomfortable since 2015/6. In 2015 China released its Made in China 2025 strategy which, amongst others, aims to move China’s manufacturing sector up the value chain and ensure the country becomes self-sufficient in key technologies such as those US semiconductors and a world leader in IT and robotics. The US think tank, the Council on Foreign Relations, described the strategy as a “real existential threat to US technological leadership”. Then in late 2016, President Trump was elected on the back of a campaign which –amongst many other things– accused China of ‘raping’ the US with its unfair trade policy, committed to raising tariffs against the country, and repatriating jobs from it. Things weren’t great, but it wasn’t for a couple years that things got really difficult.

5G, or fifth-generation wireless technology can work up to 100 times faster than the current 4G networks. That, combined with its low latency, could replace the need for the costly fiber-optic cables, enabling billions of machines to seamlessly communicate. It could make the Internet of Things a reality and revolutionise our industries and societies. The problem for the US with Huawei’s lead was not just that the Chinese might lead the next great advance in technology, but that all this might happen on a Chinese backbone. By 2018 it was clear that Huawei and ZTE were leading the race for 5G. Early that year, FBI Director Chris Wray warned against buying Huawei and ZTE phones, then the Pentagon banned the sale of their phones on US bases, then Huawei’s CFO was arrested under US orders. Since then, the battleground has done nothing but get bloodier with both the US and China’s diplomatic corps and body politics seemingly working overtime to win over the world to their very different viewpoints, and the latest salvo in which was the White House’s March 2020 release of a National Strategy to Secure 5G.

For the most part we have been surprised by these and (the many) other technology-related restrictions that have been imposed in the last few years –but should we have been? Does it not go without saying that any major world power seeking global supremacy would naturally also want to ensure technological autonomy? Did we forget the extremely tight nexus between public and private sector technology? Between defence and national security and consumer technology?

In her recent book, The Entrepreneurial State, Professor Mariana Mazzucato reminds us of the high degree of interdependency when she evidences how every technology that makes the iPhone ‘smart’ was originally US-government funded: the Internet, GPS, its touch-screen display and the voice-activated Siri.

US economist Vernon Ruttan argued in his book Is War Necessary for Economic Growth, that without US government involvement in the computing industry, its development and commercialisation would have been delayed well into this century. Certainly, IBM’s first computer, the 701, was built to fulfil national defence needs; supercomputers have US nuclear research to thank; Tor or onion routing, the US Navy; and Artificial Intelligence, speech recognition and the Internet, the US’ Defense Advanced Research Projects Agency (DAFRA).

The relationship between private and public sectors is of course symbiotic. Without industry there’d be fewer jobs, less taxation and with that there’d be less government investment in innovation and education.

Of the many challenges facing the other sovereign powers today as they confront a tech-dominated future, this is a key one. How will –say– the EU governments uphold their promise to ensure prosperity when remotely headquartered tech giants strip away domestic revenues, jobs and taxes?

Or indeed, to return to defence-related questions and the US-China stand-off, what peace can they ensure? Long gone are the days that wars were fought with men and muscle; wars today can be fought remotely with drones and rockets; by corrupting data, disrupting networks and interrupting signals. To wage those wars you need hardware, software and above all knowledge – technology experts and entrepreneurs to build, manage and maintain systems; to innovate and educate. You don’t have to own all the defence technologies you use, but the more forms of native technological defence prowess that you do ‘own’, the more advantage you may have – both militarily and economically. How does Europe’s scorecard measure there?

Nation states that do not ‘own’ technologies are in a much weaker position not only to influence how these develop, but also how governance evolves.

Good or bad, possibly the most pressing issue facing Europe (and other powers) is one of governance. Even when setting consumption norms, they are doing so as a product-takers, not makers. How can they reconcile technological progress with regulatory frameworks that protect citizens from being continuously monitored and possibly manipulated, when they do not regulate the organisations virtually supplying these services?

This, in turn, has direct effects on the availability and exploitation of what is considered one of today’s most significant economic assets: data. Whether it’s the new oil or not, access to data generated by citizens as a by-product of their online (and offline) activities, as well as to industrial data generated by machines, can lead to significant competitive advantage. Nation states without those native data pools, are at a significant disadvantage.

Take mobile phones. Our phones are more important to us today than they have ever been. We use them to Zoom and FaceTime with colleagues at work; we depend on them for calls and for emails, for IMs, for scheduling, shopping and for photographing; we do our banking on them and use them for paying; we route plan and store our tickets on them; we can even carry our IDs on them, monitor our health on them – and be traced on them. In all likelihood, our phones know more about many of us than our spouses.

The huge amounts of data coming from smartphones, wearable devices, gadgets, industrial appliances can be used to train the Artificial Intelligence algorithms that sit behind all of today’s and tomorrow’s – most advanced technologies: from personalized medicine, to driverless and connected cars, to the real-time monitoring and optimisation of anything from jet engines to windmills, through the use of ‘digital twins’ that collect and analyse the information coming from thousands of sensors.

Nation states that do not 'own' technologies are in a much weaker position not only to influence how these develop, but also how governance evolves.

Perhaps even more important, user data can be leveraged to detect behavioural patterns and make predictions on the future actions of those who have generated it, which has significant consequences for citizens, nation states and corporate actors alike. By knowing the tastes, the habits, the demographics of groups of users with similar characteristics, it's possible to influence their behaviour, to profit from it and, to some degree, change it.

Advertisers are taking advantage of this, to make their marketing campaigns on Facebook, Google, Instagram and other platforms more effective. Politicians can use the same tools for micro-targeting voters, by identifying those who can be more effectively “mobilized” (for instance, voters who are uncertain whether to go to the polls or not) and afterwards displaying individually targeted political advertisements to encourage or discourage a certain behaviour. Shadow actors can use those very same capabilities to radicalise, to disseminate fake news and sow discord, spark outrage, further polarising already fragmented societies. With appropriate judicial oversight, law enforcement can use it for beneficial purposes.

All of this highlights the importance of controlling and managing the platforms on which data is being produced and disseminated. The data pool is already immense – and it's only going to continue to grow. The EU projects a 530% increase in global data volume in the period from 2018 to 2025 – from 33 zettabytes to 175 zettabytes. As far as personal data is concerned, the landscape is dominated by a few US companies (the so-called GAFA, Google, Apple, Facebook and Amazon, to which other companies like Microsoft, Twitter, Netflix, Airbnb, Uber can be added) and their Chinese counterparts, the BATX (Baidu, Alibaba, Tencent and Xiaomi, plus Huawei).

This leads to a paradox: citizens of the EU and of other countries produce a lot of data, but aren't rewarded for it – and can't always access it, even when they need to. Most of the added value that comes from extracting and refining data is captured by foreign companies that often operate in looser regulatory environments (laissez-faire and centralized) more favourable to their businesses than say, EU organisations, face.

The EU answer to this imbalance so far has been enhancing regulations, like the General Data Protection Regulation (GDPR) which is meant to give citizens more control on how their data is being used. The GDPR sets specific rules on how to obtain data, how to store it, and how and when to delete it, among other things. It also sets liability rules and fines for mishandling, which can run up to 4% of a company's annual turnover. While the Regulation was met with a good bit of resistance from industry, it quickly proved to be an EU export success with many countries around the world taking it as a blueprint and adopting similar provisions. Even in the US, where it was originally met with vocal objections, several states have now introduced similar measures with the result that the US tech industry is now actively lobbying Congress for federal regulation.

Early days yet, but as a norm-setter then, the EU has not had a bad start. More ambitiously, the EU Commission has a newly minted strategy for shaping Europe's digital future – A Europe fit for the digital age. Within this is the European Strategy for Data, which aims to put people first in developing technology, to defend and promote European values and rights in the design, manufacture and deployment of technology and to ensure sure Europe's global competitiveness and data sovereignty. Amongst others, the Strategy foresees the creation of an EU cloud platform alliance to improve cloud's uptake in Europe and reduce the Union's technological dependencies in these strategic infrastructures. It aims to increase data portability and interoperability both for personal data and machine-generated data (in particular in very sensitive and strategic sectors such as healthcare, transportation and manufacturing).



Worth ambitions all, but it's unclear whether these efforts will lead to a change of paradigm, or only to some incremental changes that will improve Europe's competitiveness without really affecting the overall landscape. The impact of the GDPR itself seems difficult to estimate, so far. On the positive side, and if delinquencies are a measure of its success, the number of fines issued has been steadily increasing since its implementation in May 2018 (although the overall value remains relatively low). On the negative side, legitimate concerns have been expressed that, by making it more difficult for companies to collect and access the large amounts of data that are necessary to achieve breakthroughs in AI and other technologies, the law could stifle innovation in the EU. Also that foreign companies might be able to ‘game’ Europe's privacy rules. Either way, how much influence the EU will have on the expansion of tech giants outside its own territory, especially in the Global South, a strategy which has been dubbed by some as “digital colonialism” remains to be seen.

Global regulations or covenants that bind nation states, technology companies and representatives of civil society might be needed – a long shot with such differing interests, ambitions and civil rights, privacy and economic norms.

In this modern version of colonialism, rather than land grabbing, expropriating natural resources or labour, what foreign actors (nation states and companies) are pursuing, according to some scholars, is control and surveillance of entire populations by means of control of their digital infrastructures. Examples of this strategy include Facebook's Free Basics project for developing countries, Huawei's and ZTE's investment in building connectivity networks in Africa, local educational initiatives by Google, Microsoft and others.

Nor does the EU's effort seem to address head-on what is widely considered to be the main obstacle to the non-abuse of online data: the current business model of the Internet, which is based on the continuous monitoring and profiling of users' activity to collect behavioural data for marketing or surveillance purposes.

Attempts to regulate and set principles on Internet governance and online users' rights have been going on for a while at the global and national levels: from the Charter of Human Rights and Principles for the Internet (<https://internetrightsandprinciples.org/>) by the Internet Rights and Principles Coalition (first drafted in 2011, with ongoing revisions), to the Marco Civil in Brazil (2014) and the Declaration of Internet Rights in Italy (2015) and others. These efforts provided important guidelines and established fundamental principles on Internet governance, but failed to have a significant impact on daily practices of data collection and treatment.

In 2008 an alliance of Internet and telecommunications companies, human rights and press freedom groups, investors, and academic institutions from around the world, launched the Global Network Initiative (GNI). The coalition, which counts Google, Facebook, Microsoft, Nokia, Ericsson among its members, was founded with the mission “to protect and advance freedom of expression and privacy rights in the information and communications technology (ICT) sector”. The GNI board performs recurring assessments of its members’ operations to make sure they are aligned with its principles.

The process, however, is confidential and not open to the public. The organisation’s focus also seems more on protecting Internet users from abuses from governments, intelligence agencies and other nation states than on defending them from the possible abuses of the Internet companies themselves. Principle 3 and Principle 5, in particular, list some actions – from minimising data collection, to providing clear and understandable privacy policies, to enabling controls over how personal data is collected and used – that should be taken by signatories to respect and protect people’s privacy and personal data.

More than 80 organisations have joined the initiative, including Facebook, Google, Microsoft, Amazon and Twitter. While the Contract certainly provides a well-articulated decision-making framework and also points to the relevant human rights regulatory contexts on which the key principles are hinged, without strong accountability measures it risks resembling a Manifesto, similar to Mozilla’s “Pledge for a Healthy Internet” more than a real contract, which usually contemplates sanctions for infringers (incidentally, the lack of sanctions is mentioned by Mozilla as the reason for not signing the Contract).

A more technical solution to avoid the Internet just becoming a battlefield in which governments, and companies compete (and, at times, collaborate) with each other for the control of vital network infrastructures and for the collection and commercialisation of valuable data generated by machines and citizens, could be the adoption of a bottom-up, decentralised approach to the Web, the so-called DWeb.

Unlike the current situation, in which a certain content is usually hosted on a single server and is located by using a specific address (the Uniform Resource Locator, or URL), with the decentralised web the same content is spread across and can be accessed from multiple locations; Dweb links identify information based on its content, not location - making it more difficult to censor or delete. The intention of the proponents is that the DWeb would free users from the “walled gardens” of centralised platforms (Facebook, Amazon, etc.) and allow them to discuss and share information and multimedia without intermediaries. In doing so, it would also solve or mitigate the problems of data breaches, micro-targeting, surveillance and user profiling, as it would give back control to users on what to share and with whom.



The idea undoubtedly raises other issues, however: with no-one in charge, who would be responsible for online harm, misinformation and the like? It's already difficult enough to identify judge and remove dangerous content right now, with the DWeb it might be downright impossible. How would legitimate data access be ensured? Who would decide on what's legitimate and what is not? Would requirements such as the European "right to be forgotten", which gives users the possibility of asking for content removal, lose their rationale?

For better or worse, anyway, the DWeb seems to have still a long way to go; although there are already several decentralised apps and platforms (like Mastodon or Diaspora), they have little traction and poor user experience.

In any event, it would seem unlikely now that the genie is out of the bottle that companies or governments will allow the economic, intellectual and practical opportunities that come with centralised data collection and processing pass them by. If emerging trends are any indication, quite the opposite. The spreading of wearable devices, IoT in the home, biometric data to make payments and access services, will affect people's lives in ways difficult to assess now.

The COVID-19 pandemic in 2020 also seems to have given an unexpected boost to the adoption of digital services and tools in fields and segments of populations that were still lagging behind. In education schools and students in lockdown were forced to take classes remotely; families that never used it before have taken to social media; in healthcare volunteers have been enlisted and are contacted by apps; data pools are being shared; 'contact tracing' apps, have been designed to monitor the spread of the contagion and are now being trialled across the world, in what might be regarded in the future as a watershed moment; the first examples of governments supplying smartphone-mediated digital services on a massive scale.

Before the pandemic, the predominant attitude in western democratic societies, was that of a “techlash”, a soft revolt against the invasion of private spaces by companies and nation states through digital technologies. In authoritarian regimes meanwhile, the use of these tools for surveillance and control of the population was becoming more and more widespread.

Since the onset of the pandemic, the mood has changed. On the one hand the US-China relationship has worsened. Countries have worked individually rather than collectively to counter the pandemic. On the other, global interdependencies have been brought to the forefront like never before. The hope of some is that the episode (if it indeed proves to be an episode, not worse) will help unite an otherwise splintered world. The despair of others is that it will worsen the fissures; if nations cannot work together to save lives, where will they cooperate?

The mood has also changed when it comes to surveillance and civil liberties. Post-pandemic it's possible, if not likely, that at least some of the technologies that several less democratic countries have been using to monitor and govern their citizens, will be adopted in the West – albeit hopefully in a more balanced and respectful way. Such a move could prove valuable in the fight against viruses, but it could also intensify the 'digital Cold War' as nations fight for the control of key data and infrastructures, while simultaneously converging in the use of tools and techniques used.

If so, it is of the outmost importance that safeguards are put in place to avoid abuses from all parties involved: citizens, companies, governments. The principles contained in the Contract for the Web - and in other charts and manifestos - could be a good starting point, as long as they do not stay only on paper, but are enforced across society through accountability measures and mechanisms.

At the same time, efforts to build decentralised versions of apps and services will doubtless continue and could, in time and with due norms, become the basis for a real alternative. One thing however is certain: be it in the form of a “Cold War” or in the form of a peaceful coexistence between different approaches, digital is going to become more and more entwined in societies across the globe. Going back is not an option, going forward norms are needed.





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07

Climbing to the top

**Why the future generation of supercomputers will
(need to) be built with open hardware and software**

By Mateo Valero and Robin Wauters



Japan is home to one of the most famous mountains in the world; Mount Fuji, located on the island of Honshū. Commonly used as a cultural icon of Japan, it was not much of a surprise when the Kobe-based scientific research institute RIKEN Center for Computational Science in August 2019 announced that it would use the mountain and its rocky peak as inspiration for both the name and logo of its flagship supercomputing project, Fugaku.

At that point in time, not a lot of people outside of a small part of the global scientific community had heard of Fugaku, which had started development in 2014 as the successor to the so-called K computer. That changed somewhat less than a year later when it made headlines around the world for -at least temporarily- beating both the United States and China at something that is bound to define a large part of humanity's future: ultra high-performance computing.

In essence, a supercomputer is "just a computer" but with a dazzlingly high level of performance, as it usually clusters multiple highly-performant, optimised machines which are all configured to accomplish a specific type of task. This optimisation will typically include finely-tuned hardware and custom processors and accelerators, a specialised network, vast amounts of storage, and so forth.

Conversely, the workloads that require a supercomputer usually have two things in common; they either require computation on a colossal amount of data, or they are very computationally-intensive -sometimes they are both-. Supercomputers are exceptionally fit for what is known as parallel computing, which refers to the process of breaking down larger problems into smaller, independent parts that can be executed simultaneously by multiple processors communicating via shared memory, the results of which are combined upon completion as part of an overall algorithm.

Fugaku is such a supercomputer, and in June 2020 it managed to capture the lead in an ever more important speed ranking that is currently dominated by American and Chinese machines in both absolute numbers and aggregate computing power.

As Fugaku was crowned the world's fastest supercomputer in the 55th edition of the TOP500, as the twice-yearly ranking is called, it displaced US-based systems Summit and Sierra, and bumped a duo of Chinese contenders down to the fourth and fifth spots on the list. European systems did not make it into the top five in this particular game of tag, although there are systems in Italy, France, Germany and Switzerland rounding out the current top 20.

This is important for a number of reasons.

Picture below from Barcelona Supercomputing Center

Supercomputers let researchers create significantly more accurate simulations for things like modeling climate change, the development of new drugs, advancements in transportation and manufacturing technology and others.

The race is on, and it’s as global as it is crucial

Countries are locked in an expensive high-stakes contest to develop the speediest computers on the planet for bigger reasons than to merely demonstrate their technological and economical prowess (although that definitely plays a big part as well). In reality, there are a myriad of motives driving and accelerating the development of high-performance computing systems and its underlying infrastructure by nation states, and political and economic unions such as the European Union.

This is despite the rather prohibitively high costs involved; the top systems typically cost anywhere between \$500 million and \$1 billion to develop, and require huge amounts of physical space and power to operate.

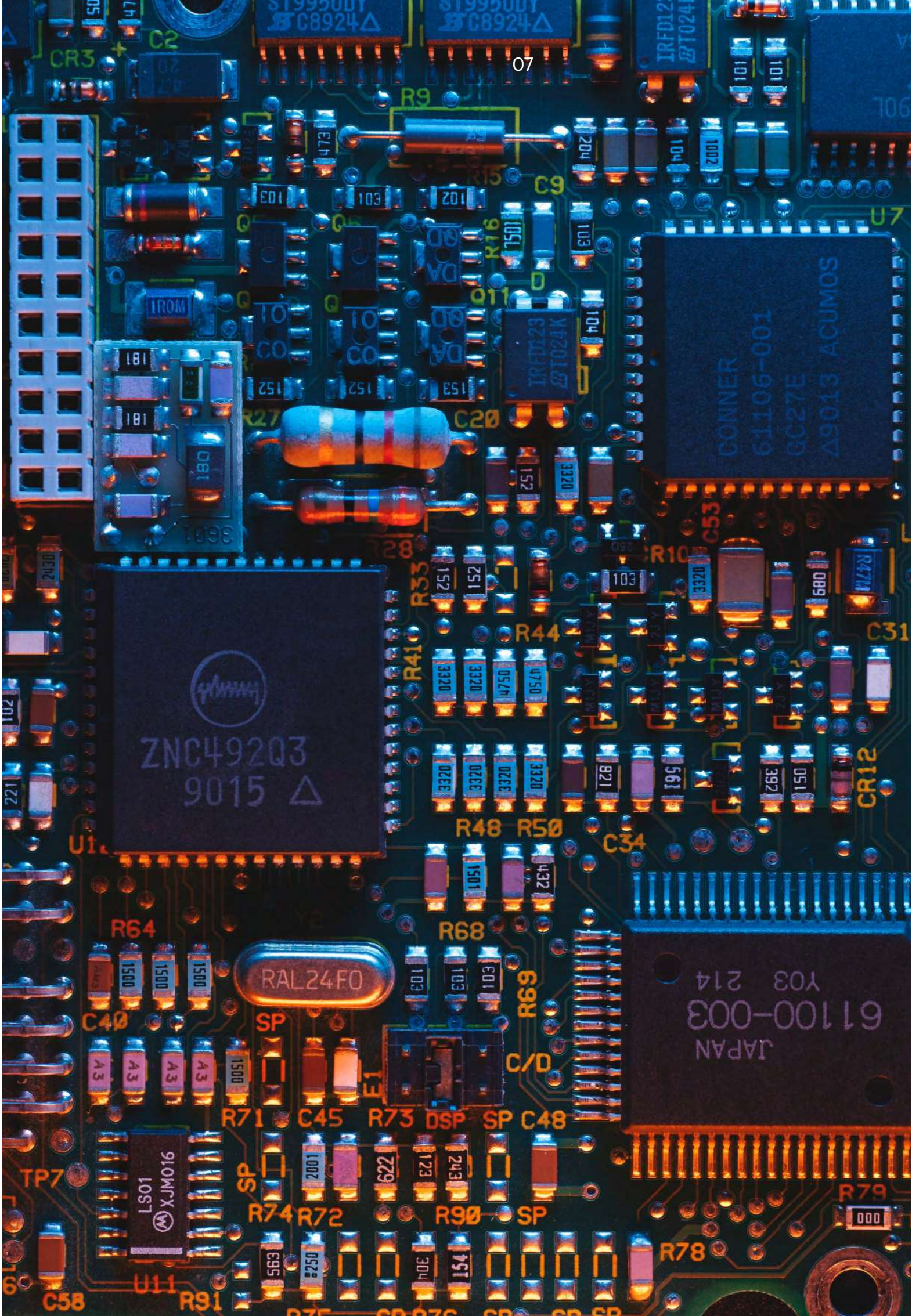
Supercomputers let researchers create significantly more accurate simulations for things like modeling climate change, the development of new drugs, advancements in transportation and manufacturing technology, weather forecasting, oil and gas exploration, molecular chemistry, financial trading and quantum mechanics - to name but a few examples.

Already, supercomputers are being used to identify COVID-19 drug candidates and other ways to help fight the global pandemic; a platform built by an EU-funded public-private consortium called Exscalate4CoV allows rapid identification of safe-for-humans drugs for immediate treatment as well as for novel coronavirus inhibitors to address future emergencies. Another initiative worth noting is the COVID-19 High Performance Computing Consortium, a private-public effort spearheaded by the White House Office of Science and Technology Policy, the US Department of Energy and IBM.

Other major reasons for nation states to develop high-performance computing systems include modern warfare and other military purposes, as supercomputers play a vital role in tasks such as weapons design, code-breaking, Artificial Intelligence, and the analysis of data on major (historical and current) armed conflicts and future security threats.

And even though the pioneering supercomputers date back to the 1960s, in many ways it feels like this technological race between titans is only just getting started.

China continues to dominate the aforementioned TOP500 ranking with regard to system count, claiming close to half of the world’s fastest machines with 226 supercomputers on the list, and the country is expected to continue competing intensively with RIKEN, alongside the United States, to reclaim the top spot away from Fugaku in the near future. The consensus is that it will be difficult for the Japanese research center to hold on to its fastest supercomputer crown for only a short period of time; there are multiple parties interested in taking it away from them, and the stakes are ever higher.



From mobile chips to processors for the world’s swiftest computers

But there is another reason why the development of the Fugaku supercomputer is such a remarkable feat, and marks a major milestone in the world of high-performance computing.

RIKEN’s partner in the creation of Fugaku, information technology juggernaut Fujitsu, chose to design microprocessors for the supercomputer using the basic technology at the heart of billions of smartphones, an unusual choice for high-performance computing systems.

To pull that off, the company licensed chip designs from Arm, a Cambridge, England-born semiconductor and software design giant that is now owned by another Japanese conglomerate: SoftBank and its Vision Fund.

The choice for that type of microprocessor certainly made waves; the world of supercomputer chips is mostly in the hands of AMD and Intel, and they have typically evolved from processors that were used for personal computers and servers.

It is also a testament to how much of a driver for change the recent technological advances within the mobile phone manufacturing and (largely open) mobile software industry have been for the world.

For more perspective on this, we turned to Mateo Valero, the director of the Barcelona Supercomputing Center (BSC), a unique high-performance computing center which brings together a staff of more than 600 scientists devoted to research on future supercomputers.

Valero says the vision for using mobile chips for supercomputers was born at the Barcelona Supercomputing Center almost a decade ago, when the center debuted the ‘Mont-Blanc projects’. Its aim was to design a new type of computer architecture - based on Arm processors, which stood out for its high level of energy efficiency -capable of setting future global HPC standards-.

The motivation behind the Mont-Blanc projects was Valero’s belief that Europe needed to have its own supercomputing technology to be technologically sovereign, and that supercomputers based on European components had to be designed (more on that later). This background mission was cut short, however, when Arm was acquired by Softbank in 2016 for \$32 billion, the Japanese juggernaut’s largest-ever purchase.

Says Valero: In 2020 we can see that part of the result of our investigations has been reflected in the world’s fastest supercomputer, Fugaku. This satisfies us enormously, because we also maintain a constant and very close investigative relationship with Fujitsu and Arm, but we also regret that this technology is no longer European”.

For what it’s worth, while SoftBank bought Cambridge, England-based Arm in 2016 for \$32 billion, its largest-ever purchase, it was reported in July 2020 that the Japanese company may be looking for alternatives for the chip maker, including a full or partial sale of Arm. According to another recent news report by Reuters, Arm has moved to raise licensing fees for a number of customers in recent negotiations -more on why that matters next pages-.

The software, part of the HPC equation

If the choice of a processor designed initially for mobile phones was a surprising decision, at least for people without Valero's knowledge and experience on the subject, what was definitely not surprising about the creation of Fugaku is on the software side of things.

Its operating system, at least partially, banks on the Linux kernel -but then so do literally all 500 of the world's speediest computers-. That said, there are interesting connections to be made between the history and ongoing rise of Linux - and open source software programming in general -and the future of supercomputing, at least according to some-.

One of the prime examples of open-source software development, the Linux kernel was initially released by Finnish software engineer Linus Torvalds back in 1991 (coincidentally a few years before the first edition of the TOP500 supercomputing speed ranking was even published) and was originally developed primarily for use in personal computers.

Today, Linux is by far the leading operating system on servers, mainframe computers and supercomputers, and also boasts an enormous install base on smartphones, courtesy to the dominance of Linux-based mobile OS Android.

The results are in, and they say open source has won, basically. Since its release now almost 30 years ago, Linux has undoubtedly and comprehensively altered the entire software industry beyond recognition.

Now, a relatively young organisation wants to do the same for processors and other hardware, which is highly relevant to the future of supercomputing, as well as to Europe's chance to compete and perhaps even play a leading role in the further development of high-performance computing systems and infrastructures.

RISC-V rising

To supercompute, one of the things you need is a harmonious combination of highly specialised hardware, processor and software programs.

As mentioned, the latter are quite easy to find in a free and open form in large part thanks to the maturation of the Linux kernel, Arduino and the open software communities that support them, but the same does not go for the more tangible elements in the stack equation.

Take chips, for instance. Even though Fugaku has licensed microprocessor designs from Arm, most makers of high-performance computing devices still turn to Intel and AMD for their chips. There are simply not a lot of alternatives out there when it comes to processors, which comes with drawbacks for supercomputer makers: the relatively steep licensing costs for chips, but also the intellectual property that big semiconductor companies hold and charge for.

This is the current situation, and it's one that RISC-V hopes to fix.

Born out of the University of California-Berkeley more than a decade ago, RISC-V (which is pronounced Risk-Five) is a nascent computer architecture that's available under open, free and non-restrictive licences.

"RISC-V enables members to design microprocessors and other types of chips that are compatible and interoperable with software designed for the architecture, which means its licensees do not have to pay royalties to large, entrenched semiconductor industry incumbents", explained Valero.

When SoftBank acquired Arm in 2016, it did so in part to capitalise on an expected boom in the Internet of Things (IoT), in which everyday devices from traffic lights to refrigerators are expected to connect to the Internet. But in IoT, the chip company has already been reported to face competition from RISC-V, leading the company to spin off two IoT software businesses back into SoftBank to focus on its core chip technology.

Notably, no patents were filed related to the open RISC-V architecture to date, as its infrastructure itself does not necessarily represent any new technology; it is based on computer architecture ideas that date back at least 40 years. RISC processor implementations -including some based on other open instruction set architecture (ISA) standards- are widely available from various vendors across the globe.

The eponymous foundation behind RISC-V, which was founded in 2015, says it counts more than 500 member companies today, including the well-known likes of Google, Huawei, Samsung, IBM, Red Hat, Qualcomm, Alibaba Cloud, Western Digital, Raspberry Pi and NVIDIA.

One of the reasons it boasts widespread industry support from both processor and device makers is that it is modular, as in designed to be freely extensible and customisable to fit any market niche.

Another is that the RISC-V movement comes from the world of academia and is billed as politically neutral, not an unimportant aspect considering the high stakes involved in the global supercomputing race.

In fact, the RISC-V Foundation announced in November 2019 that it would relocate to Switzerland, citing uneasiness over US trade regulations. As of March 2020, the organisation is now de facto called RISC-V International, a Swiss non-profit business association, meeting at least part of its growing community's concerns.

Although it is still early days, and RISC-V has many mountains to climb in the face of large, established and aggressive competitors, many hope that the architecture will have much of the same effect on the world of high-performance computing as Linux has had on the software industry.

Today, it is arguably the strongest contender to truly become the open hardware platform of the future. And for some, it is considered Europe's best chance to vy for global leadership when it comes to supercomputing -or at least to stay in the game-.

Supercomputing in Europe

Going back to the TOP500, which ranks and details the most powerful supercomputer systems in the world, Japan, China and the US are currently undoubtedly in the lead, and actively duking it out for the top spots on the list.

Europe plays a secondary role at best, with only eight supercomputers ranked in the top 25, four of which are located in Italy (alongside two in France, and one each in Switzerland and Germany). The highest ranked supercomputer in Europe today is the JUWELS Booster Module, the sixth most powerful supercomputer in the world, and the overall leader among non-governmental systems.

But the entirety of supercomputers in Europe also rely heavily on non-European technology, which limits the EU's ability to compete effectively, and comes with its own set of challenges on a number of data sovereignty, intellectual property, security and geopolitical levels.

As is often the case, the European Union suffers from multiple (often conflicting) dynamics, in part driven by a fragmented approach to innovation and research in the high-performance computing field, in part by nationalistic reflexes.

This is how the EuroHPC Joint Undertaking, a €1 billion joint-initiative between the EU and several member states to develop a top-tier supercomputing and high-performance computing innovation ecosystem in Europe, describes the situation on its website:

"The computing and data needs of European scientists and industry do not currently match the computation capabilities available in the EU. No EU

supercomputer is in the global top 10, and the existing ones depend on non-European technology. This brings an increasing risk for the EU of being deprived of the strategic or technological know-how for innovation and competitiveness. This situation may create problems related to privacy, data protection, commercial trade secrets or ownership of data. In addition, Europe consumes about 29% of HPC resources worldwide today, but the EU industry provides only ~5% of such resources".

Coincidentally, the Barcelona Supercomputing Center is one of the most active centers in the EuroHPC project, as director Valero continued to advocate the importance of having a European-scale supercomputing initiative and strategy after Arm's sale to SoftBank in 2016.

In 2021, BSC will have one of the first supercomputers co-funded by the European Commission (dubbed MareNostrum 5) and is taking an active role in the research of technologies (processor, accelerators, software and hardware stacks, etc.). Even though it continues to work with Arm, it is betting heavily on RISC-V; de facto, the Barcelona Supercomputing Center is a member of the RISC-V Foundation and deeply involved in the further development of its technology.

Says BSC director Valero: "Open source hardware makes it possible to avoid being a prisoner of the countries that control the large multinational supercomputer vendors and related technologies in the sector".

Europe’s response (so far)

Indeed, as highlighted previously, competing in the supercomputing field is of great strategic importance for sovereign countries and blocs for a variety of reasons, which has led to the European Union launching and supporting a number of initiatives to up its game and give a significant boost to its competitiveness. As previously mentioned, the EuroHPC Joint Undertaking is the largest, with its aim to develop a world-class high-performance computing innovation ecosystem in Europe, but there are several others worth highlighting.

One such initiative, the HPC Europa project, fits within the pioneering Distributed European Infrastructure for Supercomputing Applications (or DEISA), which was formed in 2002 as a consortium of eleven supercomputing centers from seven European countries. In essence, it provides academic and industrial researchers with access to world-class supercomputers and other high-performance computing systems, albeit with a limited budget (€9.2 million).

Another is Eurolab4HPC, a two-year Horizon 2020 project meant to strengthen academic research excellence and innovation in high-performance across Europe. There’s the non-profit association PRACE (Partnership for Advanced Computing in Europe), an EU-funded initiative that aims to enable impactful scientific discovery and engineering R&D “across all disciplines to enhance European competitiveness for the benefit of society”.

And then there is ETP4HPC, essentially an industry-led think tank and advisory group of companies and research centres that was set up in 2012 and is heavily involved in high-performance computing research in Europe.

An EU supercomputer chip in the making?

A fifth and arguably most notable project is the European Processor Initiative (EPI), which is building a new low-power central processing unit (or CPU) based on European technology. This CPU will admittedly rely on a closed-source processor core, but will bundle an accelerator based on the open-source RISC-V architecture (see details above in previous pages).

“Ultimately, the goal is to create a microprocessor for an exascale machine based on European tech, rather than proprietary alternatives”, as Valero explains.

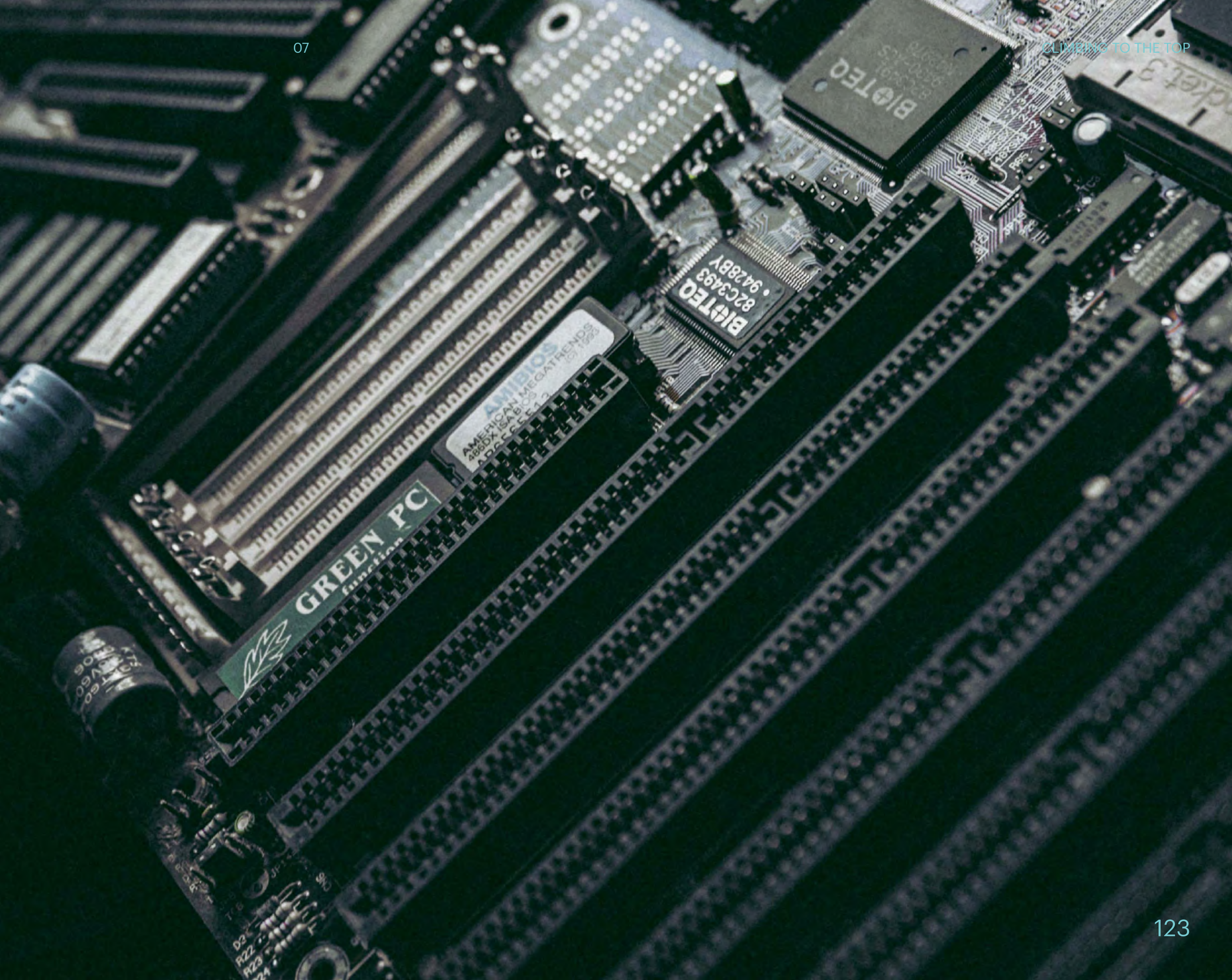
This supercomputer will be capable of one exaflop of performance: one quintillion or a billion billion operations per second, which is around a billion times faster than your average desktop computer. Exascale capability is the next frontier; a computing power level roughly comparable to aggregating all the combined computing capabilities of the entire EU population's smartphones.

In November 2019, the Barcelona Supercomputing Center, one of the leading supercomputing centers in Europe, announced the opening of the European Laboratory for Open Computer Architecture (LOCA). Its self-described mission is to design and develop energy-efficient and high-performance chips, based on open architectures such as RISC-V, but also OpenPOWER, and MIPS, for use within future exascale supercomputers.

In March 2020, the research center followed up on the LOCA announcement with the unveiling of the MareNostrum Experimental Exascale Platform (MEEP), an emulation platform that will explore hardware/software co-designs for exascale supercomputers and other hardware targets, based on European-developed IP.

On a related sidenote, there is more innovation happening on the processor front in Europe. A British startup called Graphcore is taking on several semiconductor titans with a recently launched chip designed specifically for running cutting-edge Artificial Intelligence algorithms.

When Graphcore, which is based in the English city of Bristol, unveiled the new computer chip, it said it managed to put a remarkable 59.4 billion transistors and almost 1,500 processing units into a single silicon wafer. The company also said that in benchmark tests, its chip performed up to 16 times faster than those from NVIDIA, which currently leads the market for chips designed specifically for intensive machine-learning applications.



Europe and the exascale road ahead

In its policy outline upon its formation, the President of the European Commission, Ursula von der Leyenled, predicted that exascale supercomputers will be available around 2022, and that it has every intention to play in the top league: “Pooling and rationalising efforts at the European Union level is essential to reach exascale capabilities and place a European supercomputer among the world top three by 2022”.

One reason why this is considered such a vital part of the EU’s strategy: a third of the global demand for high-performance computing capabilities comes from European industry players, SMEs and researchers, currently a mere 5% of those capabilities are actually provided by European supercomputing centres.

As a result, European innovators are increasingly using supercomputers located outside the European Union, which leads to important risks in terms of access, data protection, cybersecurity, and privacy.

But if the EU wants this to change, it will also need to find a way to bankroll the steps that need to be taken to get there.

As the European Investment Bank wrote in a ‘Financing the future of supercomputing’ paper published in June 2018: “In order to address this investment gap, securing the appropriate financing to cover the high costs of funding and maintaining the world-leading position of European High Performance Computing remains a challenge. While the EU and national governments are actively promoting the sector with various initiatives, public funding alone will not be sufficient to finance the broad uptake of HPC by industry and SMEs in the coming years. The EU needs to continue acting as a cornerstone investor, mobilising public funding alongside a clear public value proposition. This should ultimately be recognised and rewarded by the private sector through co-investments”.

Put frankly, the EU will need to put its euros where its mouth is.

Conclusion

If you look at the top 5 fastest supercomputers in the world today, it would appear the high-performance computing race involves only American, Chinese and Japanese contestants.

But with a number of supercomputers currently ranked in the list of top 20 speediest machines, Europe has healthy ambitions not to stay in the backseat for much longer.

Put simply, Europe wants to be a player, not a buyer, in the field of high-performance computing. This is considered a strategic resource to have, and not some vanity contest.

After all, high-performance computing systems are bound to play a major role in things like drug development, cancer research, Artificial Intelligence, modeling climate change and weather forecasting, molecular chemistry, quantum mechanics, astrophysics and much more, and supercomputers can also be employed for a number of military and large industrial purposes.

The EU has committed to double down on its effort to create a cluster of pan-European innovation ecosystems linked to the field of high-performance computing, and build supercomputers that can ultimately achieve exascale performances.

“The Fugaku demonstrates that new HPC technology can break through and become the top machine, for a short time. This is exciting because we can trace the origins of the machine back to the research done by the BSC. We believe this can be done again, but leveraging a completely open ecosystem, software and hardware, based on Linux, many other open-source software components and RISC-V as the basis for the hardware”, explained Barcelona Supercomputing Center director Mateo Valero.

Indeed, with a deeply rooted history in the creation and mainstream adoption of open-source software programs (e.g. the Linux kernel for operating systems and Arduino for IoT devices), there are many lessons to be learned in Europe to help it keep a seat at the high-performance computing table and maintain, or even increase its global competitiveness.

“Coupled with a large, active and world-class scientific and research community, Europe has an opportunity to benefit from current advancements in open hardware ecosystems and standards to create and operate supercomputers that do not rely heavily on non-European technology, which would represent a real risk to its future data and technological sovereignty”, Valero added.

“As the United States and China continue to be locked into an ongoing trade war and economic conflict, it is not an option for Europe to stay on the sidelines when it comes to supercomputing. In fact, it has a clear incentive to take its destiny in its own hands”, Valero concludes.



Mateo Valero

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08

The role of humans in the digital society

By Virginia Dignum and Bennie Mols



From the 20th century inventions of the computer and the internet gradually a whole new set of digital technologies have evolved: algorithms, big data, Artificial Intelligence, robotics, biometrics, virtual and augmented reality, and smartphone networks like 5G, to name a number of important ones.

Whereas humanity created these digital technologies, in turn these technologies shape society, and even what it means to be human. Digital technologies impact core human values like autonomy, control, safety, security, privacy, dignity, justice and power structures. Technological development is like an evolutionary process in which humans and technology evolve in a symbiotic way creating both new opportunities and new risks. First we create technology, then it recreates us.

The central question in this chapter is how to shape digitisation so that it enables the society that its citizens want. In order to answer this question, we first need to think about the ways in which people are involved. An open, inclusive approach where everybody is welcome to participate is needed to design technology so that shared human values are built in the technology. We need to take into account that people have different cultural, social and economic backgrounds, different levels of involvement and different interests. That causes technology to have different effects on different groups. Consequently, different groups have different needs and views about the role of digital technologies in society. Engineers are those who ultimately will implement technology to meet societal principles and human values, but it is policy makers, regulators and society in general who can set and enforce the purpose.

Each individual and socio-cultural environment prioritises different moral and societal values. That is, which society citizens want should be decided in a democratic process with at its core the individual's right to self-determination. The implementation of digital technologies needs therefore to consider the socio-political environment it is inserted into. However, a digital technology like Artificial Intelligence (AI) might impact self-determination by taking decisions that people used to take themselves, which in turn will impact the democratic processes and ultimately society itself.

Dealing with these issues requires a human-centred approach to digital technologies. This means that the leading requirements for digital technology should be: empowering humans, protecting humans and facilitate engagement for social transformation. Incentives for ensuring these functions can be both regulatory or market based.

A human-centred approach also leads to the question of human control in a society in which machines operate more and more autonomously. How much control should humans have over digital systems? In many applications the concept of 'human plus machine' is a more fruitful concept than the concept of 'human versus machine'.

Scenarios for the digital society

In order to explore the consequences that digitisation can have for humans, we now sketch three possible scenarios for our digital future.

Scenario 1: Let the market rule

Digital technologies have a few characteristics that make them different from previous, analog technologies: they scale easily and with little costs to bigger sizes, and they easily transcend borders. When the market for digital products and services is left free in a laissez-faire way — with no government intervention at all — this rapidly leads to a ‘winner takes all’ end result.

When we let the market rule the digital economy, priority is given to maximising company profits and maximising share-holders value, without taking into account important public values like the environment, equality or privacy.

For example, company A, which is only slightly better than company B in providing a certain service, let’s say information search, quickly acquires more users. More users means more data on and insight in these users. Company A can subsequently improve its service and even create completely new services (for example health care) based on data that it originally collected for different purposes. Any newcomer will then have such a competitive disadvantage that it has very little chance to survive on the market. The result is a market ruled by a monopolist. This is an extreme version of what presently is the case with platforms like Facebook and Twitter and with search giant Google.

When we let the market rule the digital economy, priority is given to maximising company profits and maximising share-holders value, without taking into account important public values like the environment, equality or privacy. When companies can earn money with fake news and polarisation of views, then that is an unwelcome societal outcome of a laissez-faire-market-process. This is an extreme version of the American capitalistic philosophy in which the government intervenes as little as possible in the digital economy.

Scenario 2: Let the government rule

At the other end of the spectrum we have a country like China, whose government wants to steer digital innovation in a top-down way. The government decides which technologies will be developed and how they are going to be used. In an extreme scenario the government acts as a Big Brother on its citizens: it collects all the data of where citizens are, how they move, what they do and what they buy. These data can be used to score citizens: citizens who behave not well enough according to the government get a low score and might be refused housing, traveling, jobs or medical care. By now, all kinds of technical complications have prevented China from building a fully functioning social credit system, as it is called, but it still is a dystopian possibility.

Scenario 3: Let the government inspire the market

In between the previous two scenarios we have a scenario in which the government in a democratic way defines the missions of the digital development -for example the UN’s sustainable development goals-, defines the boundary conditions -for example a CO₂-emission cap- and then leaves it to the market to develop products and services. Often it is under-appreciated that governments historically have been very successful in creating big technological breakthroughs by doing long-term and high-risk investments that are too costly and too risky for companies.

Huge amounts of public money have made possible the development of the foundations of the modern digital society: the computer, the internet and the smartphone. Only after these foundations were laid tech-companies had the possibility to flourish. A healthy digital ecosystem therefore needs both government vision and government funding, public-private partnerships, start-up culture and a healthy market competition. Governments should stimulate companies to find solutions for the societal problems that its citizens find important.

The political view of the EU is to choose such a middle way between the American view in which business is leading and the Chinese view in which government is leading. The EU favours to balance the interests of individuals, society and business. In this political view human progress according to European core values is key, instead of the more narrow economic progress.



What should digital technology ensure?

As described in the introduction, human-centred digitisation should empower humans, protect humans and incentivise engagement for social transformation.

Empowerment

Empowering humans refers to the question of what humans need in order to cope well in the digital society. Digital technologies should be designed to augment, complement and facilitate human cognitive, social and cultural skills, and at the same time leave meaningful opportunity for human choice. Education, training, access to knowledge, inclusiveness and closing the digital divide are some of the tools that can empower humans.

Empowerment starts with access and education. Ensuring that everybody can use technology, taking into account fairness and opportunity requires political will and education.

On the issue of inclusion, diversity and access much has been said and written, in particular where it relates to bias. However, more than only looking at objective percentages of certain groups (men, women, minorities...), it is important to understand how inclusion is experienced, so the subjective feeling. Broadening engineering education curricula to include the humanities and social sciences that are essential to ensure the responsible design and development of digital technologies, will also contribute to a more diverse student population.

Protection

Protecting humans refers to the need to safeguard human well-being. This goes beyond issues of security and safety, privacy and data protection, but should first and foremost ensure that universal human rights are guaranteed and contribute to the achievement of 17 Sustainable Development Goals (SDG's), which the United Nations have formulated for the 2015-2030 period. These include fighting climate change, poverty and hunger, and striving for gender equality, good health care and good education.

Experience shows that digitisation often leads to unintended consequences and new risks that might endanger core public values. The widespread use of digital technologies is eroding the capability to level majority sentiment, traditionally a function of democratic institutions. On the one hand, the internet has rendered the diversity of citizens' views more salient, and has proven a powerful medium for discontented citizens to put pressure on the democratic institutions and force changes in policies. People who entertain extremist opinions are now able to connect with like-minded people, and to voice their opinions without any regulation or control. On the other hand, AI and big data are creating possibilities to generate and distribute fake and misleading information, and personalise content to exacerbate the feelings of individuals and (radical) groups.

Digitisation has also led to a shift in power structures in which Big Tech companies like Google and Facebook have achieved market dominance and control over an enormous data collection that its users have given away in return for free services.

Unfortunately, what is beneficial for humans as consumers, free services, is not beneficial for humans as citizens, because of the loss of privacy, no control of data and giving too much power to only a few companies.



Enabling humans to shape the digital society

After having explained what we mean by empowering, protecting and engaging humans in the digital society, let’s now look at some instruments that can be used for reaching these three aims.

How to empower humans?

In the field of education and training, programs can be offered to help people of all ages develop digital skills, computational thinking and media literacy. For people who want to dig deeper, coding lessons are a great way to empower them to write their own computer programs and to better understand the workings of the software they use in everyday life.

Finland, Sweden and the Netherlands already offer free national online courses to educate its citizens in the field of Artificial Intelligence. The Finnish AI-course is for everybody freely available in English. At schools courses can be introduced to let groups of children build their own little robot. This has the advantage that it combines skills needed for the digital world (like programming and computational thinking) with skills needed in the physical world (engineering, designing, tinkering, cooperation) and it’s an outstanding way to discuss various aspects of the digital world: How to make a robot safe? Which values should be embedded in a robot? What are robots good at and what not?

Even though the history of computing shows great achievements by women already in the early days (e.g. the pioneering thinking about coding by Ada Lovelace in the 19th Century, long before the first real computer was built; or the role of women in breaking Nazi codes during the Second World War) the number of women in computer science in Western countries has dropped sharply after a peak in the late 1970’s and early 1980’s. According to the British professor of computer science Dame Wendy Hall, this is the result of the way personal computers were marketed after their commercial introduction in 1981: “as toys for boys”. And what is true for computer science is equally true for the industrial IT sector: globally, the percentage of female IT leaders is only about 9%. Whatever the exact reasons for a gender disbalance are, as digitisation has become such a powerful, global force, striving for inclusiveness of women should be an important part of empowering people. The American non-profit organisations ‘Girls Who Code’ and ‘Girls in Tech’, or the ‘Women in IT Awards’, are some concrete initiatives to reduce the gender gap in IT.

Inclusiveness should not only be about including more women, it should also be about including people from more diverse ethnical and social-economic backgrounds, as well as people with disabilities.

The need for this is illustrated by looking at the present diversity in the workforce of two of the Big Tech-companies. For instance, at Google 2,5% of the employees are black and 3,6% Latino; and at Facebook the numbers are 3,8% and 5% Latino, respectively.

Empowerment should also be used to close the digital divide within countries and between countries. At present about 55% of the world population has access to the internet.

Although this is a great achievement, it also means the 45% has no access. This leads to a digital divide between people who can benefit from online services via the internet and those who can’t. And as those services are becoming more and more powerful (information search, communication, e-shopping, e-health, e-government, e-banking etcetera...) the digital divide in turn leads to a power divide. Closing the digital divide should therefore be a priority in any scenario for the digital future. The European Union already in 2015 developed a plan to close the digital divide between the EU-member states.

Finally, empowerment should not only be directed towards individuals, but also towards public institutions like schools, universities, libraries, cultural institutions and hospitals. Especially in Europe such institutions have a rich history in delivering goods and services for the public benefit.

How to protect humans?

First of all, humans need to be protected by ensuring that digital technology is designed and used responsibly. This is an issue of governance. It is up to governments and citizens to determine how issues of liability should be regulated. For example, who will be to blame if a self-driving car harms a pedestrian? The builder of the hardware, for example of the sensors used by the car to perceive the environment? The builder of the software that enables the car to decide on a path? The authorities that allow the car on the road? The owner that personalized the car decision-making settings to meet her preferences? And how can current product liability laws be understood in face of systems that act as a result of a long (autonomous) learning process? All such questions must be informing the regulations that societies put in place towards responsible use of digital systems.

As digitalisation fundamentally changes the society, we also need to rethink our traditional universal human rights. Do they need to be changed? Do we need additional human rights in the digital age? Various organisations have already explored this issue. Some of the proposed new rights include: ‘the right to the protection of personal data’; ‘the right to not be measured, analysed or coached’ and ‘the right to meaningful human contact’. Others have proposed rights like ‘the right to disconnect’ or ‘the right to be or remain anonymous’.

One of these rights, ‘the right to the protection of personal data’, is since 2018 already part of an existing EU regulation, the General Data Protection Regulation (GDPR). The right is protected by regulatory agencies, like the European Data Protection Supervisor or a national equivalent. Also with respect to other public values, regulatory agencies can be powerful instruments to protect humans against the power of companies and governments. In the same way, consumer organisations can help to protect citizens in their role as consumers.

Protecting people against misinformation and fake news is notoriously hard and should be done by combining different approaches, both technological and non-technological.

Most important is to raise awareness about the problem, to develop media literacy, to acknowledge the importance of a free and independent press and to train critical thinking.

In addition, technologies can be developed to filter misinformation and fake news, or at least to give a warning that some information might be false. Platforms like Facebook and Twitter should do much more to fight the intentional spread of false information. If self-regulation of such platforms doesn’t work, and unfortunately often it doesn’t, then regulation on national and international levels is needed.

In the first years after the public release of the world wide web in 1991 there was an almost utopian optimism that the internet would lead to better communication and better functioning democracies. However, within two decades the internet became a playing field of commercial interests, leading to a few Big Tech companies that dominate the market for information search (Google - which also acquired YouTube) and communication (Facebook - which also acquired Whatsapp; Twitter).

We should realise that the internet has an important public function that is too important to be left only to the market. Visions already have been developed of how Europe might take back control and protect its citizens much better. One of the visions is to cultivate what is called ‘the commons’: shared resources and social practices maintained by communities and not by companies for commercial interest. Two successful examples of such commons are Wikipedia and the Creative Commons license.

The principle of cultivating the commons can be used in developing new digital technologies. Take the idea of ‘smart cities’, cities that aim to become more efficient and environmental by using an extensive network of smart sensors and smart analysis of data streams. With the principle of cultivating the commons in mind, smart cities should make sure that the data collected about their citizens will not be owned by commercial parties involved in making the city smart, but by the citizens that provided the data in the first place.

How to engage humans?

The most significant form of engagement in a democratic society is voting: both in local, regional and national elections, and also via referendum. But engagement of course includes much more than voting. Citizens can express their opinions in the media, in public debates, they can join civil movements and other public organisations. They can join trade unions and organise protests. These are all classical forms of engagement. In the last two decades the internet, the smartphone and the communication platforms have changed the communication landscape fundamentally by allowing communication to be fast, cheap, global, direct and by giving everybody with internet access a voice.

It's still an unsolved problem of how the new digital tools can best be used to engage people.

On the one hand, digitalisation has definitely broadened the 'public square', the imagined space where people collectively debate what they want in a society. More people than ever before in history can give their opinion in public. But on the other hand digitalisation has led to a fragmentation of this public square. We are not all hearing the same debate anymore, we can all create our own personalised media experience. It's still an unsolved problem of how the new digitals tools can best be used to engage people.

What is definitely important for engagement is that there is a broad consensus on what the aim of the engagement should be. In this respect it is a victory that many nations and businesses have agreed on the United Nations 17 SDG's.

Obviously such complex societal problems can never be solved by digital technologies alone, but for each of the SDG's digital technologies can be identified that can contribute partly to solving them. Some examples are: automatic analysis of satellite images to predict harvests, precision agriculture that uses data analysis and agriculture robots to save on water, energy and pesticides, and medical diagnosis via smartphones in areas in developing countries where people do own smartphones but lack a sufficient number of doctors.

Since 2017, the UN, together with the International Telecommunication Union (ITU) and XPRIZE, has been organizing the annual AI for Good conference in Geneva. Here representatives from science, industry, government and non-governmental organisations come together to discuss the question how AI can help achieve the 17 SDG's. A recent scientific paper co-authored by one of us Virginia Dignum (VD) concluded: "AI can enable the accomplishment of 134 targets across all the goals, but it may also inhibit 59 targets. However, current research foci overlook important aspects. The fast development of AI needs to be supported by the necessary regulatory insight and oversight for AI-based technologies to enable sustainable development. Failure to do so could result in gaps in transparency, safety, and ethical standards."

AI, however, is only one of the digital technologies. In the context of thinking about the digital future, it would be good to broaden the scope to other digital technologies and ask the general question of how digitisation can best contribute to achieving the SDG's.

Last but not least, the SDG's would need to become more widely known among ordinary citizens. Most people know about climate change, too few know about other important SDG's. Here lies a task for governments, businesses, NGO's and media to more effectively communicate the SDG's and the way digital technologies can contribute to solve them. Very important in this communication is to find the right balance between raising awareness for the problems on the one hand, but on the other hand also showing positive examples of what already has been achieved with the help of technology, like prolonged life-span, reduction in early childhood deaths and a reduction of infectious diseases to name only a few. Positive examples from the past can prevent fatalism and inspire possible solutions for the future.





Embedding values in design

Running through all the three enablers (empowerment, protection and engagement) is the question of human control. We now discuss two models for human control: First, designing technology so that our values are built in from the beginning. And second, the concept of ‘human plus machine’ instead of ‘human versus machine’.

A piece of digital technology should not just do the thing for which it was functionally designed, it should also do it right, meaning that its wider impact on society is in accordance with our values. Values can range from privacy and equality on the level of individuals to sustainability on the level of society. Technology ‘doing it right’ means that societal, ethical and legal requirements should be embedded in the design from the beginning.

All too often technology is designed only with functionality in mind, without thinking ahead of the ethical and societal consequences that the technology might cause.

Let’s look at three examples.

Google Glass, a smart glass released on the market in 2013, is an example of a technology that was rejected by society because of its intrusion on privacy. Wearers of the Glass could potentially record all they were seeing without people noticing and without any permission by the people being recorded. On top of this was the fear that automatic face recognition would even be able to display information on people in public spaces to the Glass-wearers. Google Glass showed a mismatch between the values embedded in the technology and the values considered important by society.

In October 2018, Amazon decided to stop using a recruitment algorithm. The algorithm appeared to systematically disadvantage women compared to men. This is just one of many examples from recent years in which algorithms were found to discriminate in decisions about people. The Amazon-recruiting algorithm used historical data that were biased against women. By thinking about the values that are implicitly embedded in the historical data, the designers could have embedded our present values better in the design of the recruitment algorithm.

The design of Twitter and Facebook news feeds is optimized for a maximum number of likes by its users. This has led to the amplification of extreme opinions and fake news. Both types of information trigger our emotions which leads to more likes and clicks. This is a clear example of how the design impacts the value of users and society.

A successful example of embedding values in design is a privacy friendly camera system for crowd control. In crowd control you only need information about how many people are at which place, but you don’t need to recognise people’s faces. By using a technique called ‘coarse graining’ the camera system automatically blurs the faces of all people so that nobody can be identified. In this way the value ‘privacy’ is embedded in the crowd control system from the beginning.

‘Human plus machine’ instead of ‘human versus machine’

Red Burns, the creator of the Interactive Telecommunications Program at New York University - also called ‘Godmother of Silicon Alley’ (New York’s technology district) - once said: “Don’t see the world as a market, but rather a place that people live in - you are designing for people, not machines.”

Humans are always part of any digital system: humans do the design, humans define the technical requirements, humans incorporate moral and ethical values, humans build, maintain and update the digital system. Therefore, every digital system, however autonomous it might seem, is still essentially a human-machine system.

Furthermore, whenever a new technology is implemented in an organisation, it changes not just the work that individual people do, but also how people function as a team. Often there are unforeseen side-effects. An interesting example is the introduction of a tele-operated robot in the operating room of a hospital. Because the surgeon tele-operating the robot does not stand anymore next to the operation table and the assistants, the communication between the surgeon and her assistants changes from using gestures or body language to speaking, in order to bridge the much larger distance. The whole operation team has to learn to communicate effectively in a new way.

In addition, the assistants suddenly get more important tasks to do, like helping to place the robot arm better in the patient, a task for which the assistants traditionally have not been trained. These are all changes in the organisation of an operating team that were not considered when operating robots were first introduced. Hospitals now learn this by trial and error, but it would be much better if these unforeseen side-effects are considered before introducing the tele-operation robot.

By realizing in which tasks machines are better than people and in which tasks people are better than machines, we can think about how we can combine the best of both worlds.

Only in this way can we get the most out of our digital technologies. The future is not about intelligent machines per se, but about hybrid intelligence: people together with machines. It’s better to have a doctor who works together with a smart computer than a doctor who doesn’t. It’s safer to have an aircraft controlled by a combination of man and machine than an aircraft that only relies only on one of the two. In many applications the combination of human plus machine is more powerful than either the human or the machine.



Concluding remarks

Digital technologies impact core human values like autonomy, control, safety, security, privacy, dignity, justice and power structures. The central question of this chapter was how to shape digitisation so that it enables the society that its citizens want. In answering this question it is important to realise that different societal groups are differently affected by digital technologies and therefore have different needs and different views.

The EU favors to balance the interests of individuals, society and business. In this philosophy developing digital technologies according to European core values is key. The European view on a digital society can be seen as a middle path between the American view in which the market plays the dominant role and the Chinese view in which the government plays the dominant role.

Developing digital technologies according to European core values should empower humans, protect humans and facilitate engagement for social transformation.

Empowering humans can be done via education and training, inclusiveness and closing the digital divide. Protecting humans can be done via governance, human rights for the digital age, fighting misinformation and cultivating the public, non-commercial role of digital technologies. Engagement for social transformation can be facilitated by fair democratic processes, fact-based, balanced and non-polarising public debates, and by taking the UN’s Sustainable Development Goals as a common aim.

Finally, in order to develop human centred digital technologies, core human values need to be embedded in the design and it should be realised that in many applications the combination of human and machine is more powerful than either the human or the machine in isolation. At the heart of the digital society should be the idea that humans should flourish more with than without digitisation. Digitalisation should never be an aim in itself, but always a tool for expanding human capabilities and improving people’s lives.



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09

Public value, platform capitalism and digital feudalism

Alternatives to the extractive new-feudalistic behaviour of big tech platforms

By Mariana Mazzucato, Rainer Kattel and Parminder Bahra



It's mid-March, 2020. Italy is at the forefront of the epicentre of the COVID-19 pandemic; infections rise exponentially, intensive care units are at risk of being at full capacity and hospitals in danger of being overwhelmed. The Italian government imposes some of the toughest restrictions on movement anywhere with drastic limits on travel; schools and universities remain closed and outdoor gatherings are forbidden.

"There were north of 700-800 deaths per day", says Luca Boschin, "but most of the people we knew didn't really care. You would go around the streets and notice people gathering together. It was crazy. We thought, maybe there is an opportunity to inform people in a different way, that what they were doing was going to make the crisis worse".

"So we came up with the idea of accessing publicly available Instagram pictures and videos, apply them to our visual AI technology and see if we could understand if and where these gatherings were happening. We could produce a report that would help influence people to change once it was released to the public".

Boschin is co-founder of LogoGrab (soon to be rebranded Visua), an AI-visual recognition firm that works with major global marques to assist with brand protection, authentication and identification of counterfeit products on the web.

The other half of the "we" Boschin refers to is Andrea Stoppa, founder of Ghost Data, a collective of tech experts who come together to produce reports and research that are in the public interest. "The group's work is unpaid. They, like myself, have day-jobs as tech consultants or similar, but at night they come together to produce reports that have an impact on society", says Boschin.

The COVID-19 research was illuminating. Of the half a million images scraped from social media platform Instagram, they found 1,316 violations to the restrictions. Half of these were taking part in group activities, 26% were spending time at the beach and 17% were out in parks and parkland.

When Facebook, the owners of Instagram, found out about the report they told Stoppa and Boschin to cease scraping their data: "The tech giants don't want anyone to use their data. Facebook's concern was that we were processing their data to resell it but we tried to explain to them that this is just something that we're doing, you know, we are seeing our friends and family dying and we're trying to give a hand".

Ghost Data and LogoGrab were going to produce more reports and behavioural insights but decided not to after Facebook's intervention.

We have just described a case of platform capitalism: over the last two decades, firms which leverage data aggregation and create multi-sided markets -digital platforms- have come to take a predominant place in the corporate landscape. The most commonly referenced of these firms, the US-based tech giants -Alphabet, Amazon, Apple, Facebook, Netflix, Microsoft, and Uber among others- have established market positions, consolidating search, e-commerce, operating systems, and digital advertising markets internationally.

Capitalism has always excelled at creating new desires and cravings.

The big platforms, however, have both accelerated and inverted this process. Rather than just creating new goods and services in anticipation of what people might want, they already know what we will want, and are selling our future selves. Worse, the algorithmic processes being used often perpetuate gender and racial biases, and can be manipulated for profit or political gain.

Thus, the battle for personal data comes as no surprise. It is becoming the world's most valuable commodity and while we all benefit immensely from digital services such as Facebook and Google search, we didn't sign up to have our behaviour catalogued, shaped, and sold. It is evident that digital platforms, algorithms and big data could be used to improve public services, working conditions and the wellbeing of all people. However, these technologies are currently being used to undermine public services, promote zero-hour contracts, violate individual privacy and destabilize the world's democracies -all in the interest of profits-.

This chapter shows that the monopolisation of data and rent extraction is not the only game in town. Rather than just private profit, public value can be generated through data collection, analytics and innovative new business models and digital platforms - from dealing with the COVID-19 pandemic and saving our oceans to making climate affected communities more resilient and small-scale fishers in the Global South report ocean data in exchange for mobile phone top-ups-.

Fundamentally, creating public value means governing the process from a market shaping not a market fixing viewpoint. Governments can and should be shaping digital markets to ensure that collectively created value serves collective ends. This means making sure that the way that intellectual property rights and data ownership are structured, privacy is ensured, antitrust rules are enforced, tax systems are structured and public investment into R&D is directed, are governed in the public interest. Furthermore, governments, too, are now creating platforms to identify citizens, collect taxes, and provide public services. Owing to concerns in the early days of the Internet about official misuse of data, much of the current data architecture was built by private companies. But government platforms now have enormous potential to improve the efficiency of the public sector and to democratize the platform economy.

We show that there are clear alternatives to the extractive new-feudalistic behaviour of big tech platforms; these alternatives rely on public purpose and value being at the heart of public-private collaboration.

The Fundamental Economic Challenge of our time

Platform capitalism is extremely good at value extraction. Just as landowners in the seventeenth century extracted rents from land-price inflation, and just as robber barons profited from the scarcity of oil, today's platform firms are extracting value through the monopolisation of search and e-commerce services. Yet, as the case of Ghost Data and LogoGrab shows, platforms can take very different forms and shapes, and they can, if properly governed, generate value for all actors in a given ecosystem. We need to have a better understanding of how value is distributed among users, various supplier firms, and the platform itself. This is why platform governance has become one of the most important issues for the future of capitalism. We should aim towards a transformative approach to the nature of the digital economy –away from the data-extractive practices and towards a privacy enabling, agency building economy–.

Platform governance for public value should focus directly on the prevailing business model of platform capitalism, and specifically on the source of economic rents. Breaking up large companies will not solve the problems of value extraction or abuses of individual rights. There is no reason to assume that many smaller Googles or Facebooks would operate differently or develop new, less exploitative algorithms.

Creating an environment that rewards genuine value creation and reduces value extraction is the fundamental economic challenge of our time. Of course, some will argue that regulating the platform economy will impede market-driven value creation. But they should go back and read their Adam Smith, whose ideal of a “free market” was one free from rents, not the state.

We must ensure that the explosion in data serves society’s interest and not just that of a few large companies.

We must identify data, digital platforms and other emerging solutions that can engender public value to increase the welfare of communities and broader society, such as that identified by Ghost Data and LogoGrab in the example shown before.

Where data is privately owned, we must ensure that actors operating for public good have access. Conversely, private entities should have access to public data but leveraged on favourable terms for the state. Finally, we should explore whether the private sector can play a role in enhancing the economic welfare of society through its ownership and use of data.

The scale of the challenges should not be underestimated but it is clear, as we will show, that public value can be generated through alternative governance models to transform communities as they take on society's biggest challenges.

Key to this is to rethink the fundamentals of capitalism: business produces value, governments redistribute it. We argue that innovation is a cumulative process embedded in institutions and contractual relationships. This assumes that the value created through innovation is collectively generated by a range of stakeholders, including the private sector, the state and civil society. In other words, the market and the economy itself are an outcome of the interactions between these sectors.

Data and digital infrastructure create new ways to tackle global challenges; yet we need to rethink the fundamentals of our current capitalism and public sector to take advantage of this potentiality.





The COVID-19 pandemic

The coronavirus pandemic heralded a new era of collaboration between the government and public and private sectors. Researchers at universities and companies around the world raced to develop a vaccine and develop new digital tools to help counter the pandemic.

Dozens of new vaccines were put forward for preclinical development while a handful entered clinical trials within a matter of months.

While there has been significant investment, success can only be achieved if there are clear and transparent rules of engagement based on public-interest goals and metrics. A critical step is to adopt a mission-orientated approach -- a clear purpose -- that focuses both public and private investments on achieving a clearly defined common goal, for example developing an effective COVID-19 vaccine that can be produced at a global scale and made universally free.

Could a similar mission-orientated approach in respect of data have allowed Ghost Data and LogoGrab [See Ghost Data case study] to produce public value from the Instagram data? In this case, a collection of private individuals provided pro bono work to use a private sector platform's data to deliver research findings to support public health authorities facing a national crisis. Ultimately, the private sector entity didn't want this public value to be generated.

Diana Coyle of Oxford University warns that "policymakers need to recognize the urgency of the challenge at hand. Now is the time to start developing data strategies, policies, and regulations. Otherwise, the gains of the data age will be seized by a small number of big companies, and much of the potential benefit to society will be squandered".

Markets are co-created by actors from all sectors, however, conventional economic theory does not view public actors as creators and shapers. Our current discussions of value have been "McKinsey-fied" -- a term used by the artist Olafur Eliasson -- which means that valuable is what can be rationalised, made more efficient.

This misunderstands the role of the state. If anything, the new platform companies are profiting from technologies that were funded by taxpayers who provided the key underlying technologies.

To get real about value we need to concentrate on purpose throughout governance and production, recognise that economic value is created collectively and build more symbiotic partnerships between public and private institutions and civic society.

What does this mean for data? We need to develop a new governance structure. Platform economy business models need to be rethought, as do the relationships and ownership structures of data. Failure to embrace public purpose within data will result in private sector rent-seeking activities and the public value that could save lives or energise the economy will remain trapped in the servers of a handful of tech companies.

Rather than simply assuming that economic rents are all the same, economic policymakers should be trying to understand how platform algorithms allocate value among consumers, suppliers, and the platform itself. While some allocations may reflect real competition, others are being driven by value extraction rather than value creation.

The oceans, climate emergency and public value

The most ambitious public organisations –those that invented the welfare state, put a man on the moon, created the Internet, and are today funding renewable energy and creating sustainable carbon-neutral cities– did more than just fix market failures. They had ambition, purpose, and a mission that extended beyond day-to-day politics.

Such goals can only be achieved through collaboration between both private and public sectors, that together, via the process of innovation, co-create and co-shape markets.

One such goal, which one could argue is universally accepted, is the protection of our oceans. Battered by climate change, pollution and illegal, unregulated and unreported fishing, the lungs of our planet are under serious threat.

To mitigate these threats, scientists, governments and the private sector need access to the “data tsunami” that is being captured through new technology such as satellites, autonomous underwater vehicles and other platforms. Used in conjunction with data streams from social media, smartphones and low-cost sensors, they can create a real-time understanding of what is happening to our oceans and their habitats.

There is, however, a problem - ownership. According to Annie Brett, a fellow at the Center for Ocean Solutions, Stanford University, data is held by government agencies, researchers and private companies and is not accessible to all actors who share this mission.

Even if that data was accessible, current data management techniques within ocean research make it impossible for the information to be shared.

One effort to address the issue of poor data collection in developing countries is Eachmile Technology’s Fishcoin application. It is a browser-based application used on mobile phones which incentivises fishers in developing countries to provide data on their catch in exchange for mobile phone top-ups.

The Fishcoin app uses Blockchain technology, which ensures that the captured data is accessible to everyone using the system and that it is immutable. Eachmile Technologies co-founder Alastair Douglas says that capturing this data is not only important for the management of our oceans but also the livelihoods of the fishers and has many additional applications [see Fishcoin case study].

Fishcoin provides an alternative business model where data and the platform provide value and incentives to not only provide data in the fight against overfishing but also encourage fishers to act in a sustainable way and therefore make progress toward mission-orientated goals such as the UN’s Sustainable Development Goals.

In order for such platforms to scale, the public sector needs to take purposeful action in collaborating and supporting these actors.

Platforms for change

While social media is dominated by a handful of “extractive” digital firms, public purpose and the fulfilment of societal goals is leading to the development of exciting new forms of data collection.

In Barcelona, the municipality is supporting a pilot project that provides residents tools to collect and share data to help determine policies and priorities for their communities and neighbourhoods. It also gives them control over how their data is shared with other actors, if at all.

Francesca Bria, now the President of the Italian Innovation Fund, worked as the Commissioner of Digital Technology and Innovation for the City of Barcelona and project coordinator of the pilot programme, Digital Democracy and Data Commons (DDDC).

It is part of the EU-funded DECODE (Decentralized Citizen Owned Data Ecosystem) project (also led by Bria) which creates legal, technological and socioeconomic tools to allow citizens to take control over their data for the common good.

DECODE seeks to overcome two of the problems outlined earlier; first, the misuse and overuse of data - where it is useful to think less about data as a commodity to be bought and sold and more as a shared resource or common good; and second involving the underuse of data. Bria considers data, “a new meta-utility, a public infrastructure, like electricity, water, roads, and clean air. City data is critical to run future smart AI-driven and data-intensive public services in transportation, healthcare and education”.

Underpinning DECODE are the “data commons”, a broad range of initiatives in which data is shared as a common resource among individuals or organisations, who collectively decide on the rules that govern access to it.

Commons provide a useful set of principles to support privacy-enhanced sharing of data for public value, with the aim of reconciling both personal and collective control, while maintaining transparent, accountable and participatory governance over data, says Bria.

For the City of Barcelona, this means a rethink of data ownership. For example, it has included “data sovereignty” clauses in private sector procurement contracts which require any supplier that works for the city to provide the data it gathers, while providing a service, in a machine readable format.

“The data was turned into a public good and placed in the public domain, while at the same time preserving privacy, ethics and security by design via the use of strong cryptography,” explains Bria.

The project utilises a number of digital tools created by DECODE to empower citizens. Speaking to WIRED magazine, Bria says the approach reverses the process of data being harvested and funneled into private sector partners so the city could be run more efficiently or used to develop services and products for sales: “We are reversing the smart city paradigm... We started aligning the tech agenda with the agenda of the city”.

Those involved in the pilot were given access to various apps which allowed them to manage the permissions around their data; who gets access to it, how it is shared and for which purposes. They also received physical sensors which they placed in their neighbourhoods to collect data such as noise, temperature, humidity and pollution which they could use to influence local policies. A dashboard for visualisation of the data collected through the DECODE project and about 30 public and commercial datasets provided by the municipality, allowed residents to compare and blend the information that could lead to the creation of public value.

Bria says DECODE demonstrates, “how data can then be governed and managed as a common good, shifting agency and control to citizens themselves”.

Those behind the pilot say it shows that the collection of data can produce policy-changing insights, such as the starting point of collective environmental actions as residents use their data to drive advocacy and action for change in the city.

Eight thousand miles away in New Orleans, ISeeChange, a remarkable communities-based social media platform is doing just this. It empowers neighbourhoods to document their environment, climate and weather to help make better and more resilient decisions around planning and infrastructure in the face of climate change.

“The one thing that you can always talk about with any stranger anywhere in the world is the weather. That small talk though, in the era of climate change, is big talk”, says Julia Kumari Drapkin, CEO and founder of ISeeChange. Users post pictures and leave comments on the platform about changes they have noticed in their neighbourhoods, such as unusual levels of heat and rain and irregular patterns in the seasons. Drapkin says the most important data is that held in stories and photos “because people react very quickly and emotionally to those things”.

A single post might show a flooded area draining more slowly after a storm compared to a neighbouring area or tide marks left from a flood that might indicate record flood levels. All of this is evidence of change and extreme events, something that might not be obvious when you’re living through a succession of these events. Combine the community’s observations and you have very powerful, engaging and tangible stories that explain the impact of climate change where they live and work.

“The dominant platforms do not realise that every story has incredible data and insights and that ‘story data’ from community members should be just as important in the process of understanding what to prioritise in a community; how to spend money and adapt to issues like climate change”, says Drapkin.

The project provides an app and tools for residents to measure and track climate change impacts. In some instances, they provide sensors and rain gauges to collect micro-level real-time data. Each community post is automatically connected to publicly available remote sensing data such as satellite measurements of nearby CO₂, year-on-year temperature anomalies, cloud cover, humidity, dew point, air pressure and wind speed.

“Our data show the planning model is broken in a number of ways”, says Drapkin, who adds that they “constantly see differences” between ISeeChange data and the public and private data that is used by city planners and the construction firms employed by them.

She says their data is not capturing what people are experiencing and the models they use to inform their infrastructure decisions are out of date: “So if we are annotating in real-time alongside these climate events, we are fact-checking it on a storm by storm basis. We see flooding in areas that the model does not predict - there’s a mismatch”.

The mechanism through which communities are expected to voice their concerns is also not working, says Drapkin: “I guarantee you, somebody with three kids and two jobs isn’t coming to your four-hour workshop on Saturday. Civic engagement itself is a luxury that most people who are impacted by climate change can’t afford”.

She argues the ISeeChange app can make it easier for communities to engage and participate and claims a four-fold improvement in engagement over traditional approaches while adding that the public becomes a partner over time when there is a consistent dialogue with them about climate.

For all this talk of public value, ISeeChange is, in fact, a private sector organisation: “Thus far our clients or customers have been in the public-private space. We work directly with cities and also private companies, such as engineering firms, who have been hired by them,” says Drapkin, adding, “it’s the mix of quantitative -rain intensity, heat, flood heights among others- and qualitative data that is a unique selling point to our clients”.

But what about the community’s data, is there a danger that it can be misappropriated? “We don’t publish all the data that we collect. We don’t want it scraped by actors we can’t control because the public contributes their data and we don’t want to harm the public”.

Information sharing is the driver for change within these communities, says Drapkin, in stark contrast to the dominant social media platforms, “ISeeChange is not designed to be extractive of your time, it is not an attention economy site, rather, it is an insight in the economy site”.

Conclusion

Innovation does not only have a rate of progression; it also has a direction. The threat posed by data hoarders, rent-seekers and other technologies lies not in the pace of their development but in how they are being designed and deployed. The challenge for us is to set a new course.

Digital capitalism offers us starkly different options: global and largely extractive platform economies or local community-driven yet highly interlinked global digital value creation for tackling grand challenges.

Digital technology will not make the choice for or against these options; the choice will have to be made through reforming existing governance structures of platform capitalism.

And for this reform agenda, we need a public sector capable of developing a digital platform innovation ecosystem that produces value for all and penalises rent extraction through regulation, anti-trust and tax policies.





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10

Urban autopia (self driving vehicles)

Mobility and sustainability in the cities of the future

By Raúl Rojas and Rene Millman

It's the year 2050. Jane has a meeting in Barcelona in a few hours. She asks her smart mobile device to order an autonomous taxi to take her to the airport for a flight from Berlin. The car drops her off at the terminal. While in the car, she has already checked-in, so it is just a walk-through security and onto her flight on a zero-emissions electric plane. Once in Barcelona, she uses her smartphone and calls for an autonomous rideshare shuttle to her final destination.

Autonomous cars are expected to ease commutes, make driving safer and increase the quality of urban life. There are several stages towards this sunny future, but one step that is easy to forecast is the imminent rise of the fully autonomous vehicle. PwC estimates 40% of the mileage driven could be done in autonomous vehicles in 2030. Their impact represents a challenge for the city as we know it, since cars will have to understand the urban environment and cities will have to evolve in order to accommodate such smart vehicles.

Mobility is key to making our cities liveable; it enables people and goods to get around. However, in large cities we are witnessing its increasing degradation. The number of city dwellers in the world will reach 6.3 billion by 2050, from 3.6 billion in 2010, according to the United Nations. It is estimated that 85 per cent of the population will be urban by 2050. With such massive increase in population, there is very likely to be an increase in congestion and commuting times. In turn this would increase the cost of transportation and emissions.

It is clear that modern metropolises face a great challenge in improving mobility for their citizens. The problems facing politicians, transportation experts and urban planners centre around increasing safety, easing congestion, and improving accessibility. Of course, there are also growing environmental concerns. To respond to these issues, we have to move away from the old urban paradigm to the new concept of smart cities, focused precisely on mobility and connectivity concerns.

There are several stages to make sure cities continue to be liveable. The cities themselves will have to devise innovative solutions around transport. Financial support needs to be available at a national and local level to help cities adopt new technologies vital to develop mobility ideas. Autonomous vehicles can play a fundamental part in tackling the challenges around developing smarter and safer cities.

There are several stages to make sure cities continue to be liveable. The cities themselves will have to devise innovative solutions around transport.

The benefits and challenges of autonomous vehicles

As more urban areas embrace the idea of becoming smarter, autonomous vehicles play an essential part in that advance. The main reason for smart cities is to correct the errors in the traditional urban landscape.

Congestion is the main issue plaguing cities. The emergence of autonomous vehicles has the potential to bring important benefits to society by reducing the need for private car ownership. This means a decrease in congestion as people share autonomous vehicles and use them alongside existing public transport.

Autonomous cars will work in tandem with smart city infrastructure -such as sensors, data sharing and analytics- to increase road safety. Along with safer vehicle behaviour and reaction times, autonomous vehicles could markedly decrease the number of people killed on roads.

Future cities also need to take into account the needs of all its citizens. Autonomous vehicles could provide improved accessibility for disabled people and the elderly that are cheaper than existing options.

While this sound great, there are possible difficulties that may appear from the introduction of autonomous vehicles if the appropriate regulation is not in place.

If an autonomous vehicle becomes non-operational when confronted by unforeseen weather conditions or unidentified obstructions it could become a roadblock for all other road users.

The disabled and elderly may well benefit from autonomous cars if they are not fit to drive themselves but could find themselves cut off from using such services if they need assistance getting in and out of vehicles.

There is also a risk that if autonomous vehicles are deployed well before private car use has decreased this could in turn create more traffic. This may be made worse if autonomous vehicles drive around without passengers, waiting to be used.

Regardless of potential advantages and disadvantages, what is the situation today and how do we plot a course to an autonomous future?



The present

Today, you just can't walk into a car showroom and buy a fully autonomous car as there are none currently available in the market. There are cars with driver-assistance systems, such as cruise control, lane keeping and collision avoidance, but these still require drivers to keep their hands on the wheel at all times in case they need to take control in an emergency.

For a fully autonomous car to go on sale to the general public, it will need to be designed, developed, tested, produced, approved, and marketed. This will have to happen in conjunction with the creation of new legislation and infrastructure to support such vehicles.

Until then, there are trials around the world aiming to find out how ready society is for self-driving cars and how they will use them. In Las Vegas, US, an experimental fleet of 30 autonomous vehicles provide an on-demand car service just like taxis. Lyft works with self-driving company Aptiv to provide the service. However, a driver still sits in the car for safety reasons.

A UK government-backed consortium has launched trials in London with volunteers riding as passengers in the vehicles, which are currently operating on two routes in Croydon and Bromley, London. British company FiveAI is leading the project by supplying the software that controls the vehicles, which has been 'developed and trained' on UK roads. The trial is running through a consortium called StreetWise, which includes car insurance company Direct Line Group, and TRL, an independent organisation focused on transport innovation. A crucial part of this testing is to find where autonomous vehicle systems fail and what can be done to ensure safety.

French car manufacturer PSA Group is conducting tests in the Spanish city of Vigo into the impact that communication technologies can have for the development of automated vehicle functions. The goal is to see how vehicles can communicate with the surrounding infrastructure in a complex urban environment.

Should these experiments and others like them prove fruitful, the ramifications of the mainstream adoption of autonomous vehicles on city streets will see profound changes in how our future cities function and how they are set up.



How autonomous cars will change cities

As autonomous vehicles begin to change the way people move in cities, the urban environment will have to drastically change in terms of design and use. If properly thought out, autonomous vehicles could increase the sharing of cars, reduce congestion and combat climate change.

Currently, most vehicles are inactive for about 95% of the time. The requirement for a large parking space surface has resulted from the huge rise in car ownership. The cars are parked on the road or in large car parks, both taking up space in urban areas.

However, autonomous vehicles do not need to remain at a destination. Passengers could be dropped off. The car could then move on and pick up other passengers. When not needed, these vehicles could park on the periphery of the city, or in the parking lots of large malls, until needed again. This is borne out by a few studies.

Recent studies have shown that if all trips in a city were carried out by a fleet of self-driving cars shared by users, autonomous vehicles could cut the need for parking by up to 90 per cent. That is, 90 per cent of conventional cars could become unnecessary under certain conditions. This means that large amounts of public space could be freed up for other uses.

According to data from Singapore, the MIT Senseable City Lab Unparking study found that shared autonomous cars, which pick up and drop off many people per day before finding a free parking spot, would cut the need for cars in Singapore from the existing 676,000 to 200,000.

Such moves to replace parking with something more please and aesthetic is already underway in Amsterdam. There are plans to get rid of 11,000 parking spaces by 2025. In place of parking there will be space for more trees, bicycle racks and the pedestrians.

A massive decrease in the number of cars on the road could also lead to less money spent on road construction and maintenance as thoroughfares will last longer and fewer lanes will be needed for vehicles.

In addition to freeing up valuable real estate, autonomous vehicles could negate the need for car ownership as well.

Fleets owned and operated by ride-sharing service providers could fill the gap between private vehicle ownership and public transportation. This will drive down the need for car ownership. According to PwC's report, titled eascy – The five dimensions of automotive transformation, by 2030, the stock of cars could fall from 280 to 200 million in Europe and 270 to 212 million in the United States. By the same timeframe, more than one in three kilometres driven will be under one of the many forms of vehicle 'sharing'. There will be likely to be far fewer car owners.

A massive decrease in the number of cars on the road could also lead to less money spent on road construction and maintenance as thoroughfares will last longer and fewer lanes will be needed for vehicles.

In a future smart city covered completely by autonomous vehicles, the roads may not need traffic lights. Researchers at the Massachusetts Institute of Technology (MIT), the Swiss Institute of Technology (ETHZ), and the Italian National Research Council (CNR) have developed slot-based intersections that could replace traffic lights. This is based on a situation where vehicles equipped with sensors pass through intersections by communicating and remaining at a safe distance from each other, rather than coming to a halt at traffic lights. The system should be flexible enough to accommodate pedestrian and bicycle crossings with vehicular traffic.

While autonomous vehicles will see changes to how roads are constructed and maintained as well as car parks and parking spaces repurposed for other uses, they will need enhanced networks and communications infrastructure to ensure there is order and safety for vehicles, other road users and pedestrians. We shall see next what is needed to make this future a reality.

What infrastructure is needed?

A city serviced by fully autonomous vehicles will require the right infrastructure. While most talk has understandably been centred on the safety of such vehicles, there are other very important questions to ask: When will infrastructure be ready for self-driving cars? And what technology will be used and where will it be the most effective?

According to the KPMG’s Automotive Vehicle Readiness Index, the country with infrastructure most prepared for autonomous vehicles is the Netherlands. It is working with neighbouring nations to launch groups of driverless trucks to transport flowers on major “Tulip Corridor” routes from Amsterdam to Antwerp and Rotterdam to the Ruhr valley. In second place is Singapore, which has created a test town for driverless vehicles complete with traffic lights, bus stops, skyscrapers and a rain machine that recreates its stormy tropical weather.

Before any infrastructure can be put in place, city planners will have to ensure that laws are in place so that it is legal for autonomous vehicles to operate and to safeguard the safety of passengers, pedestrians and operators alike.

Autonomous vehicles will not only require consistent regulations across multiple jurisdictions and standard road construction and renewal, but also smarter signage, crash barriers, pavements and kerbs.

Sensors

City planners will need to include sensors on lanes, kerbs and pavements to enable autonomous vehicles to anticipate hazardous or unforeseen conditions far ahead.

Smart road signs

At present, autonomous vehicles use sophisticated image recognition to read road signs. Machine-readable signs could use wireless beacons that broadcast to traffic such directions as “keep right”. Such broadcasts would be detectable by vehicles but imperceptible to humans so as to not distract them.

Lane marking improvements

Car manufacturers have had to create complex sensors and maps to overcome the issues surrounding poor road markings. Autonomous vehicles will require radar-reflective road markings to ensure the safety of passengers and other road users. In Canada, the operator of the 407 Express Toll Route (407 ETR) and 3M Canada, started testing in 2019 the use of high-visibility pavement marking tapes optimised for advanced driver assistance systems (ADAS) in the Greater Toronto Area. This high-visibility tape lane marking technology being put onto the road by 407 ETR is to help ensure both humans and machines can accurately judge their position on the road.

Reinforced roads

Autonomous vehicles could have a noticeable impact on the road surface because they will do what they are programmed to do. Such cars will be trained to stay in the middle of the lane, meaning that the weight of every vehicle will always be in the same two tracks. Humans don’t tend to do this and use all of the lane. To prevent these roads from developing hollow tracks, the software in the vehicles will have to be programmed to position the cars in the lanes taking this into account during daily rides.

Power and networking

The infrastructure that is essential to keep autonomous cars on the move will require power and networking to operate all the sensors it needs and to communicate with cars. City planners will have to ensure that whether they build a new transit system or a motorway, there should be power and networking in place so that sensors can monitor traffic conditions.

Support facilities

Fleets of autonomous cars providing shared mobility will need facilities to service and charge vehicles. Smart city planners will need to create them, also for buses and trains. Parking lots that are no longer needed could be repurposed in order to provide these facilities. Support facilities should be located where the least disrupt the urban environment.

Idling and pickup areas

As mentioned earlier, autonomous vehicles could spell the end of the need of massive amounts of parking, but still these cars will need somewhere to go when not in use. Some car parks could be repurposed to provide a place for idling cars. Not only that, these cars do not need space to open doors so the same used to park 15 traditional cars could fit 40. According to a study carried out by researchers at the University of Toronto, car parks could accommodate 62 to 87 per cent more autonomous cars than ones for conventional vehicles.

Traffic management systems and connected autonomous cars

Traffic management systems are already part of life in major cities. With the mainstream adoption of connected and autonomous vehicles, such systems can become smarter as these vehicles will be able to send and receive data from sensors dotted around a city. Connected vehicles using vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications, alongside IoT sensors and platforms, cloud infrastructure and data analytics will be used to predict road congestion, detect road incidents, and enable traffic to re-route appropriately. Autonomous vehicles will use data from smart traffic management systems to carry out changes in speed and alter course without human intervention.



What legislation is needed?

With city roads full of autonomous vehicle, new laws will have to be enacted. For example, in the event of an accident involving an autonomous car, who is at fault? Regulating responsibility is necessary.

In 2015, Volvo Cars president and chief executive Håkan Samuelsson said that the manufacturer would “accept full liability whenever one of its cars is in autonomous mode”.

Prior to laws governing self-driving cars, there has been a lot of legislation to put in place to ensure that trials of autonomous cars can take place.

In the UK, the government has created the Centre for Connected and Autonomous Vehicles (CAV) to work on legislation to enable testing on motorways and cities, including London and Coventry.

In Germany, the Autonomous Vehicle Bill was passed in June 2017, amending the existing Road Traffic Act outlining what is required of highly and fully automated vehicles, while also focusing on drivers’ rights.

France established in 2019 a legislative framework that will permit autonomous car testing on public roads. The French government’s aim is to deploy ‘highly automated’ vehicles on public roads between 2020 and 2022.

Spain’s regulation of autonomous-driving tests currently comes from an instruction approved in November 2015 by the Direccion General de Tráfico (General Direction of traffic). The rule includes all self-driving cars up to Level 5, this entails full autonomy on all roads and any condition. The DGT has collaborated with Israeli vision technology firm Mobileye to turn Barcelona into a full-scale test laboratory by putting a 5,000-vehicle fleet in the city equipped with Mobileye’s 8 Connect technology.

In the US, things are a little different. According to a report by Wired, in many states, companies testing autonomous vehicles don’t have to specify, how many vehicles are being tested, where they are tested and how the cars are performing. At a federal level, the government does not appear to be monitoring this situation.

The Japanese government passed legislation in 2019 approving rules for operating partially self-driving vehicles, paving the way for the use of autonomous vehicles on public roads in the future. Under the country’s revised traffic law, vehicles with autonomous capabilities must be fitted with travel data recorders for traffic accidents analysis.

In August 2018, China launched national standards for testing smart autonomous cars on roads. The standards cover vehicle tests in 34 traffic situations, such as decelerating after sensing speed limit signs and stopping when pedestrians are recognised ahead.

With laws and infrastructure in place, smart cities can start to accommodate autonomous vehicles.

How will we transition to smart cities fit for autonomous cars?

There will inevitably be a period where driverless cars will share the roads with traditional cars with human drivers. That means cities will have to adapt to supporting both modes of transport for the foreseeable future.

Self-driving vehicles currently comprehend the road marking system they have been designed for, but in the future, they will have to be able to understand different national markings.

Road layouts have been designed for people driving; these would need adapting to ensure that there is a safe environment for all vehicle types.

Smart cities and autonomous vehicles will be crucial constituents of a future where mobility is considered a service rather than a privately-owned asset. The future will see "city operating systems" that share data between local government, citizens and mobility service providers to detect issues and model transport solutions.

A future where cities are smarter, more sustainable, safer and more habitable will require local and national governments to work with private companies and services providers to confront the technological, environmental, economic, and political components of creating smart cities. If done correctly, the results will be incredible and may just save the planet from ecological collapse.



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Published

January 2021

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