Foreword

by *Alex 'Sandy' Pentland*[*]

Magic

This book, written by Cosimo Accoto, describes how our culture and the concepts we use to know it will change as our world fills up with code, data, objects and platforms with a computational intelligence. One of the most profound changes is that we will move from speculatively asking "what are the facts?" to "what is going to happen?". Instead of retrieving dead documents talking about the past, we move to a future orientation where our code and software queries cause millions of scenarios to be simulated in order to foretell the future, as is already done today for weather, automobile traffic, and financial planning. To support these oracular powers, the world is also filling up with sensors and algorithms providing the raw data for accurate projection of the future.

As the world becomes alive with sensors and all objects have a computational intelligence we may become like magicians: we will be able to say "make it so" and the change, however complex, will happen…and often even in anticipation of our desires, so that seas of complexity and problems will part before us without our even being aware and experience so much has been done on our behalf mainly on a subperceptual, automatic, preemptive way.

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This vision of the future may seem to depend on an overly optimistic best-case future, but it applies equally to many dystopian futures. Moreover, and importantly, our culture is already being altered by the spread of invisible software, sensor data and computational intelligence. We no longer worry about getting lost or finding the best route, due to data concentrated from billions of cell phones. We no longer need to visit a physical travel agent to obtain precious paper tickets, our travel reservation is just there when we need it. And so on, and so on. But it is changing our culture so slowly that it is only people like Cosimo who can explore and philosophically see the big picture clearly.

Thinking about ourselves: from generalizations to predictions

As we move into a world made from data, most of the ways we think about the world, society and human behavior change in a rather dramatic way. For instance, philosophers like Adam Smith and Karl Marx never had more than half the answers. Why? Because they talked about markets and classes, but those are aggregates. They're averages.

While it may be useful to reason about the averages, social phenomena are really made up of millions of small transactions between individuals. There are patterns in those individual transactions that are not just averages, they're the things that are responsible for the financial crash of 2008 and the Arab spring. You need to get down into these myriad details, these micro-patterns, because they don't just average out to the classical way of understanding society. We're entering a new era of social physics, where it's the details of all the particles – the you and me – that actually determine the outcome.

Reasoning about markets and classes may get you half of the way there, but it's this new capability of looking at the details, which is only possible through ubiquitous data, that will give us the other 50 percent of the story. We can potentially design companies, organizations, and societies that are more fair, stable and efficient as we get to really understand human physics at this fine-grain scale. This new computational social science offers incredible possibilities – and powers that can be used both for good and bad.

This is the first time in human history that we have the ability to see enough about ourselves that we can hope to actually build social systems that work qualitatively better than the systems we've always had. Corpo-

real sensors, societal sensors and environmental sensors will offer us the opportunity to move from reality mining to reality making. The living labs we have set up, systems which allow entire communities of people to experiment with new rules and new capabilities, are a key invention that allows us to test and deploy ideas and determine if they actually lead to better futures or whether they have unintended consequences. That's a remarkable change, where changes in our society are no longer determined by speculative debate but instead are subjected to experimental evaluation. It's like the phase transition that happened when writing was developed or when education became ubiquitous, or perhaps when people began being tied together via the Internet. As happened for social physics, data – Cosimo writes – help us to reimagine other philosophical concepts such as: time, space, agency, subjectivity, law and experience.

The fact that we can now begin to actually look at the dynamics of social interactions and how they play out, and are not just limited to reasoning about averages like market indices is for me simply astonishing. To be able to see the details of variations in social outcomes and the beginnings of political revolutions, to predict them, and even control them, is definitely a case of Promethean fire. A world built on data can be good or bad, but either way it brings us to interesting times. We're beginning to reinvent what it means to have a human society.

A world of sensors and an emerging collective intelligence

The most powerful part of the human intelligence is our social brain, our ability to remember people, interactions and relationships. Indeed, the large size of the human brain seems mainly to be due to the need to keep track of all this social information. However, our society has not built many tools to support our social brain. Facebook, LinkedIn and other platforms are mostly either gossip machines or catalogs of resumes, run more for the benefit of the owners than the users.

But imagine that we could supercharge our social brain – giving people data-driven tools and anticipatory information that allow them to really know what is going on in companies, cities and governments.

To accomplish this supercharging, we need tools that aid our social brain through social sensing and relationship tuning, just as today's computer tools extend our memories and ability to calculate. By teaching computers

more about how humans interact best, they can play the role of social secretaries and social network connectors. Algorithms, artificial intelligence and new platforms (if properly designed and openly shared) could enhance our humanity. A social data sense will hopefully improve our society, and we are building tools that let us test claims about the performance of new social systems.

The ability to find new ideas and create new connections is the bedrock for building human organizations that are creative and fast-moving. To understand how this works, think of an organization as a sort of brain, with the employees or members as the individual neurons. Static organizations – symbolized by the ubiquitous "org chart" – have fixed connections and, as a result, a limited ability to learn. Typically, these types of organizations become siloed, with little communication between departments, and cut off from new ideas. In that state, they risk falling to the competition. By supercharging the organizations' "social brain", the connections – between employees, departments and teams – can continuously reorganize themselves in response to shifting circumstances.

Importantly, this idea of adaptable connections is exactly the insight powering today's cutting-edge artificial intelligence, including both statistical machine learning and deep learning "neural net" approaches. In these models – as Cosimo clarifies – the connections between simple logic machines are reconfigured as the system learns. In contrast to logic machines, people can remake not just their connectivity but also their function, offering a fluid architecture that is qualitatively more powerful. Armed with the right feedback, human "smart neurons" can fill communication gaps to accelerate learning, anticipate "unknown unknowns" and invent new structures to address emerging market forces.

Dissolving boundaries: distributing power

As our world fills up with data, sensors, algorithms and objects with computational intelligence you can begin to create a new social sensorium, an entirely different world in which personal needs and desires are central, and rigid, machine-like uniformity fades away. This sort of oracular vision is already allowing us to engineer transportation, energy, and health systems that are dramatically personalized and consequently much better. We are at a phase transition. We are moving from the reasoning of the

enlightenment about classes and about markets to fine-grain understanding of individual interactions and systems built to support the intentions and needs of individuals based on fine-grain data.

Importantly, the most secure and efficient data architectures are those that have no central points. In such distributed systems there's no single place for a dictator to grab control. So, security in a data rich society also means a higher level of transparency and choice for individuals, which mitigates against central control. New technological protocols such as blockchains may help to build new open and secured peer networks. The power of the state and big organizations tends to dissolve in a distributed data and computation rich world – Cosimo explains how new sovereignty regimes are emerging – because the organizations that will survive will be distributed among many stakeholders and without the hard information boundaries that you see today.

Magic for whom?

One of the great questions is: who is this new data rich world going to be for and what is it going to look like? A key insight is that your data is worth more if you share it because it enables systems like public health to work better for *you*. Data about the way you behave and where you go can be used to can stop the spread of infectious disease. If you have children, you don't want to see them die of an H1N1 pandemic. How are you going to stop that? Well, it turns out that if you can actually watch people's behavior in real time, something that is quite possible today, you can tell when each individual person is getting sick. This means you can actually see the spread of influenza from person to person on an individual level. And if you can see it, you can stop it. You can begin to build a world where infectious pandemics cease to be as much of a threat.

Similarly, if you're worried about global warming, we now know how patterns of mobility relate to productivity. This means you can design cities that are far more efficient, far more human, and burn an awful lot less energy. But you need to be able to see the people moving around in order to be able to get these results. That's another instance where sharing your data is invaluable to you personally. It's everybody contributing his or her data that's going to make a greener world, and that is worth far more than the simple cash value of the data.

But, of course, these examples assume that we have already put in place the correct governance, transparency, privacy, and accountability for such data and the consequent decisions. Moreover, today the data is often siloed off and unavailable for public use, and sharing personal data is dangerous because of data theft and bad actors. Vulnerability is, of course, an emergent property of our complex sociotechnical systems, as Cosimo makes clear. It was for these reasons that I proposed the New Deal on Data to the World Economic Forum in 2008. The New Deal is simple: people have rights to control data about them. Since the initial discussions in Davos the idea has run through various forums and turned into the Consumer Data Bill of Rights in the United States, and the Data Rights rules in the European Union (EU). The core idea is that people are willing to share their data if they can expect that it is safe, and they can derive personal benefit from sharing. We have also to digitally redesign the concept of our identities to better fit a digital world. Consequently, by giving power to individuals to control data about themselves, we can have the sort of democratized data-sharing environment that will allow us to create a healthier, greener and more peaceful world. The battle for personal privacy still rages, of course, but I believe that the tide has now turned in favor of the individual.

Hello, New World

> Expressive code is creative, generative, and world-building
> E. Swanstrom, *Animal, Vegetable, Digital*

As I am about to end this book, menacing clouds are hanging over our planet. The map I'm observing shows the areas where these turbulences have been most concentrated recently. However, these are not alarming atmospheric phenomena, although they have all the appearances of such. In a climate of mutual accusations and retaliations between the United States and Russia, a cyberattack was launched last year against the American internet infrastructure by suspected Russian hackers. The map view shows, like cyclones dropping on cities, the geographic points of the network that have been the subject of this massive information assault, the largest in the era of the internet. Because of these three cyberterror waves, a series of system downs prevented access to services and applications to millions of citizens, users and consumers. Particularly heavy was the attack on Dyn, one of the US hosting giants on which many internet companies rely, such as CNN, New York Times, Netflix, Twitter, Spotify, eBay and Visa, rendering unreachable those and several other platforms for about two hours.

This was an attack on network logistics (not directly on platforms), perpetrated – as far as it is known from the first reconstructions – through a *botnet*, a network of machines and objects of the internet of things. Millions of connected devices, such as webcams, thermostats and infected printers, were transformed into bots and used for a denial-of-service (DoS) attack aimed at preventing the use of resources and services on the network. In a direct response, American hackers – according to NBC –

penetrated the Kremlin's command-line information system, thus demonstrating their vulnerability.

And these are not the only episodes. In recent months, other hackers (assumed in this case to be Chinese) attacked an American aircraft carrier equipped with nuclear weapons for the purpose of sussing out military information. In both cases, the Department of National Security has opened an investigation to find the perpetrators and the main reasons for the attack. Beyond the suspicions and responsibilities that are yet to be verified, this event brings to the fore, albeit with a dramatic import, the deepest motivations for the design and publication of this book.

Philosophy still matters

This is not, however, an essay on computer security or a book prompted by a recent – albeit rather serious – chronicle event. Rather, it is the result of a long, philosophical journey matured over the last few years, aimed at highlighting the relevance of software code as the primary engine of our civilization, culture and contemporary economy. This code that takes multiple forms invisibly connects sensors, data, algorithms, machines, artificial intelligence (AI) and platforms. In this case, the chronicle has given visibility to something that is usually hidden from view and therefore underestimated. Usually we become aware of software only when it fails or when, as in other cases, it threatens our very existence both as individuals and as social beings. But software code is far more than what a computer war event could expound: it is a kind of "technological unconscious" that shapes and mobilizes our personal as well as our professional lives whether private or public. It is the invisible engine of our contemporary society and – this is the central point – it is also the condition that makes this world possible. This book was born, basically, with the observation that our culture lacks the speculative and philosophical view of contemporary and future software society. Its aim is to present and promote a more conceptual and speculative analysis on code culture. Time has come to think philosophically about software and its ecosystem: sensors, data, algorithms, machines, platforms.

Abroad, especially in the United States, there are presently in different universities curricula and courses (not to mention full programs and research projects) devoted to code. But the public debate on the cultural

role of code, data, algorithms and artificial intelligence has only just begun to scratch the surface. In spite of its growing relevance, society is lagging behind in dealing seriously with the code revolution and its implications (consciously and critically – rather than relying on hearsay or taking matters on faith). But above all, in my opinion, we are culturally late in preparing present and future generations for digital thinking.

Today, however, *software takes command* – as Lev Manovich, the theorist of software culture, has recently written.[1] Contemporary society, economics, science and culture are strongly permeated and shaped by the software code embedded in processes, architectures, environments and objects, media and even implanted in humans, animals and plants. Faced with this pervasive and constituent presence, software as a central element of contemporary culture and society remains, however, still underestimated in its scope and its meaning, often limited and narrowed to issues of technological engineering.

In particular, this restriction tends to relegate software and coding practices to a subordinate and marginal position in cultural, epistemological, social and economic domains, not partaking into the discussions, reflections and analyses that take place in the more advanced research and development laboratories of the world. Meanwhile, *the code is eating the world* – to take a slightly apocalyptical tone. It is the software code that though hidden, activates or, as the case may be, deactivates transports and commercial logistics, financial transaction activities, digital multimedia productions, marketing and advertising automatisms, medical devices and tools, self-driving vehicles, new monetary technologies and so on. I am convinced that a philosophical lens can help to make this technological unconscious visible or, at least, observable.

This is a philosophically oriented book, but it is not a philosophical book. It is designed to arouse the interest of different readers: it is addressed to managers and business leaders, to public institutions and public figures, to the protagonists of social innovation and the third sector, to students who face technology from different disciplinary perspectives, curious about how computational evolution is morphing our world. It is not, therefore, directed primarily to philosophers. So, I beg them to forgive me if the language and the discourse are not academically disciplined. I remain firmly convinced that, avoiding certain language obscurities, the contribution of philosophical discourse to illuminate and stimulate a deeper technological understanding is more and more crucial.

I am also convinced, moreover, as sustained by Luciano Floridi philosopher of information,[2] that philosophy has to go back to dealing with the central issues of our present and near future, and not merely comment on and discuss the writings of past philosophers. However, the philosopher must have the desire and ability, strengthened by a conceptual heritage matured over time, to dig dirt again, to understand, to venture, to dissect and deconstruct the technological domains that have emerged in recent years. I will proceed in a lay manner on this path and through the various chapters, dialoguing with a selection of international philosophical texts that I consider relevant (largely unknown to the general public) to trigger and stimulate readers. As I myself have had the opportunity to do in researching digital philosophies for this volume. But not just in books.

Code, data and algos cultures

The writing of this book has benefited from a very special time and place: a long period of study, research and discussion at MIT as a visiting scientist. A summer and an autumn spent in an institution that has, in fact, been to me many places. First of all, the research center on complex sociotechnical systems, MIT SSRC (Sociotechnical Systems Research Center) inspired by professor Alex Pentland and recently affiliated to the new MIT IDSS Institute for Data, Systems and Society. But then, without any doubt, the "future factory" that give shape to this modern wonderland that is the Media Lab of MIT. Directed by Joi Ito, here innovation cultures pervade all disciplines from affective computing to civic journalism, from liquid interfaces to algorithmic cryptocurrency, from radical atoms to social physics. Finally, I have to mention CSAIL, the extraordinary center of research on computer science and artificial intelligence. All talented people that I am happy to thank collectively here for the stimulus and support they offered me. The responsibility for writing, of course, remains entirely my own. Special thanks, from everyone too, go to professor Alex Pentland, "Sandy" – as he is affectionately called at the Human Dynamics Lab – who welcomed, with openness and enthusiasm, the idea of this unusual, cultural and philosophical exploration. These thanks extend not only to the recognition of the personal and collective talent of this research group, but also and above all to the spirit of that profound vision for which innovation must serve to build a better world – as the MIT motto says.

The title *In Data Time and Tide* has, simultaneously a poetic value and a provocative intent. It is poetical insofar as it recalls an old English expression that today survives only in the proverb "Time and tide wait for no man". It is said to emphasize that people cannot stop the passing of time, and therefore should not delay doing things. In our case, it is inevitable to live in a world build by data, code and algos (I call it *a programmable future*) and we should no longer postpone to better and deeply understand our new world. But it also wants to be provocative. As we will discover at the end of this path, what we will talk about is nothing but a "proto-data" world. A world in which, due to the recent *deep learning revolution*,[3] data directly feed smart code, creating our ultimate world interface. Recently criticized by some as "the tiranny of data", it seems also a world largely closed and dominated by a few.

For this reason, to remain open and inclusive in the search for a positive and better construction, it is necessary to attempt a philosophically oriented exploration. Which is, by definition, the subject of this book.

Indeed, I would like this text to help widen our perspective on the possible directions that our future can take, a future where – as we will see in the different chapters – code, sensors, data, machines, algorithms and platforms can produce a better world. I have opened this preface mapping the destruction attempted upon our world by means of the code and data (or, better, by the humans that make use of them). In closing this introduction, I would like to propose, in the form of a wish, a different map of the potential creation of a better world. We intend to also underline the possibilities offered today by digital and AI (assuming, of course, that technology will be driven by far-sighted humanity). This map, of recent creation, shows the poorest areas of the planet discovered through the analysis of satellite images that are used as data sensors to which machine learning and AI algorithms have been applied. In this case, the intention of the Stanford researchers was to identify, with a data-driven and AI-driven system, the most disadvantaged areas where to engage supportive and recovery policies.

The design (not easy) of this new, better world, thanks to the help of sensing, mining and making technologies is, therefore, within our reach. Our explorative journey can now begin. With a last warning to readers. Maps of unexplored territories are built along adventurous paths, difficult and uncertain. We must balance, with confidence, courage and caution. By updating the motto of those learning to code, let's start by saying, "Hello, New World".

Finally, I would like to thank Egea and Bocconi University Press for having believed that the reading and reasoning that I was condensing might one day have the chance to become (also) an English book. It is my sincere appreciation for the fatigue, the intellect and the joint will of all people who, in various ways and at different times, have come into play in this adventure. And a special thank to Professor Derrick De Kerckhove for having appreciated the book and decided to make available his intelligence and knowledge in personally translating it. For me, it's an honor, a privilege and a real joy.

Notes

[1] *Software Takes Command* is the title of a recent book by Lev Manovich dedicated to the culture of code and software.

[2] As Luciano Floridi expressed in an interview with Sophia's Online Magazine: "Bad philosophy is disinterested in current problems. If you deal with what it means to make politics today in the information society, what is ethics in the era of *onlife*, what is knowledge in the era of big data and algorithms, where science is going when as today it is dominated by large research groups ... it would be a philosophy of our time" (*The Philosophy of Information: Interview with Luciano Floridi*, www.lachiavedisophia.com – June 20, 2015).

[3] In *The Deep Learning Revolution*, one of its pioneers, Sejnowski explains how deep learning techniques (from language translation to driverless cars to voice assistants such as Siri and Alexa) is changing our lives and transforming every sector of the economy. Artificial neural networks can now play poker better than professional poker players and even beat Lee Sedol, the Korean Go champion of the world, as happened in 2017.