# 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.