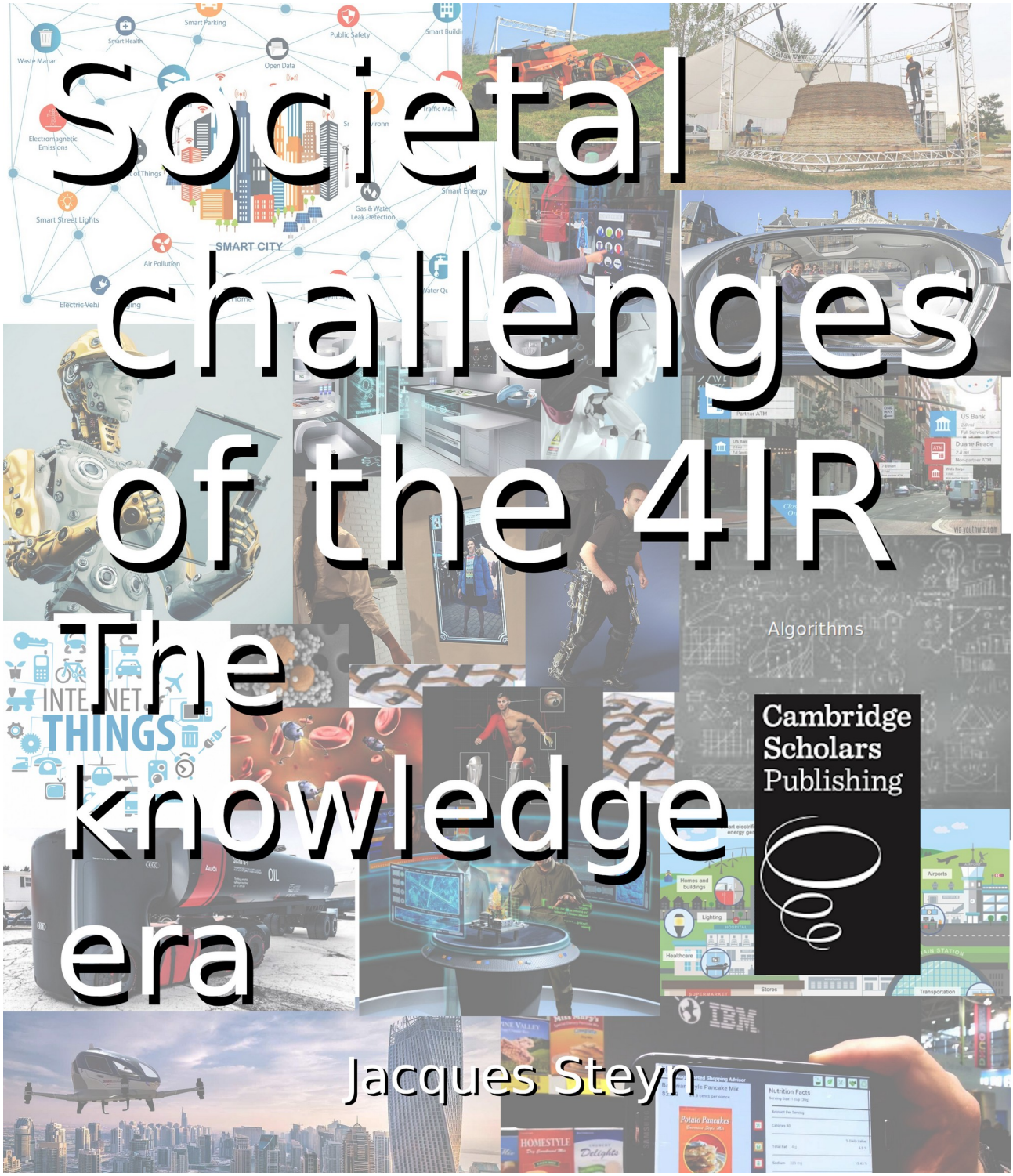
Societal challenges of the 4IR
The knowledge era
Algorithms
Cambridge Scholars Publishing
Jacques Steyn

Call for book chapters

Book Title
Societal challenges of the 4IR. The knowledge era.

Call in brief
Unlike previous industrial revolutions brought about by mechanical machines, the present revolution brought about by cognitive machines and revolutionary innovations in an astounding number of disciplines will have a profound impact on the way humans live, affecting the very definition of what it is to be human. This requires in-depth investigation.

See below for details.

Disciplines
The theme of the proposed book is relevant to any discipline with an interest in the socio-technical, thus all disciplines that investigate the human-technology relationship. Broadly speaking, these include: which is most of the liberal arts or humanities, economics, and the technical sciences that include studies on human factors - multi-disciplinary, inter-disciplinary, or cross-disciplinary.

Anthropology	Economics	Medicine and health
Archaeology	Engineering and technology	Political science
Cognitive sciences	History	Psychology
Computer Science	Human geography	Sociology
Development studies	Law, Philosophy	other...

Editor
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The theme

How might societies change when cognitive machines take over tasks previously performed by humans? What will the impact be on ways of living? What kind of changes to human activities, such as work, play and living in general might require different types of institutions, organization, ethics and ideologies than those we have today?

While previous Industrial Revolutions were mechanical and about muscle skills, the 4th Industrial Revolution is cognitive and about brain skills. During previous technical revolutions muscle power workers could be re-skilled. Instead of manually using a shovel, a mechanical digger now did the shovelling, while the human operator now used his muscles to control the machine instead of the shovel. When machines take over the control of other machines, what is left for humans to do? Machines now have the ability to take over cognitive functions previously only possible by humans. Several ideologies define being human in terms of labour. Automation eliminates humans from the production system. How will this change human livelihoods and living?

A somewhat superficial view of human history proposes that after the hunter-gatherer epoch, humans lived predominantly in an agricultural era, to be relatively recently being replaced by an industrial era, and even more recently by an information era. The definitions of such eras are broadly based on economic activities. The great ideologies of the past few centuries, capitalism and communism, revolved around exploring the nature of labour, which provide inputs into the manufacturing of goods. These goods might be physical or more abstractly, information goods. Some define being human in terms such as labour performed in the

production of goods. If machines produce without much human input, thus eliminating humans from production, such definitions no longer hold. When machines perform all these human activities, if humans can no longer be defined in terms of labour, what is left for humans to do? How is being human to be defined?

Optimists about the impact of the 4IR on the future of human societies promote the notion of some kind of nirvana or Shangrila state. Humans no longer need to work, and will live by playing and being entertained. Pessimists propose that societal divides of various types will increase. The cognitively "privileged" few, who are able to write the algorithms to drive these machines and those who sponsor their activities will benefit. The remaining majority might need to be pacified with remedies such as basic universal incomes, and enslavement of some form or another.

Measured in terms of GDP, economic inequalities were somewhat reduced over the past few centuries. Measured in terms of the GINI coefficient, divides within societies seem to have increased. The industrial revolutions of the past promoted consumerism for middle-classes, but did not eliminate poverty. The middle-classes in many countries have grown poorer over the last half a century. This happened in societies where the value of labour in the production process, performed by humans, was and still is remunerated. Some scenario construction is required to imagine a world without such human labour, and remedies regarding remuneration.

The recent discontent in so many countries with unhappy citizens rising up against the mainstream put in power by the industrial/information revolutions relate to economic and labour issues, and perhaps an underlying ideological struggle. Even societies within the European Union are not immune. Apart from those with more frequent media exposure, such as the Yellow Vests and events in Catalonia, turmoil is found in numerous European countries, as well as across the globe. As machines take over more and more of human activities, the dissatisfaction with the status quo might explode. Will we see revolutions reminiscent of the French one? Will we see some neo-Marxist revolutionaries on the rise; or the anti-capitalist jihadism increased?

We don't know. But this is surely worth investigating.

Examples of the kind of questions that require investigation

Against this very brief backdrop, many questions require attention. The problem of societal changes that the 4IR will introduce can be approached from many more angles than hinted to above. Here are a few more, and you are welcome to suggest other angles.

Technology

Discussing the impact of technology on humans can of course not be well understood without analysing the potential of these technologies as well. It has been argued that less than 20% of all technologies promoted as being the best new thing eventually have wider societal impact. It might be possible that of all the promised 4IR technologies only a small percentage take off. However, there is hardly a technology of the previous industrial revolutions that is not affected. Also, new types of materials, radical innovations in production, as well as innovations on several levels of scale seem to suggest that this technology revolution will have a profound impact. A high level interpretation (a big picture view) of 4IR technologies is needed. In literature on design philosophy and philosophy of technology, artefacts are often defined in terms of the designer's intentions. The perspective is from the point of view of humans. But what then when machines do the design?

New materials make possible the redesign of perhaps all artefacts thus far constructed and created by humans. New production methods make possible the re-conceptualisation of the factory.

Here is a short list of some of the new 4IR technologies relevant for discussion about the challenges the might introduce to the present way of living and impact on societies. The list is not exhaustive.

Artificial Intelligence (AI)	autonomous vehicles (drones)	biofabrication
3D printing	smart objects	wearable technologies
Internet of Things (IoT)	nano-bots	new composite materials / fabrics
genetic engineering	smart environments	intelligent materials
bio-engineering	mass customization	smart logistics
quantum computing	glocalization	blockchain
embodied interactions	remote controlled events	new types of sensors
augmented and immersed reality	JiT (just-in-time) manufacturing	big data

Infrastructure

4IR technologies (such as big data, smart cities, smart agriculture) require an intricate and complex infrastructure, presently possible only in dense urban areas. To date ICT networks still have not reached deep rural areas, and the so-called last mile, despite optimistic promises that have dominated media since the 1990s. This applies not only to poorer regions such as Africa, but even rural areas in highly developed economies. Most 4IR implementations depend on a solid and high bandwidth ICT infrastructure.

Urbanization

There has been a migration of humans to urban areas since the earliest agricultural revolutions, which increased with industrial revolutions. Until less than a century ago the majority of populations lived as agriculturalists. Today 55% of the global population live in cities, and within the next few decades the increase might be to two-thirds of the global population.

Urban design is already a problem, and green urbanization even a bigger problem. The 4IR, particularly cognitive machines, make possible smart cities. The challenge remains of how to balance technological smart cities with ecologically smart cities. Might 4IR offer decentralization potential (the opposite of urbanization)? Might 4IR such as small-scale 3D printing in deep rural areas, with super-fast information connectivity, remote machine control, remote health care (including surgery) and so forth reduce the need to live in cities?

Food

Food security is presently a major global concern, especially with the increasing changing weather patterns many parts of the world are now experiencing. The 55% majority of urban dwellers depend for food produced by an ever-increasingly smaller number of farmers, and by an increasingly number of corporate agricultural entities. The 4IR offers automatized and intensive agriculture. There is an increasing interest in small-scale and urban farming using a variety of urban "hothouses" (indoor vertical farming, aeroponics, artificial lighting) for food production. Might such innovations have better results on a small scale, challenging the now dominant large corporate agricultural practices?

Economics

What will the economics of the future be? The notion of fiat money is being challenged by the introduction of blockchain currencies. Might bartering become fashionable again? Might knowledge become the new currency?

The re-engineering of almost all economic activities will need to be designed in order to make use of cognitive machines and the entire potential of 4IR: the nature of the factory and all its systems (production, assembling, warehousing, logistics, transport), the nature of business, access to services, and so forth.

Will there be an increasing divide between the have's and have not's? Perhaps macro-economic theory will need to be redesigned as the basis of both classic capitalism and communism, namely the nature of labour and production, requires redefinition if machines perform these activities. Or will there be new kind of jobs? The optimists seem to think so. The pessimists argue that apart from those who write algorithms for machines that learn and can build other machines and their sponsors, only human creativity and innovation abilities remain - but these skills are not universal. What kind of jobs might the new kinds be?

Conversation and debate is required around topics such as post-capitalist societies based on information economics, universal income, block-chain monetary systems as opposed to fiat money, the definition of work, remuneration regimes, and other impacts.

Education

Traditionally universities were the brokers of knowledge. The changing landscape of recent times has put universities under tremendous strain leading to much introspection in attempt to redefine these institutions. Whereas academics used to be the custodians and distributors of knowledge, the availability of online learning resources have the potential to make lecturers obsolete - at least concerning their traditional role of knowledge distributors and quality control officers. MOOCs have made some inroads into traditional educational models and income streams, resulting in challenges around certification and several other traditional university roles.

If knowledge is so readily available online in many different presentation modes, and freely, how could and should institutions of learning change? If machines can do "thinking", what should students be taught? And how? Which teaching and learning methods should be used? The challenges of the knowledge era on institutions of learning are tremendous as they equipped the workers of the past with high level skills to operate in a world created for the past. A new world needs to be constructed, but what skills do new workers need to acquire in a world operated by clever machines?

Privacy, security and autonomy

The smart world of smart cities and the Internet of Things require an interconnected world where the nodes (whether human or inanimate) share information. Already there is some degree of backlash against social media and search engine monopolies for seemingly abusing the privacy of citizens. With claims of information warfare and interfering with elections using information weapons, such as misdirection, misinformation and fake news, together with algorithm manipulation, the autonomy of the individual is under threat. IoT requires an intense level of network communications never before possible, which increases the risk of control. Surveillance technologies in the interconnected world of smart cities and networks raise serious ethical concerns.

Ethics

A host of ethical conundrums require discussion and debate. Perhaps every aspect of how human nature has been defined in the past is affected. Here are a few. At what point will a biological human individual cease to be defined as human when most body parts have been replaced by artificial parts? - the cyborg issue. If there is absolutely nothing for humans left to do except being entertained, because machines do all the work, who are we? This is not only an economic question. To what extent should AI algorithms be trusted in decision-making

processes? Some present ethical questions will become even more important. Surveillance potential is increased manifold and once IoT is ubiquitous it will be possible on a universal scale. The concern with privacy issues will most likely intensify.

More

The 4IR technologies of the knowledge era impacts on most, if not all, the traditional academic disciplines. Genetic studies and scanning technologies are only beginning to scratch the surface of understanding human anatomy (especially of the brain). Nanotechnology make possible new types of "medicines", such as "nano-pills". This will certainly impact on how health is viewed and managed. Scanning techniques, such as LIDAR have already changed the disciplines of engineering, architecture, archaeology, geography and history.

Angles and approaches

Authors might consider different approaches to addressing the societal challenges of the 4IR and of cognitive machines.

1. Implementation of the new technologies

There is an extensive list of new technologies of the 4IR. Time-frames and the scale of their global implementation are not known. Technology revolutions might take decades, in the past even centuries, before obtaining a global reach. There is also the matter of whether all or only some of these new technologies will be implemented globally; or if not implemented globally, what might the global impact be? Usually a smaller percentage of the numerous innovations are successfully adopted by societies. The recent spate of globalization reached mainly cities. Will the expansion of 4IR again reach only cities, or might it also be truly global by reaching remote and deep rural locations and societies?

2. Consequences of the implementation of the new technologies

What might the impact be on different kinds of societies by the implementation of 4IR and cognitive machines? How will these technologies change the societies we know? To what extent will societies change? Which aspects of societies will change? What will the impact be?

3. A future society

Considering impacts further into the future might lead to unwarranted speculation. Yet as scientists we need to be prepared for the consequences of such events, and advise on managing them for the benefit of society. Scenario construction and creatively constructed remedies might yield useful results to manage severe challenges.

This would be a multidisciplinary book, and be of value for understanding the new arising world.


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