# Robonomics: principles, benefits, challenges and solutions

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# Dr. Stanislav Ivanov

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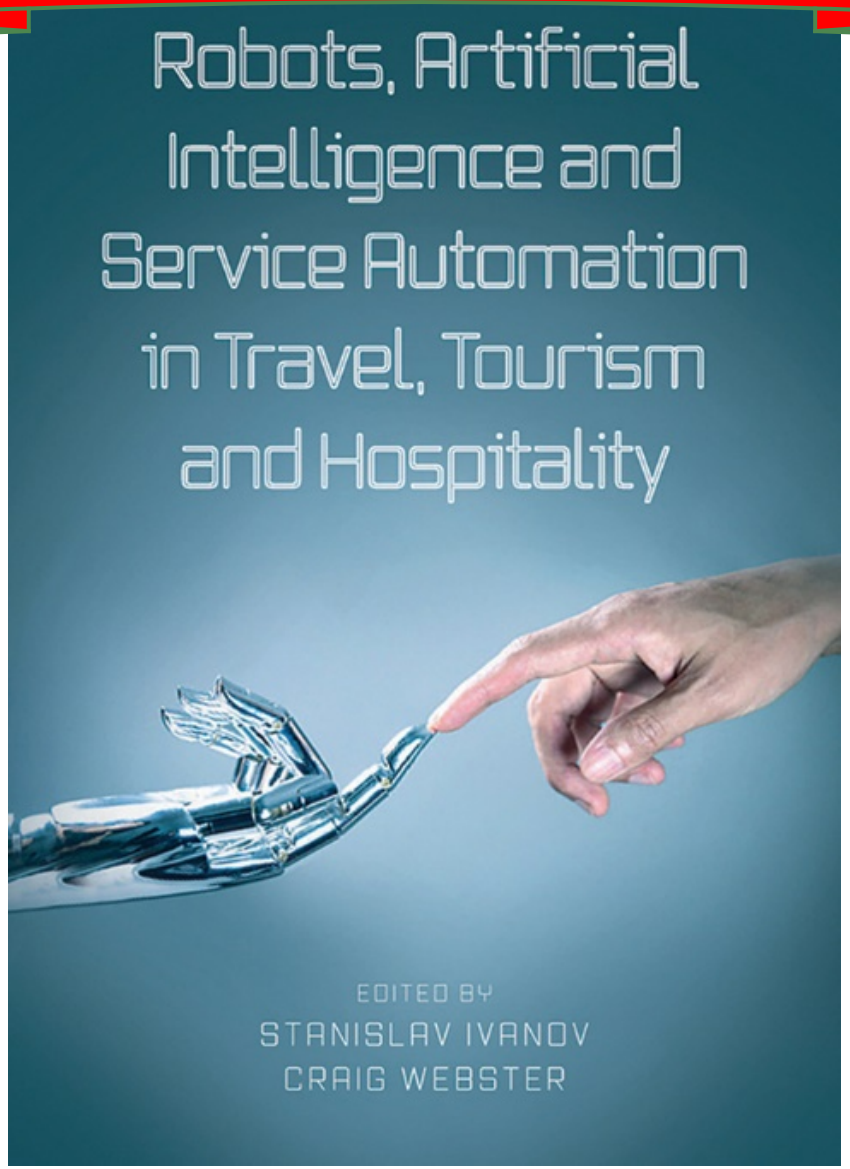
- Editor-in-chief of the *European Journal of Tourism Research* (http://ejtr.vumk.eu)
- CEO of *Zangador Ltd*. (http://www.zangador.eu)
- Member of *AIEST* (https://www.aiest.org)

# 69th AIEST Conference

*Key facts:*

- Dates: 25th-29th August 2019
- Organiser: Varna University of Management, Varna, Bulgaria
- Venue: Rosslyn Hotel Dimyat 4* (http://dimyat.rosslyn-hotels.com/)
- More information at: https://www.aiest.org/conference/conference-2019-varna/

# Forthcoming on 14th October 2019



# CALL FOR PAPERS

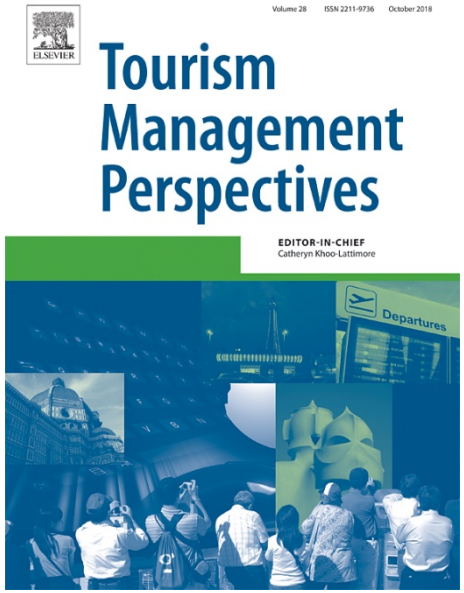

## TOURISM ECONOMICS

Special Issue on "The Economics of Revenue Management in Hospitality and Tourism"

*Guest Editor*

Stanislav Ivanov, Varna University of Management, Bulgaria,

stanislav.ivanov@vumk.eu




**Tourism Management Perspectives**

**Special Issue: Tourism beyond humans - robots, pets and teddy bears**

Editor-in-chief: Catheryn Khoo-Lattimore
Associate Editor: Babak Taheri

**Special Issue Editors:**

**Stanislav Ivanov**, Professor in Tourism and Vice Rector (Research), Varna University of Management, Bulgaria

**Ulrike Gretzel**, Senior Fellow, USC Center for Public Relations, Annenberg School of Communication & Journalism, University of Southern California, USA

**Ian Yeoman**, Associate Professor, Victoria University of Wellington, New Zealand, and Visiting Professor, European Tourism Futures Institute, The Netherlands

# https://nexttourismgeneration.eu

The Next Tourism Generation (NTG) is a Tourism Sector Skills Alliance for implementing a new strategic Blueprint approach to sectoral cooperation on skills

NTG
Next Tourism Generation Alliance

14 partners represent the whole Tourism sector including specialists in hospitality, food and beverage, travel agencies, attractions and recreation.

The blueprint strategy will respond to skills gaps in tourism and hospitality, especially soft skills and emerging skill needs in digital and sustainability applications

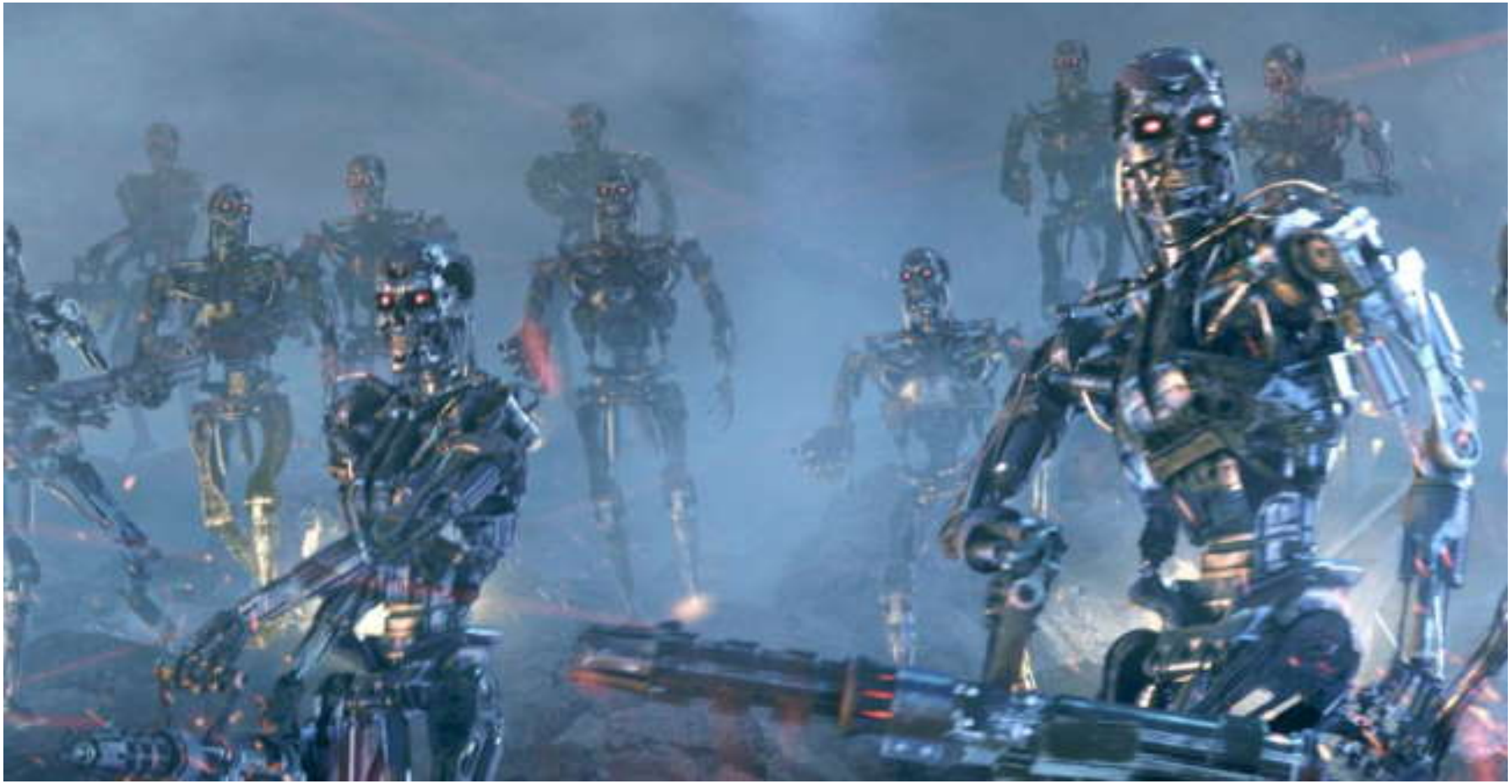
NTG project will concentrate upon to bridge the gap between education and industry and progress the skills needed

Co-funded by the Erasmus+ Programme of the European Union

# Robots, AI and automation technologies have arrived …

Source: http://vignette4.wikia.nocookie.net/starwars/images/c/c8/Counterparts.jpg

https://en.wikipedia.org/wiki/BB-8



Source: http://vignette2.wikia.nocookie.net/avp/images/4/49/Terminator.jpg

Source: http://www.kurzweilai.net/images/robot-thinking-one.png

# Application of robots, AI and automation technologies

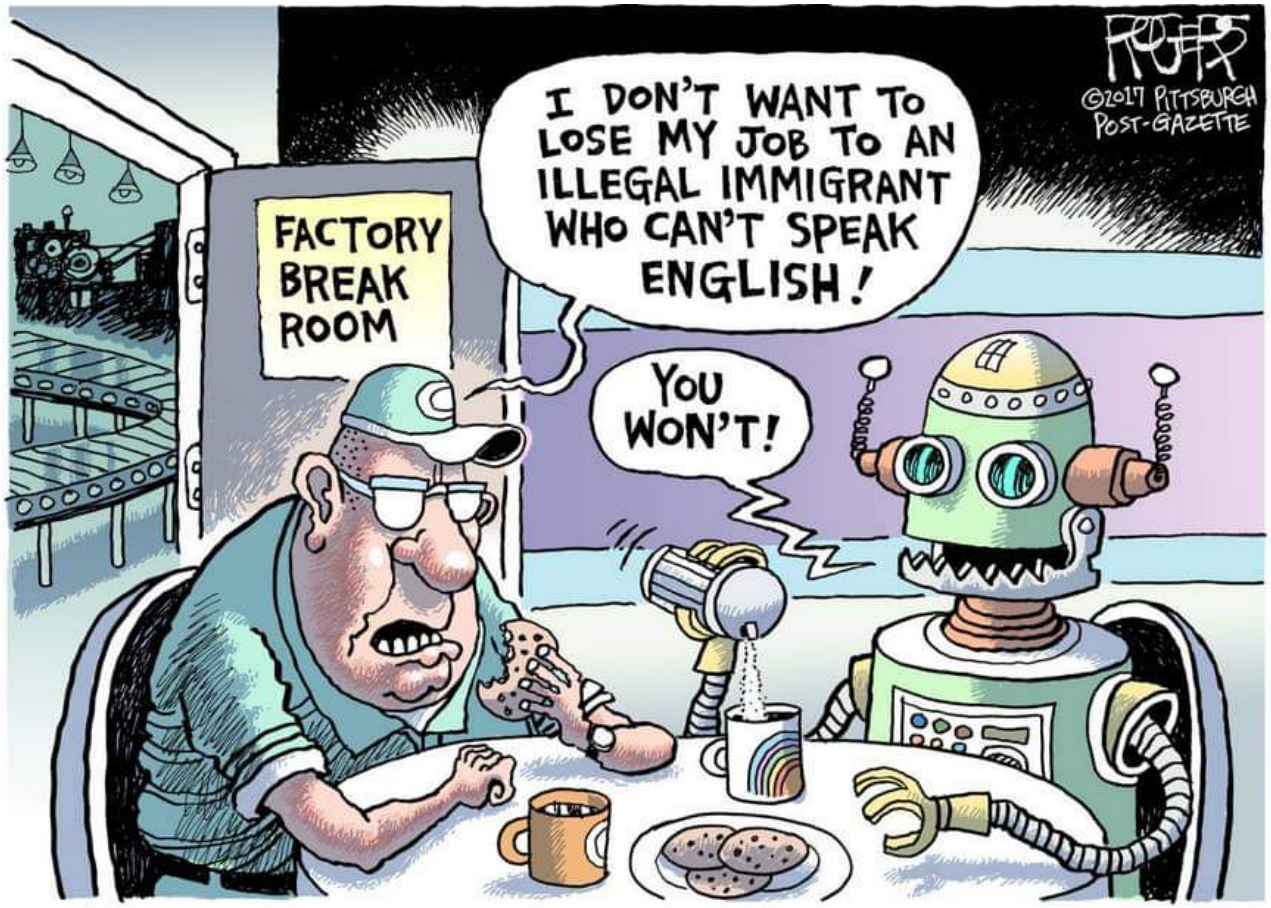
# Application of robots, AI and automation technologies:

- *Manufacturing*

http://www.businesskorea.co.kr/sites/default/files/field/image/Industrial-Robots-Hyundai-Heavy.jpg

# Application of robots, AI and automation technologies:

- *Manufacturing*



# Application of robots, AI and automation technologies:

- *Warehousing, supply and logistics*

https://abm-website-assets.s3.amazonaws.com/inddist.com/s3fs-public/styles/hero/public/featured_image/2017/01/Amazon-Robots.jpg?itok=fhqW-lPW

# Application of robots, AI and automation technologies:

- *Warehousing, supply and logistics*

http://spectrum.ieee.org/automaton/robotics/industrial-robots/german-warehouse-robots-tackle-picking-tasks

# Application of robots, AI and automation technologies:

- *Agriculture*

http://sparc-robotics.eu/wp-content/uploads/2014/05/polni-robot-amazone-bonirob-44e031.jpg

# Application of robots, AI and automation technologies:

- *Transportation / Autonomous cars*


https://media.wired.com/photos/5a6fbe7d68851b1549e7d280/master/w_799,c_limit/Waymo-Minivan.jpg

# Application of robots, AI and automation technologies:

- *Medicine*

http://mediad.publicbroadcasting.net/p/wual/files/styles/x_large/public/201712/xi.jpg

# Application of robots, AI and automation technologies:

- *Warfare*


https://media.defense.gov/2010/Feb/01/2000398487/1088/820/0/090609-F-0000M-777.JPG

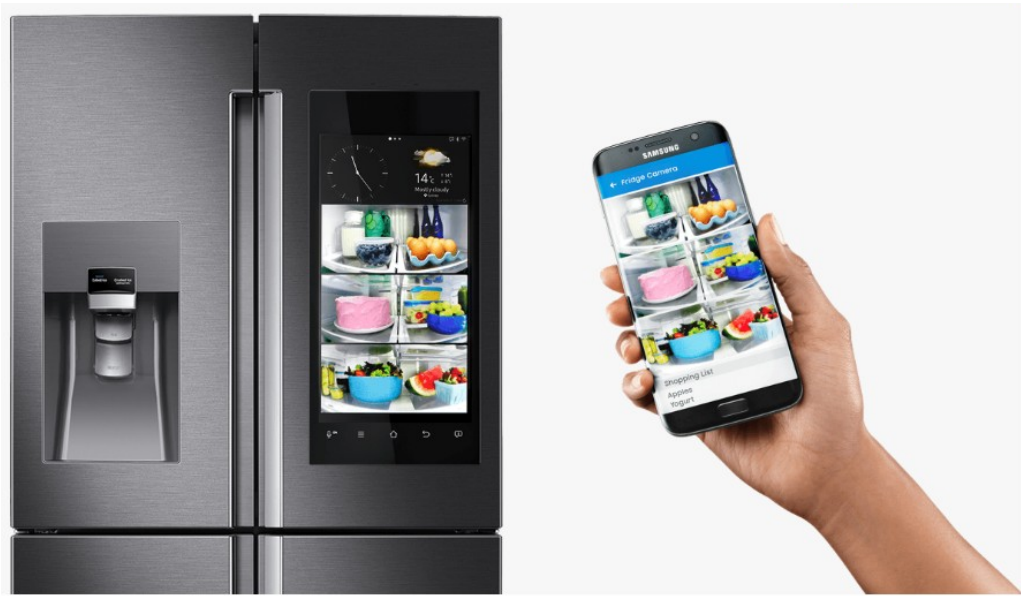
# Application of robots, AI and automation technologies:

- *Legal services*

http://www.kurzweilai.net/will-ai-replace-judges-and-lawyers

# Application of robots, AI and automation technologies:

- *Households*




https://www.samsung.com/au/family-hub-refrigerator/

http://www.roboticstrends.com/images/photos/xiaomi-mi-robot-vacuum.jpg

# Application of robots, AI and automation technologies:

- *Households*

http://www.verifyrecruitment.com/blog/wp-content/uploads/2018/02/IOT-Smart-Home.png

# Application of robots, AI and automation technologies:

- *Swimming pools*
- *Gardens*

Photo credit: Stanislav Ivanov

https://allpools.net/wp-content/uploads/2017/08/2-Various-Types-of-Pool-Cleaners.jpg

# Application of robots, AI and automation technologies:

- *Guards*

http://cdn.hiconsumption.com/wp-content/uploads/2014/11/K5-Security-Guard-Robot-3.jpg

- *Parcel delivery*


https://media.wired.com/photos/5c48c3ab9fa6e032a790af23/master/w_799,c_limit/amazon-scout.jpg

# Application of robots, AI and automation technologies:

- *Education*

Source: https://3e7e6c34hre53ebyea38hmr6-wpengine.netdna-ssl.com/wp-content/uploads/2017/09/nao.png

- *Entertainment*

https://robots.nu/img/uploads/2018/08/10/Vector%2C%20adorable%20robot%20from%20Anki.jpg

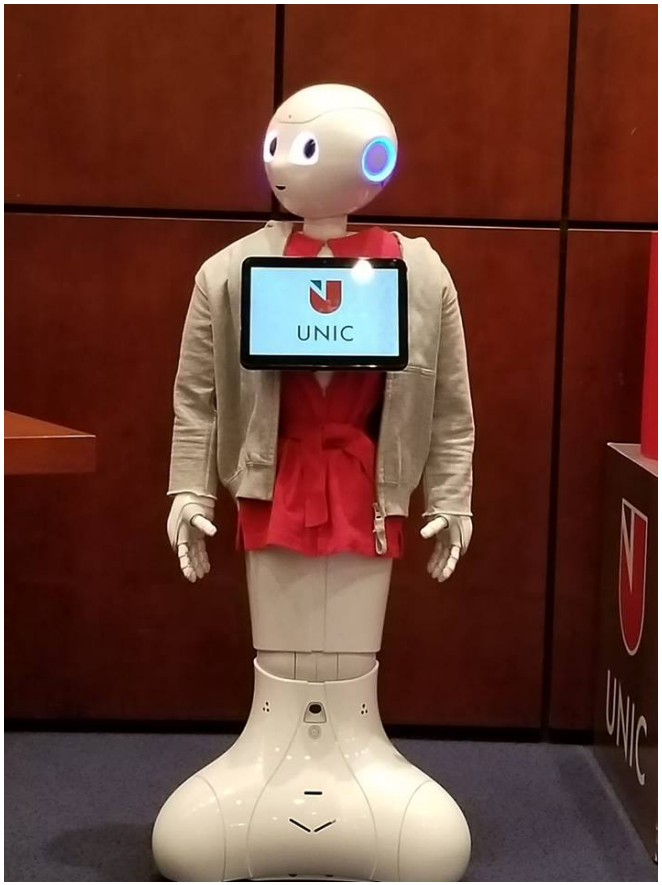
# Application of robots, AI and automation technologies:

- *Information provision in service industries*


Photo credit: Stanislav Ivanov

# Application of robots, AI and automation technologies:

- *Smart-looking and attentive robotic students!*




Source: Ulrike Gretzel

# Application of robots, AI and automation technologies:

- *Cucumbers cutting robots*


Special slide for Ulrike Gretzel ☺

# Application of robots, AI and automation technologies:

- *Sex services*

18+

https://surgefs.imgix.net/quality=v:80/K25JiHV0QUKIXCo9usln?auto=format&ixlib=imgixjs-3.3.2&w=1000

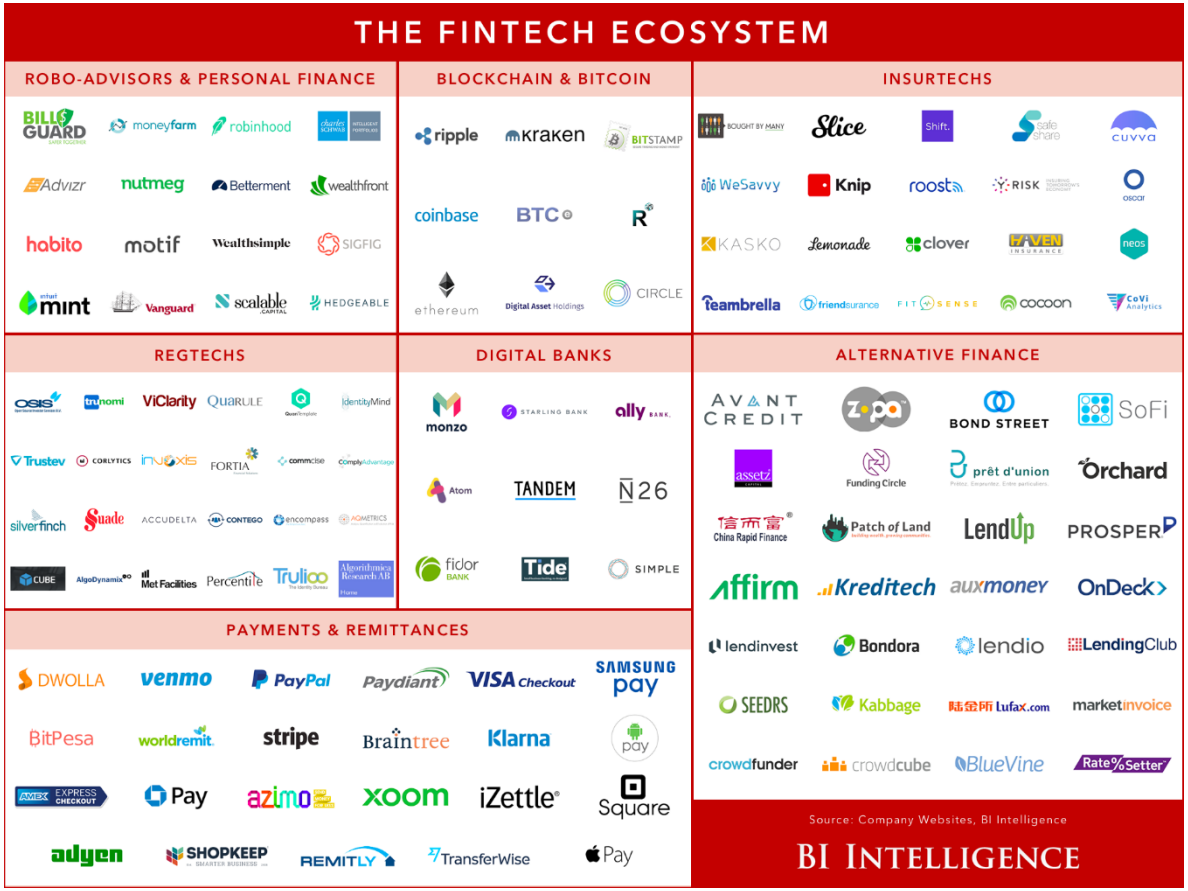

https://www.vanguardngr.com/wp-content/uploads/2018/02/Sex-robot-2.png

# Application of robots, AI and automation technologies:

- *Search engines*
- *E-commerce*


# Application of robots, AI and automation technologies:

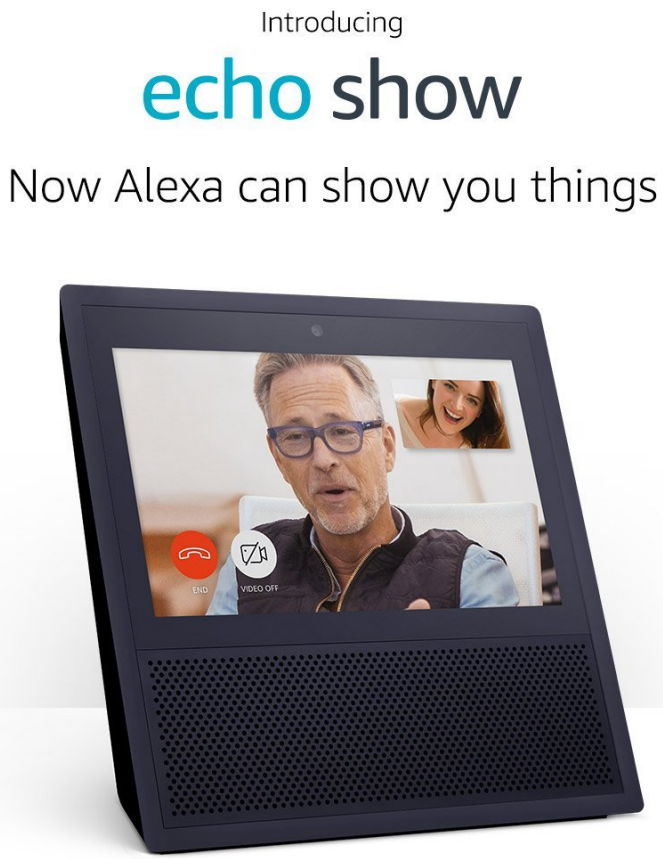
- *Finance*




http://static3.businessinsider.com/image/581cd80d46e27a2e008b4cf3-1920/fintech-ecosystem-diagram.png

# Application of robots, AI and automation technologies:

- *Digital assistants*





Skills add even more capabilities like ordering a pizza from Domino's, requesting a ride from Uber, opening your garage with Garageio, and more. Enabling skills lets your Echo do even more—simply discover and enable the skills you want to use in the Alexa App.

New skills are being added all the time. You can also see ratings and reviews to learn what other customers are saying about the thousands of skills available in the Alexa App. Discover and enable skills.

*"Alexa, tell Garagio to close my door."*

*"Alexa, ask Automatic if I need gas."*

*"Alexa, ask HuffPost for headlines."*

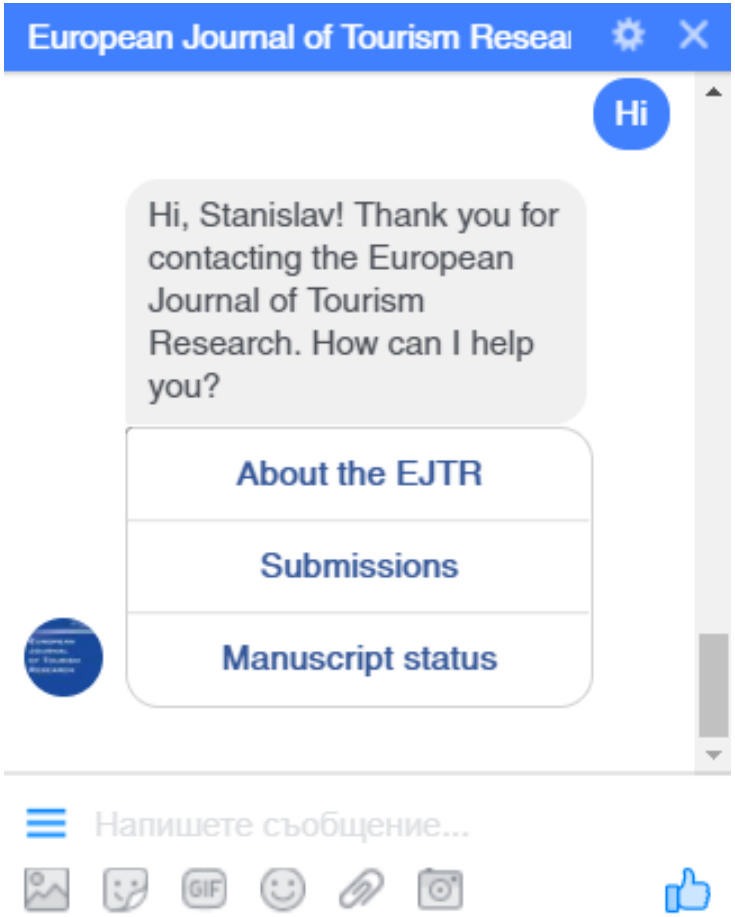
*"Alexa, ask TV Shows what time does The Walking Dead start?"*

*"Alexa, ask Campbell's Kitchen for a recipe."*

*"Alexa, ask Fidelity, how is the NASDAQ doing today?"*

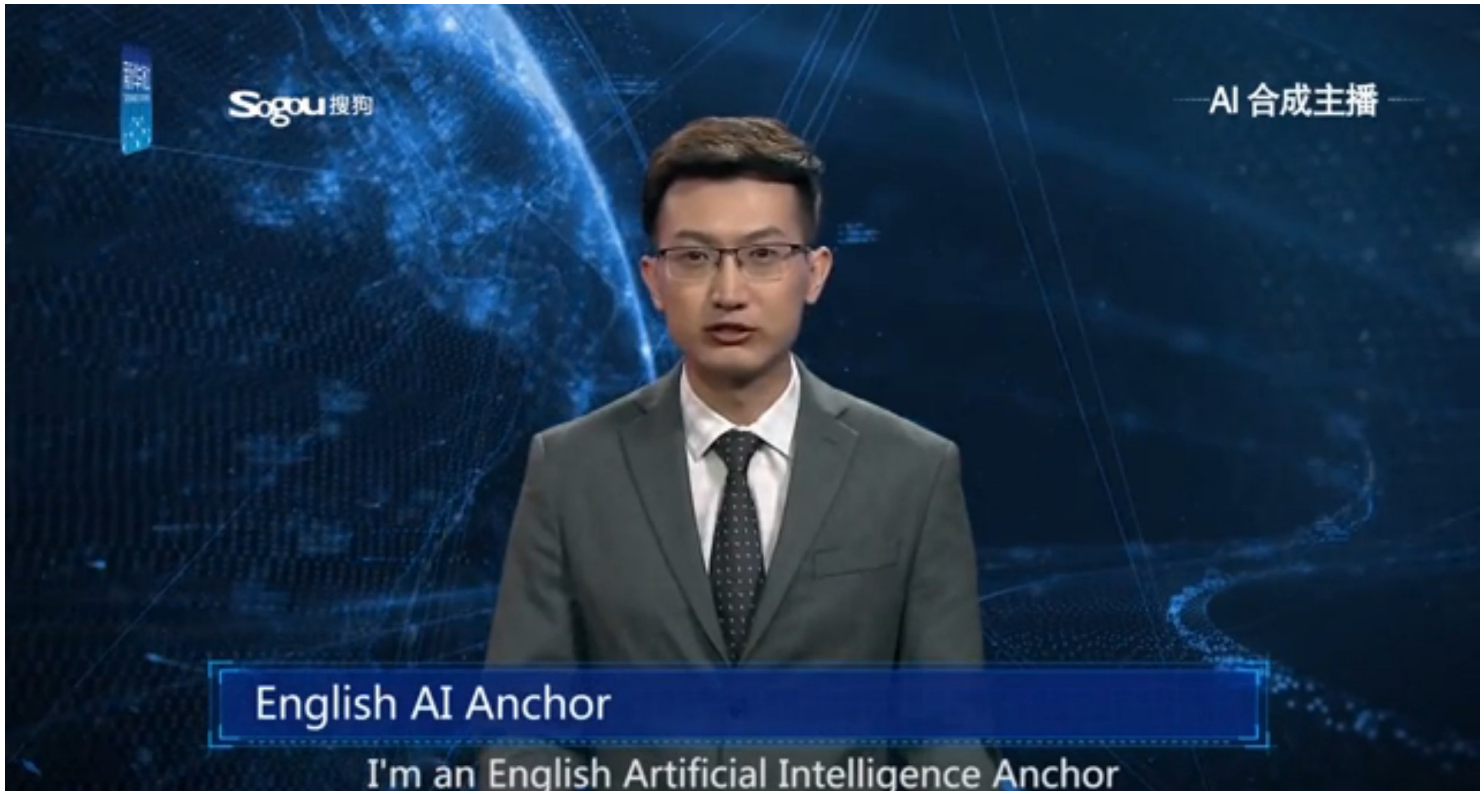
# Application of robots, AI and automation technologies:

- *Social media chatbots*



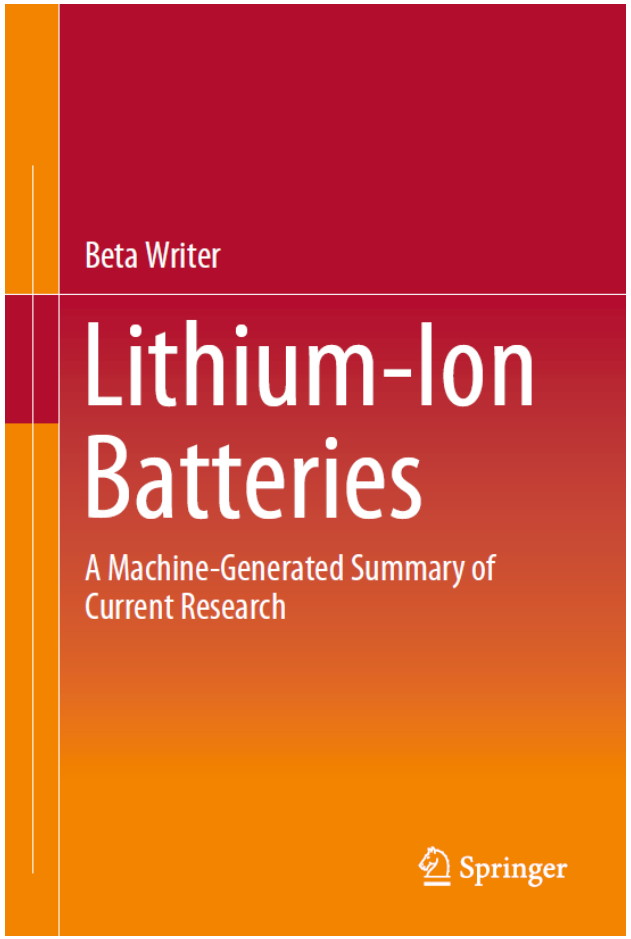
# Application of robots, AI and automation technologies:

- *Journalism*



# Application of robots, AI and automation technologies:

- *Academic research*



# Application of robots, AI and automation technologies:

- *Retail*


https://www.mark-up.it/wp-content/uploads/sites/3/2016/03/60273bf8cee75ed9a721e642cda0c43e.jpg

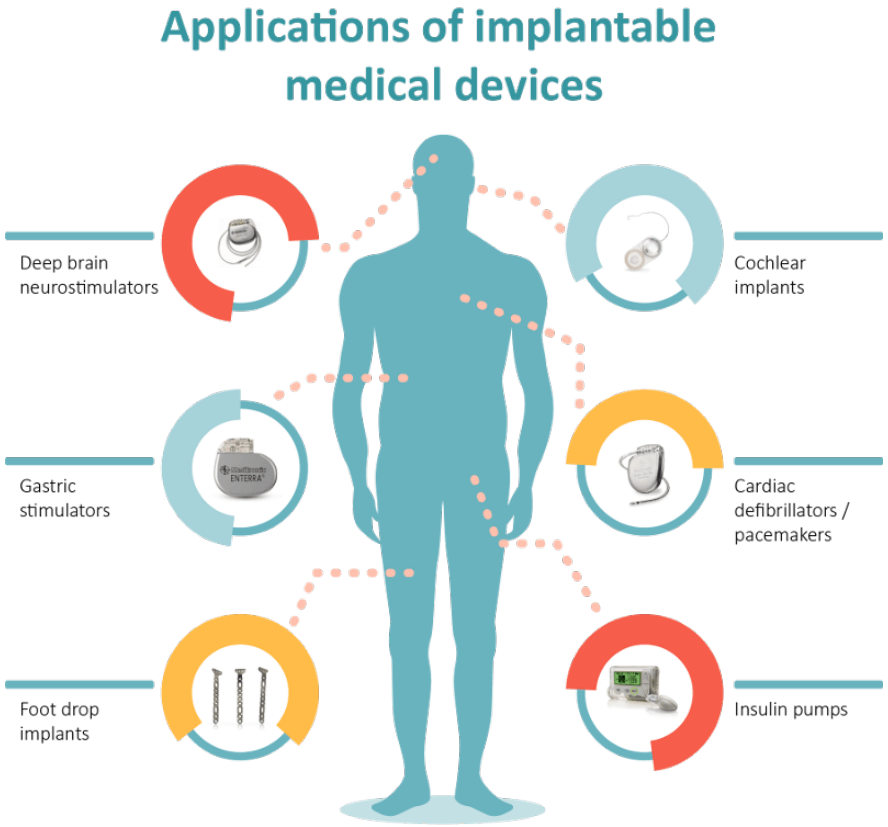
# Application of robots, AI and automation technologies:

- *Wearable technology*


http://www.crewtoo.com/wp-content/uploads/2015/08/technology.jpg

# Application of robots, AI and automation technologies:

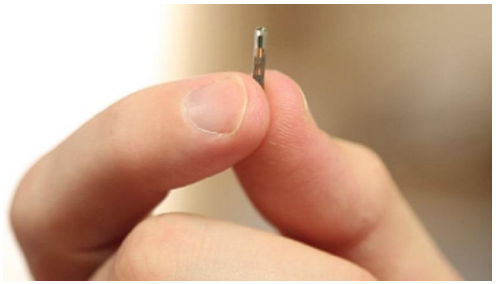
- *Implantable technology*




https://2wpb9mpgou83870m43d4f7bp-wpengine.netdna-ssl.com/wp-content/uploads/2017/08/Applications-of-implantable-medical-devices-s.png

# Application of robots, AI and automation technologies:

- *Human microchip implants*



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https://static.independent.co.uk/s3fs-public/thumbnails/image/2017/04/06/15/an119077210epa05887654-a-pi.jpg

https://am14.akamaized.net/med/cnt/uploads/2017/04/2015-02-26-YouTube-Microchip-768x432.jpg

The tendency to use RAIA in the production of goods and services will accelerate in the future until society reaches a point when all (or an overwhelming share of) goods and services are produced by RAIA with limited human involvement. Such an economic system, based on robots, artificial intelligence and (service) automation, is called '*robonomics*'

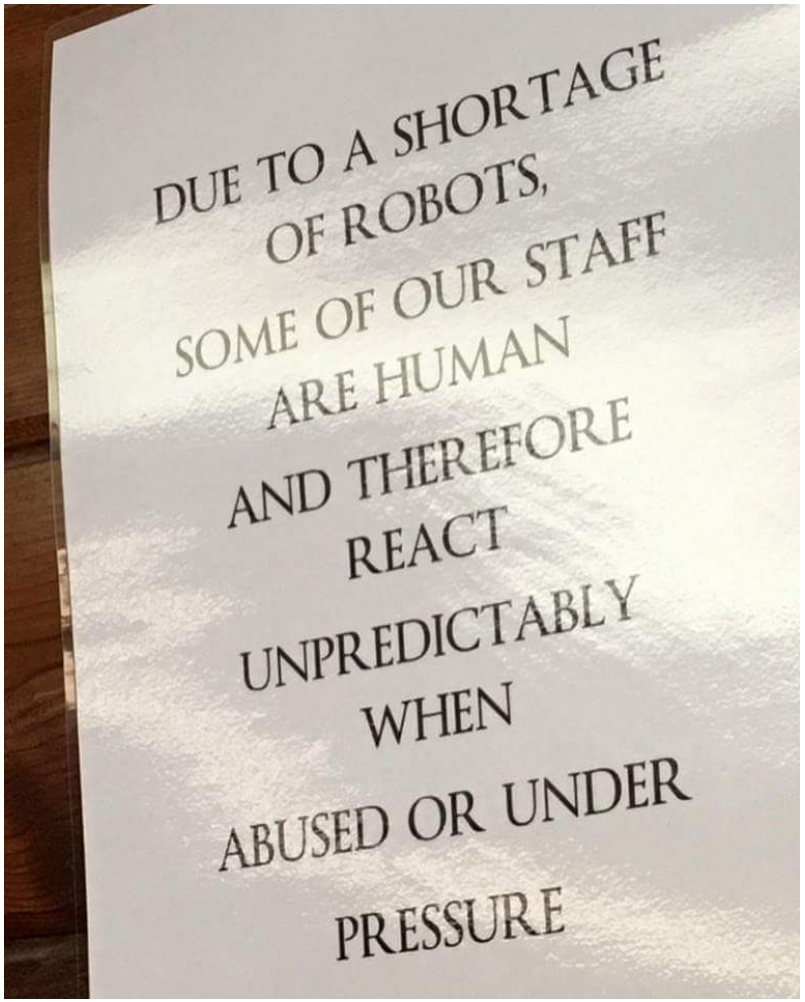
*Robonomics* is an economic system that uses robots, artificial intelligence and (service) automation technologies as production factors, instead of human labour.

# Why RAIA technologies? (1)

- RAIA could work 24/7
- RAIA could implement various tasks and expand their scope with software and hardware upgrades
- RAIA could provide constant or improving quality of their work
- RAIA could fulfil their work correctly and in a timely manner
- RAIA could do routine work repeatedly

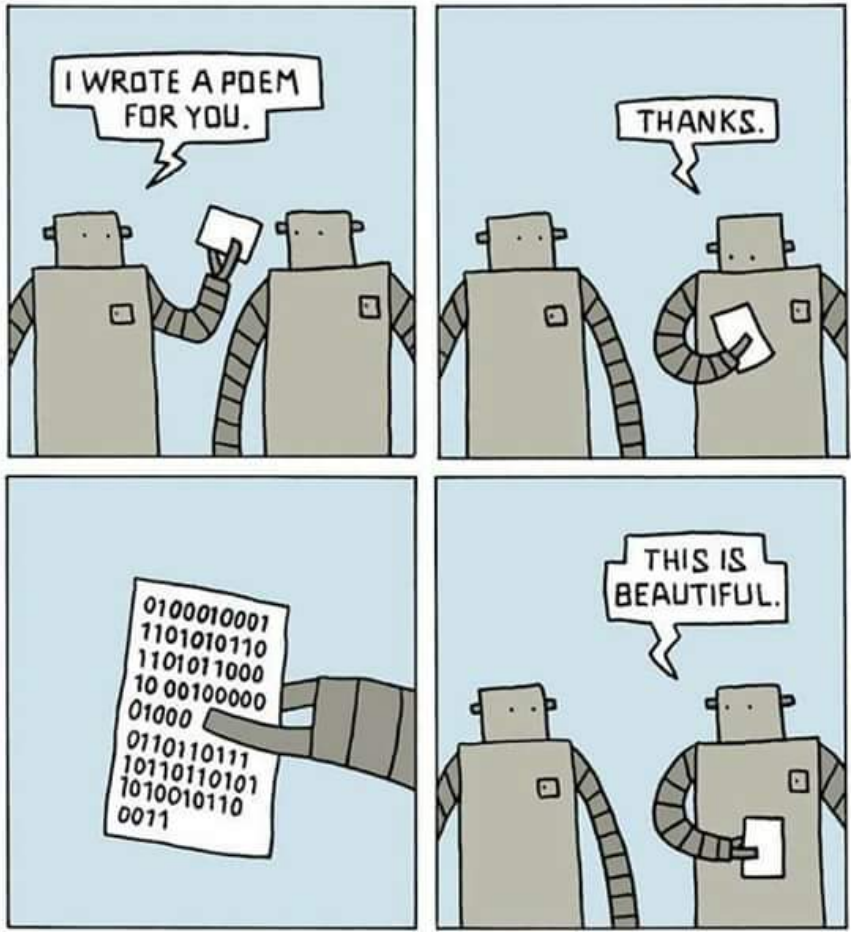
# Why RAIA technologies? (2)

- RAIA do not complain, get ill, go on strikes, spread rumors, discriminate, quit their job without notice, show negative emotions, shirk from work



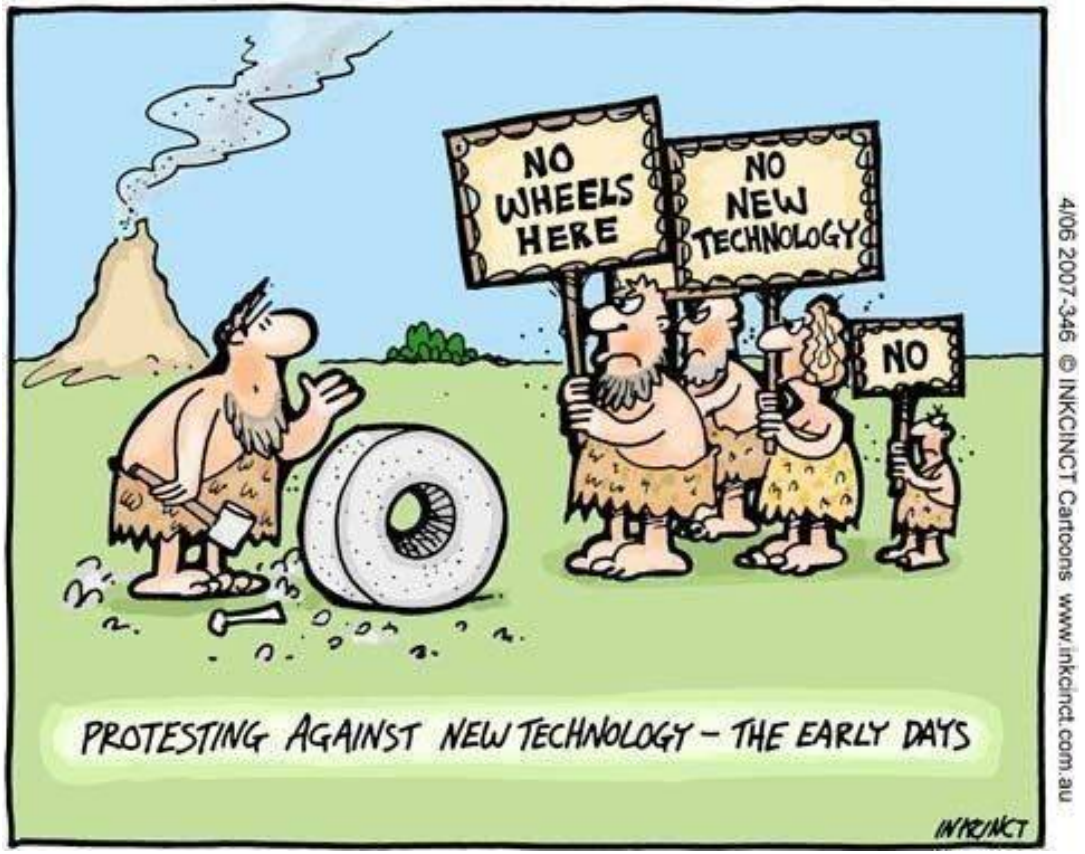
# Why not RAIA technologies? (1)

- RAIA lack creativity



# Why not RAIA technologies? (2)

- RAIA may (will) be perceived as threat by human employees (e.g. Neo-Luddism movement)



# Why not RAIA technologies? (3)

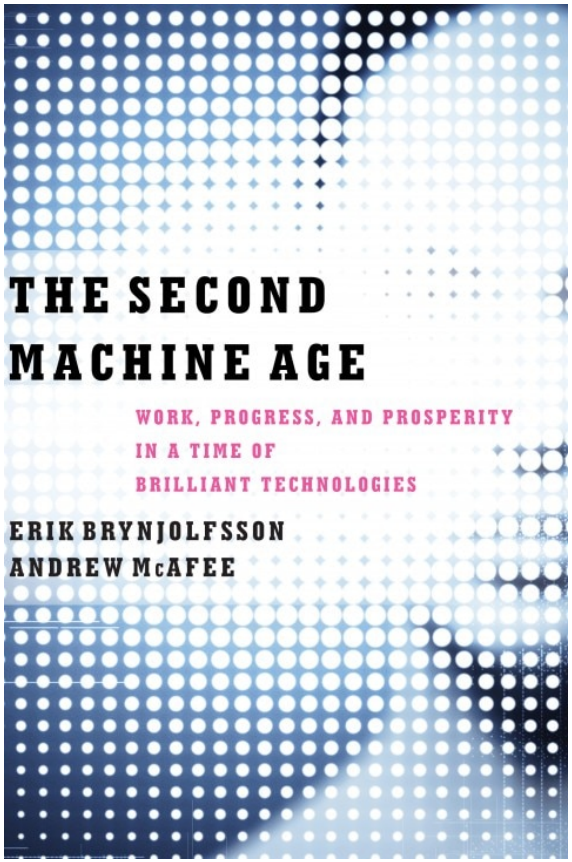
- RAIA will not be any time soon completely independent of human supervision
- RAIA lack personal approach
- RAIA can orientate in structured situations (at least for the moment)

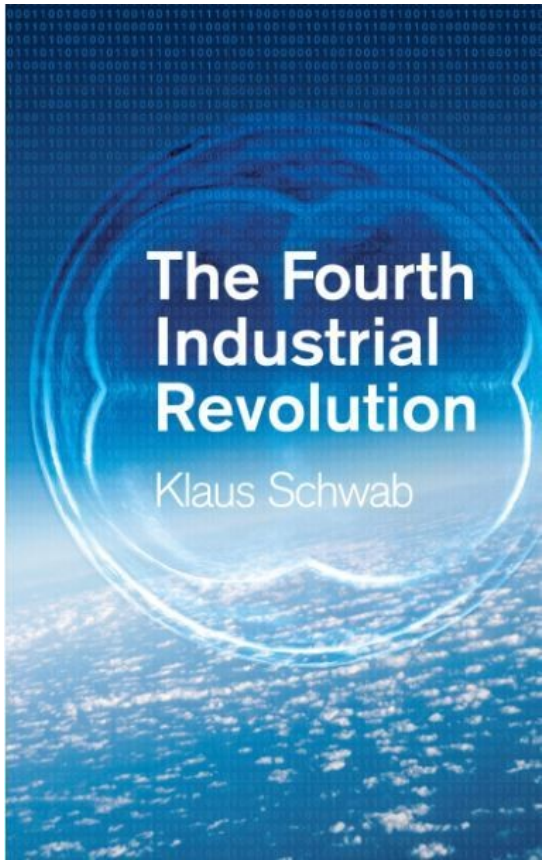
# Prior studies

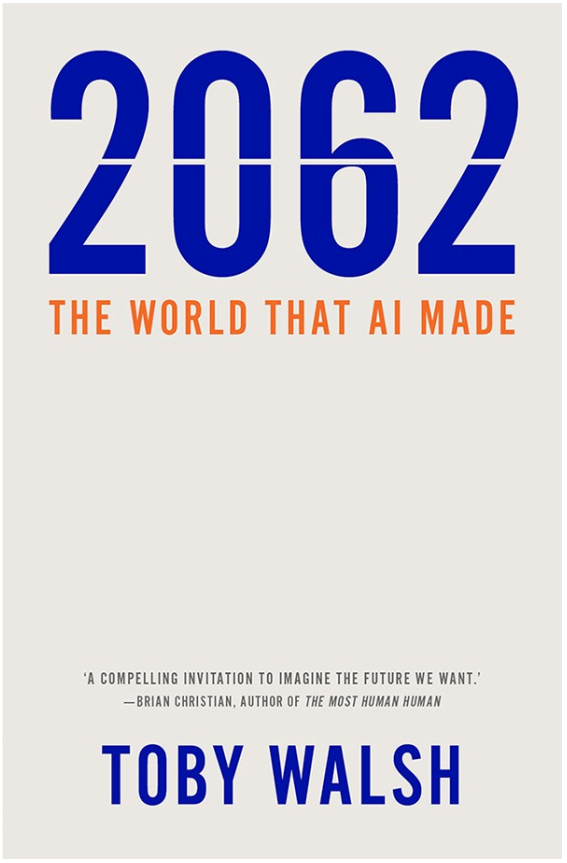
# Prior studies
## *Opposing views of technological progress*

- Researchers' attitudes towards RAIA range from the positive appraisal of liberating humans of manual labour and creating new business opportunities (Brynjolfsson & McAfee, 2014; Frank, Roehring & Pring, 2017; LaGrandeur & Hughes, 2017; Talwar, 2015) to fear of pauperising and making humans obsolete in a fully robotised society (Barrat, 2013; Crews, 2016; Leonhard, 2016).

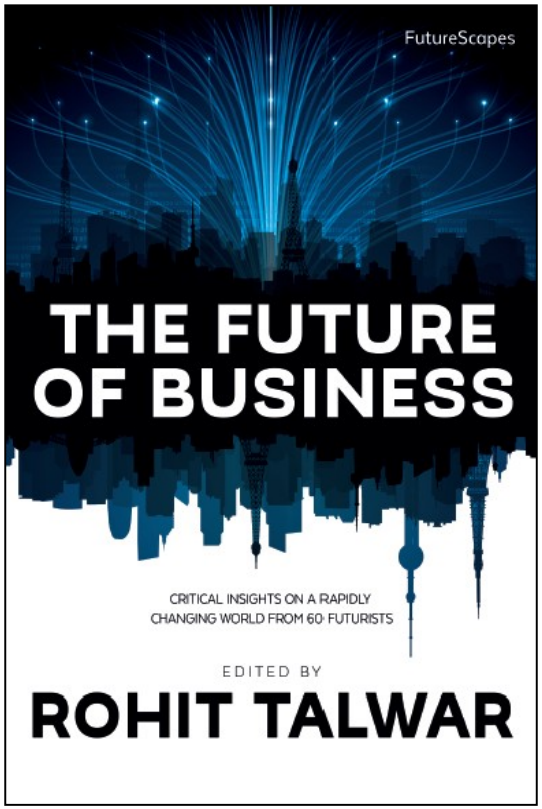
# Prior studies
## *The optimists*



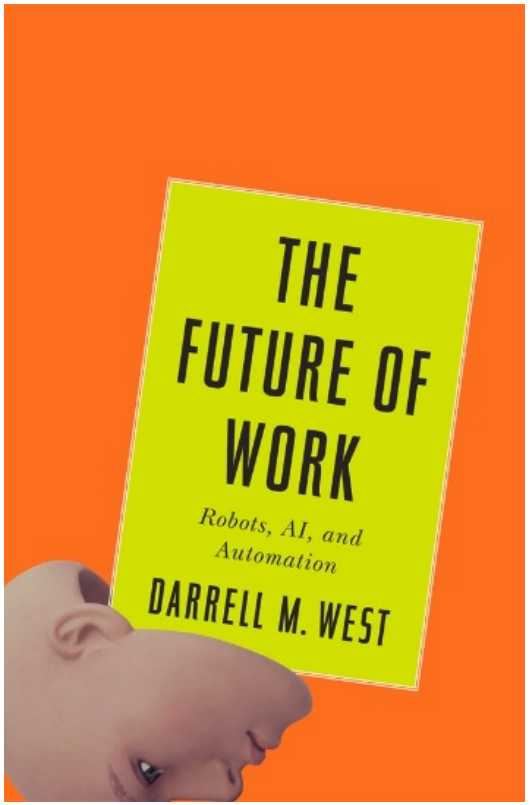



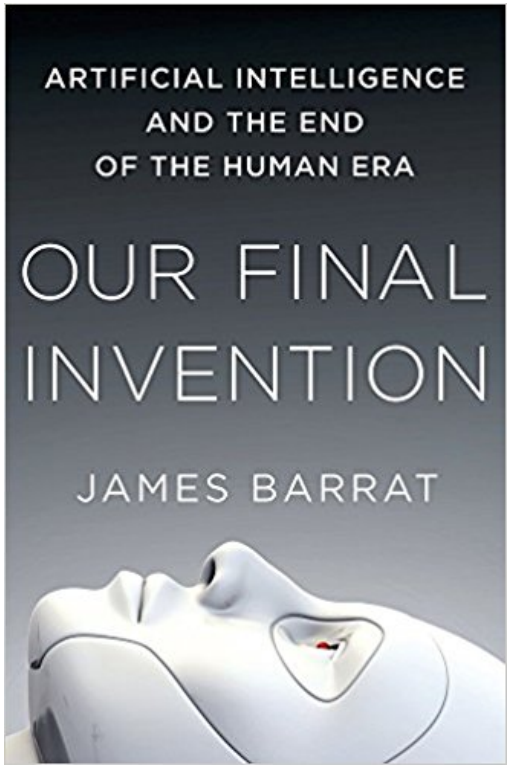
# Prior studies
## *The optimists*

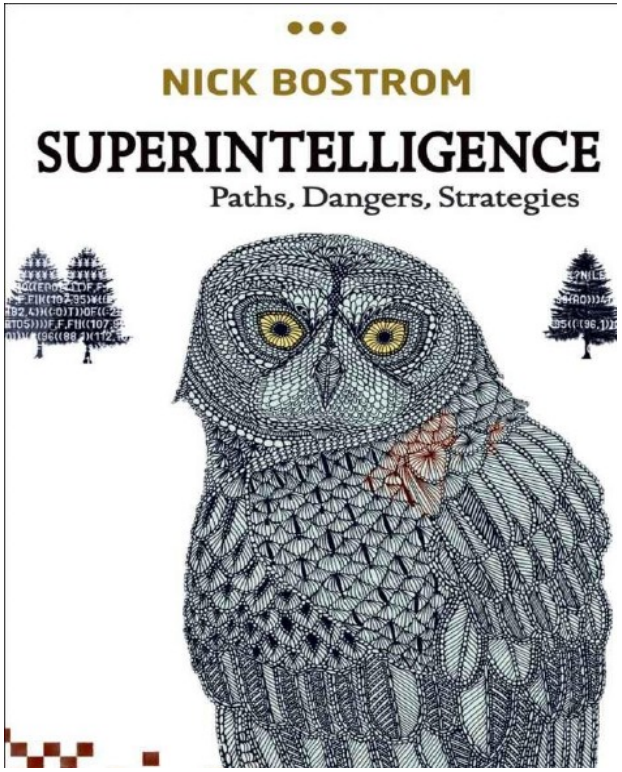


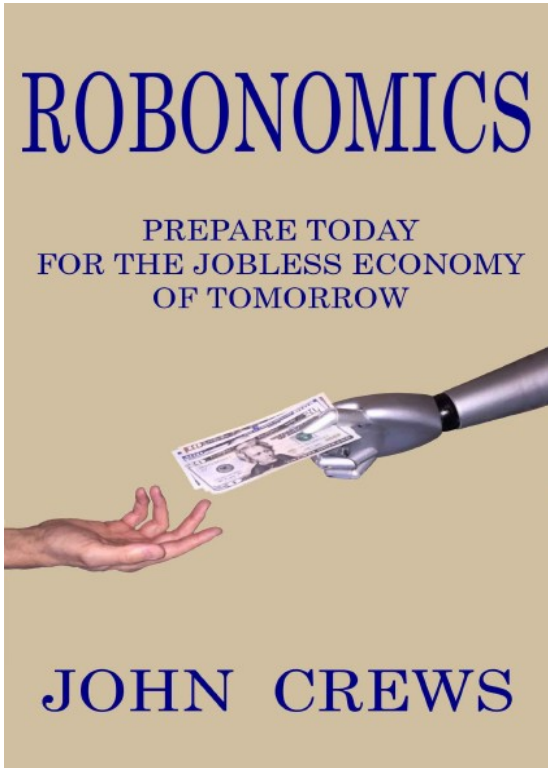




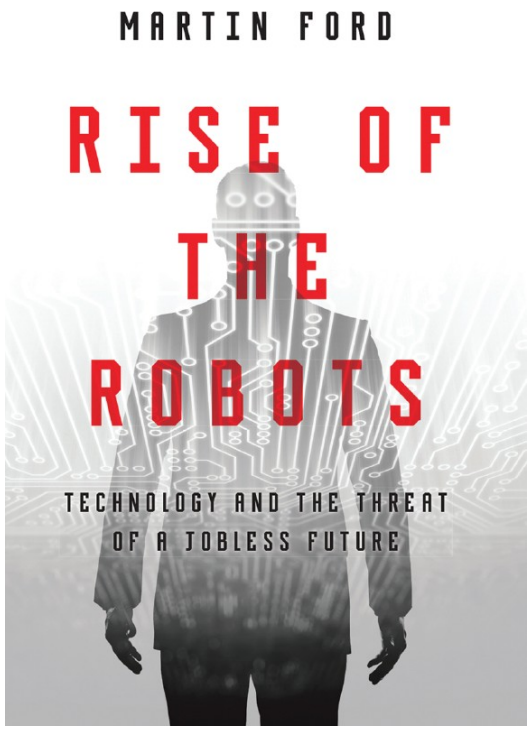
# Prior studies
## *The pessimists*



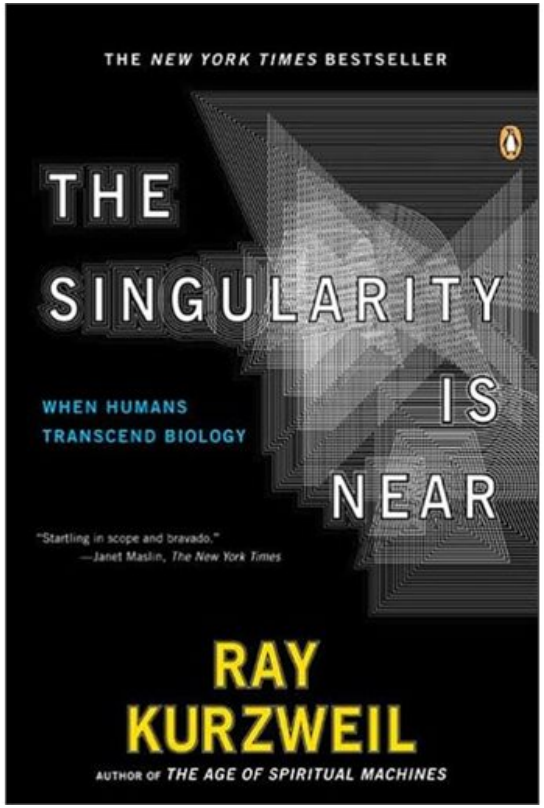



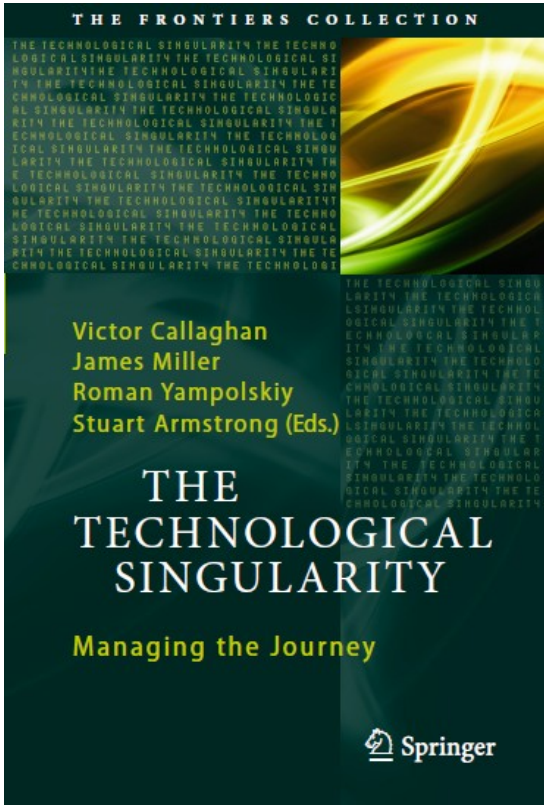



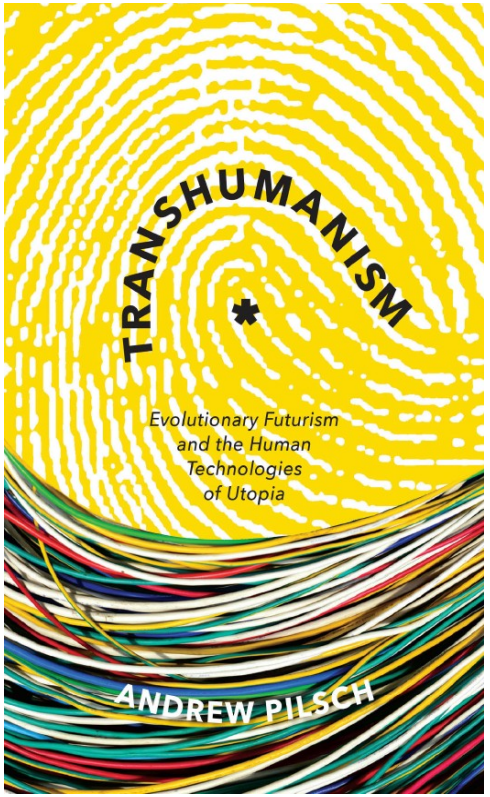
# Prior studies
## *The pessimists*

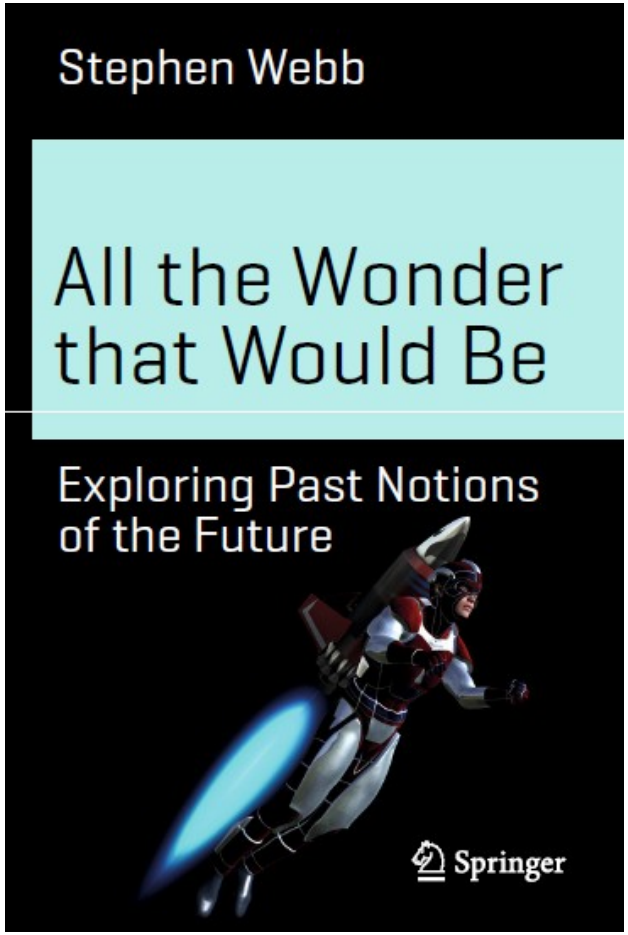
# Prior studies
## *The transhumanists …*



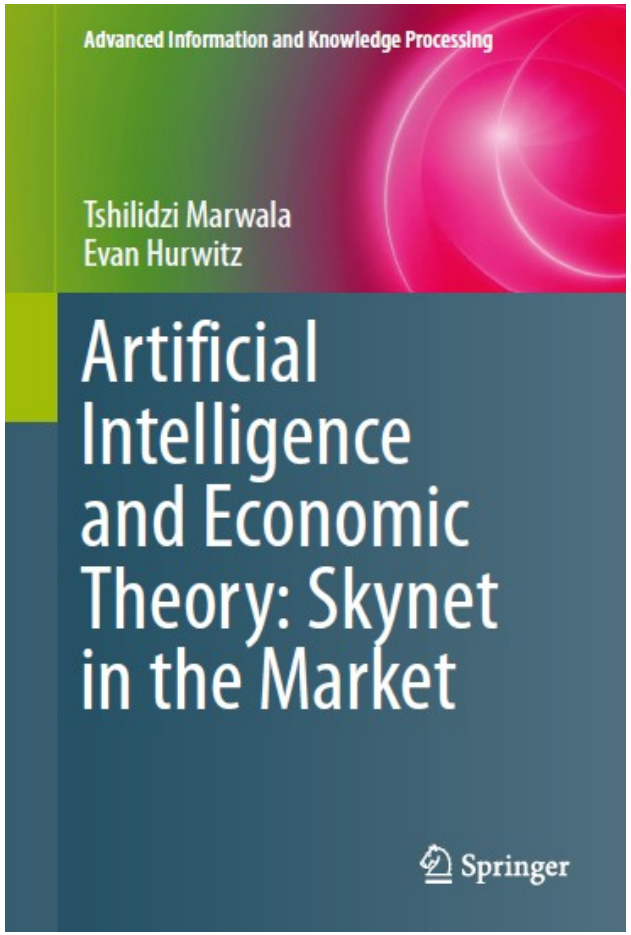



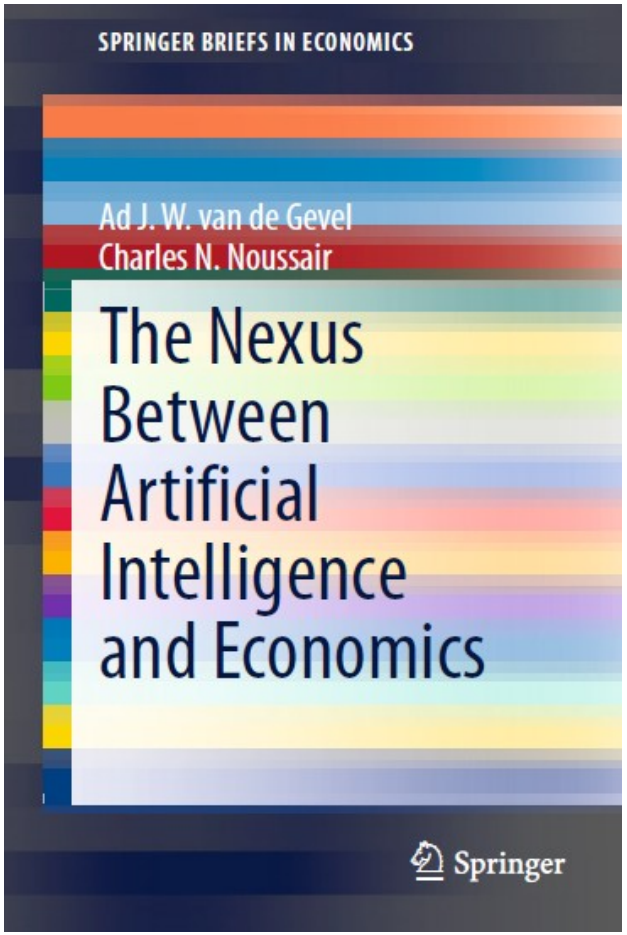



# Prior studies
# … *and the disillusionment*

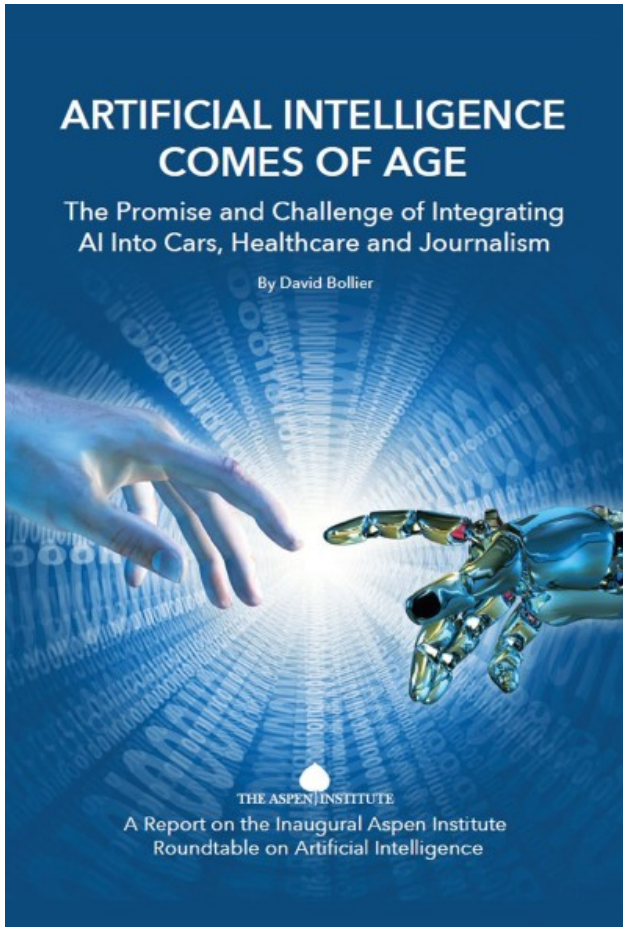



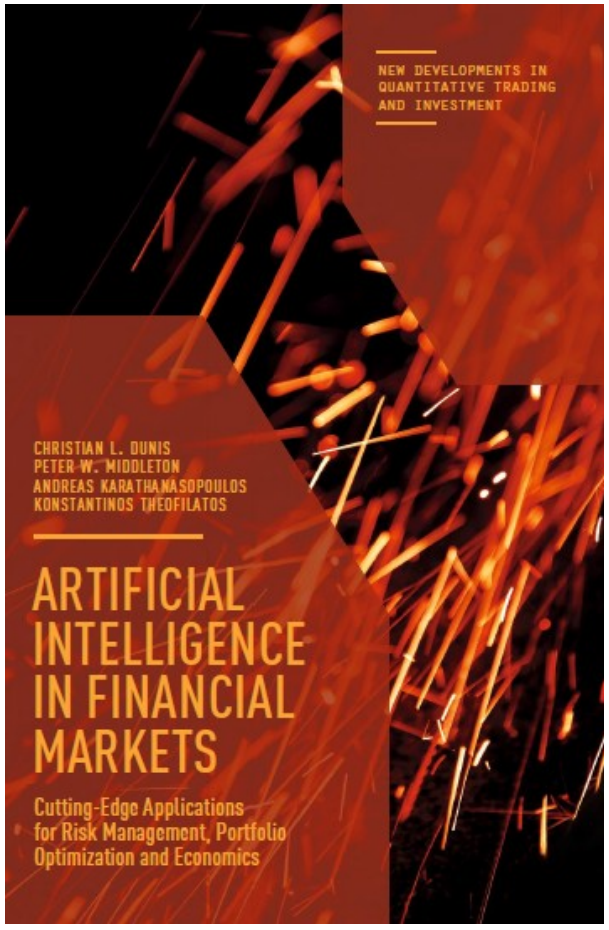
# Prior studies
## *Economics*

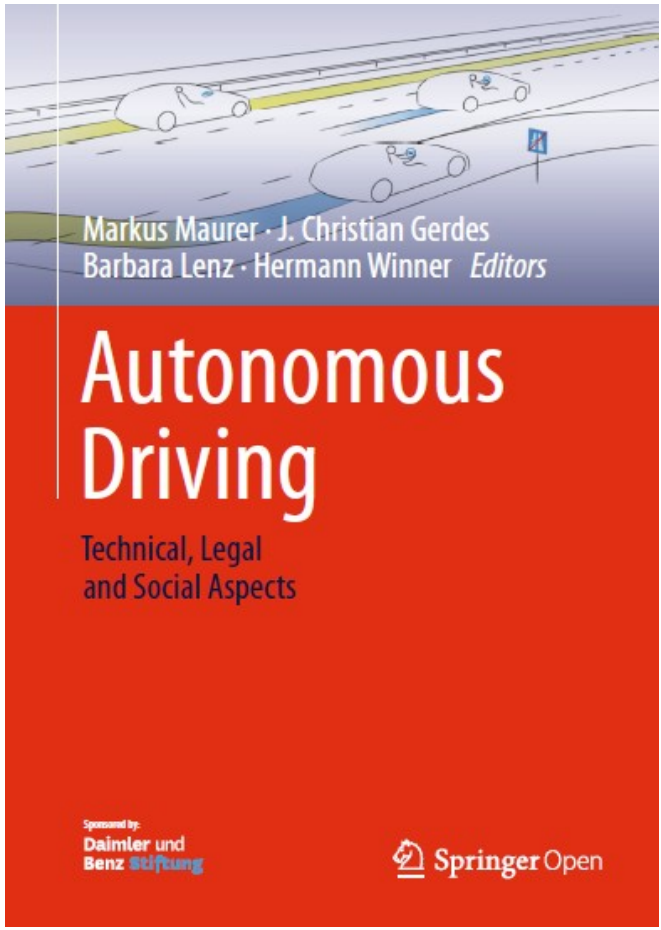


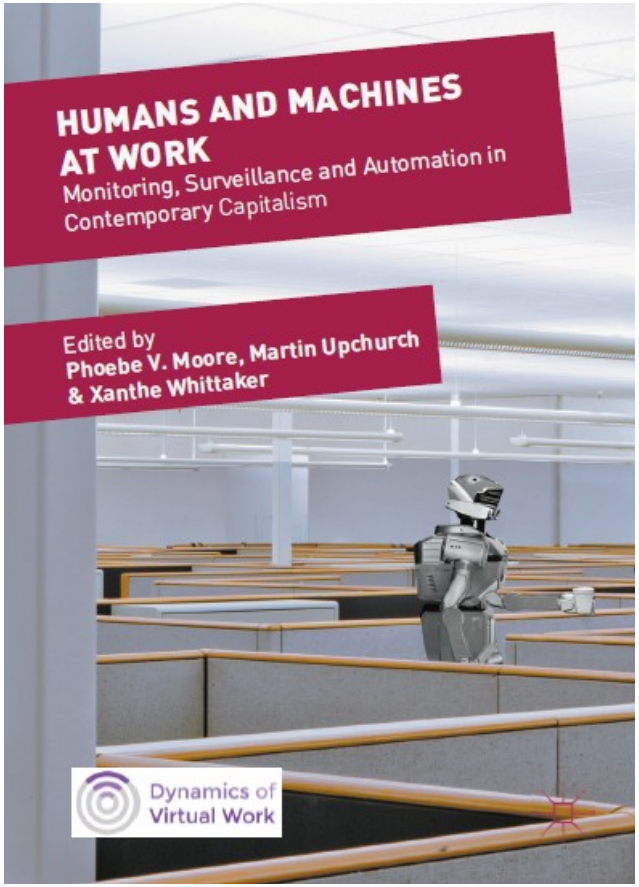
# Prior studies
## *Industry focus*

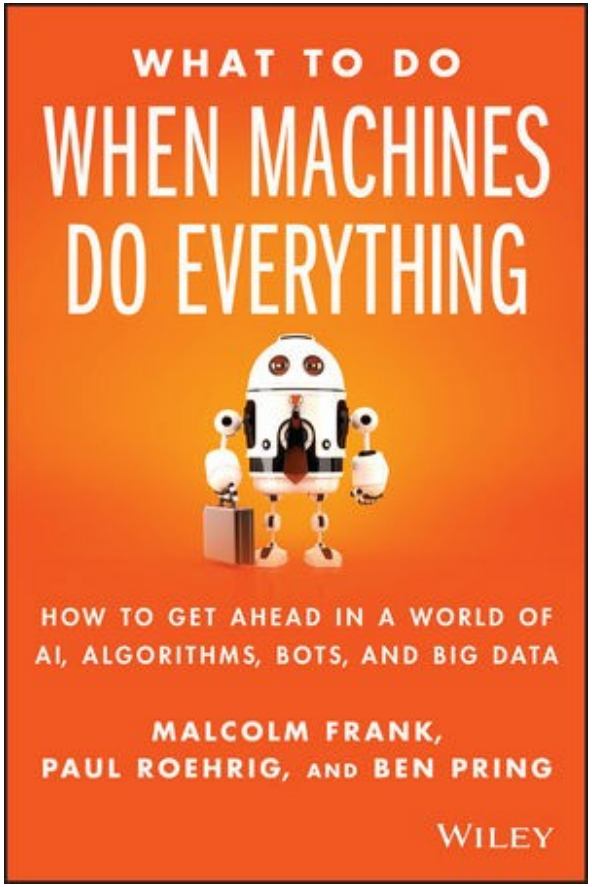


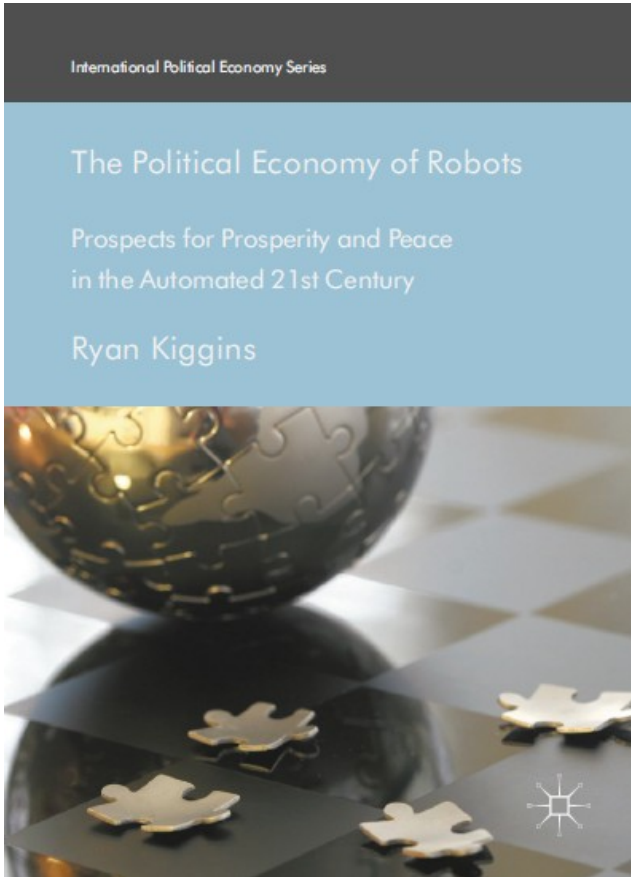



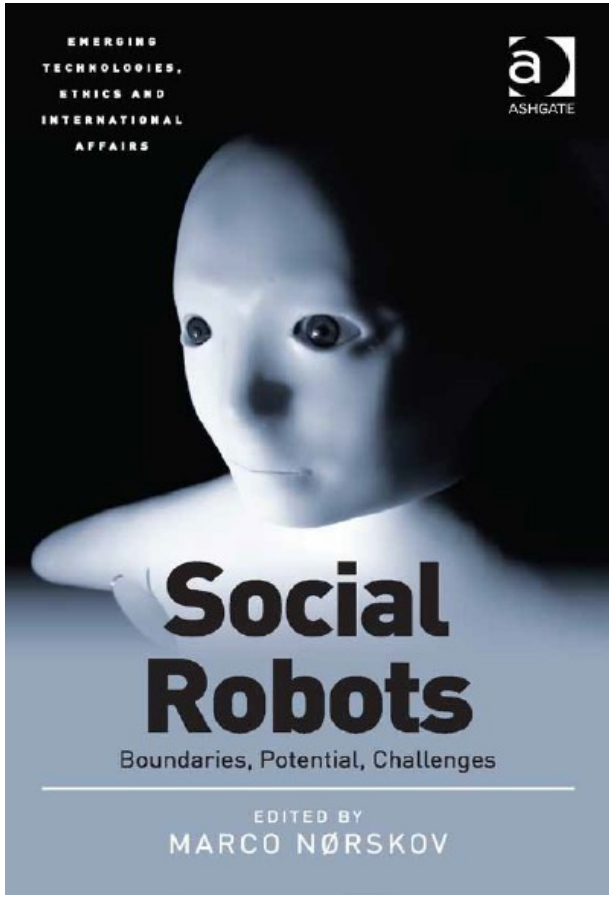
# Prior studies
## *The political economy of robots and the future of work*

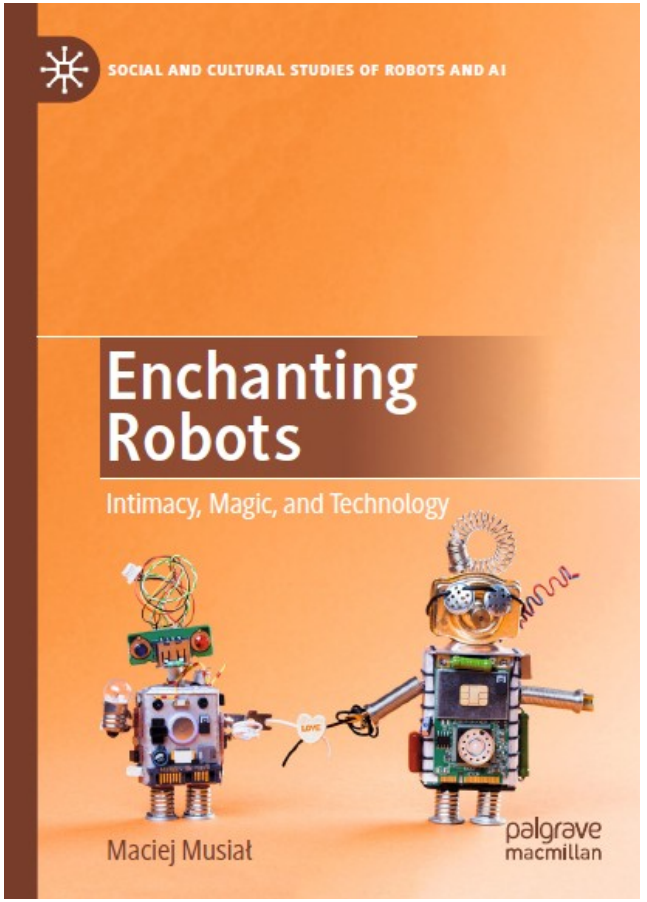


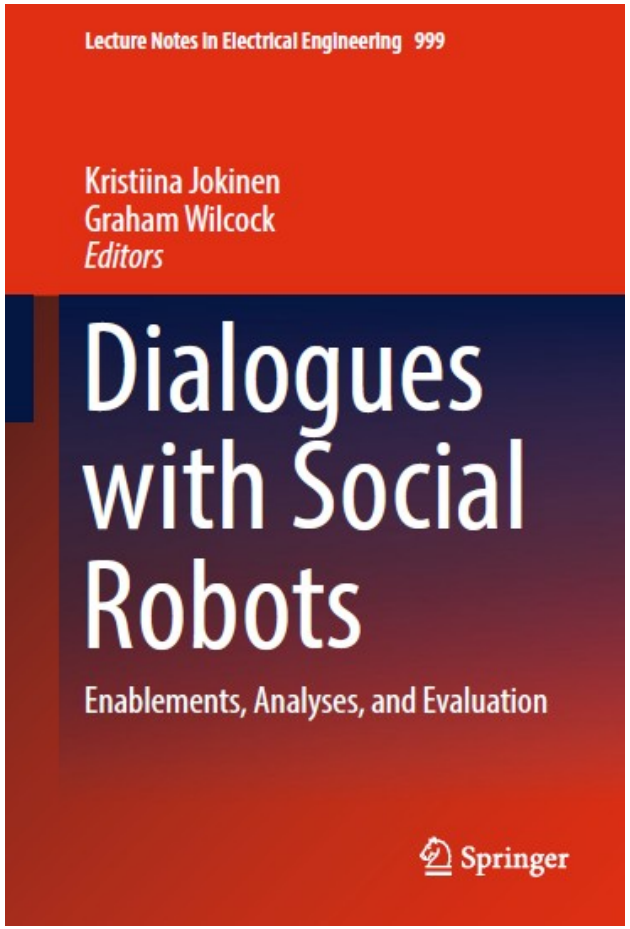



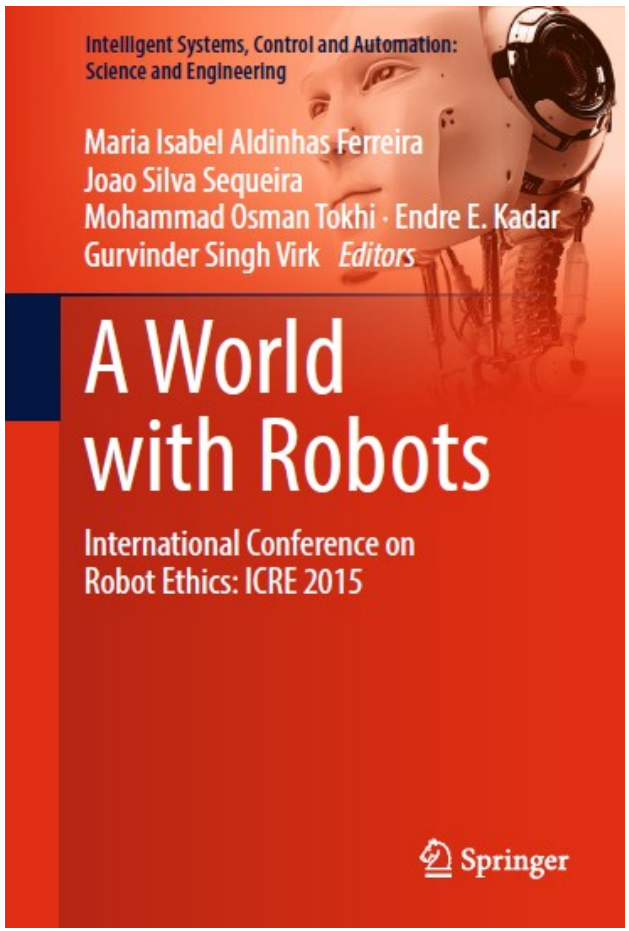
# Prior studies
## *Robots everywhere*

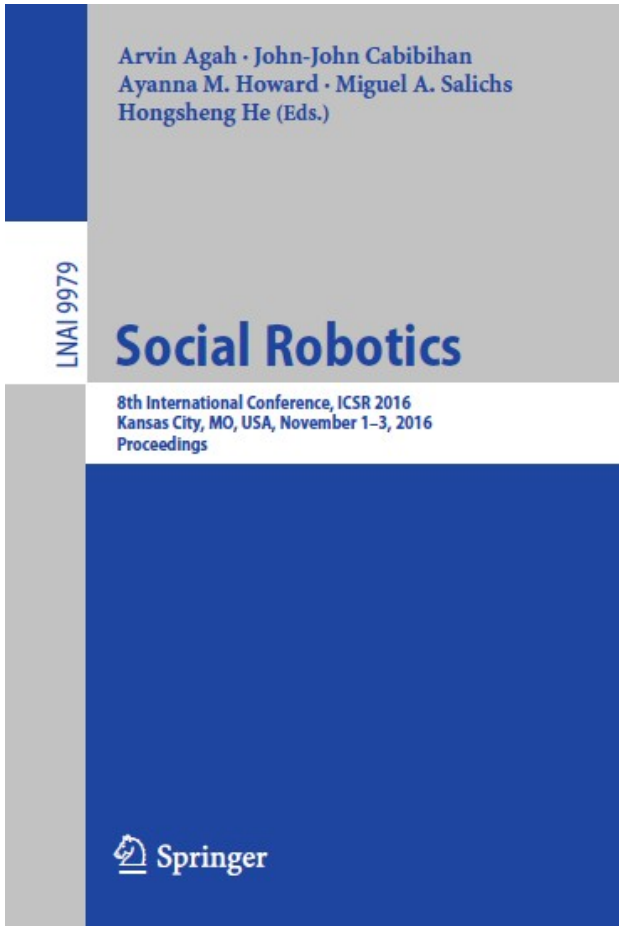



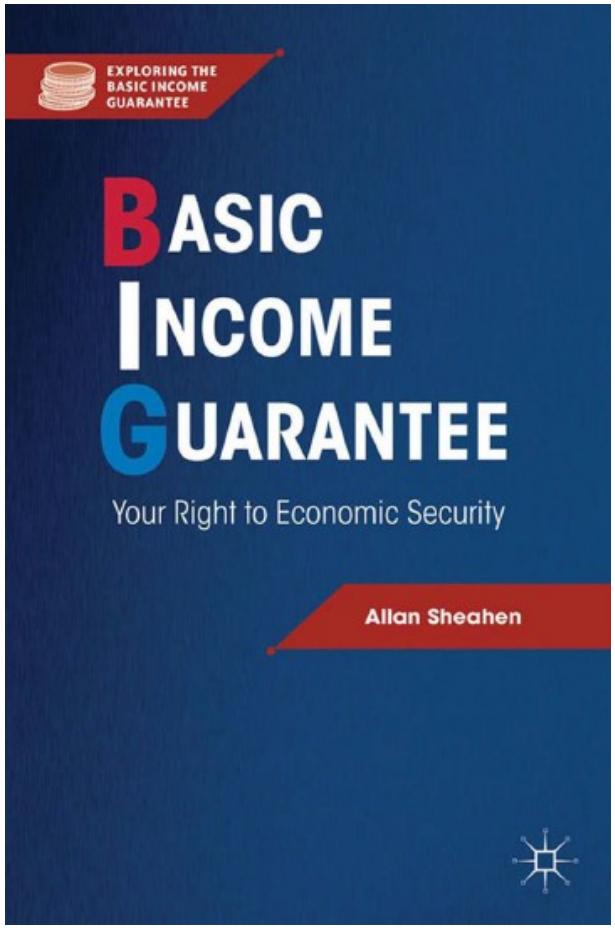
# Prior studies
## *Conference proceedings*

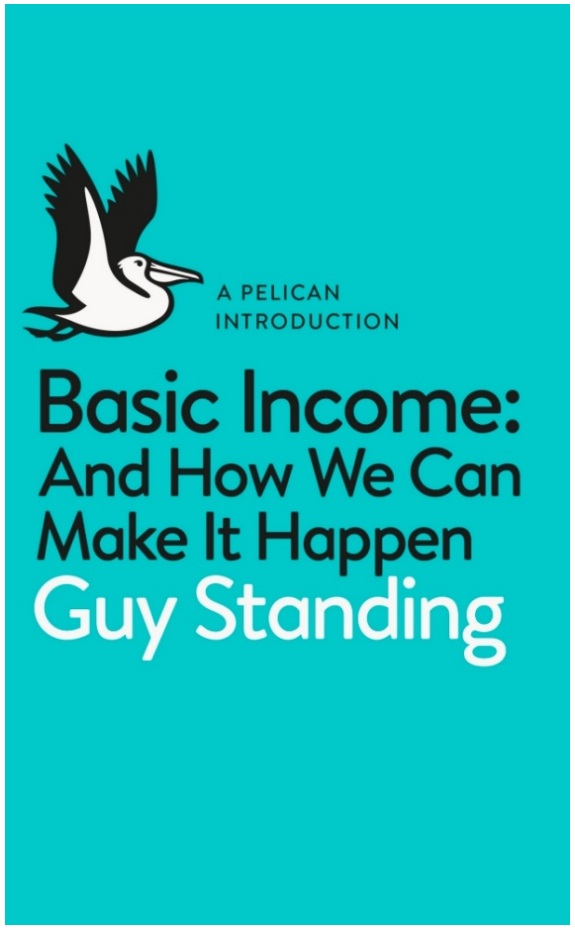


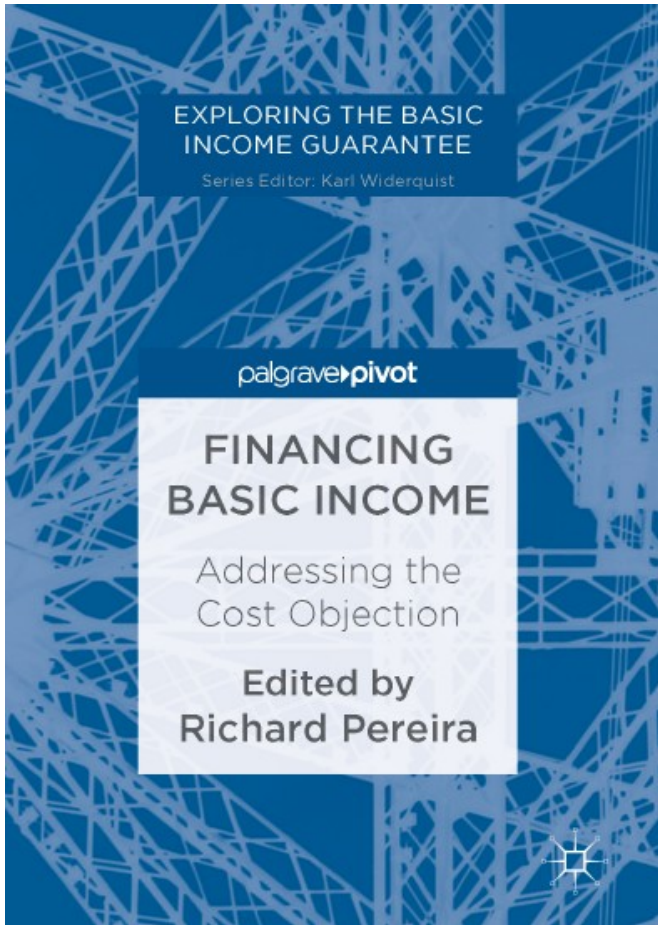



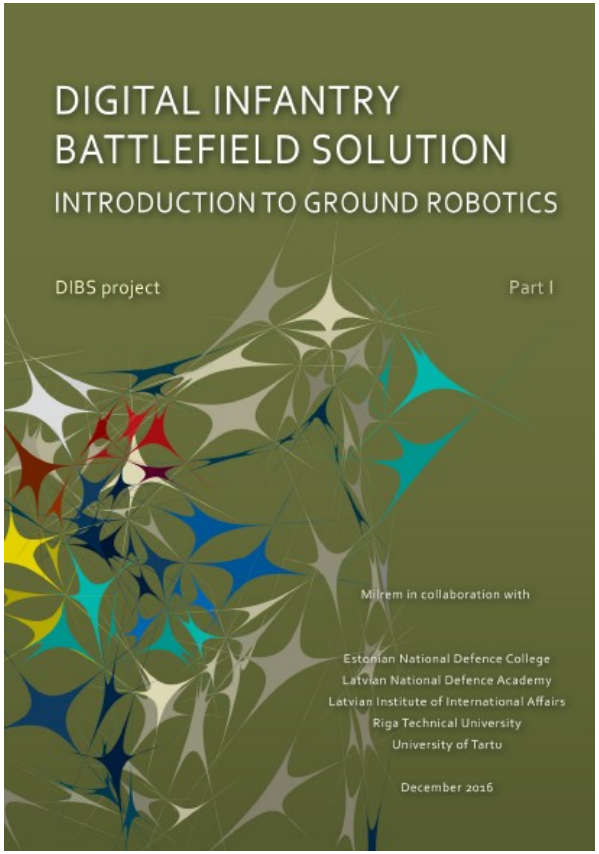
# Prior studies
## *Basic income*



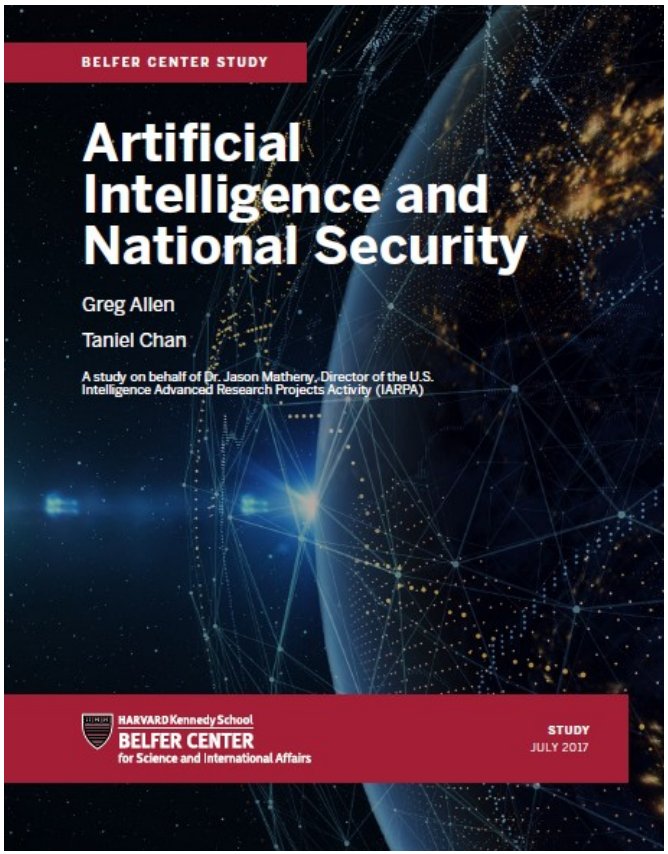



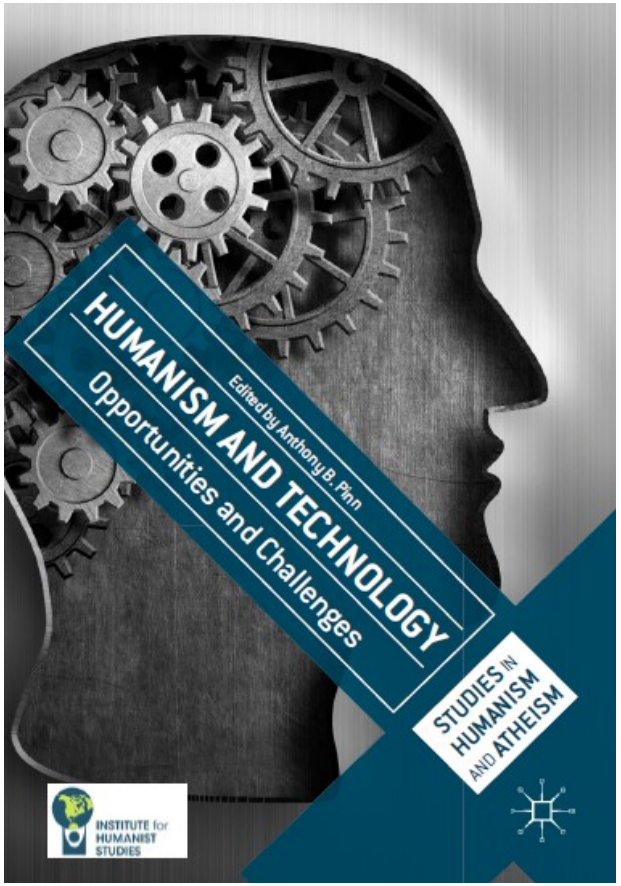
# Prior studies
## *National security and warfare*

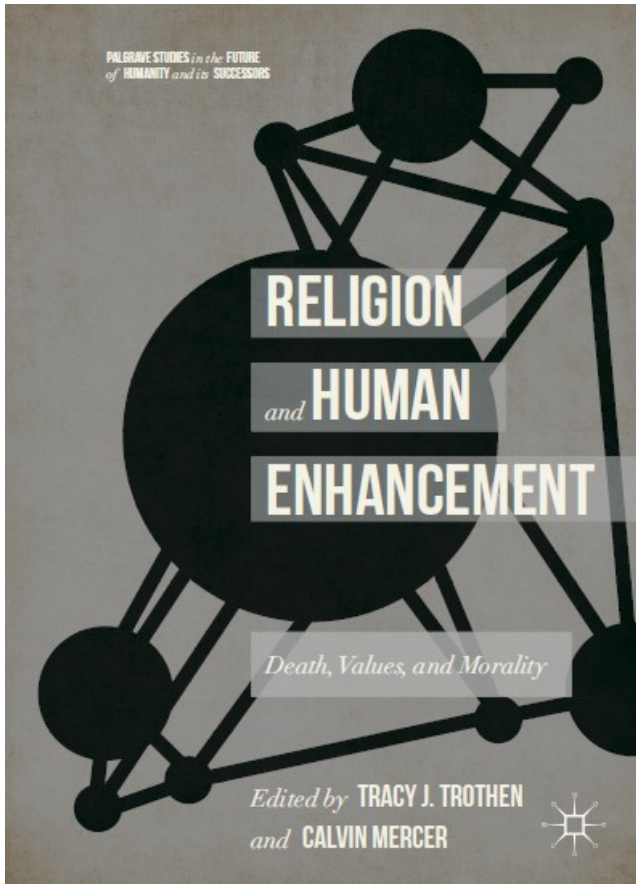


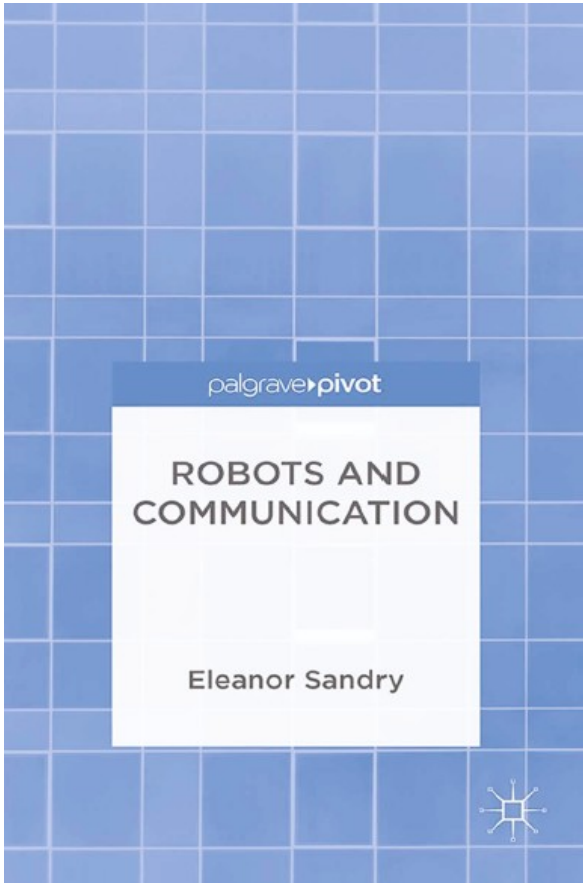




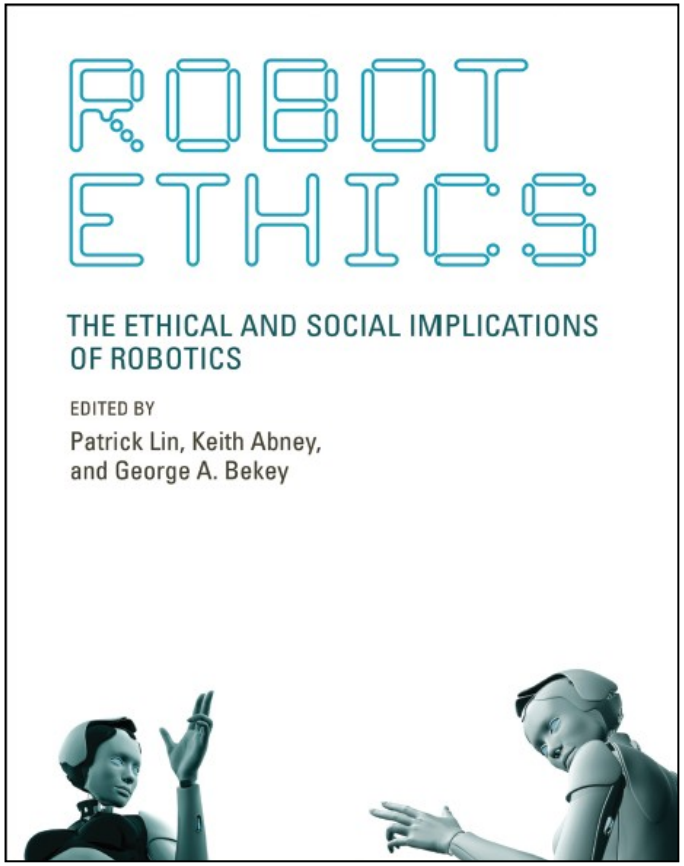
# Prior studies
## *Even humanities deal with robots*

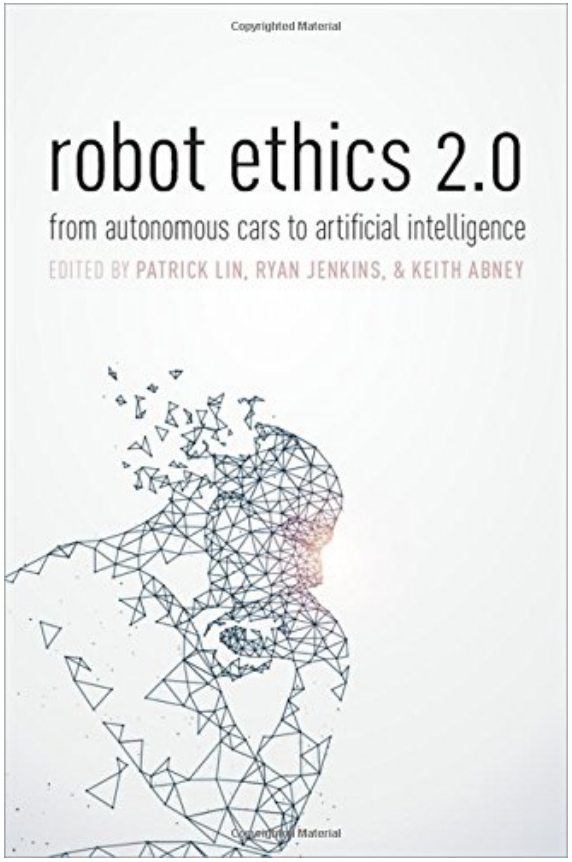


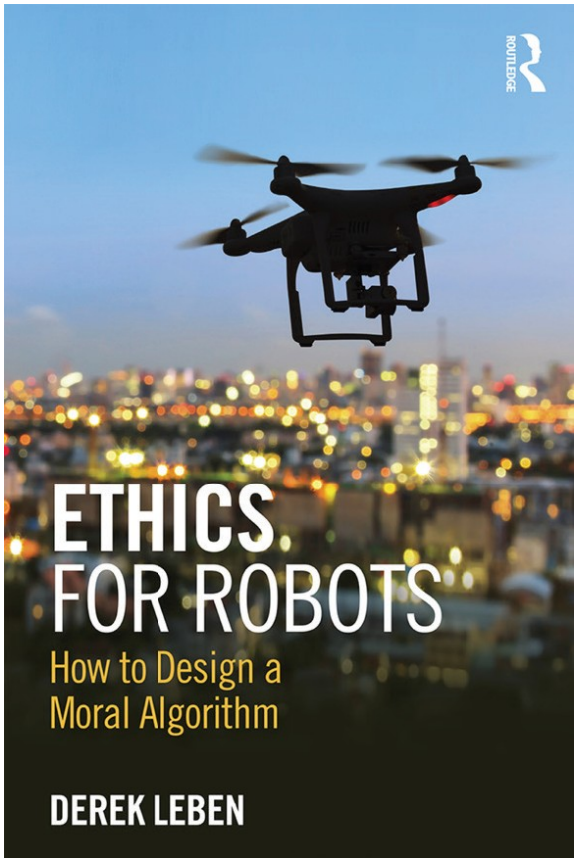



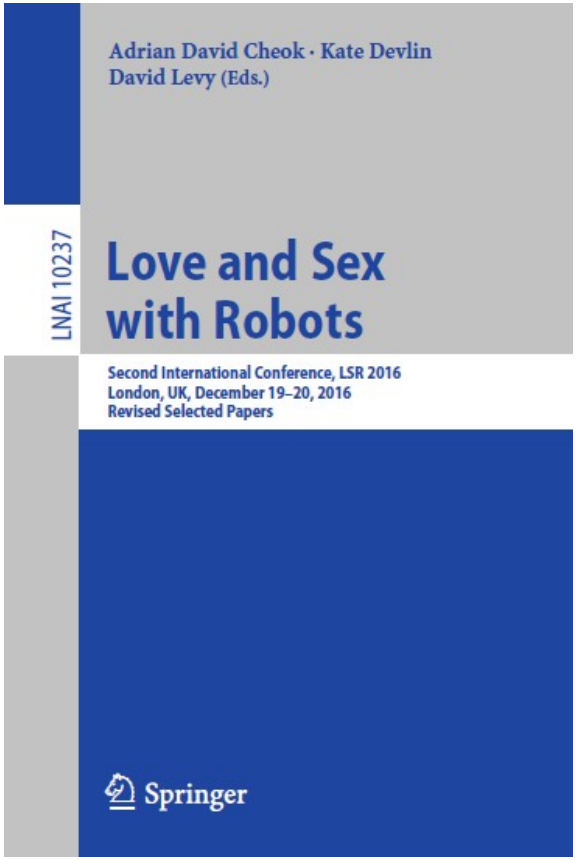
# Prior studies
## *Robot ethics*

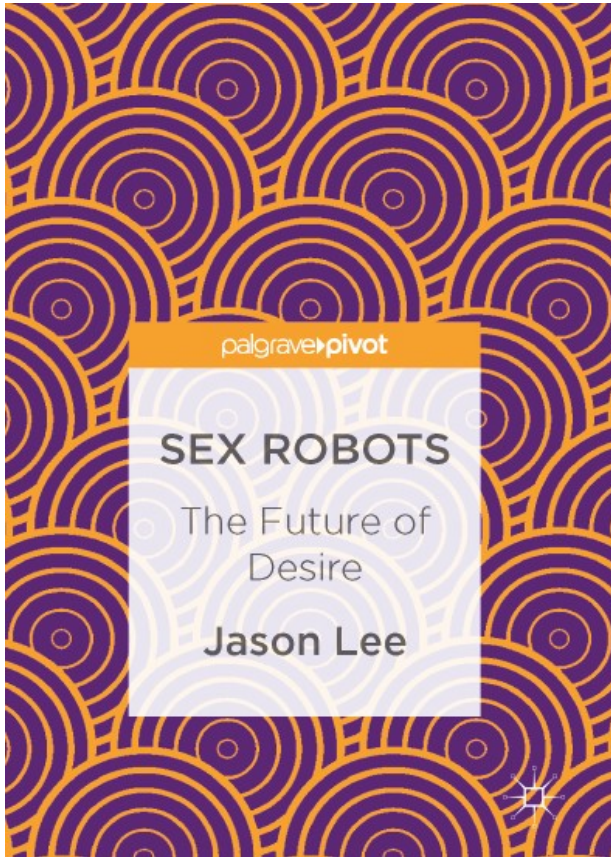


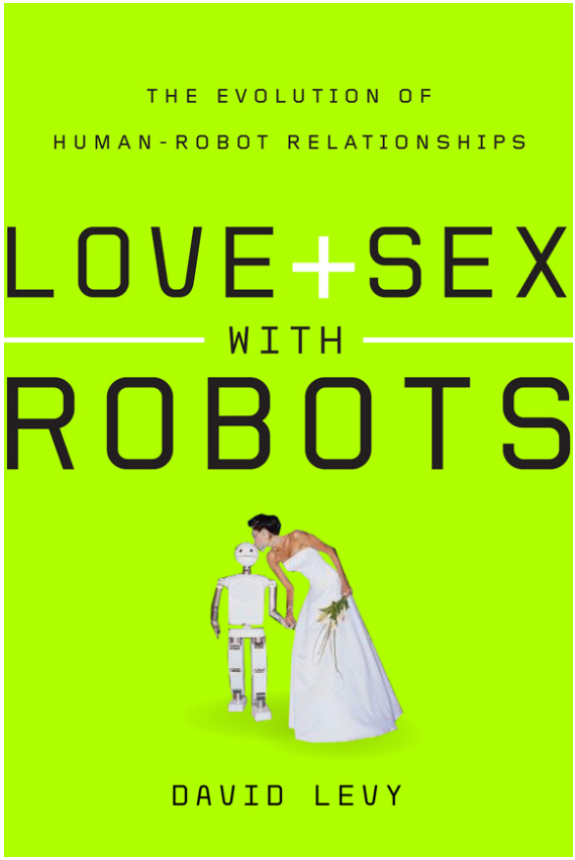



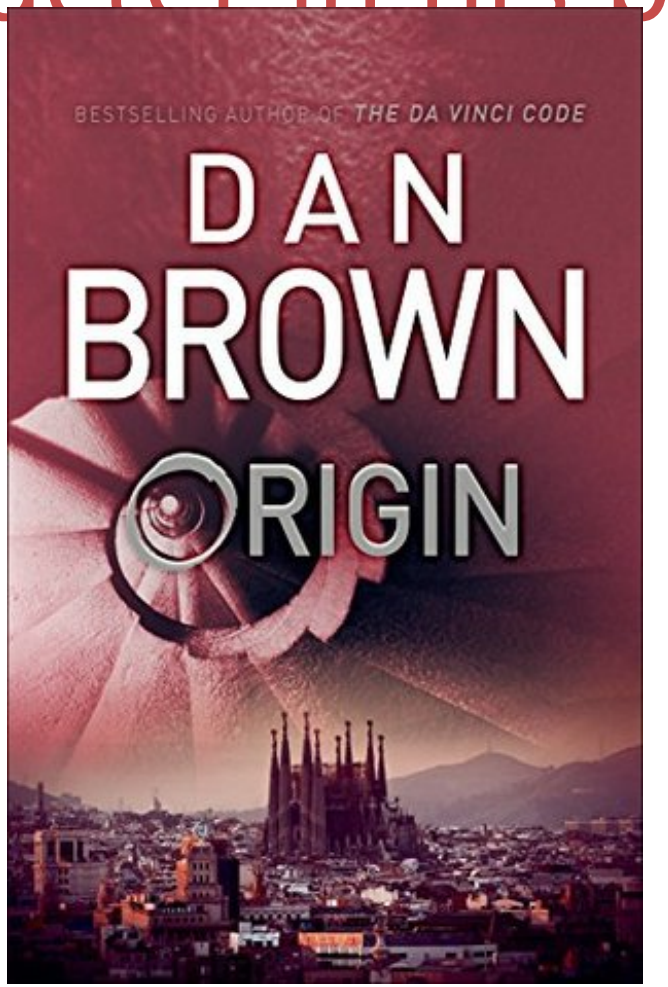
# Prior studies
## *Sex with robots*



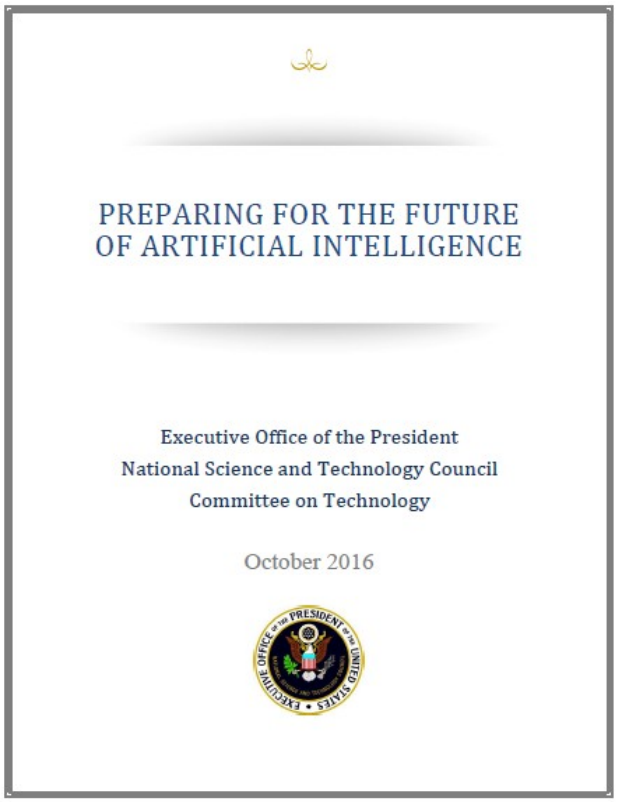



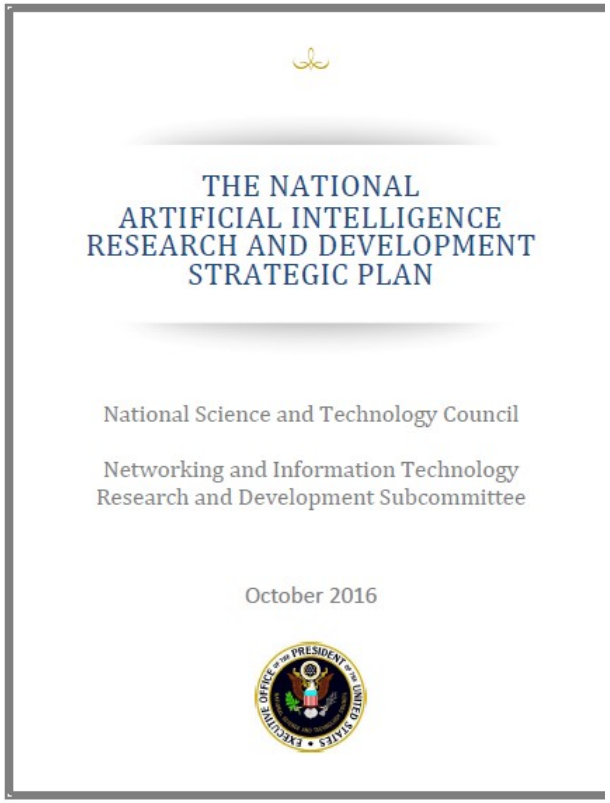



# Even Dan Brown incorporated artificial intelligence as a character in his book!



# Robonomics is inevitable


PREPARING FOR THE FUTURE
OF ARTIFICIAL INTELLIGENCE
Executive Office of the President
National Science and Technology Council
Committee on Technology
October 2016


THE NATIONAL
ARTIFICIAL INTELLIGENCE
RESEARCH AND DEVELOPMENT
STRATEGIC PLAN
National Science and Technology Council
Networking and Information Technology
Research and Development Subcommittee
October 2016

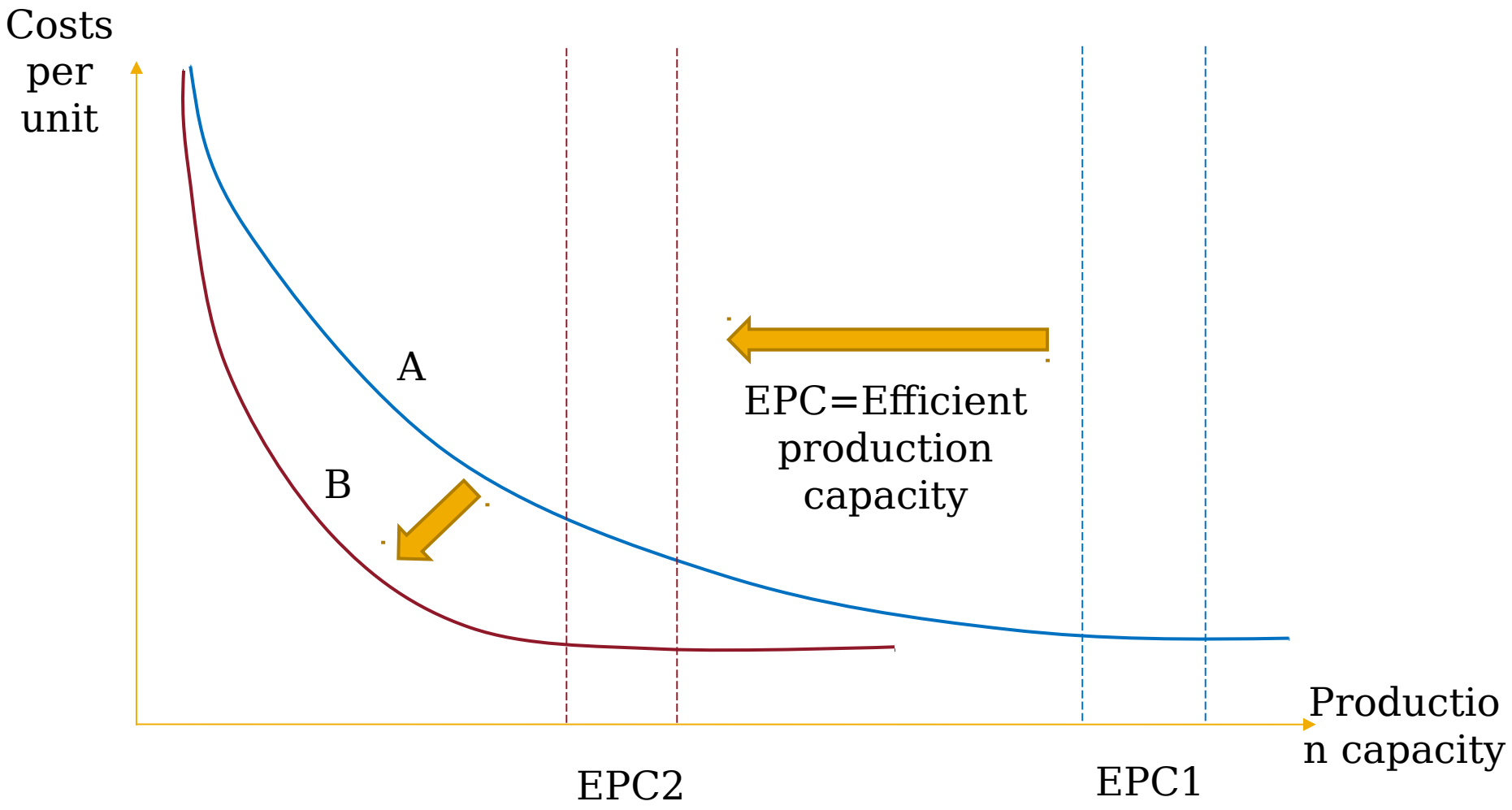

The Next Production
Revolution
IMPLICATIONS FOR GOVERNMENTS AND BUSINESS
OECD

# Principles of Robonomics

# Principles of *Robonomics* (1)

- High level of automation
- Active use of variety of single- and multi-purpose industrial, service and social robots
- All or most of the products (goods and services) are produced / provided by robots, artificial intelligence and automation technologies
- High cost-efficiency of production – economically efficient on-demand single/few unit(s) production of some goods
- Small and dispersed factories, close to consumers (reshoring)

# Principles of *Robonomics* (2)



# Principles of *Robonomics* (3)

- High level of standardisation of services – strict algorithmisation of service provision
- Labour and capital abundance are not competitive advantages, but knowledge and creativity
- Fewer but more knowledge-intensive jobs
- Disconnection between employment and incomes - employment is not the major source of incomes

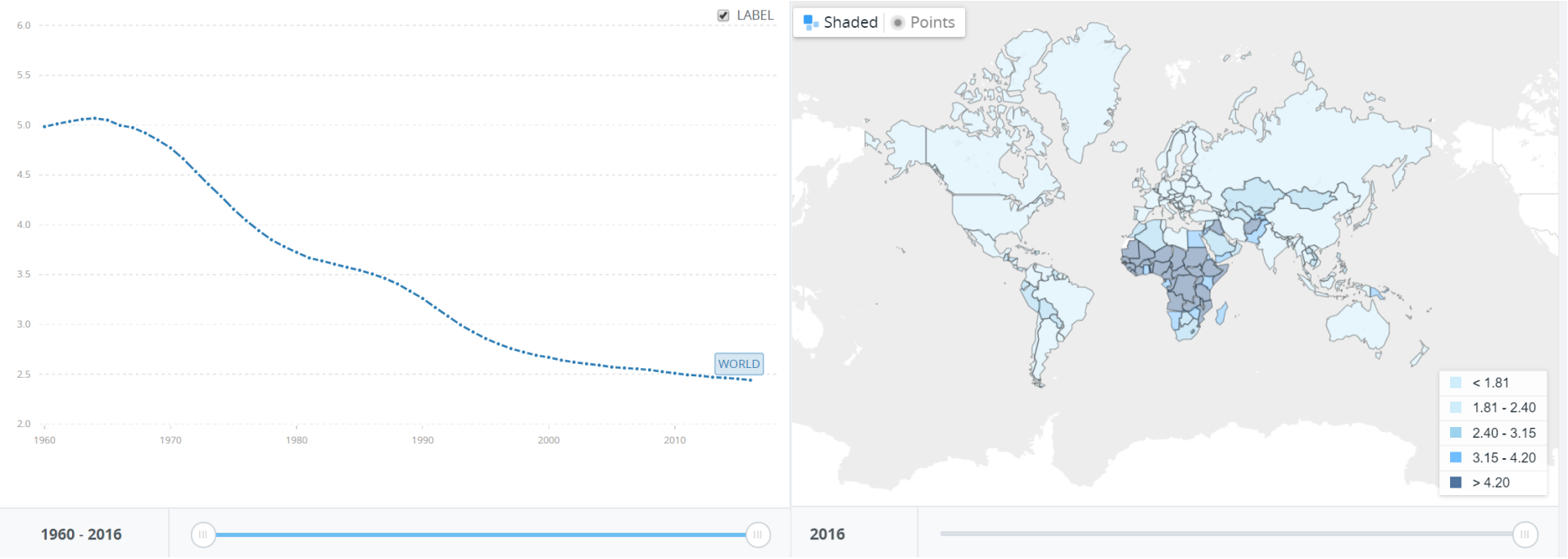
# Drivers of Robonomics

# Drivers of *Robonomics*

# Drivers of *Robonomics*
# *Macroenvironmental factors*

- Demography:
  - Aging population > disruptions in the labour market

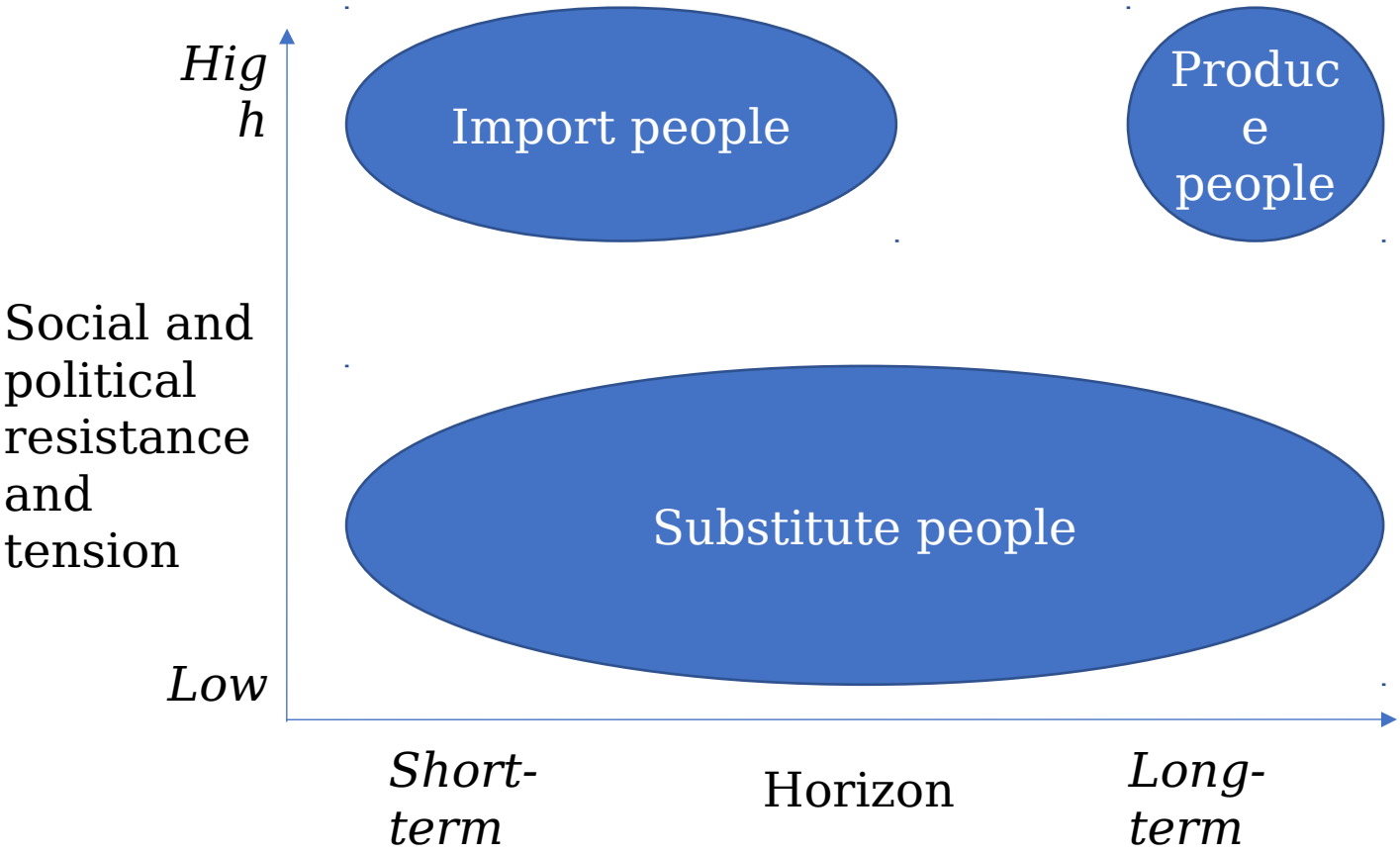
*Number of children per woman (1960-2016)*




https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?end=2016&start=1960&view=chart&year=2016

# Drivers of *Robonomics*
# *Macroenvironmental factors*

## *Solutions to plummeting populations*



# Drivers of *Robonomics*
# *Macroenvironmental factors*

- Politics:
  - Governmental control on populations

BUSINESS INSIDER

**China has started ranking citizens with a creepy 'social credit' system — here's what you can do wrong, and the embarrassing, demeaning ways they can punish you**

Alexandra Ma Oct. 29, 2018, 12:06 PM

An internet cafe in Wuhan, China. REUTERS/Stringer

- China plans to rank all its citizens based on their "social credit" by 2020.
- People can be rewarded or punished according to their scores.

# Drivers of *Robonomics*
## *Macroenvironmental factors*

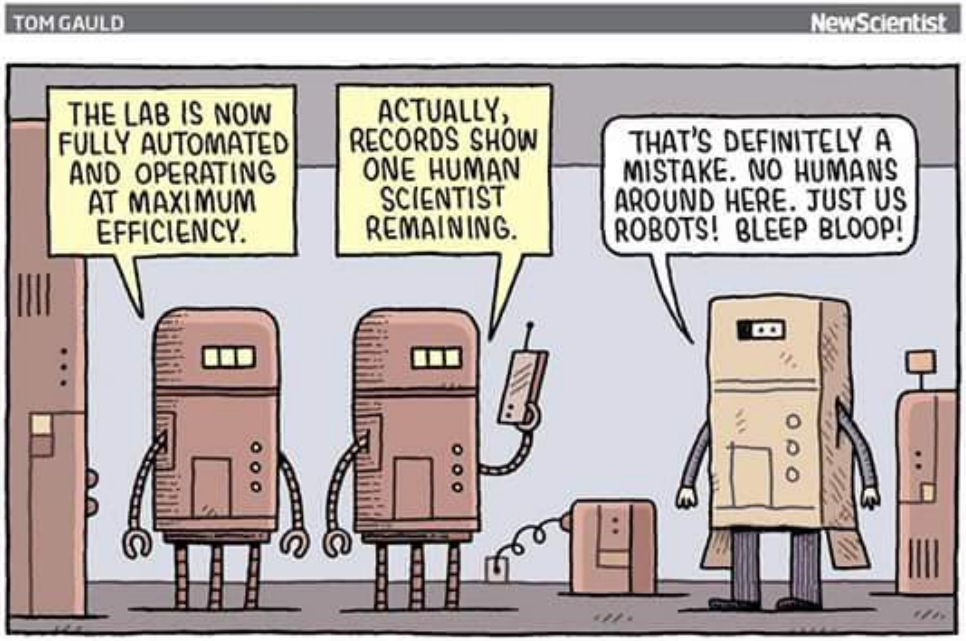
- Technology:
  - Advances in RAIA technologies
- Legal framework:
  - Antidiscrimination laws
  - Labour laws
  - Taxation
- Culture and society:
  - Attitudes towards RAIA technologies

# Drivers of *Robonomics* *Microenvironmental factors*

- Labour market:
  - Lack of sufficient and qualified human employees
- Competitive pressure:
  - Adoption of RAIA technologies by competitors
- Customers:
  - Acceptance of RAIA technologies

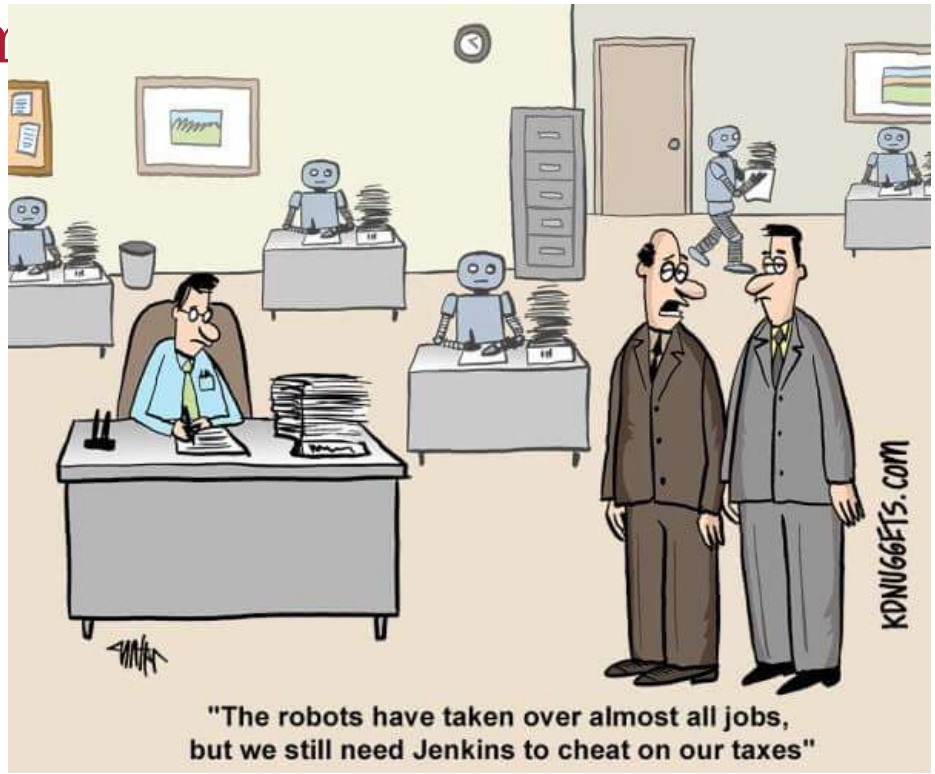
# Drivers of *Robonomics* *Corporate level factors*

- Economic efficiency:
  - Cost efficiency
  - Productivity
  - Operations management



# Drivers of *Robonomics* *Psychological factors*

- Preferences:
  - Managers' preferences towards the use of robots/automation technologies instead of human em



# Advent of Robonomics

# Advent of *Robonomics*

| Stage | Description |
|---|---|
| Stage 1 | Adoption of RAIA by individual companies in an industry |
| Stage 2 | Spread of RAIA among companies in an industry |
| Stage 3 | Gradual spread of RAIA among industries and countries |
| Stage 4 | Spill-over effects of RAIA from developed to developing economies in the form of substituting low-cost labour in developing countries for automated factories in developed economies and bots |

# Benefits of Robonomics

# Benefits of *Robonomics*
## *Short-term*

- Decrease in costs and prices
- Improved environmental sustainability of production
- Short-term increase in birth rates

# Benefits of *Robonomics Long-term*

- Improved quality of life in the long term due to:
  - People are liberated of hard manual labour
  - Drastic increase of leisure time
  - Time for creative and pleasure activities
  - Less (no) work-related stress
  - Improved health
  - Increased life expectancy
- Global government and global citizenship
- Accelerated space exploration

# Challenges of Robonomics

# Challenges of *Robonomics* *Short- and mid-term*

- Unemployment and relative overpopulation – fewer human employees and lower salaries:
  - Frey & Osborne (2017) assess the probability of computerisation for 702 detailed occupations in the USA and conclude that 47% of total jobs in the country are risk of being substituted by AI.
  - DeCanio (2016) measures the elasticity of substitution of human labour with robots in the USA and concludes that it would lead to significant drop in wages.

# Challenges of *Robonomics*
## *Short- and mid-term*

- Psychological problems of people who find themselves with too much free time, nothing to do and no need to work => recipe for political revolutions
- Fear, social unrest and political instability
- Migration
- Wars

# Challenges of *Robonomics* *Long-term*

- Possible functional illiteracy – humans may forget how to do things once robots and automation technologies do them


*"Does your car have any idea why my car pulled it over?"*

# Challenges of *Robonomics* *Long-term*

- Division of society between employed and unemployed
- Changes in social values – is human life valuable? Do we need other people to satisfy our needs when we have robots?
- Possible significant decrease in population in the long-term

# Solutions to the challenges of Robonomics

# Proposed solutions to the challenges of *Robonomics*

Prior literature has elaborated on some solutions to technological unemployment like *mandating employment, government job creation, work sharing, employment impact statements, tax policies and financial incentives for job creation,* etc. (e.g. Stevens & Marchant, 2017). These solutions assume that given the right stimuli the economy will create enough jobs to keep full employment. However, they may work on the *road to* robonomics as tools to mitigate the impacts of technological unemployment, but not *during* robonomics when society reaches full robotisation of economy and people do not need to work.

# Proposed solutions to the challenges of *Robonomics*

- Constant and fluid free life-long education
- Entertainment
- Tourism and leisure activities
- Volunteering
- Robot-based taxation
- Universal basic income (Basic income guarantee)
- Birth control / birth right patent
- Redefinition of human rights

# Proposed solutions to the challenges of *Robonomics*

*Universal Basic Income*

Advantages:

- Provides income for all people in a society and serves as a social safety net
- Easy to administer

# Proposed solutions to the challenges of *Robonomics*

*Universal Basic Income*

Disadvantages:

- Requires a lot of resources to finance, which at the absence of or limited proceeds of income taxes (due to the fewer number of people working) may be difficult to finance
- May suppress many people's stimuli to work and improve their skills, thus making them permanently unemployable
- Migration and subsequent social tension if UBI is introduced in one or few countries only without strict migration control

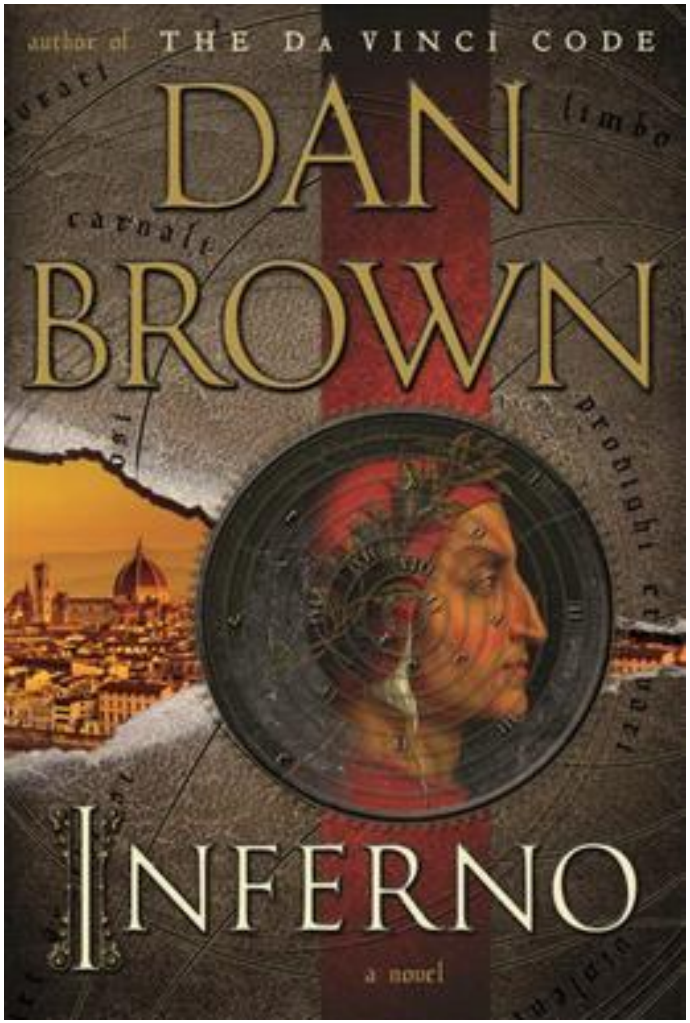
# Proposed solutions to the challenges of *Robonomics*

*Robot tax*

QUARTZ

**The robot that takes your job should pay taxes, says Bill Gates**

# Proposed solutions to the challenges of *Robonomics*



# Proposed solutions to the challenges of *Robonomics*

## *Redefinition of human rights*



https://render.fineartamerica.com/images/rendered/default/poster/8/10/break/images/artworkimages/medium/1/declaration-of-the-rights-of-man-and-citizen-french-school.jpg

http://www.un.org/sites/www.un.org/files/2015/10/07/universal-declaration-human-rights.jpg

# Proposed solutions to the challenges of *Robonomics*

## *Redefinition of human rights*

| Situation | Biological right (reproduction) | Political right (voting) | Economic right (basic income) | Outcome |
|---|---|---|---|---|
| 1 | Yes | Yes | Yes | Country default |
| 2 | Yes | Yes | No | Mass poverty |
| 3 | Yes | No | Yes | Country default |
| 4 | Yes | No | No | Mass poverty |
| 5 | No | Yes | Yes | Demographic crisis |
| 6 | No | Yes | No | Demographic crisis |
| 7 | No | No | Yes | Demographic crisis |
| 8 | No | No | No | Demographic crisis |

# Proposed solutions to the challenges of *Robonomics*

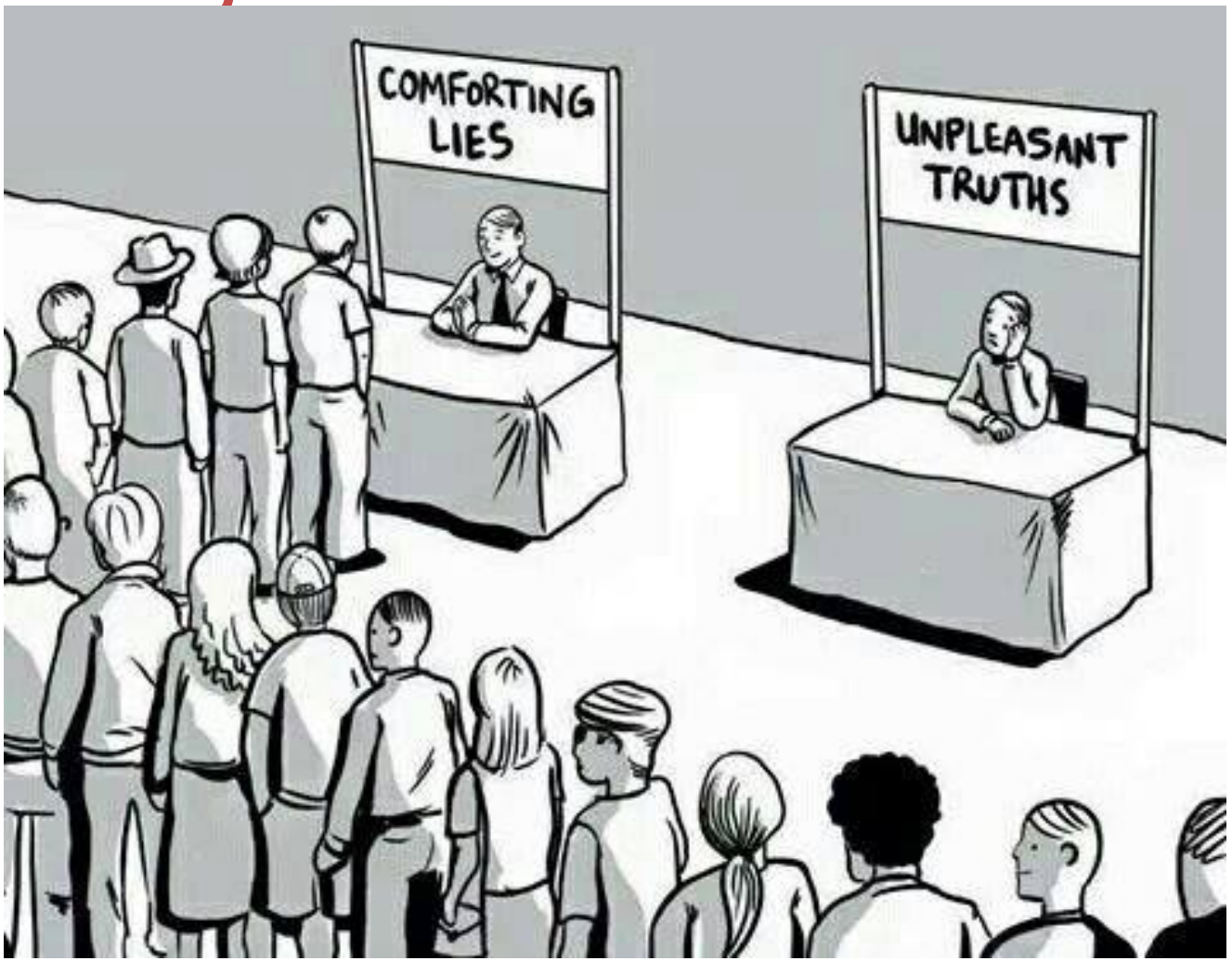
## *Redefinition of human rights*

| Situation | Biological right (reproduction) | Political right (voting) | Economic right (basic income) | Outcome |
|---|---|---|---|---|
| 2 | Yes | Yes | No | Mass poverty |
| 7 | No | No | Yes | Demographic crisis |

[7] provides a stable solution

- ✓ People self-select whether they want the cozy life without work, but subject to sterilization and without the right to vote, OR they will not receive any guaranteed income but will have the right to vote and reproduce

# Proposed solutions to the challenges of *Robonomics*



Robots, AI and automation technologies have arrived and are here to stay.

Prepare ...

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# References and further reading (2):


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- Ivanov, S., Webster, C. & Berezina, K. (2017). Adoption of robots and service automation by tourism and hospitality companies. Paper presented at the INVTUR Conference, 17-19 May 2017, Aveiro, Portugal. SSRN URL: http://ssrn.com/abstract=2964308
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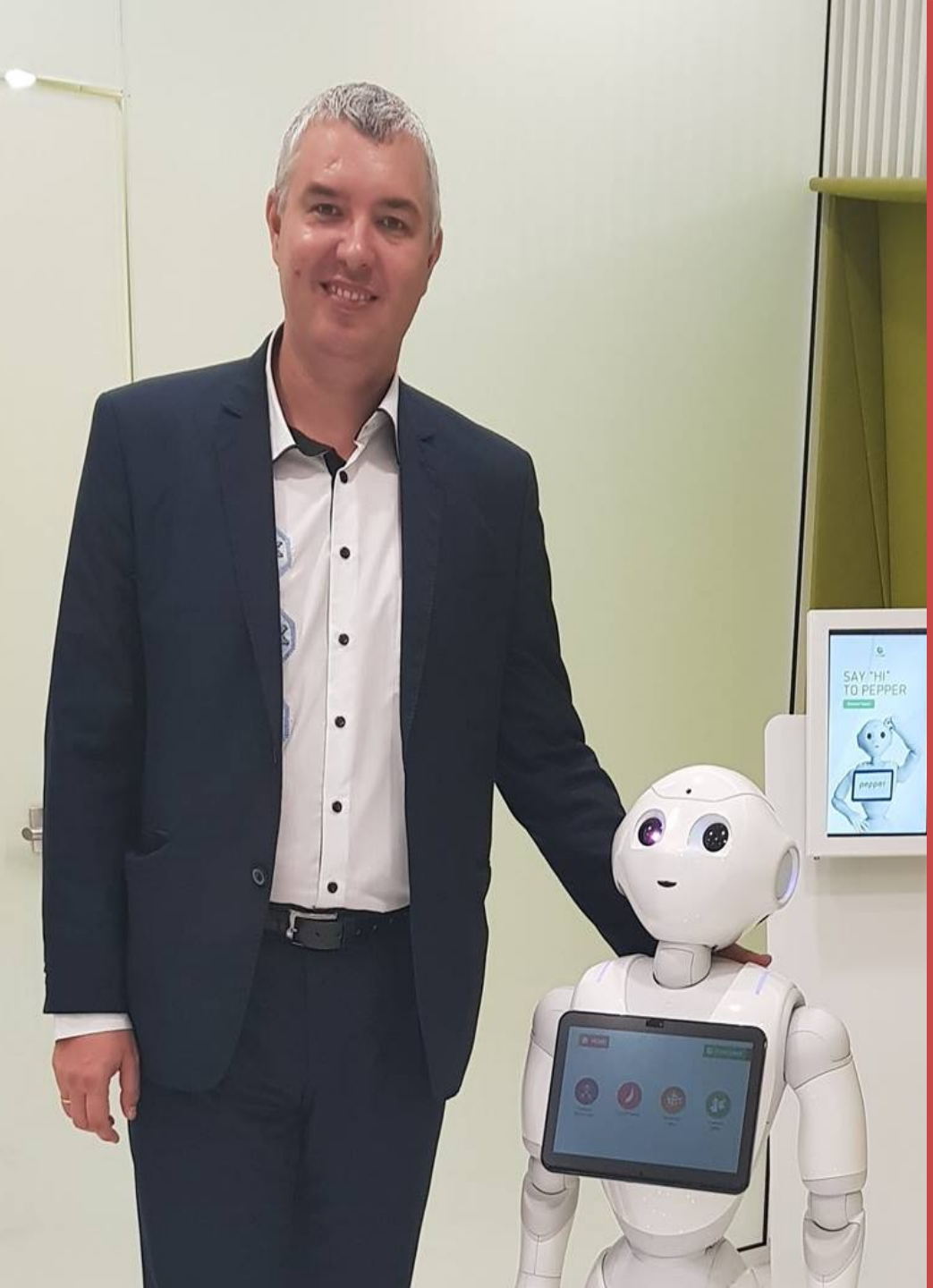


# THANK YOU FOR THE ATTENTION !

# QUESTIONS ?