



Welcome to the ShanghAI Lectures 2018!

Overview Lecture



**We will have 8 Lectures on Thursdays
9:30 to 11 CET (Summer Time today)**

Zoom.us platform

We can arrange tests if needed during the week

Overview Lecture

The Future of Robotics and AI

Intelligent Robotics, Industry 4.0, the Circular Economy and Next Generation Robotics Science and Technology Will Help Tackling Our Global Challenges in a Holistic Way

Fabio Bonsignorio^{1,2,3,4,5,6}

RoboCom++ Embodied Intelligence in Natural and Artificial Agents WG Leader¹

SPARC TG Benchmarking and Competitions²

IEEE RAS TC-PEBRAS³

Member SPARC Board of Directors⁴

The BioRobotics Institute, SSSA⁵
and Heron Robots⁶



Outline of the talk

- Global Challenges
- Robotics ‘waves’
- Industry 4.0
- I4.0 impact on the Circular Economy
- Another I4.0 side effect: impact on Construction Industry
- Open issues with current ‘paradigms’ and approaches, and the road ahead
- Societal impacts vs. Impacts on Healthy and Independent Ageing



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Welcome to the United Nations. It's your world

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 United Nations
Department of Economic and Social Affairs

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World population projected to reach 9.7 billion by 2050

29 July 2015, New York

The current world population of 7.3 billion is expected to reach 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100, according to a new UN DESA report, "World Population Prospects: The 2015 Revision", launched today.

"Understanding the demographic changes that are likely to unfold over the coming years, as well as the challenges and opportunities that they present for achieving sustainable development, is key to the design and implementation of the new development agenda," said Wu Hongbo, UN Under-Secretary-General for Economic and Social Affairs.

Most of the projected increase in the world's population can be attributed to a short list of high-fertility countries, mainly in Africa, or countries with already large populations. During 2015-2050, half of the world's population growth is expected to be concentrated in nine countries: India, Nigeria, Pakistan, Democratic Republic of Congo, Ethiopia, United Republic of Tanzania, United States of America (USA), Indonesia and Uganda, according to the size of their contribution to the total growth.





MAGAZINE | JANUARY 2016

See for Yourself: How Arctic Ice Is Disappearing



Since satellites began regularly measuring Arctic sea ice in the late 1970s, it has declined sharply in extent and thickness. Much of the decline is due to thin, seasonal ice that melts quickly in summer. This is thin stuff that doesn't survive the summer melt. As the ice disappears, so does the entire Arctic ecosystem, from plankton to polar bears. "It's like we're changing the climate around the Northern Hemisphere," says Mark Serreze, director of the National Snow and

Graphics and maps by Lauren James, Jason Esteban, and Christopher Michel



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Sydney Dispatch

Australia's new normal ... as city temperatures hit 47C people shelter from the deadly heat

In Sydney's baking suburbs, fans have sold out – and fears about the effects of climate change are mounting



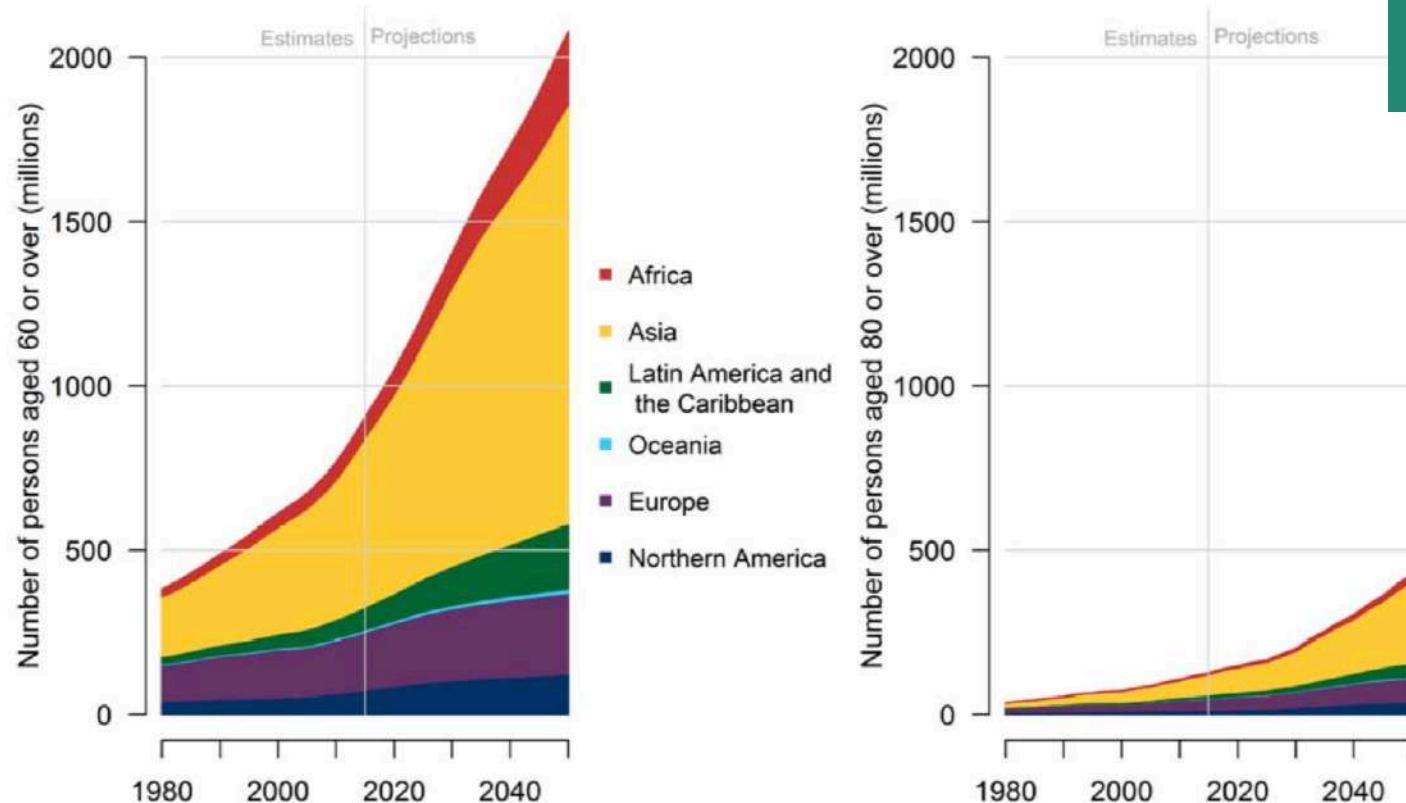
Fabio Bonsignorio

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Figure II.2.

Number of persons aged 60 years or over and aged 80 years or over for regions, 1980-2050



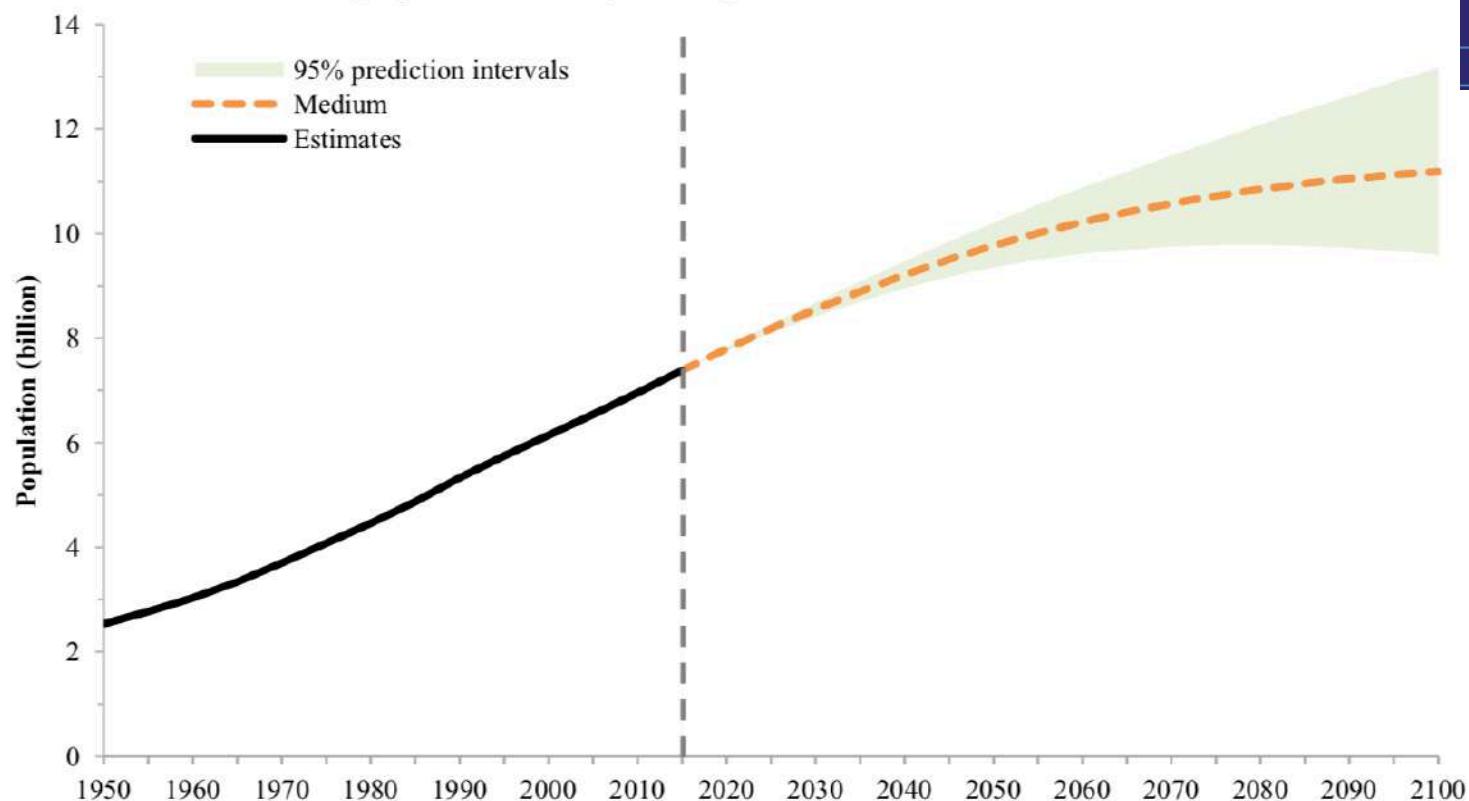
Data source: United Nations (2017). *World Population Prospects: The 2017 Revision*.

Fabio Bonsignorio

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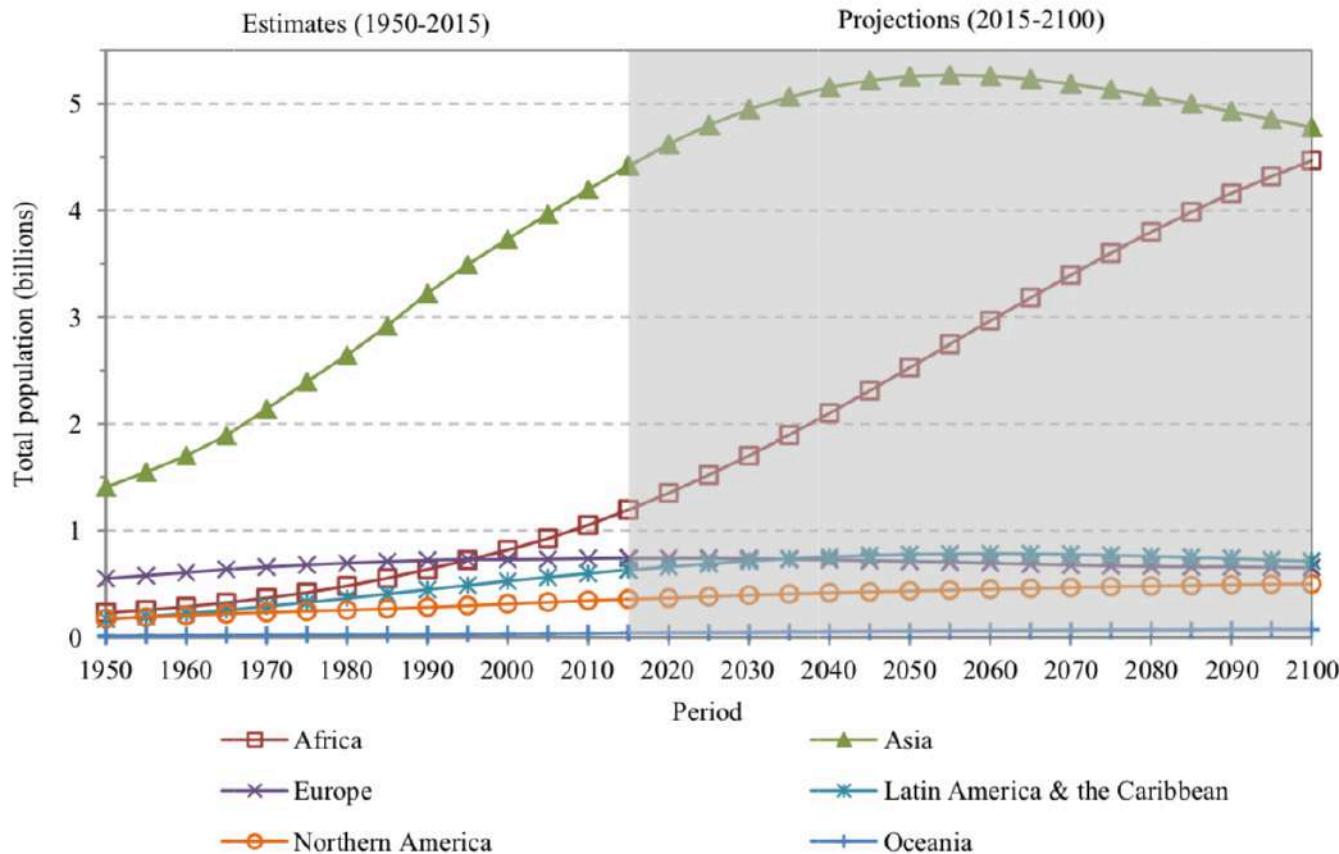
Figure 2. Population of the world: estimates, 1950-2015, and medium-variant projection with 95 per cent prediction intervals, 2015-2100



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).
World Population Prospects: The 2017 Revision. New York: United Nations.



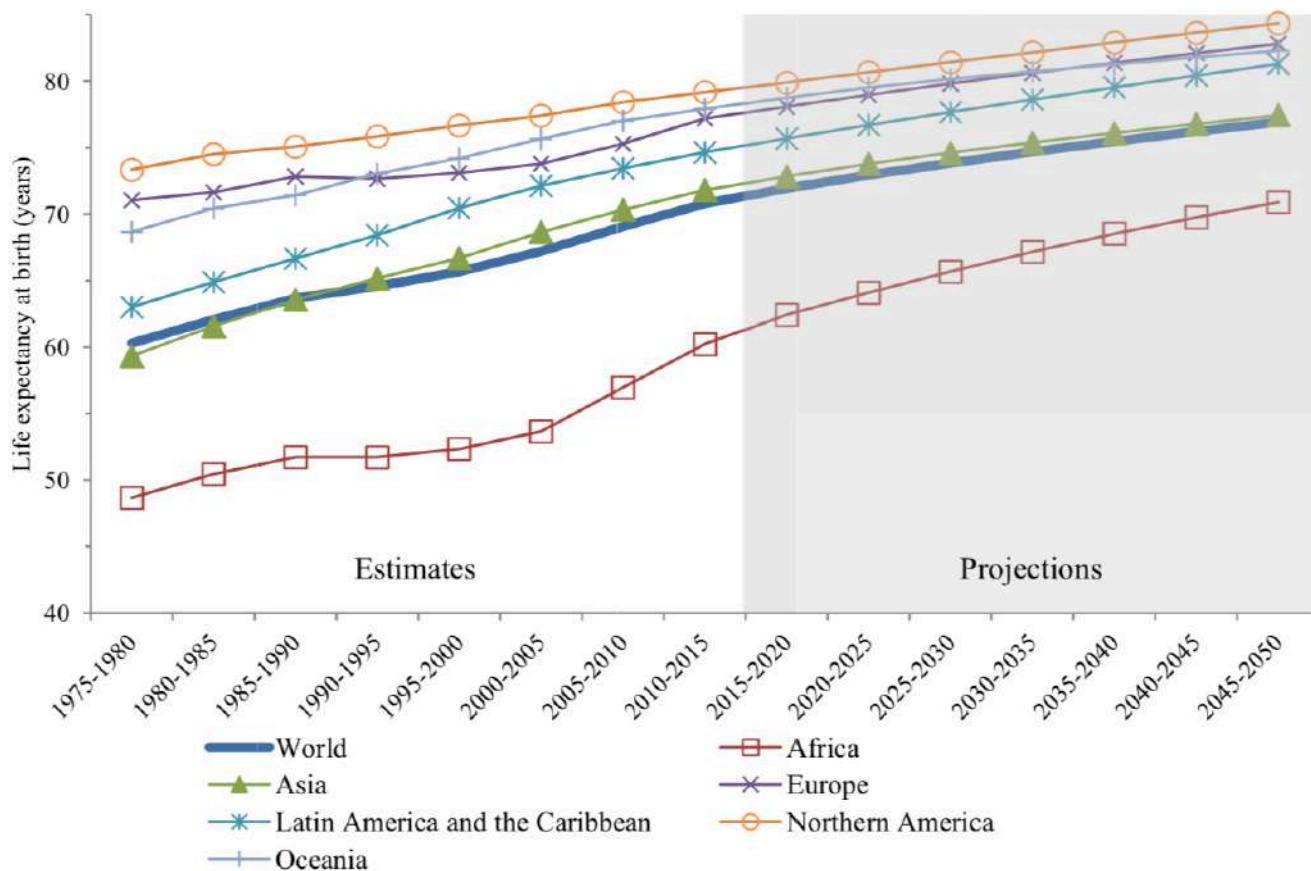
Figure 3. Population by region: estimates, 1950-2015, and medium-variant projection, 2015-2100



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).
World Population Prospects: The 2017 Revision. New York: United Nations.



Figure 6. Life expectancy at birth (years) by region: estimates 1975-2015 and projections 2015-2050



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).
World Population Prospects: The 2017 Revision. New York: United Nations.



Projected population growth, 2015-2050

Percentage of population change
between 2015 and 2050

- 200+
- 100-200
- 50-100
- 10-50
- -10-10
- -10--20
- <-20

Data source: World Population Prospects: The 2017 Revision.

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).



Endangered species

Earth's sixth mass extinction event under way, scientists warn

Researchers talk of 'biological annihilation' as study reveals billions of populations of animals have been lost in recent decades

- Opinion: You don't need a scientist to know what's causing the sixth mass extinction

Damian Carrington
Environment editor

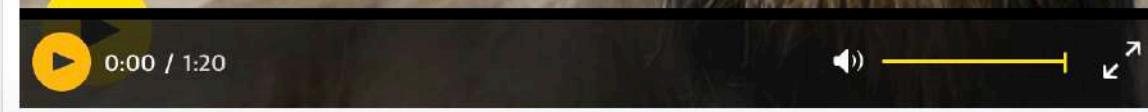
Twitter @dpcarrington

Mon 10 Jul 2017
20.00 BST



102k 2,892

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▲ Watch Alastair's video of Earth's mass extinction scientists say video report



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Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines



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Gerardo Ceballos, Paul R. Ehrlich, and Rodolfo Dirzo

PNAS July 25, 2017 114 (30) E6089-E6096; published ahead of print July 10, 2017

<https://doi.org/10.1073/pnas.1704949114>

Contributed by Paul R. Ehrlich, May 23, 2017 (sent for review March 28, 2017; reviewed by Thomas E. Lovejoy and Peter H. Raven)

 More Articles of This Classification

Quantitative and functional posttranslational modification proteomics reveals that TBC1D14

PD

Stephen Hawking: We have LESS than 100 YEARS to save the human race

THE human race is entering the most dangerous 100 years in its history and faces a looming existential battle, Stephen Hawking has warned.

By **SEAN MARTIN**

PUBLISHED: 10:58, Tue, Jan 19, 2016 | UPDATED: 13:14, Tue, Jan 19, 2016



**Climate
change**

James Lovelock: 'enjoy life while you can: in 20 years global warming will hit the fan'

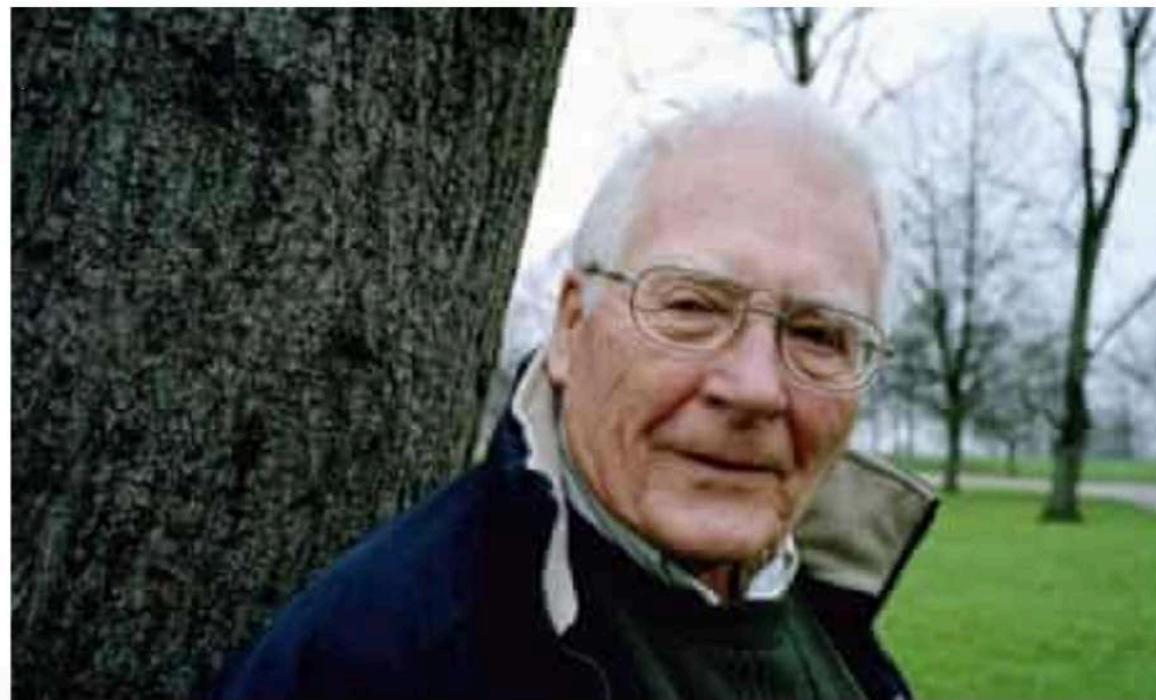
The climate science maverick believes catastrophe is inevitable, carbon offsetting is a joke and ethical living a scam. So what would he do? By Decca Aitkenhead

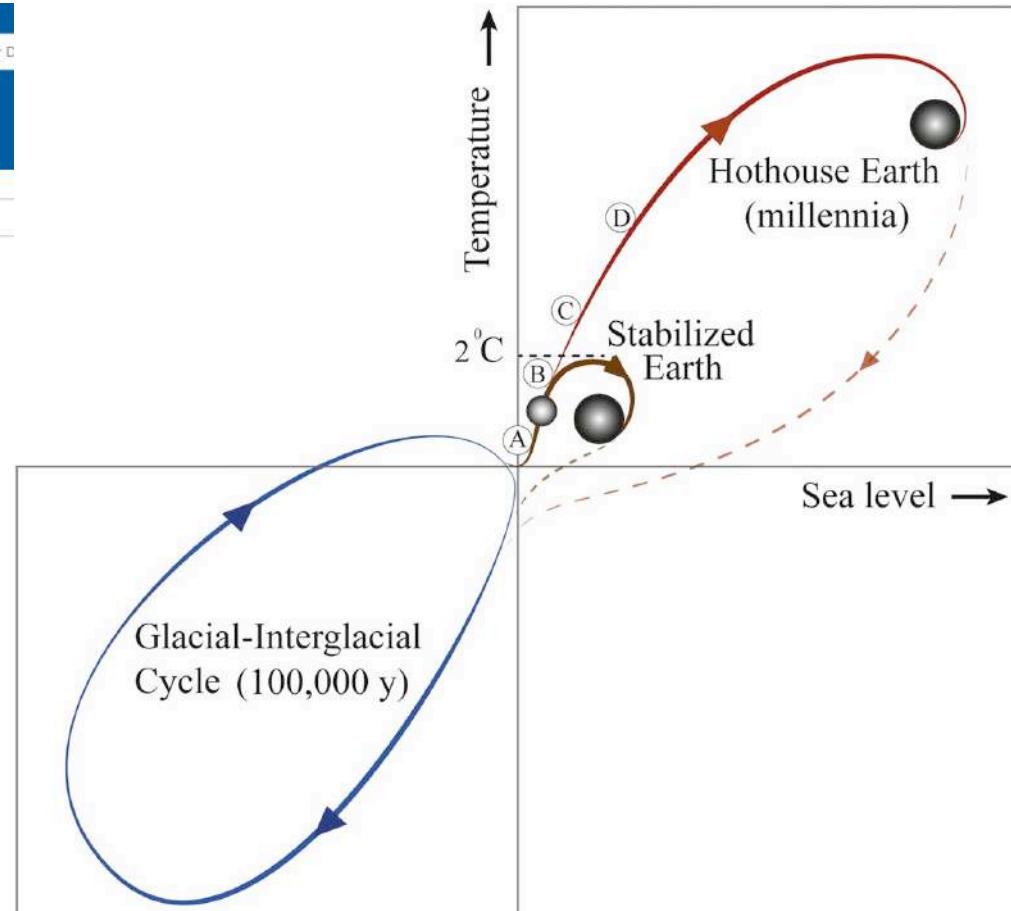
Decca Aitkenhead

Sat 1 Mar 2008
10.35 GMT

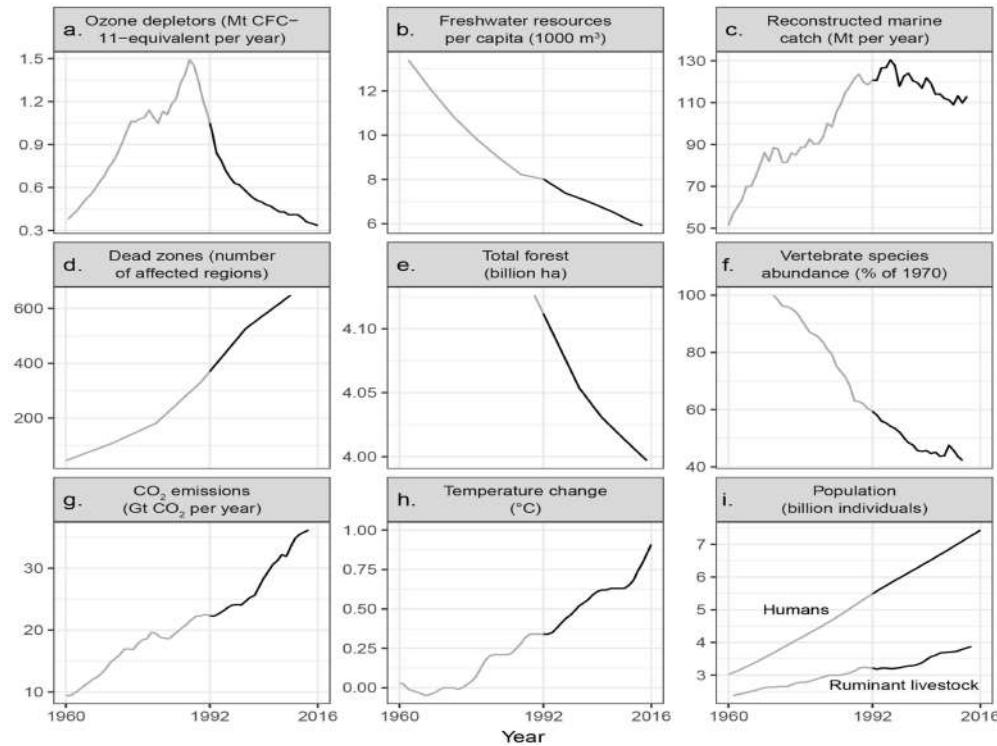


261k



What has already happened



From: World Scientists' Warning to Humanity: A Second Notice

BioScience. Published online November 13, 2017. doi:10.1093/biosci/bix125

BioScience | © The Author(s) * 2017. Published by Oxford University Press on behalf of the American Institute of Biological Sciences. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com

* William J. Ripple Christopher Wolf Thomas M. Newsome Mauro Galetti Mohammed Alamgir Eileen Crist Mahmoud I. Mahmoud William F. Laurance 15,364 scientist signatories from 184 countries



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Older and newer attempts

Juanelo Torriano alias Gianello della Torre, (XVI century) a craftsman from Cremona, built for Emperor Charles V a mechanical young lady who was able to walk and play music by picking the strings of a real lute.



Hiroshi Ishiguro, early XXI century

Director of the Intelligent Robotics Laboratory, part of the Department of Adaptive Machine Systems at Osaka University, Japan

Old ideas



"If every tool, when ordered, or even of its own accord, could do the work that befits it, just as the creations of Daedalus moved of themselves . . . If the weavers' shuttles were to weave of themselves, then there would be no need either of apprentices for the master workers or of slaves for the lords."

Aristotle

(from Politics, Book 1, 1253b, 322 BC)

Old ideas



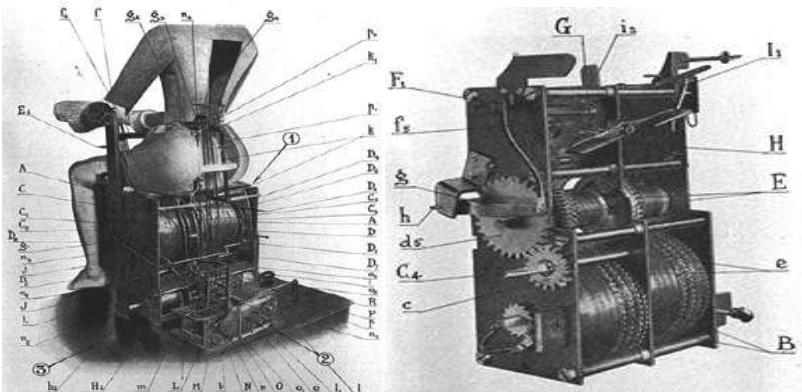
*The part of the quote "or even of its own accord" is elsewhere translated as "or by seeing what to do in advance"*²

I think this is an important part of the quote, so it's good to go back to the original text:

Aristotle uses the word "προαισθανόμενον" – proaisthanomenon this means literally: pro = before, aisthanomenon = perceiving, apprehending, understanding, learning (any of these meanings in this order of frequency) in my view it is clearly a word that is attributed to intelligent, living agents....i.e. ones with cognitive abilities (!)

*personal communication, Dr. Katerina Pastra
Research Fellow
Language Technology Group
Institute for Language and Speech Processing
Athens, Greece*

Old attempts



Jaquet-Droz Brothers (1720-1780)

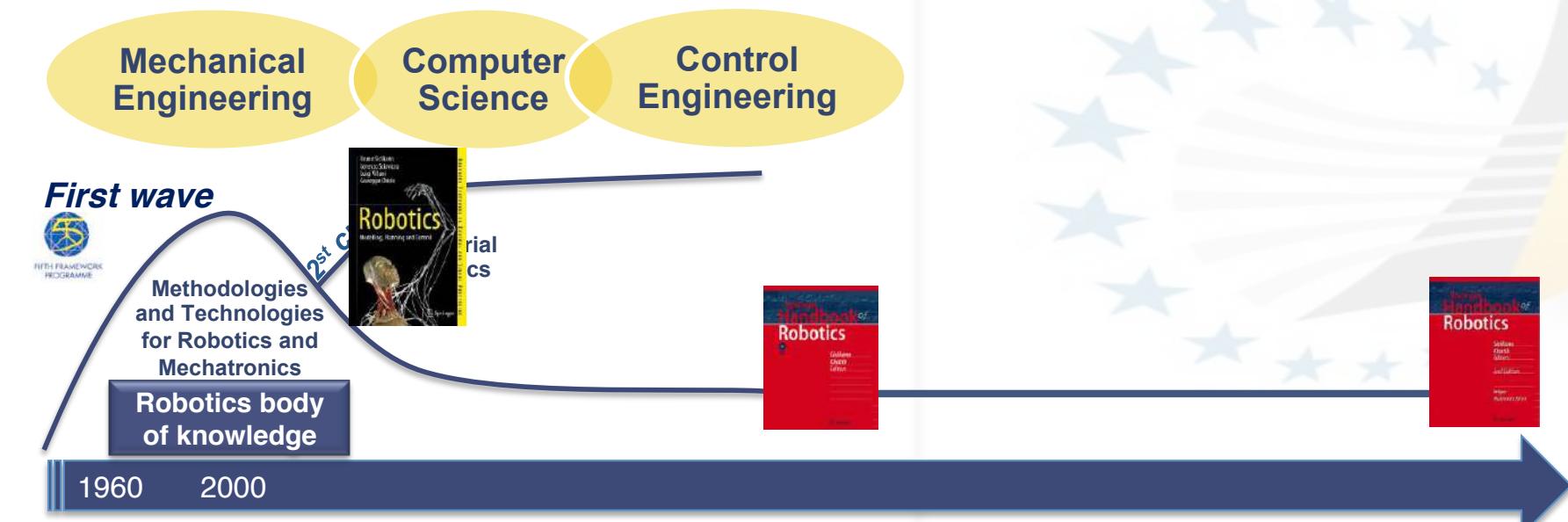
Old attempts



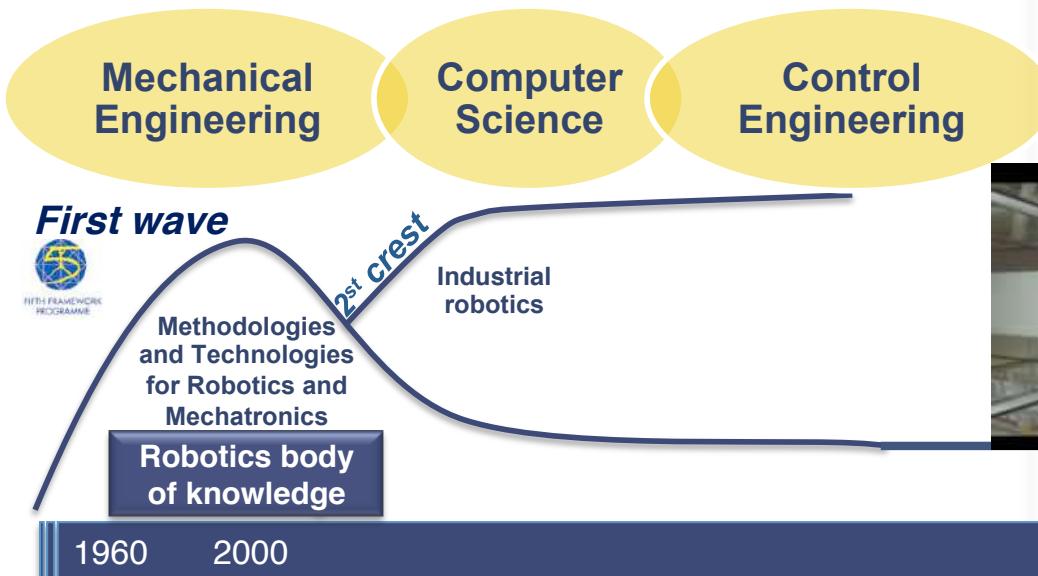
Karakuri Dolls
Chahakobi Ningyo (Tea Serving Doll) by SHOBEI Tamaya IX, and plan from 'Karakuri Zuii' ('Karakuri - An Illustrated Anthology') published in 1796.



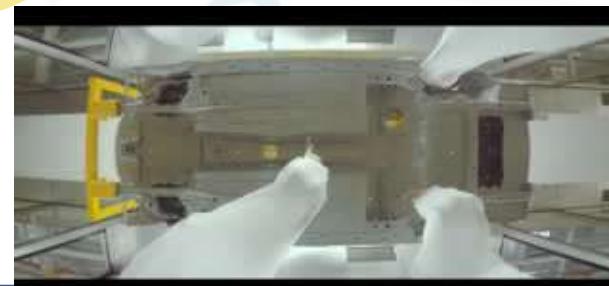
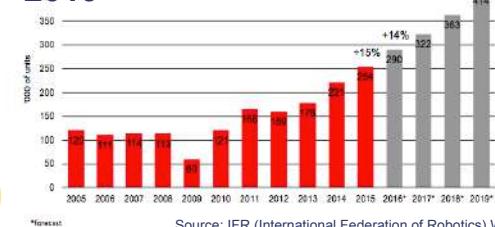
Recent successes: the first wave



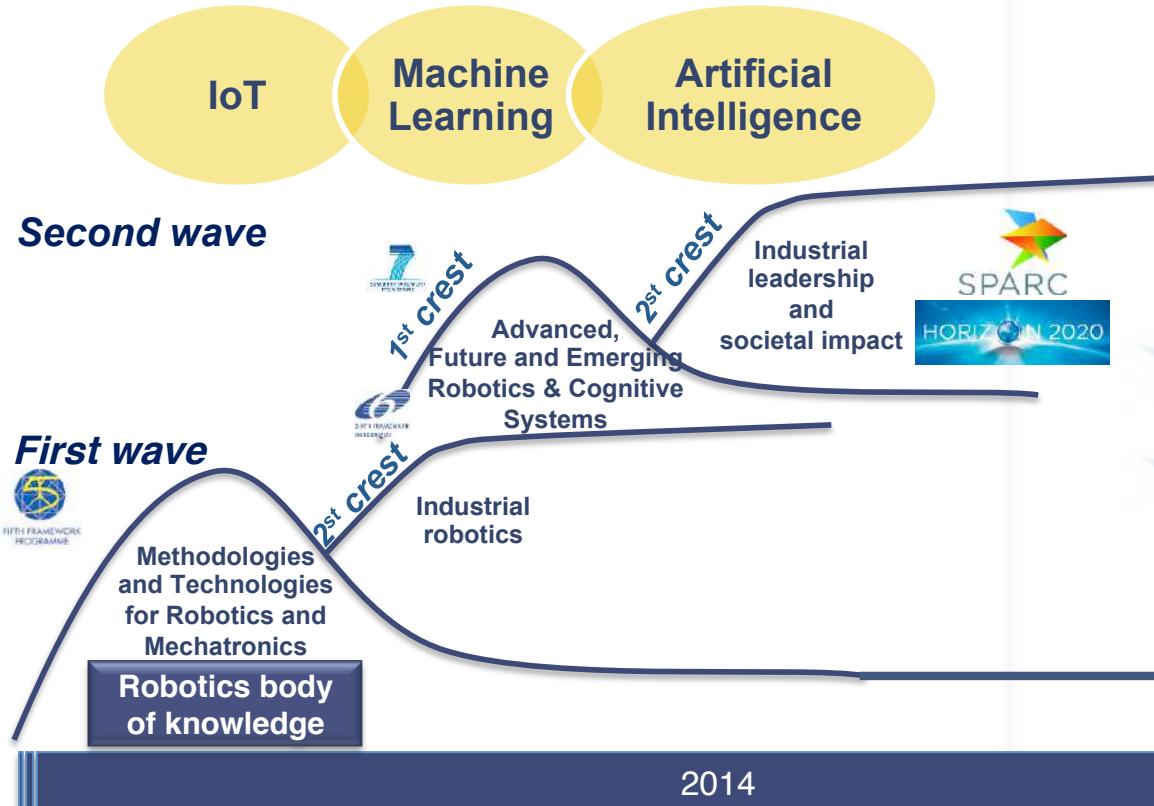
The first wave



Worldwide annual supply of industrial robots 2001 – 2019*



The second wave



Membership development

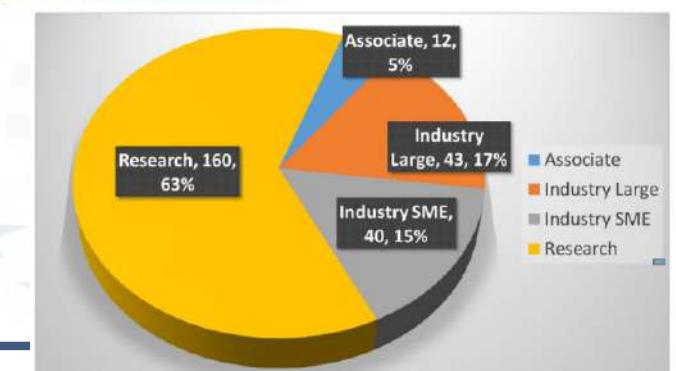


280 member organisations



Legend:

- Industry (Red dot)
- Research (Blue dot)
- Associate (Orange dot)
- euRobotics AISBL (Yellow dot)

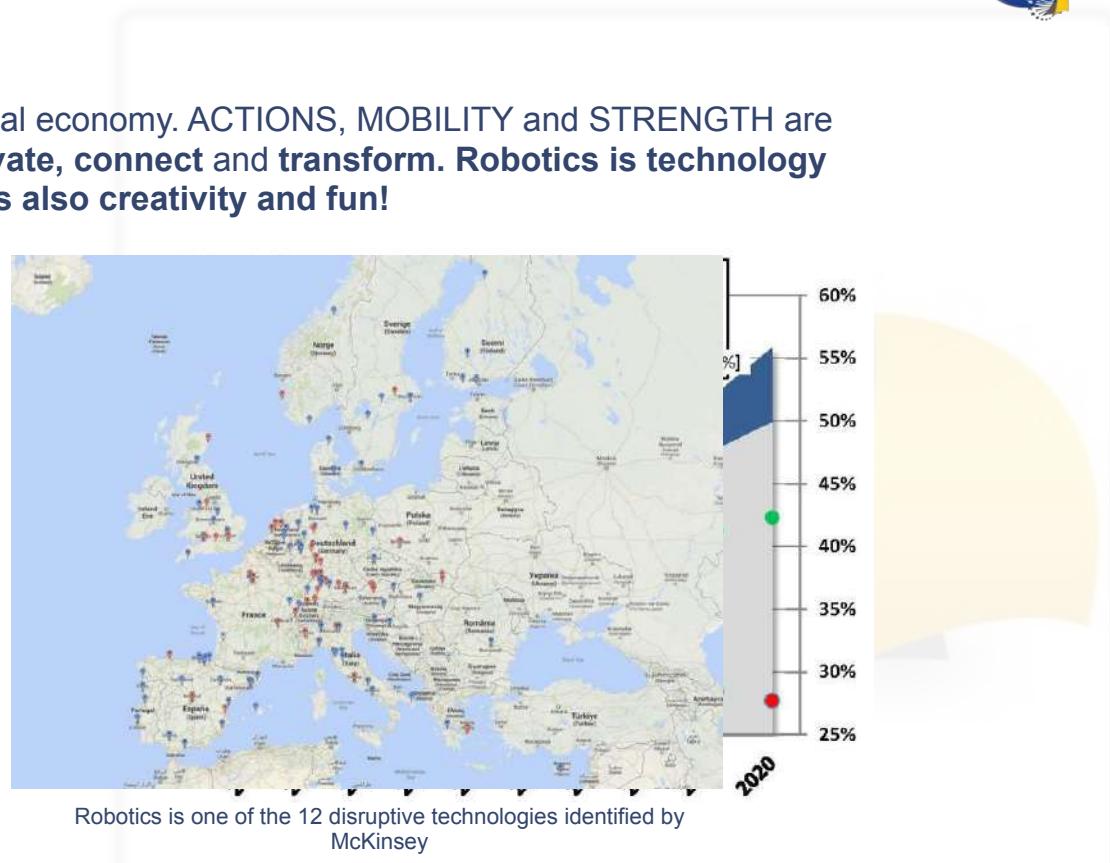


The second wave

Data are very important, but they are not all in a digital economy. ACTIONS, MOBILITY and STRENGTH are also needed! **Robotics**: a great opportunity to innovate, connect and transform. **Robotics is technology and business, but it is also creativity and fun!**

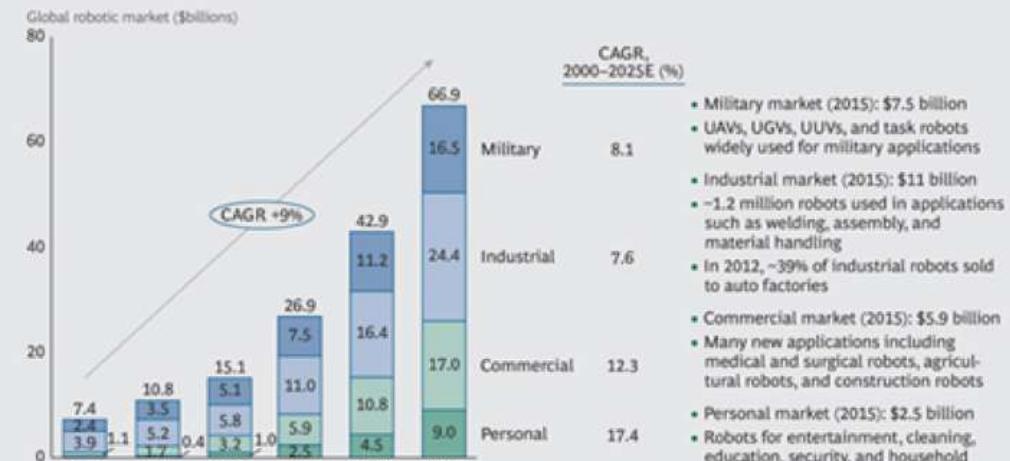
[...] The size of the robotics market is projected to grow substantially to 2020s. This is a global market and Europe's traditional competitors are fully engaged in exploiting it. Europe has a 32% share of the industrial market. Growth in this market alone is estimated at 8%-9% per annum. Predictions of up to 25% annual growth are made for the service sector where Europe holds a 63% share of the non-military market. [...]"

[...] From today's €22bn worldwide revenues, robotics industries are set to achieve annual sales of between €50bn and €62bn by 2020. [...]"



The second wave

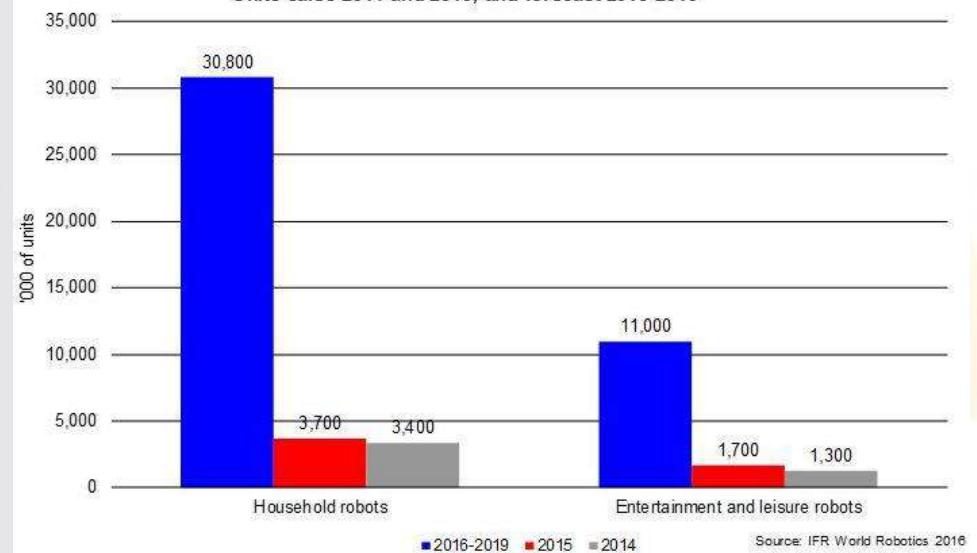
EXHIBIT 1 | Worldwide Spending on Robotics Is Expected to Reach \$67 Billion by 2025



Sources: International Federation of Robotics, Japan Robot Association; Japan Ministry of Economy, Trade & Industry; euRobotics; company filings; BCG analysis.

Note: UAV = unmanned aerial vehicle; UGV = unmanned ground vehicle; UUV = unmanned underwater vehicle. Estimates do not include the cost of engineering, maintenance, training, or peripherals.

Service robots for personal/domestic use.
Units sales 2014 and 2015, and forecast 2016-2019



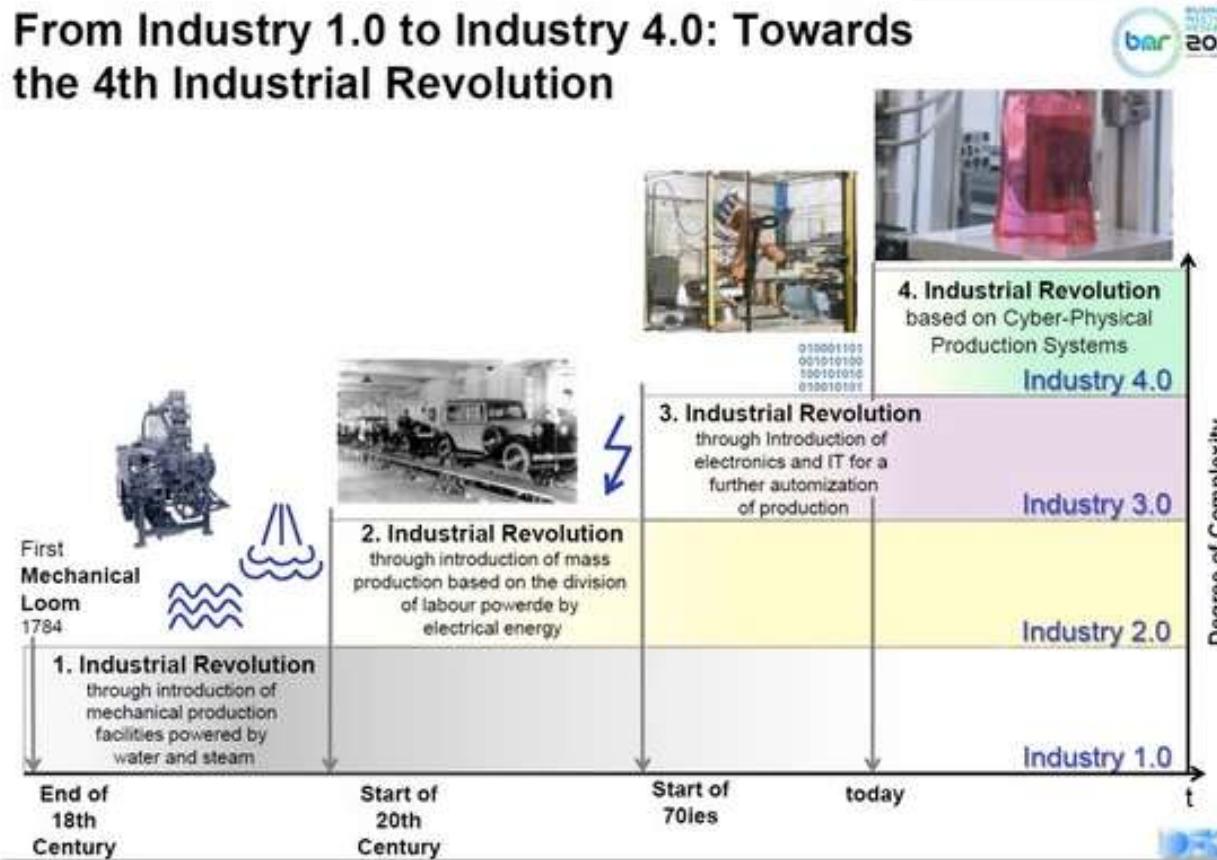
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The second wave

From Industry 1.0 to Industry 4.0: Towards the 4th Industrial Revolution



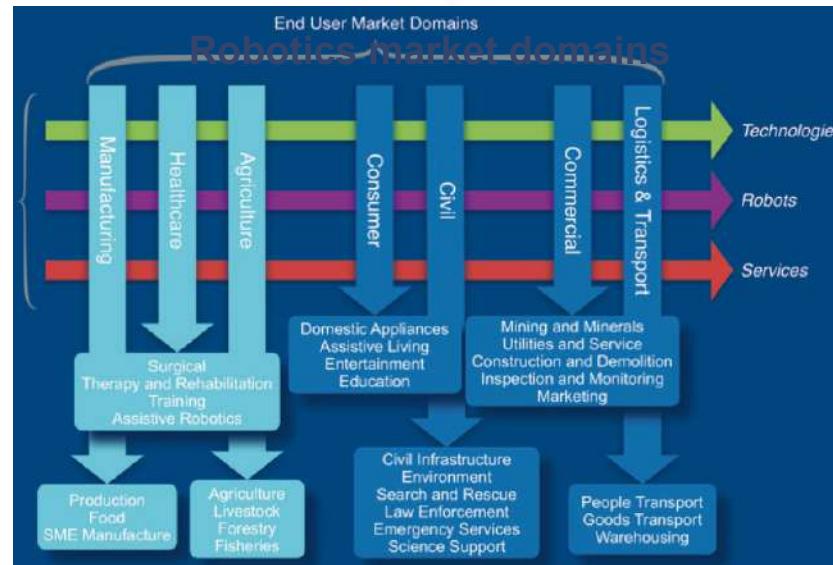
The second wave: Robotics: a great opportunity to innovate, connect and transform



- The web and IoT pull new robotic applications
- Robotics expands the boundaries of the Web and of IoT
- The Web is an 'infrastructure' of future robotics



Robots and Jobs



- Creating **new jobs** in robotics
- Creating new industrial opportunities (and **jobs**)
- Taking advantage of robotics and automation to enable GDP growth



ICT enabling components and technologies, e.g.,
MEMS, 4G, 5G

- Robotics integrates enabling ICT components
- Robotics will drive the development of new ICT components
- Robotics pulls the development of next generation communication networks

Why we need that? Today's markets are turbulent

Many market researches since many years (Zook et al., 2001, Ghemawat HBS Blog, 2007, Qin et al., 2008) show how the markets are becoming more and more ‘turbulent’: *the demand of products (shifting towards service-products) becomes more and more diversified as product mix and as product quantity variation versus time.*

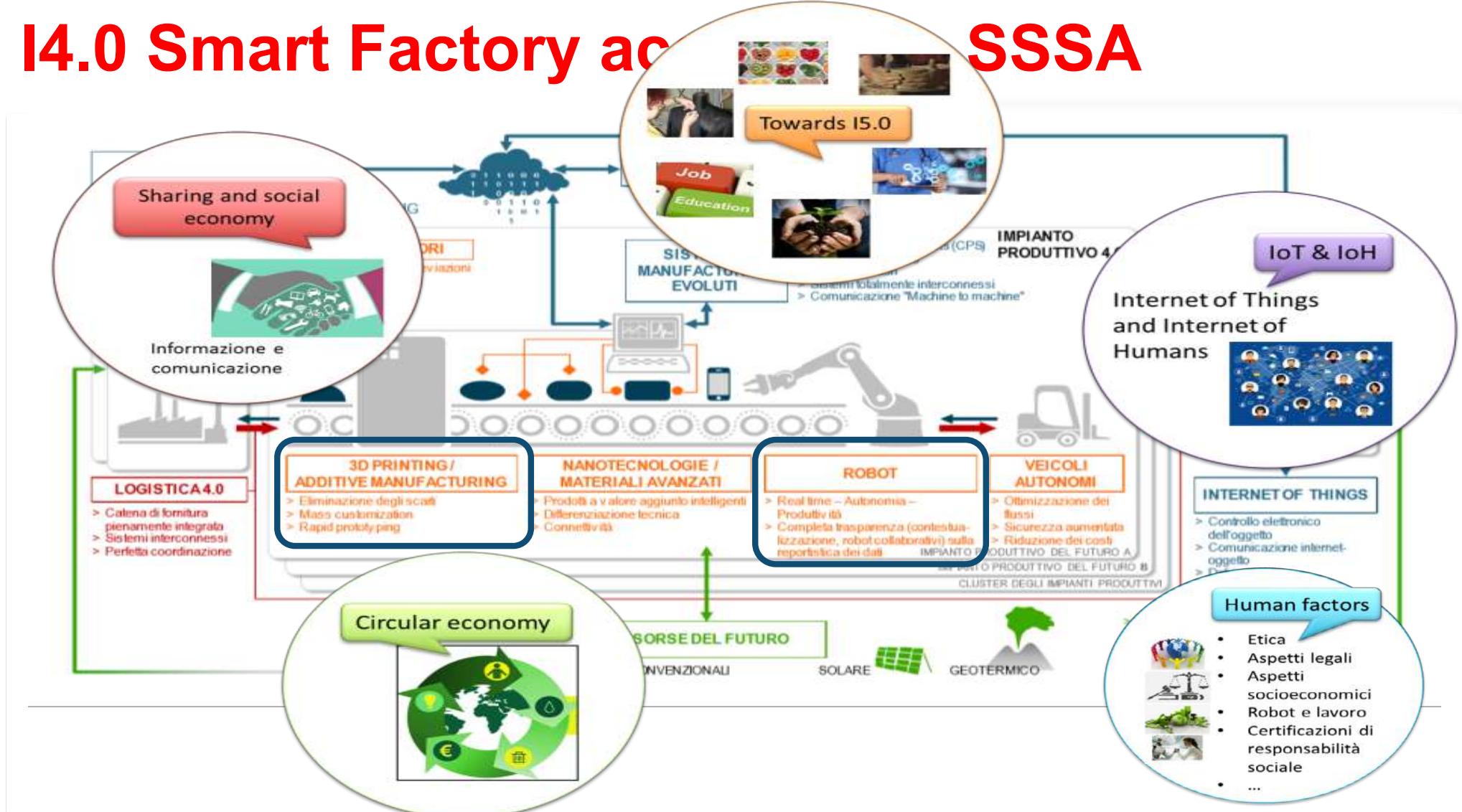
Digitalization of European Industry EU Strategy

- a. Digitalization of Products
- b. Digitalization of Services
- c. Digitalizzazione of Processes

50 G€ of investments by Bruxelles should generate benefits on industry and service sectors revenue for 110 G€/year



I4.0 Smart Factory and SSSA



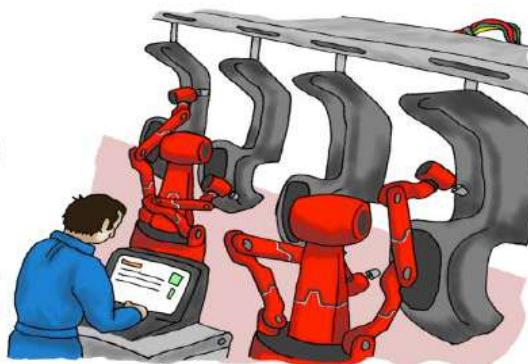
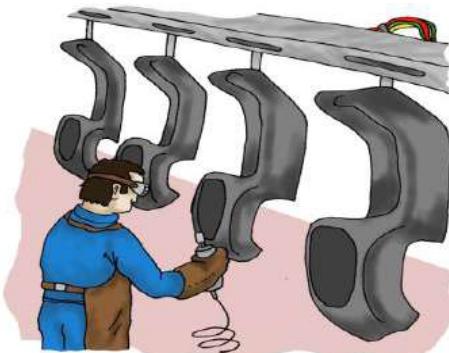


Regione Toscana

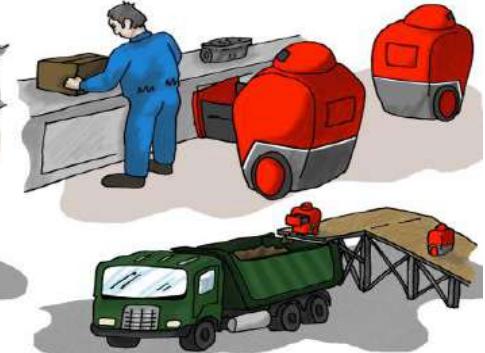


Scuola Superiore
Sant'Anna

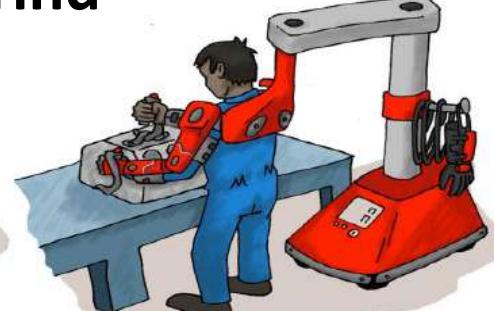
FACTORY 4.0: 'CENTAURO' Project SCENARIOS



iGrind



iSort



iWear



iTest



This is a dismantling
scenario!

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Our early work on Circular Economy

Proceedings of the 1993 IEEE/Tsukuba International Workshop on Advanced Robotics
— Can robots contribute to preventing environmental deterioration? —
Tsukuba, Japan November 8-9, 1993

1993 An Experimental Robot System for Investigating Disassembly Problems

P. Dario, M. Rucci, C. Guadagnini, C. Laschi
ARTS Lab, Scuola Superiore S.Anna
via Carducci 40, 56170 Pisa, Italy

- The initial approach to automation and robotics has **always** been **focused on assembly** whereas the managing of manufactured products at the end of their life cycle has been mostly neglected
- 1993: **disassembly and recycling** becomes **important** factors in a society where the ecological and economical implication of manufacturing is increasing

An Investigation on a Robot System for Disassembly Automation

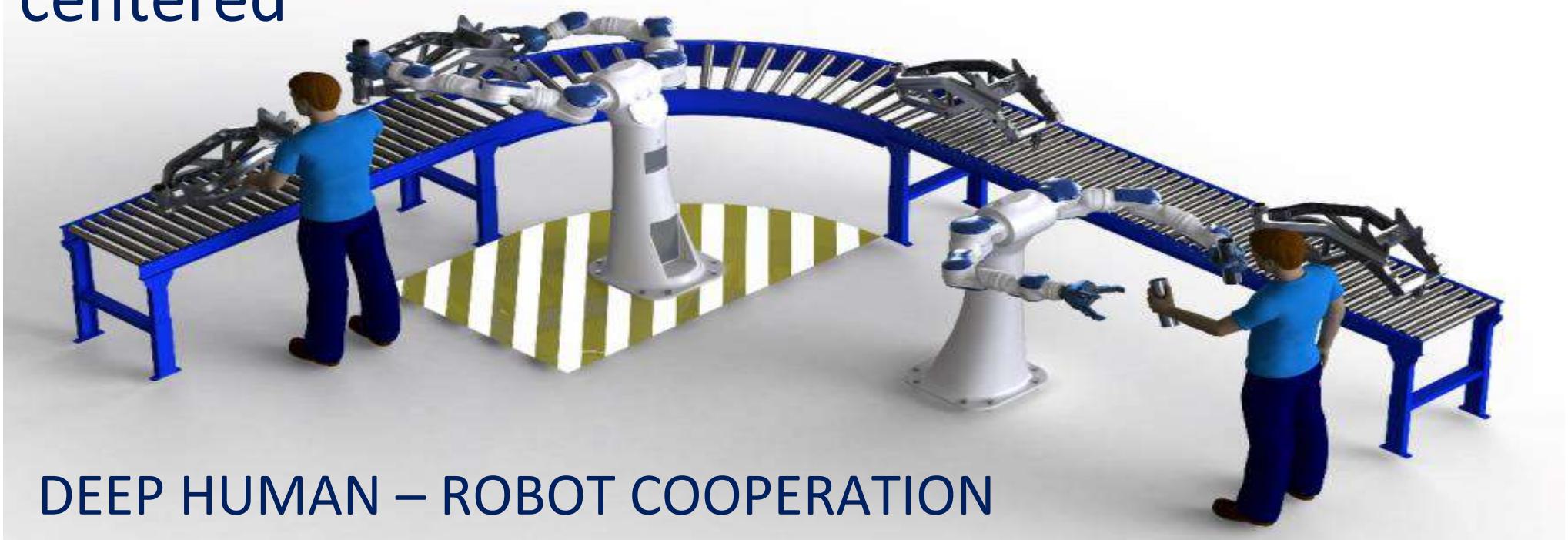
P. Dario, M. Rucci, C. Guadagnini, C. Laschi
ARTS Lab, Scuola Superiore S. Anna
via Carducci 40, 56127 Pisa, Italy

An Experimental Multisensorial Robotic System for Disassembly Automation

P. Dario, C. Guadagnini, C. Laschi, M. Rucci
ARTS Lab, Scuola Superiore S.Anna
via Carducci 40, 56127 Pisa, Italy

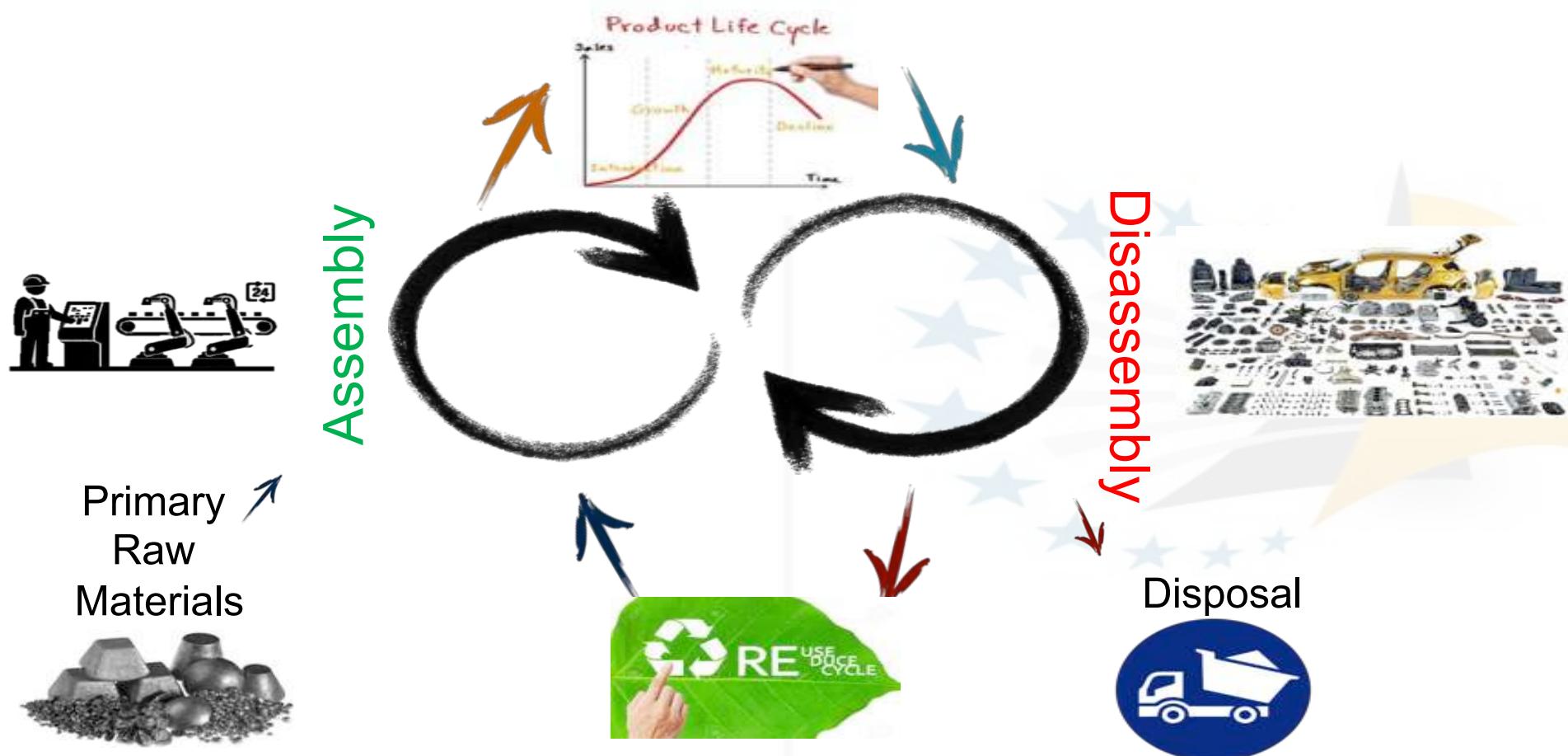
Robots on the Shop-floor

BIO-AUTOMATION: the new frontier of automation ‘eco’, bio-inspired and human centered



DEEP HUMAN – ROBOT COOPERATION

Bio-Automation: Deep Human-Robot cooperation (and workspace sharing) is needed for dismantling (and for lot of 1 artisan quality)



Disassembly Robotic Tasks for Circular Economy

Paolo Dario, Annagiulia Morachioli, Ilaria Strazzulla, Cecilia Laschi, Fabio Bonsignorio

Abu Dhabi
25th January 2016



IEEE Life Sciences Grand Challenges Conference

25-26 January, 2016
Khalifa University, Abu Dhabi, UAE



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A nice side-effect of Industry 4.0 and CE: Economically and eco-sustainable refurbishment of low quality urban areas



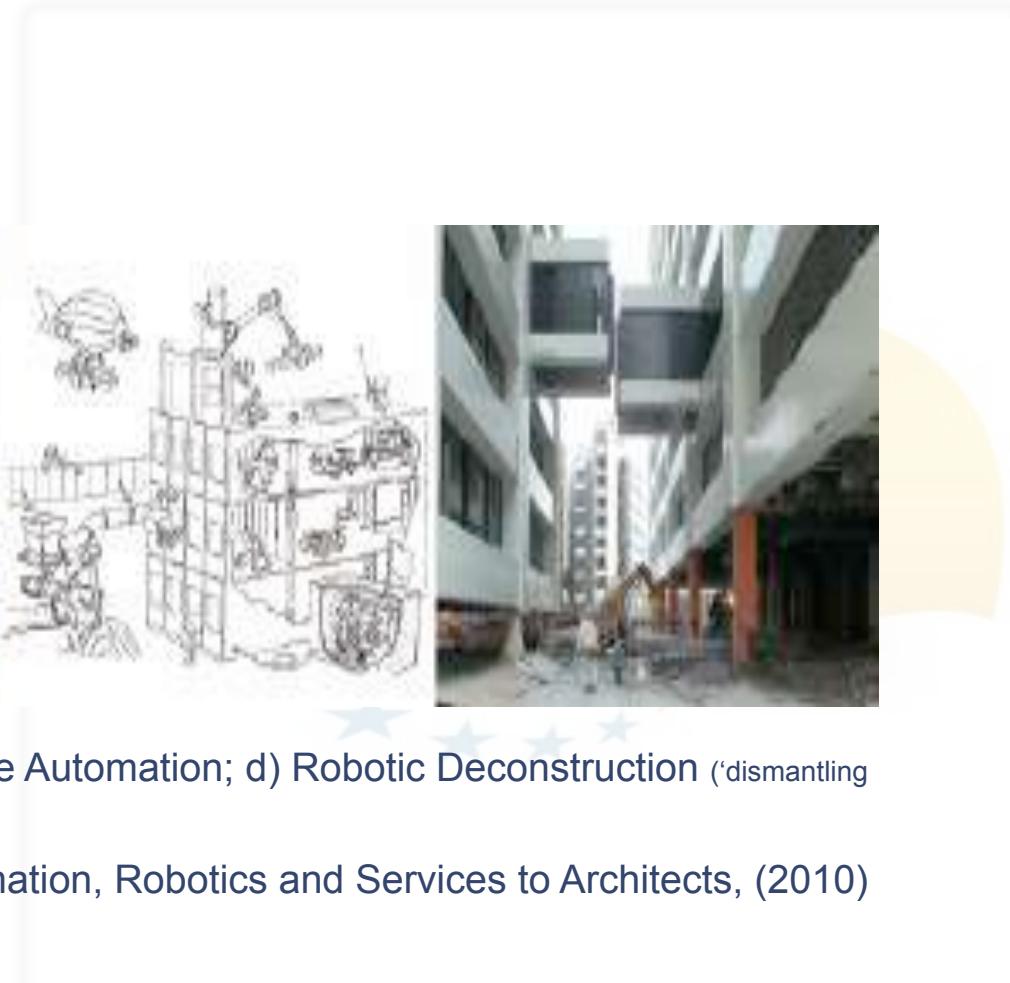
Richard and Su Rogers. Zip-Up Enclosures No. 1 and 2, 1968-71
Model. On behalf of Rogers Stirk Harbour + Partners



KieranTimberlake Associates, Stephen Kieran and James Timberlake.
Cellophane House (Exterior)

Pictures from: K. Tadashi Oshima, R. Waern (authors), B. Bergdoll and P. Christensen
(eds). Home Delivery, The Museum of Modern Art, New York, (2008)

Urban Refurbishment



- a) Ambient Innovation; b) Industrialization; c) Site Automation; d) Robotic Deconstruction ('dismantling of buildings and built environments')

from T. Block. TARSA, Teaching Automation, Robotics and Services to Architects, (2010)

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The second wave: the success stories

DARPA (American Defense Advanced Research Projects Agency) challenges have demonstrated how current robots are becoming **more accurate, fast and dexterous in structured and unstructured environments.**



Not everything worked as expected!

The second wave: the current approach shows some limitations

On the other hand the debriefing of DARPA DRC shows clearly that humanoid robots are **still far from the required level of capabilities in fact many metrics, such as time-to-completion, are highly application or task specific.**

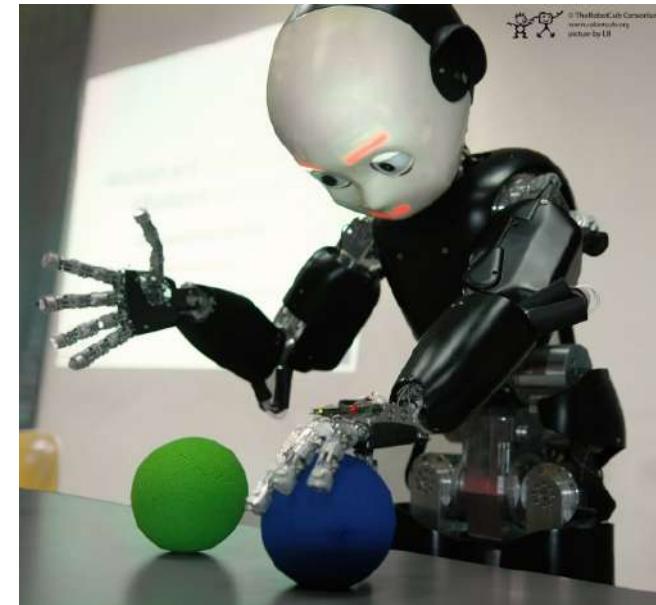


According to H.Yanco a minimum of 9 people were needed to teleoperate latest DRC's robots!!!

Pursuing new frontiers: The robotics bottleneck

Today, more functionality means:

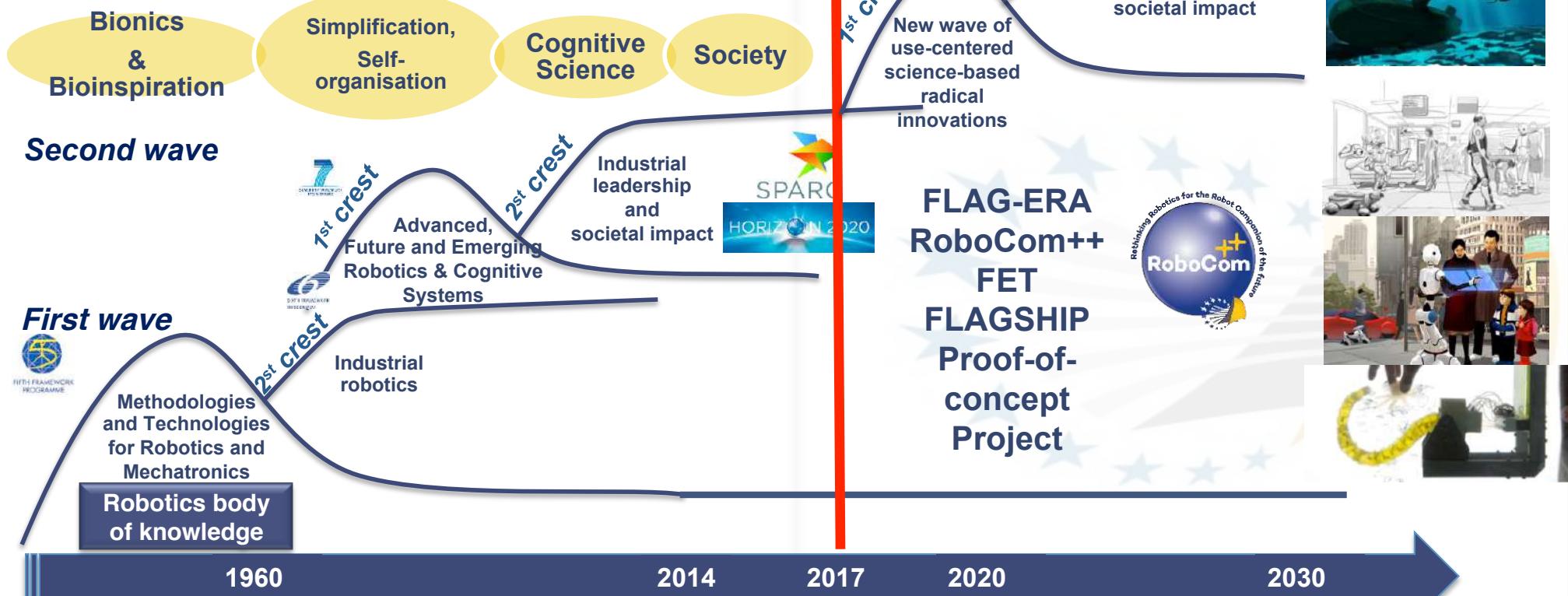
- **more** complexity, energy, computation, cost
- **less** controllability, efficiency, robustness, safety



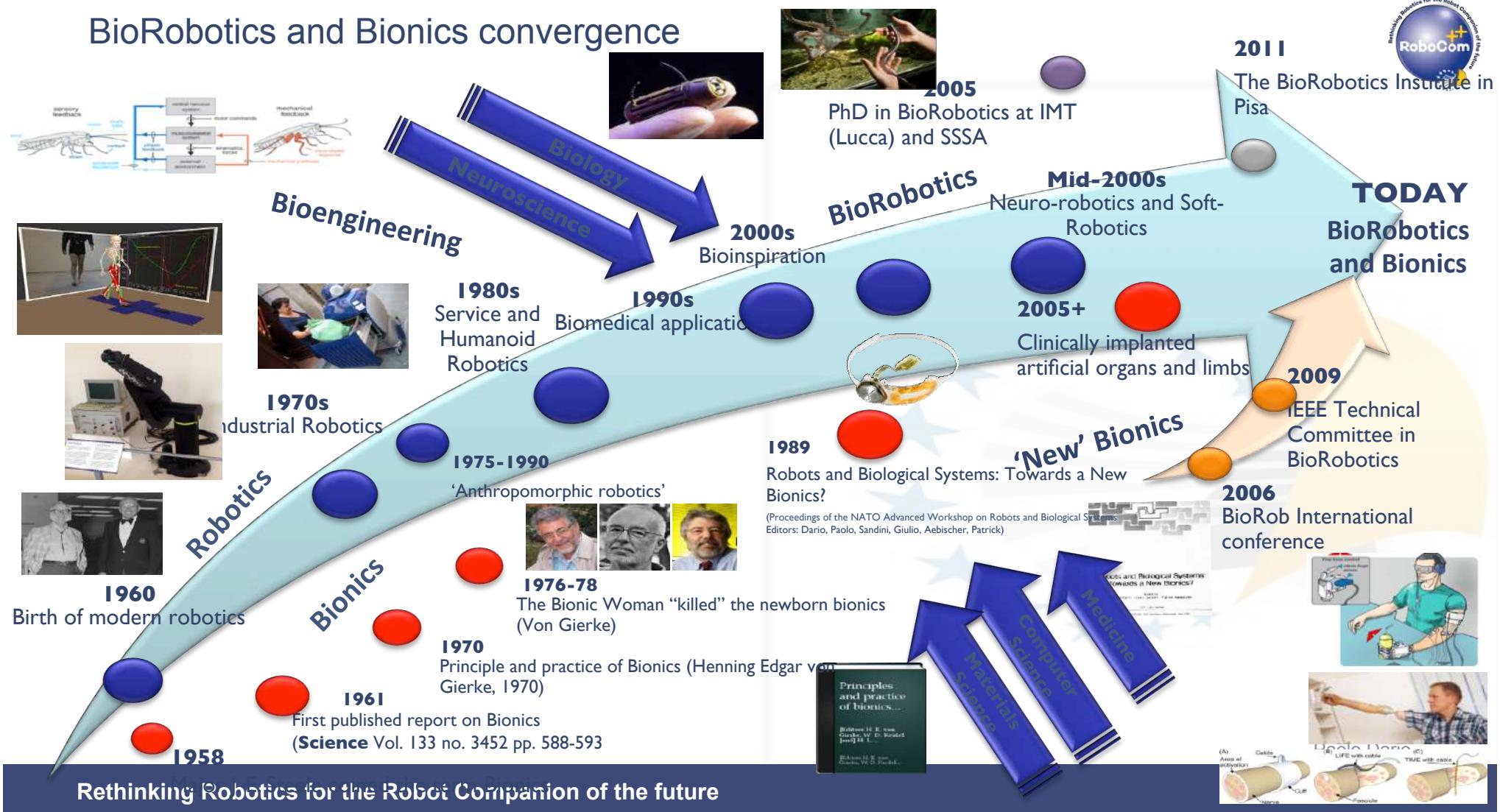
The Robotics waves



Third wave



BioRobotics and Bionics convergence



BioRobotics and Bionics convergence



Neuralink is developing ultra high bandwidth brain-machine interfaces to connect humans and computers.

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SAMSUNG **Born Disruptive**

TECH DRIVERS CLOUD ▶ SOCIAL ▶ MOBILE ▶ DATA

f **t** **in** **e** **g**

Elon Musk: I'm about to announce a 'Neuralink' product that connects your brain to computers

- Elon Musk says he will soon announce a Neuralink product that can make anyone superhuman by connecting their brains to a computer.
- He says Neuralink increases the data rate between the brain and computers and will give humans a better shot at competing with AI.
- Musk made the comments before he smoked weed and drank on Joe Rogan's podcast.

Todd Haselton | @robotodd
Published 10:26 AM ET Fri, 7 Sept 2018 | Updated 3:08 PM ET Tue, 11 Sept 2018

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Elon Musk's Neuralink brain-chip venture reportedly looks into rodent experiments

BY ALAN BOYLE on March 28, 2018 at 4:56 pm

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The GeekWire Gala: Join us on Dec. 6th!



EOLO Super
Internet + chiamate
fino a **100 Mega**
a partire da **20.000**

BioRobotics and Bionics convergence

Mary Lou Jepsen's TED talks



**Could future devices read images
from our brains?**

Posted Mar 2014



**How we can use light to see deep
inside our bodies and brains**

Posted Aug 2018



BioRobotics and Bionics convergence

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 Next-Generation Non-Surgical Neurotechnology (N^3)

Solicitation Number: HR001118S0029
Agency: Other Defense Agencies
Office: Defense Advanced Research Projects Agency
Location: Contracts Management Office

[Notice Details](#) [Packages](#) [Interested Vendors List](#)  Print  Link

 [Original Synopsis](#) Mar 23, 2018 9:10 am [Return To Opportunities List](#)

Solicitation Number: HR001118S0029 **Notice Type:** Presolicitation

Synopsis:
Added: Mar 23, 2018 9:10 am
DARPA seeks proposals to design, build, demonstrate, and validate a nonsurgical neural interface system to broaden the applicability of neural interfaces to the able-bodied warfighter. The final technology aims to enable neural recording and stimulation with sub-millimeter spatial resolution.

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 Attachment Mar 23, 2018 [HR001118S0029.pdf](#) [Attachment_1_HR00111...](#)

GENERAL INFORMATION

Notice Type: Presolicitation
Posted Date: March 23, 2018
Response Date: June 5, 2018
Archiving Policy: Automatic, on specified date

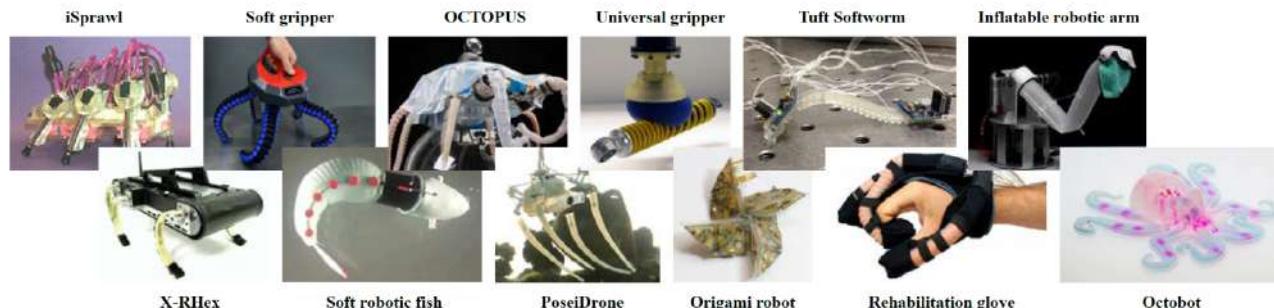


SCIENCE ROBOTICS

The screenshot shows the homepage of the Science Robotics website. At the top, there is a large banner with the text "ScienceRobotics" and the AAAS logo. Below the banner is a navigation bar with links for Home, News, Journals, Topics (which is underlined), and Careers. A search bar is also present. Under the navigation bar, there are links for Science, Science Advances, Science Immunology, Science Robotics (which is highlighted in red), Science Signaling, and Science Translational Medicine. The main content area features a large image of a soft robotic arm being held by a person's hand. To the left of the image, there is a sidebar with the text "Softness is a strength" and "Soft robotics expand the boundaries of robot abilities". Below this text is a credit line "Massimo Iregua/Kepach Production". At the bottom of the page, there is a decorative footer bar with several small colored squares.



The marvellous progress of Robotics and AI...'Look Ma, No Hands' syndrome?



Mostly stiff
Few selectively compliant elements

Entirely soft

Also sprach Rodney Brooks ☺

JUNE 17, 2017 — ESSAYS

Edge Cases For Self Driving Cars

rodneybrooks.com/edge-cases-for-self-driving-cars/



“Perhaps through this essay I will get the bee out of my bonnet that fully driverless cars are a lot further off than many techies, much of the press, and even many auto executives seem to think. They will get here and human driving will probably disappear in the lifetimes of many people reading this, but it is not going to all happen in the blink of an eye as many expect. There are lots of details to be worked out.”



- 'Look Ma, No Hands' syndrome?
- Replication of experiments
- Performance benchmarks, challenges and competitions to allow comparisons of results
- Needed to foster research advancement and enable practical application of research achievements

Much Needed to define 'How good' is a robot at performing tasks



A bit of History

Early stages
2008-2010

- 2008 Euron establishes the GEM SIG (coordinated by me, John Hallam, Angel P. del Pobil as a small funded networking project)
- Reproducibility issues in Robotics exposed at Euron General Meeting in Prague.
- Many meetings help define the issues related to Benchmarking and Good Experimental methodology in Robotics
- 2009: The IEEE RAS TC on Performance Evaluation and Benchmarking of Robotics and Autonomous Systems (PEBRAS) is established

2010-2016

- More than 20 workshops at ICRA, IROS, RSS, ERF discuss the issues and propose solutions
- 2015: the very first Special issues made of Reproducible paper on a high profile venue on IEEE R&A Magazine
- 2015: the first IEEE RAS Summer School on Reproducible Research in Robotics

Today

- Still more workshops (the latest at ICRA 2017 in Singapore)
- New cool upcoming initiatives on IEEE RAM
- The best is yet to come!



We are not alone: the ‘reproducibility crisis’

The screenshot shows the header of the EveryONE PLOS ONE community blog. The header features the "EveryONE" logo with a magnifying glass icon and the text "PLOS ONE community blog". Below the header is a navigation bar with three links: "About This Blog", "About PLOS ONE", and "Events". The main content area contains a photograph of a laboratory setup, including a blue electronic balance scale, a notebook with handwritten data, and several yellow and blue plastic strips. A "Previous" link is visible at the bottom left.

Promoting reproducibility by emphasizing reporting: PLOS ONE's approach

The screenshot shows the "nature" journal website. The top navigation bar includes links for "Home", "News & Comment", "Research", "Careers & Jobs", "Current Issue", "Archive", "Audio & Video", and "For Authors". Below the navigation is a breadcrumb trail: "Archive" > "Specials and supplements archive" > "Challenges in irreproducible research". The main content area is titled "SPECIAL" and features a graphic of three pipettes dispensing liquid into petri dishes. A red oval highlights the title "CHALLENGES IN IRREPRODUCIBLE RESEARCH" and the subtitle "Science moves forward by corroboration – when researchers verify others' results. See advances".

An experiment in Robotics is a well defined (stochastically) repeatable set of (stochastically) reproducible behaviors in well defined set of (stochastically) similar set of environments (see clinical studies in Medicine, Biology, Psychology, etc.)



Performance evaluation



Dyson's robot vacuum cleaner should be considered more intelligent than the Roomba?

How to compare, classify and rank complex adaptive behaviors (Intelligent/Cognitive)?



A new kind of papers?

- ‘description’ : a journal paper text+figures+ multimediaaccording to GEM Guidelines (or similar)
- Data sets (attachments, not just ‘multimedia’)
- Complete ‘code’ identifiers and or downloadable code (executables may be enough)
- ‘HW’ description or HW identifier (if it is identifiable)
- ...
...





THE REGULATION OF ROBOTICS IN
EUROPE: LEGAL, ETHICAL AND ECONOMIC
IMPLICATIONS
INTERNATIONAL SUMMER SCHOOL | 3-8 JULY 2017, PISA, ITALY

Reproducible Research now an IEEE priority

FROM THE EDITOR'S DESK

Research Reproducibility and Performance Evaluation for Dependable Robots

By Eugenio Guglielmelli

This issue of *IEEE Robotics & Automation Magazine* (RAM) focuses on reproducibility and measurability of robotics re-

issue, the IEEE Robotics and Automation Society demonstrates that we are well aware of and perfectly in line with



ability was introduced for computer systems in 1992 by the late Dr. Jean Claude Laprie, a senior researcher at

The screenshot shows the Code Ocean homepage. At the top, there's a navigation bar with links for 'ABOUT', 'PLANS', 'HELP', and 'CONTACT US'. On the right, there are 'LOG IN' and 'SIGN UP' buttons. The main heading is 'Discover & Run Scientific Code' with the subtext 'Code Ocean is a cloud-based executable research platform'. Below this is a button labeled '+ UPLOAD YOUR CODE'. The page features a blue background with various scientific icons and illustrations. A row of icons represents different fields: PHYSICS (atom), COMPUTER (monitor), CHEMISTRY (flask), ENGINEERING (gear), BIOLOGY (DNA helix), SOCIAL SCIENCES (people), MATHEMATICS (sum symbol), and ECONOMICS (building). Below these are four small charts: MEDICAL SCIENCES (APR 2017), ENGINEERING (JAN 2017), BIOINFORMATICS (JAN 2017), and COMPUTER SCIENCE (MAY 2017).

R(eproducible)-Articles on IEEE R&A Magazine



Medium-Long term

Prescribing criteria for statistical significance

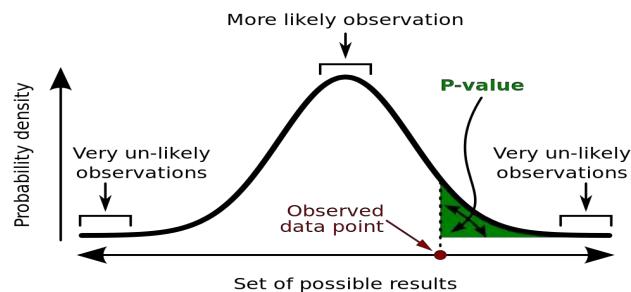
Basic

Important:

$\Pr(\text{observation} \mid \text{hypothesis}) \neq \Pr(\text{hypothesis} \mid \text{observation})$

The probability of observing a result given that some hypothesis is true is *not equivalent* to the probability that a hypothesis is true given that some result has been observed.

Using the p-value as a “score” is committing an egregious logical error: **the transposed conditional fallacy**.



A **p-value** (shaded green area) is the probability of an observed (or more extreme) result assuming that the null hypothesis is true.

Picture source: wikipedia

Advanced



Enhancing the QUAlity and Transparency Of health Research

Home Library Toolkits Courses & events News Blog Librarian Network About

Your one-stop-shop for writing and publishing high-impact health research

find reporting guidelines | improve your writing | join our courses | run your own training course | enhance your peer review | implement



Library for health research reporting

The Library contains a comprehensive searchable database of reporting guidelines and also links to other resources relevant to research reporting.

Search for reporting guidelines

Not sure which reporting guideline to use?

Reporting guidelines under development



Reporting guidelines for main study types

Randomised trials	CONSORT	Extensions	Other
Observational studies	STROBE	Extensions	Other
Systematic reviews	PRISMA	Extensions	Other
Case reports	CARE	Extensions	Other
Qualitative research	SRQR	COREQ	Other
Diagnostic / prognostic studies	STARD	TRIPOD	Other
Quality improvement studies	SQUIRE		Other
Economic evaluations	CHEERS		Other
Animal pre-clinical studies	ARRIVE		Other
Study protocols	SPIRIT	PRISMA-P	Other

<http://www.equator-network.org/>



Medium-Long term

Introducing more detailed classification of articles (see ACM 'badging')

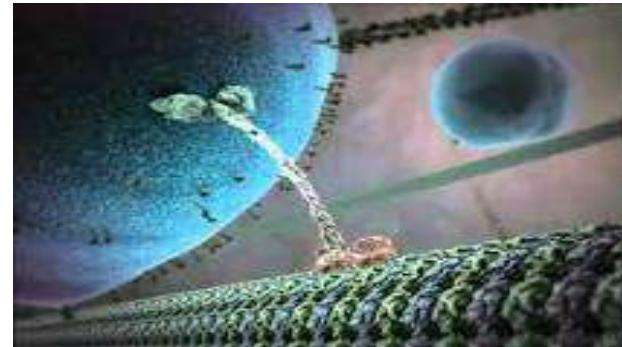


<https://www.acm.org/publications/policies/artifact-review-badging>



Is It Alive?

Big Questions lie in front of us!



Scuola Superiore
Sant'Anna



Two views of intelligence

classical:
cognition as computation



embodiment
PARADIGM CLASHES
cognition emergent from sensory-
motor and interaction processes



Soft Robotics: a working definition

Variable impedance actuators and stiffness control

- * Actuators with variable impedance
- * Compliance/impedance control
- * Highly flexible (hyper-redundant or continuum) robots

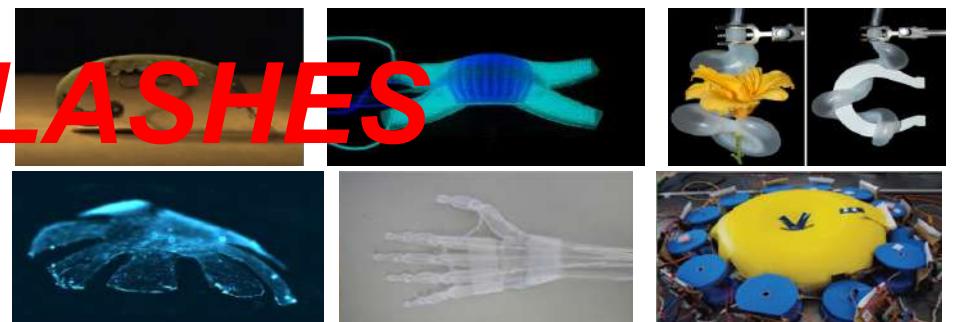


IEEE Robotics and Automation Magazine,
Special Issue on Soft Robotics, 2008
A. Albu-Schaffer et al. (Ed.s)



Use of soft materials in robotics

- * Robots made of soft materials that undergo high deformations in interaction
- * Soft actuators and soft components
- * Control partially embedded in the robot morphology and mechanical properties



Kim S., Laschi C., and Trimmer B. (2013) Soft robotics: a bioinspired evolution in robotics, *Trends in Biotechnology*, April 2013.
Laschi C. and Cianchetti M. (2014) "Soft Robotics: new perspectives for robot bodyware and control" *Frontiers in Bioengineering and Biotechnology*, 2(3)

Outline of the talk

- Global Challenges
- Robotics ‘waves’
- Industry 4.0
- I4.0 impact on the Circular Economy
- Another I4.0 side effect: impact on Construction Industry
- Open issues with current ‘paradigms’ and approaches, and the road ahead
- Societal impacts vs. Impacts on Healthy and Independent Ageing



Not 'academic issues'



The crashed Tesla S car involved in the first fatal self driving car accident on May 7th 2016. Source: Reuters



As early as in 2001 the first RoboEthics workshop was held in Pisa at SSSA



DustBot FP6 Project 2006-2009 took waste collecting robots in the streets of the Tuscan 'borgo' of Peccioli...From that experience 'Law issues' with massive deployment of robots became clearGuess who started the discussion leading to the RoboLaw Project 2011-2014) coordinated by SSSA.

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The Free Encyclopedia

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Random article
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Community portal
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Dustbot

From Wikipedia, the free encyclopedia

Dustbot is a robot that can collect garbage from homes. It can be summoned by phone call or SMS, and uses GPS to automatically make its way to the customer, collect the rubbish, and take it to a dustbin. In addition, the Dustbots carry environmental sensors to monitor the pollution levels over, for example, a pedestrian area. Prototypes have been tested in Italy, in Sweden, in Korea and Japan, and it is due for launch in 2009. The Dustbot project is funded by the European Commission.

Contents [hide]

- 1 Testing and operation
- 2 Technical
- 3 See also
- 4 References
- 5 External links

Testing and operation [edit]

Dustbot is allegedly the world's first robot that comes to take away rubbish from a residence upon request.^[1] It can be summoned to an address by phone or SMS^[2] at any time of the day.^[1] The caller's position is calculated and the Dustbot is dispatched.^[2] When the robot arrives "you use the robots display board to enter what sort of trash it is and then the robot carries it to a dust bin",^[2] said Matteo Reggente, one of the DustBot scientists.^[2] The DustBot then opens its bin, collects the trash and takes it to a designated area.^[3]

The DustBot system, consisting of the DustCart and the DustClean robots, is designed to work in tight urban areas where large trucks find it difficult to operate,^[1] such as old European cities.^[3] It can work in narrow streets which are difficult for large refuse trucks to negotiate.^[4] The DustClean robot can also sweep,

Sant'Anna

RoboLaw

Regulating Emerging Robotic Technologies in Europe:
Robotics facing Law and Ethics

FP7-SCIENCE-IN-SO
2011-1
Project No.: 289092
Start date: March 1st
Duration: 27 Months
Funding scheme: Co-project
EU Financial Contrib.
1.497.966 EUR

Home Consortium Public documents Project Results Contacts

THE ROBOLAW PROJECT HAS CONCLUDED IN MAY 2014.
TO DOWNLOAD THE DOCUMENT ENTITLED 'D6.2 GUIDELINES FOR REGULATING ROBOTICS' FILL IN THE FORM BELOW AND YOU WILL BE DIRECTED TO THE FILE DOWNLOAD PAGE.

News & Event

EUROPE REGULATES ROBOTICS JEAN MONNET MODULE

RoboLaw's Guidelines and SSSA have already heavily influenced the EU's Lawmakers work...



European Parliament

Procedure : 2015/2103(INL)

Document selected : A8-0005/2017

Texts tabled : A8-0005/2017

Debates : PV 15/02/2017 - 14
CRE 15/02/2017 - 14

Votes : PV 16/02/2017 - 6.9

Texts adopted : P8_TA(2017)0051

Document stages in plenary

Texts adopted

Thursday, 16 February 2017 - Strasbourg

Civil Law Rules on Robotics

Resolution Annex

255k Provisional edition

P8_TA-PROV(2017)0051 A8-0005/2017

European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL))

The European Parliament,

- having regard to Article 225 of the Treaty on the Functioning of the European Union,
- having regard to Council Directive 85/374/EEC⁽¹⁾,
- having regard to the study on Ethical Aspects of Cyber-Physical Systems carried out on behalf of the Parliament's Science and Technology Options Assessment (STOA) Panel and managed by the Scientific Foresight Unit (STOA), European Parliamentary Research Service;
- having regard to Rules 46 and 52 of its Rules of Procedure,

30/10/18

Speaker

153



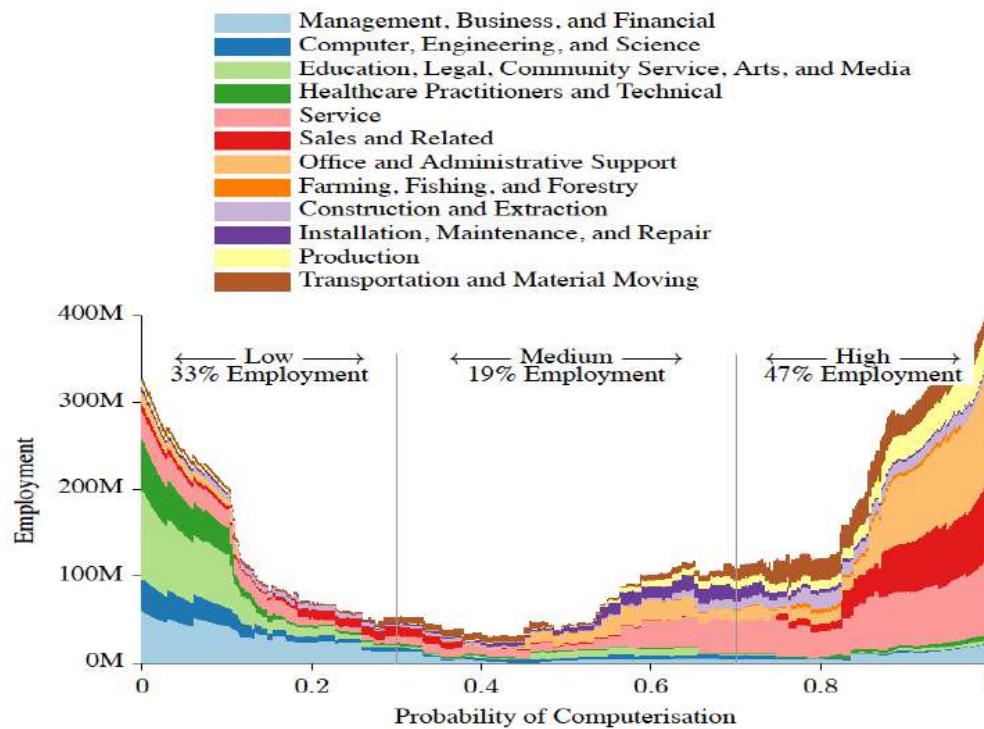


FIGURE III. The distribution of BLS 2010 occupational employment over the probability of computerisation, along with the share in low, medium and high probability categories. Note that the total area under all curves is equal to total US employment.

Global Challenge Insight Report

The Future of Jobs

Employment, Skills and
Workforce Strategy for the
Fourth Industrial Revolution

January 2016



WORLD
ECONOMIC
FORUM

COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

Bloomberg Technology

Economists May Be Underestimating How Fast the Robots Are Coming



Economists May Be Underestimating How Fast the Robots Are Coming

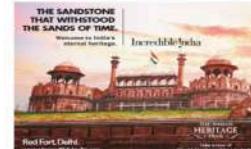
by Scott Hamilton

1 marzo 2017, 13:24 CET

BOE blog says technological change may be quicker than thought

Developed economies in danger

Economists may be underestimating how fast the robots are coming. Increasing automation and the resulting job losses are a threat to developed economies, according to a new post published on the Bank of England's blog.



Incredible India

DEMAND FULL AUTOMATION

DEMAND UNIVERSAL BASIC INCOME

Inventing the
Future

Postcapitalism
and a World
Without Work

Nick Srnicek
Alex Williams



The Opinion Pages | EDITORIAL

No, Robots Aren't Killing the American Dream

By THE EDITORIAL BOARD FEB. 20, 2017



837

OP-ED CONTRIBUTOR Tony Blair: Against Populism, the Center Must Hold

EDITORIAL The Pope on Panhandling: Give Without Worry

PADRE PONTE TIFFANY & CO. Why Is the Whitney Biennial So Important for Artists?

TIFFANY & CO.

GAIL COLLINS What to Do With Jeff Sessions

OP-ED CONTRIBUTOR Against Protesters, Republicans Must Stand Strong

Desktop Robotic Arm That Does Everything
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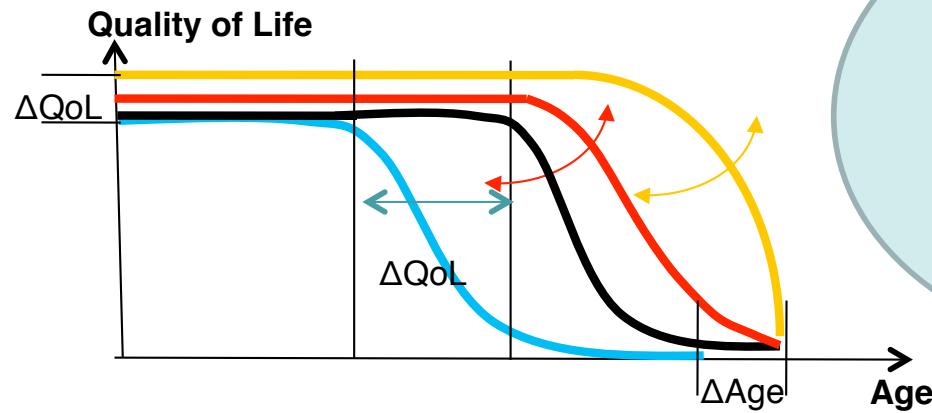
Seed Grove | OpenMV Cam | Open Source for Arduino/Ros

The New York Times

SECTIONS HOME SEARCH

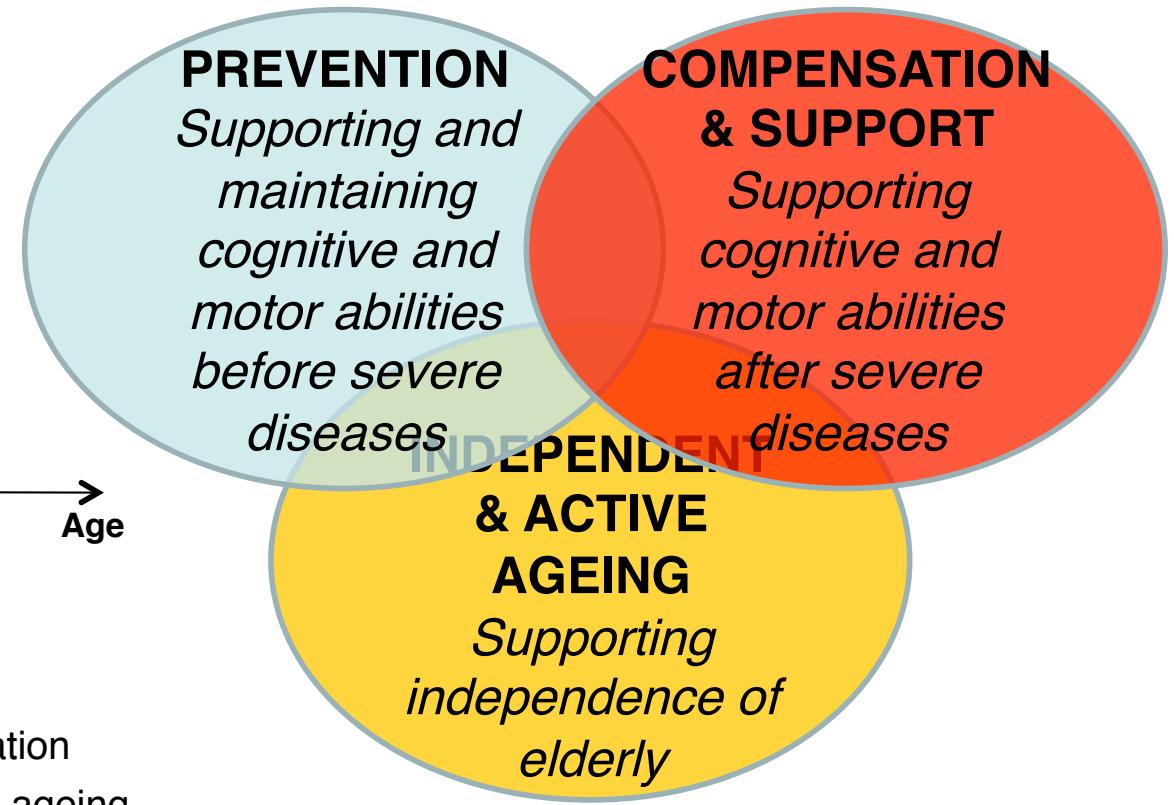
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Uncoped issues: The new Needs of ageing societies

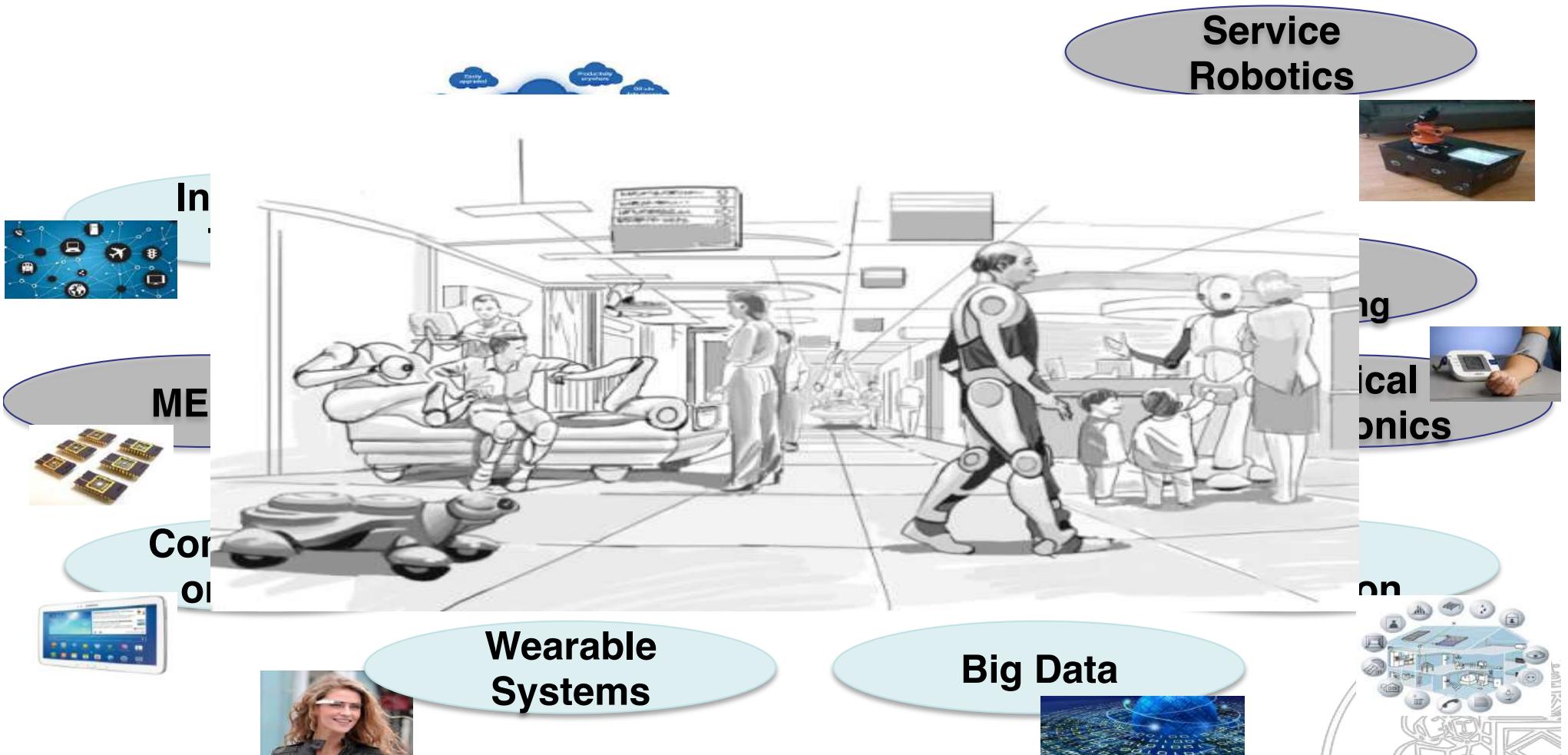


- Without devices and services
- Effects of prevention
- Effects of support and compensation
- Effects of independent and active ageing

Some outcomes from AAL2 and RobotEra Projects, Paolo Dario coordinated RobotEra.
Filippo Cavallo (also from our group) was the pm.



How can STI (Science, Technology and Innovation) contribute to the new needs of ageing societies?



Ethical Issues

“Despite the possible benefits,....:

- (1) the potential reduction in the amount of human contact;*
- (2) an increase in the feelings of objectification and loss of control;*
- (3) a loss of privacy;*
- (4) a loss of personal liberty;*
- (5) deception and infantilisation;*
- (6) the circumstances in which elderly people should be allowed to control robots*

We conclude by balancing the care benefits against the ethical costs. If introduced with foresight and careful guidelines, robots and robotic technology could improve the lives of the elderly, reducing their dependence, and creating more opportunities for social interaction”



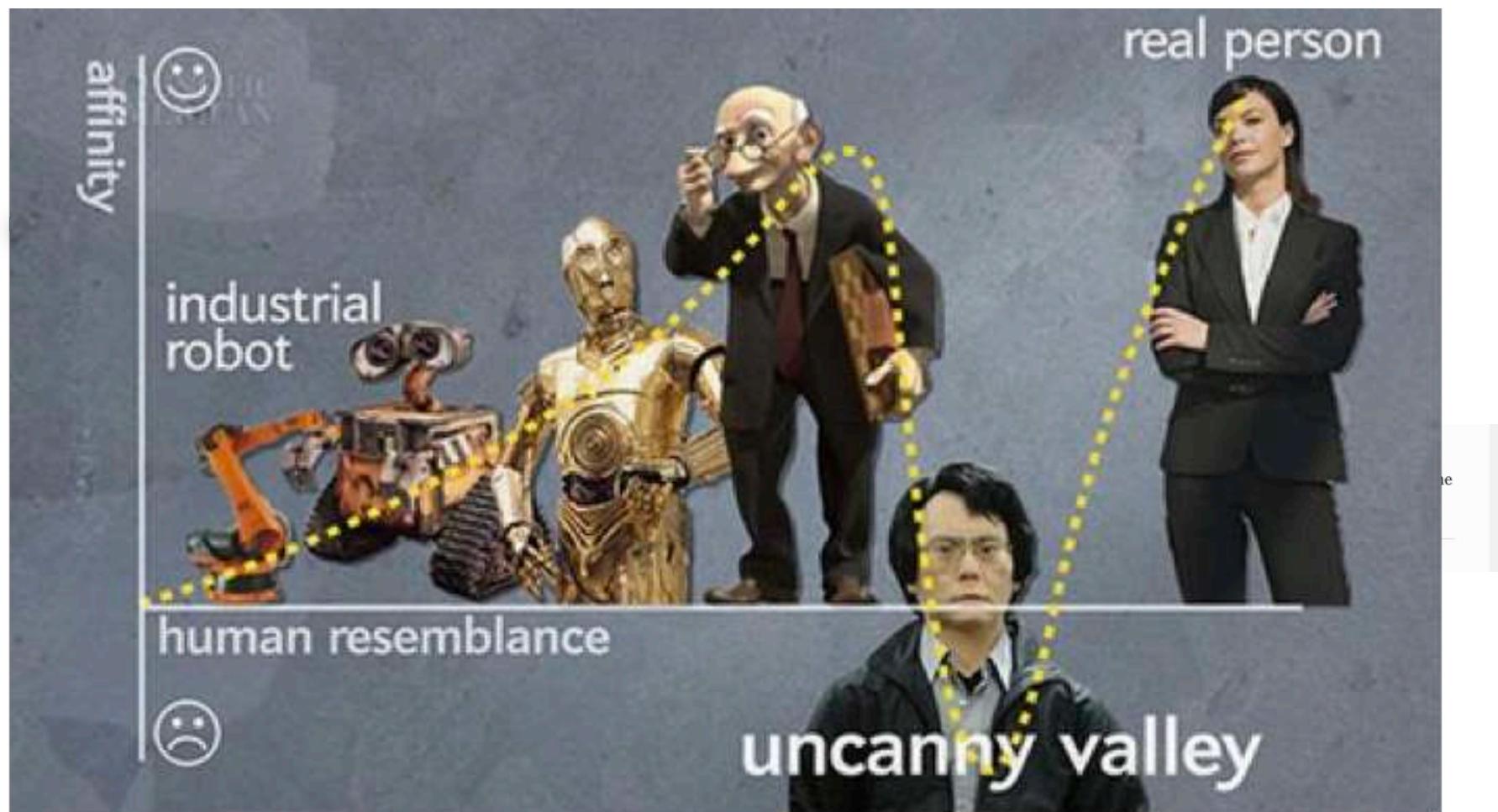


image from [scoop.it](#) Stephanie Lay

Is Radical Life Extension Good for Society?

By **Shelly Fan** - Dec 01, 2016 6,636

*From time to time, the Singularity Hub editorial team unearths a gem from the archives and wants to share it all over again. It's usually a piece that was popular back then and we think is still relevant now. This is one of those articles. It was originally published **February 14, 2016**. We hope you enjoy it!*



It's no longer a radical question.

The aging literature is replete with treatments that could **prolong lifespan by 20-40%**, at least in lab animals. Interventions such as caloric restriction, rapamycin and metformin have been studied for decades for their anti-aging capacity. Although there is still some discrepancy in their effectiveness in primates, the biomedical community agrees that they're promising.



Carry-home messages (and remarks) (1)

We will need to dramatically increase work productivity not only to cope with a shrinking work-force and growing number of people in old and very old age, but also to mobilize resources to help the ecologically sustainable development of the global economy and provide food and infrastructures to billions of more people.

- A steep progress in Robotics and AI seems a dramatic necessity in this context.
- The Advanced Mechatronic Technologies of the ‘Second Wave’ will have tremendous impact
- It seems unlikely that they can provide satisfactory ‘companions’ or life-like robustness and adaptation
- An evidence-based answer to this question requires a boost in the ways research is performed and reported
- To enable the ‘Third Wave’ of Robotics a massive effort will be needed (also in terms of dramatically improved research methodologies as existing results are ‘anecdotal’)

Carry-home messages (and remarks) (2)

- We will have to structure/digitalize living spaces to be able to exploit the existing and close future available technologies
- Given the cognitive/perception limits of current robots, teleoperation, scalable autonomy and in general human-in-the-loop solutions will work better
- Non obvious human-in-the-loop solutions: prosthetics, body-augmentation, artificial organs, high-bandwidth BCI/BRI
- We should take care of the disciplinary interfaces with translational genomics, connectomics, brain sciences, digital medicine, emerging rejuvenating technologies, to pursue successful holistic solutions for late age healthy and independent living
- We will still (sometimes remotely operating) need human caregivers: we should not leave elders and impaired persons alone with deceptive robot ‘companions’(it would/will make sense iff/when we will have conscious robots, that would open a huge number of different issues, though). Hopefully Industry 4.0, Robotics and AI (and what will follow) will free human resources!

A Weberian approach

- Ethics of conviction
(Gesinnungsethik)
- Ethics of responsibility
(Verantwortungsethik).

We need DATA and EVIDENCE



Maximilian Karl Emil "Max" Weber (German: ['ma:kst 've:bə]; 21 April 1864 – 14 June 1920) was a German sociologist, philosopher, jurist, political economist. Weber is often cited, with Émile Durkheim and Karl Marx, as among the three founders of sociology. (Source: Wikipedia)



A rant for global cooperation!



the promise of robotics....



It is our generation's responsibility to make the right choices.

The future can be bright.

Thank you!

fabio.bonsignorio@gmail.com

