MATLAB EXPO 2016

The Transformative Force of Robotics & Vision in Industry & Society

Peter Corke


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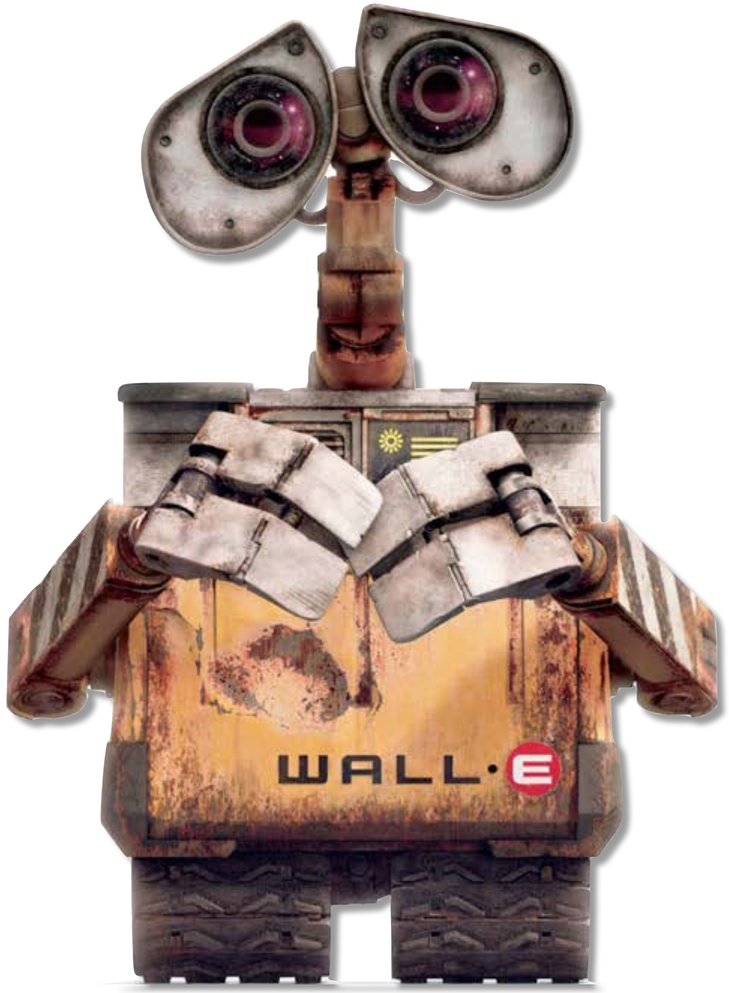
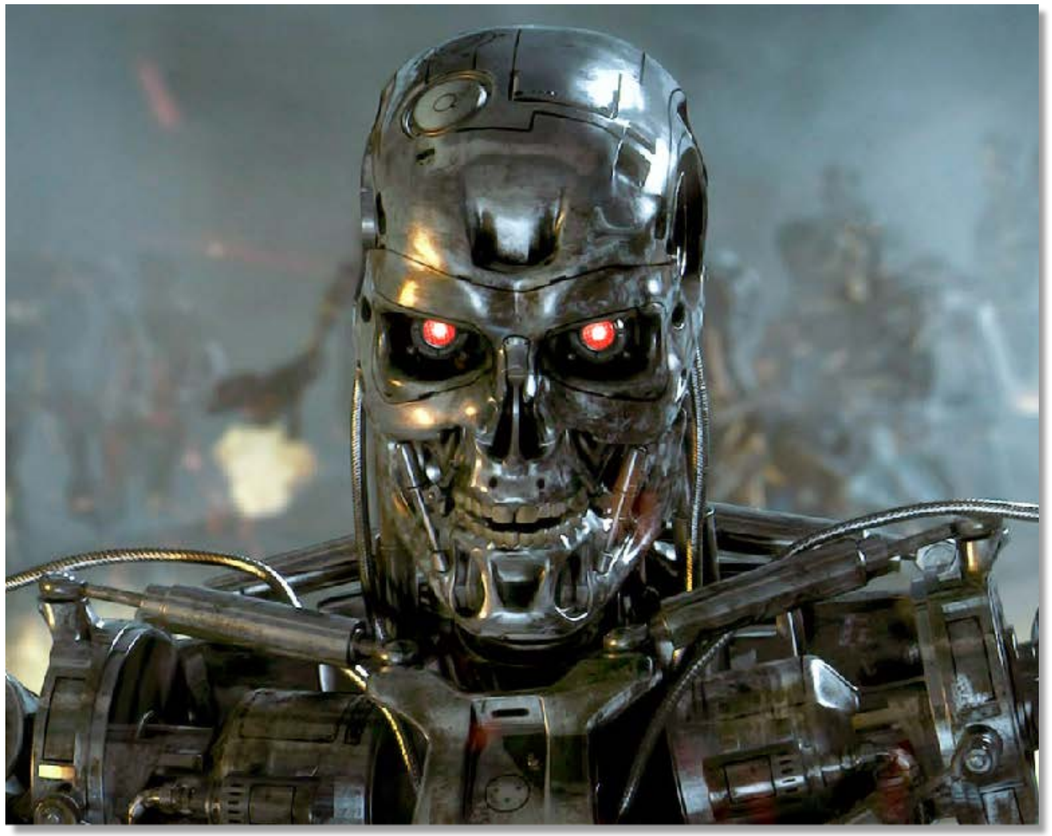
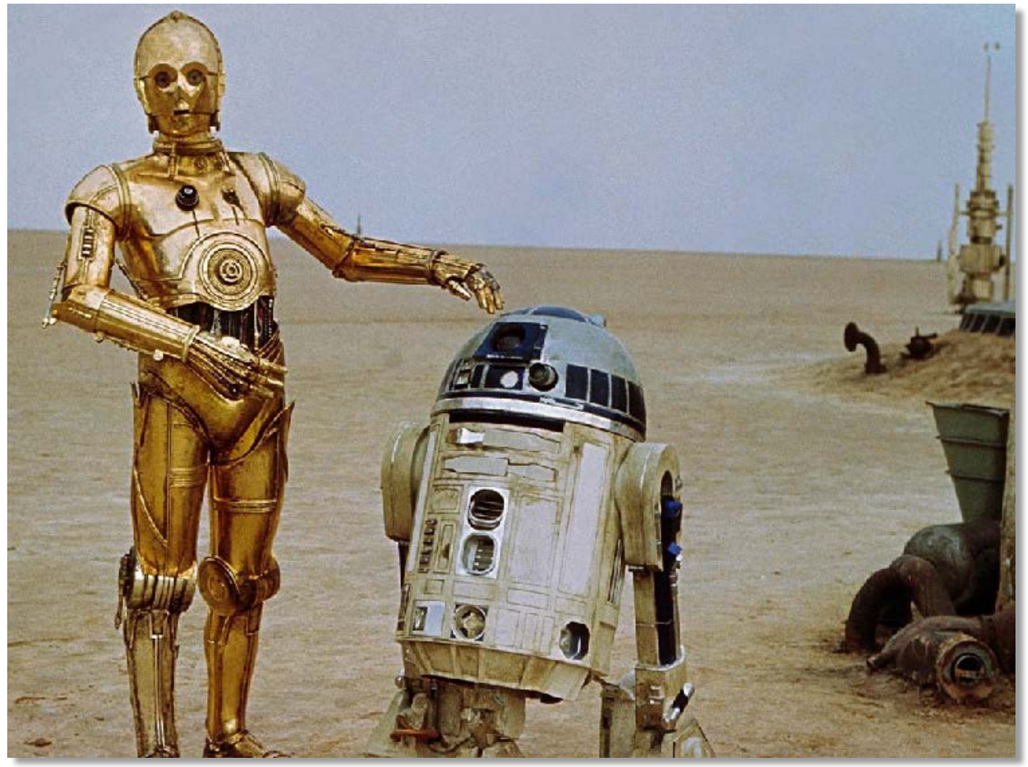
Cleve Moler
MATLA
2016
MathWor
Accelerating the pace of

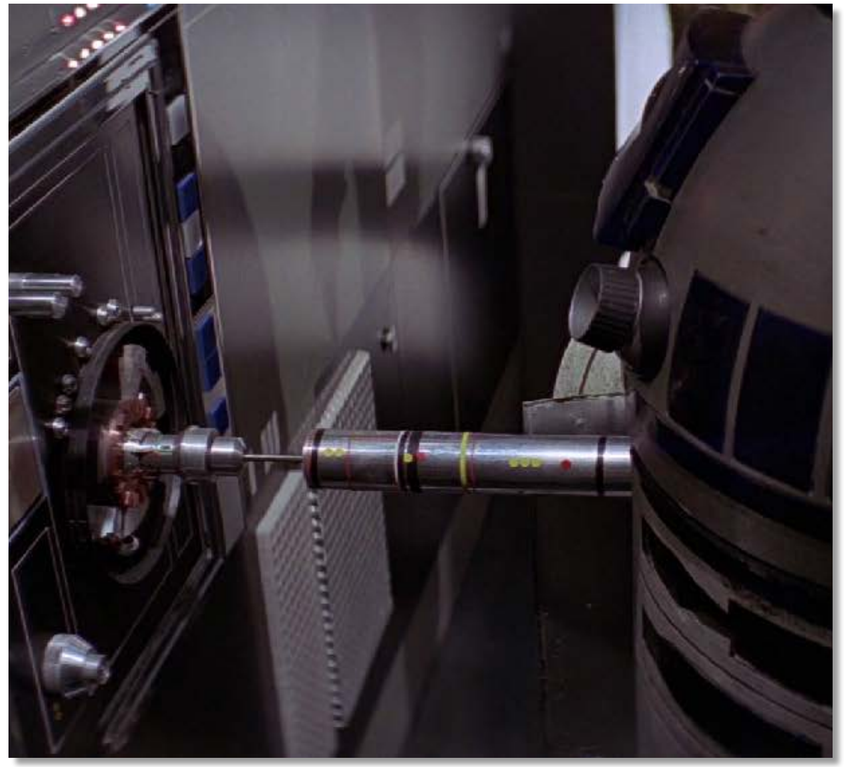
What is a robot?





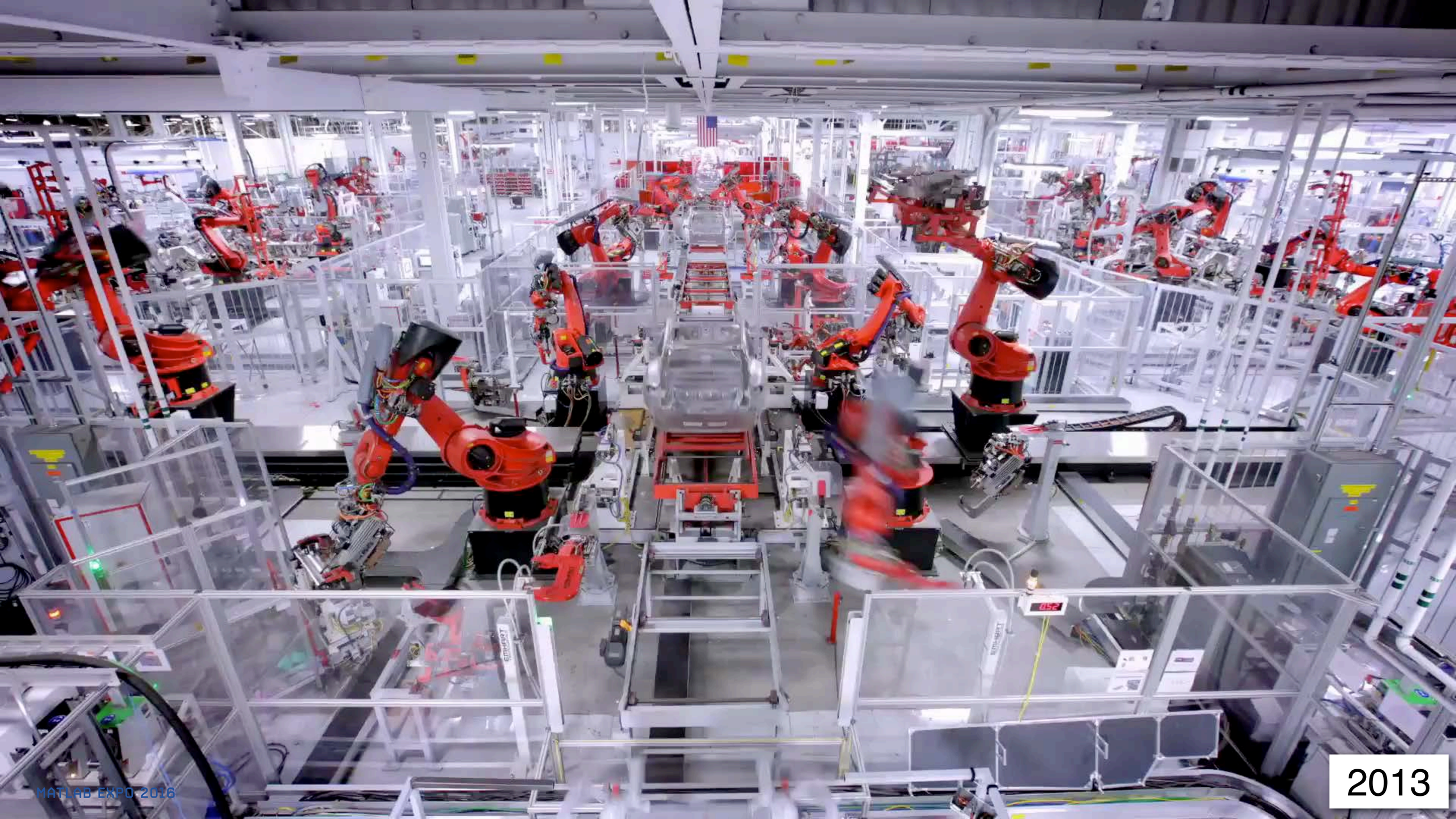
Perhaps super-intelligent machines



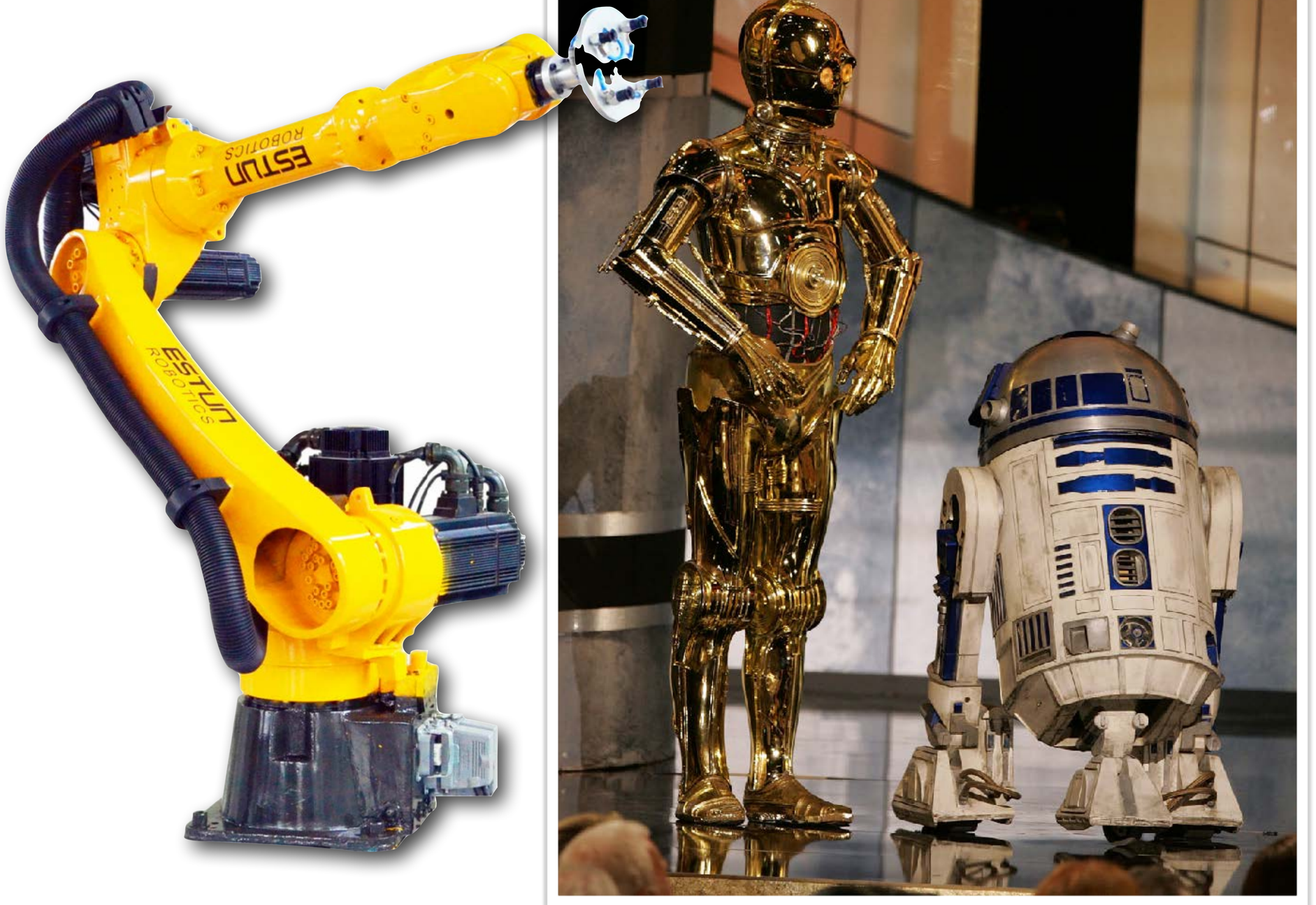


1977

or perhaps not…


MATLAB EXPO 2016
2013


M-16iB
J3


ESTUN
ROBOTICS
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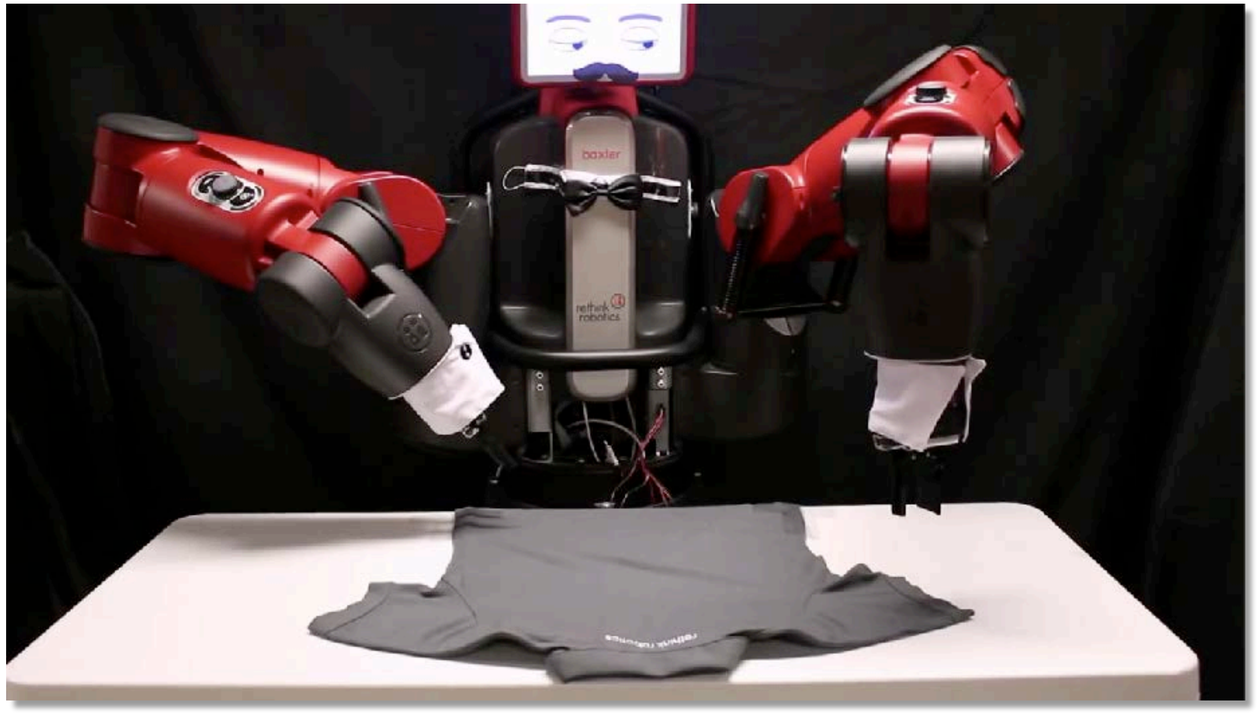
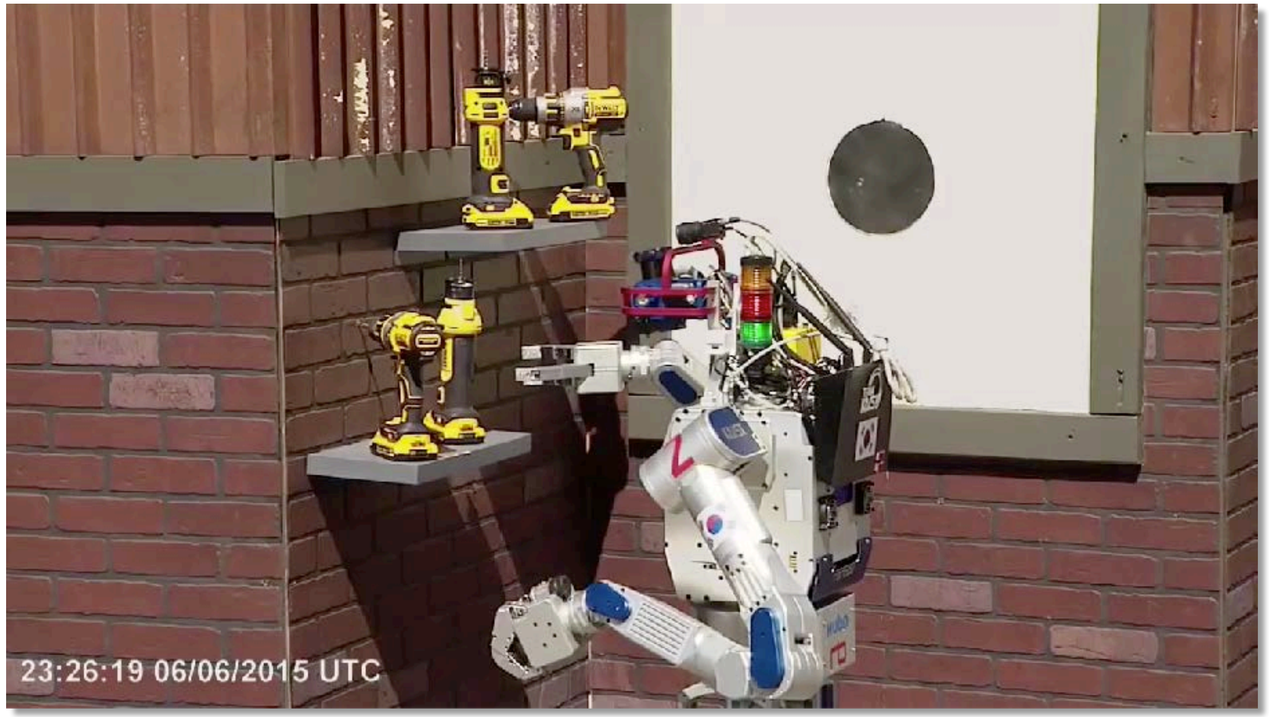

baxter
rethink robotics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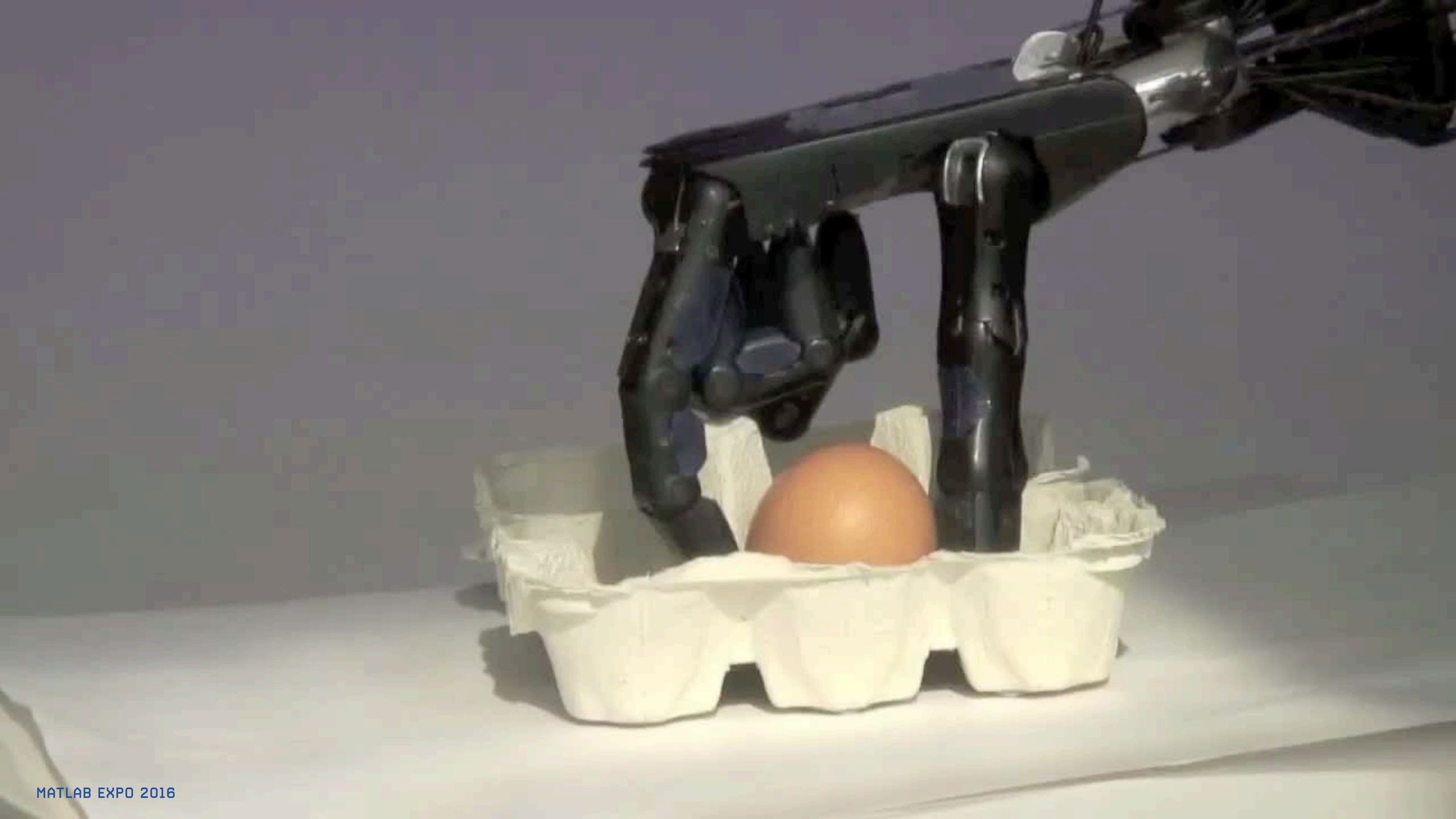
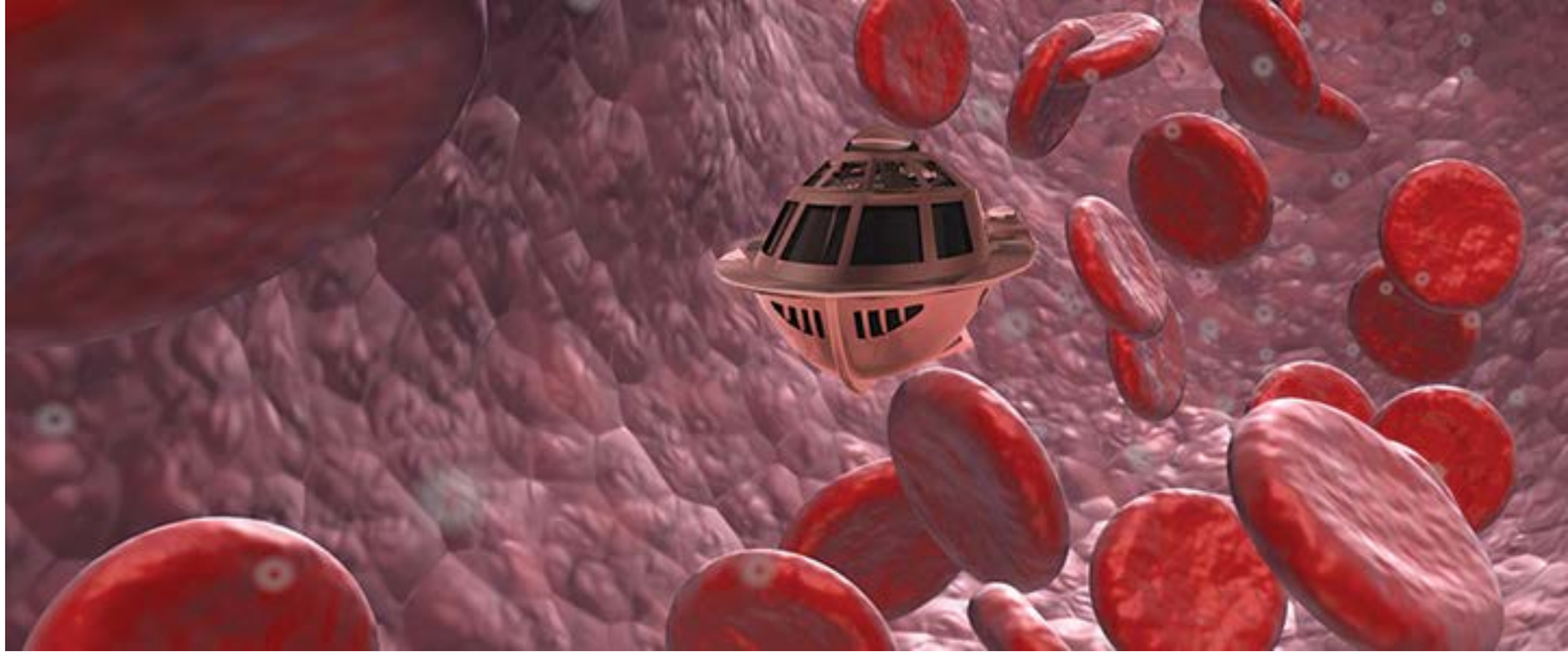
amazon
fulfillment



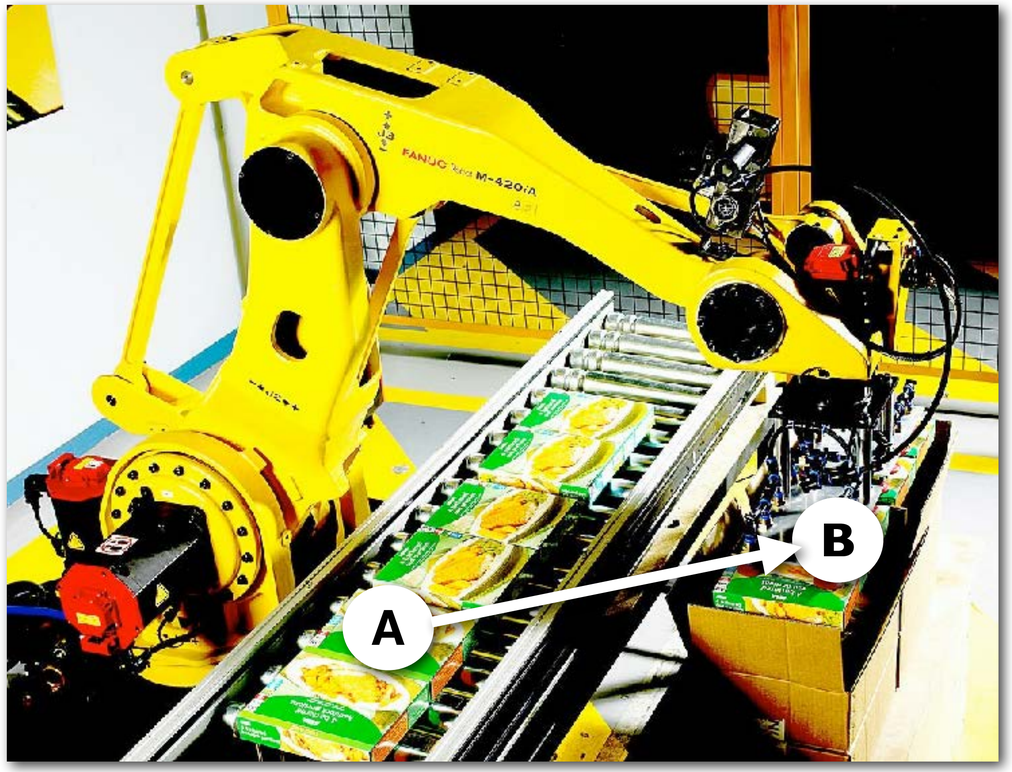

Muscle Suits
2013
Muscle Suits


fantastic
voyage



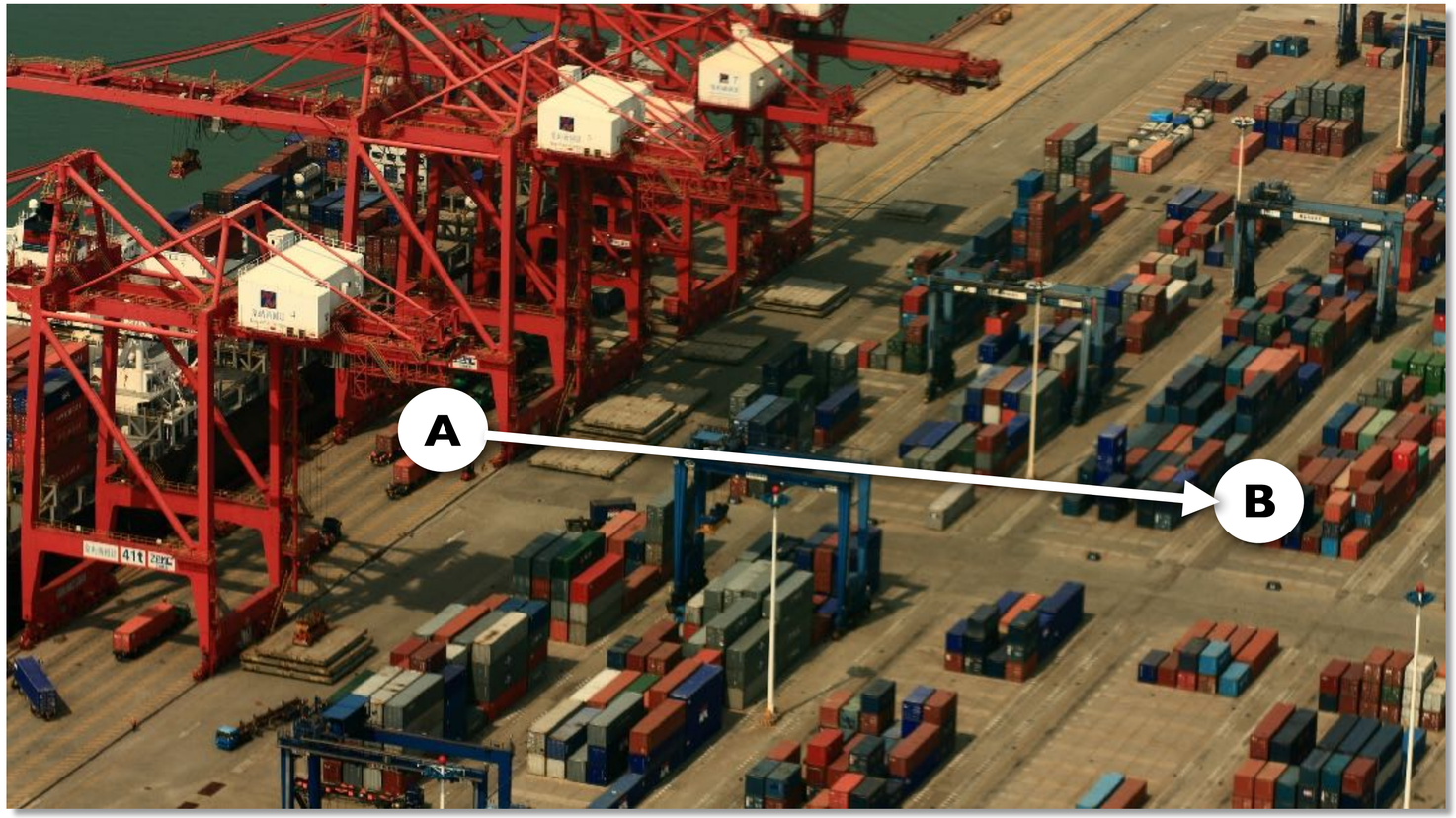
Robotics put us “inside” people

Robots move things from A to B



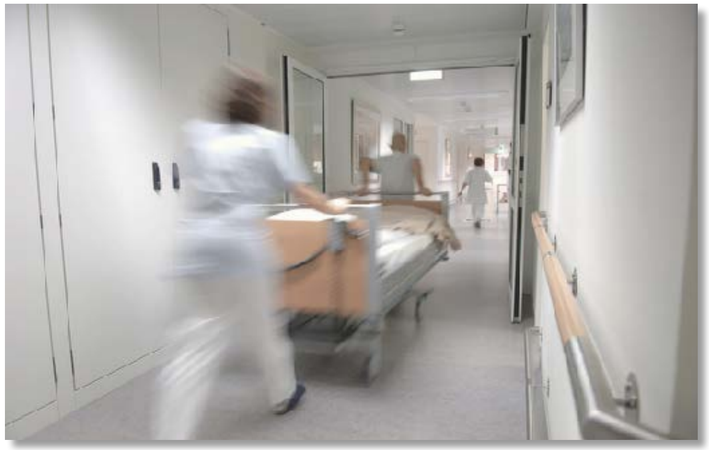
Robots move themselves and things from A to B

Robots move themselves and BIG things from A to B







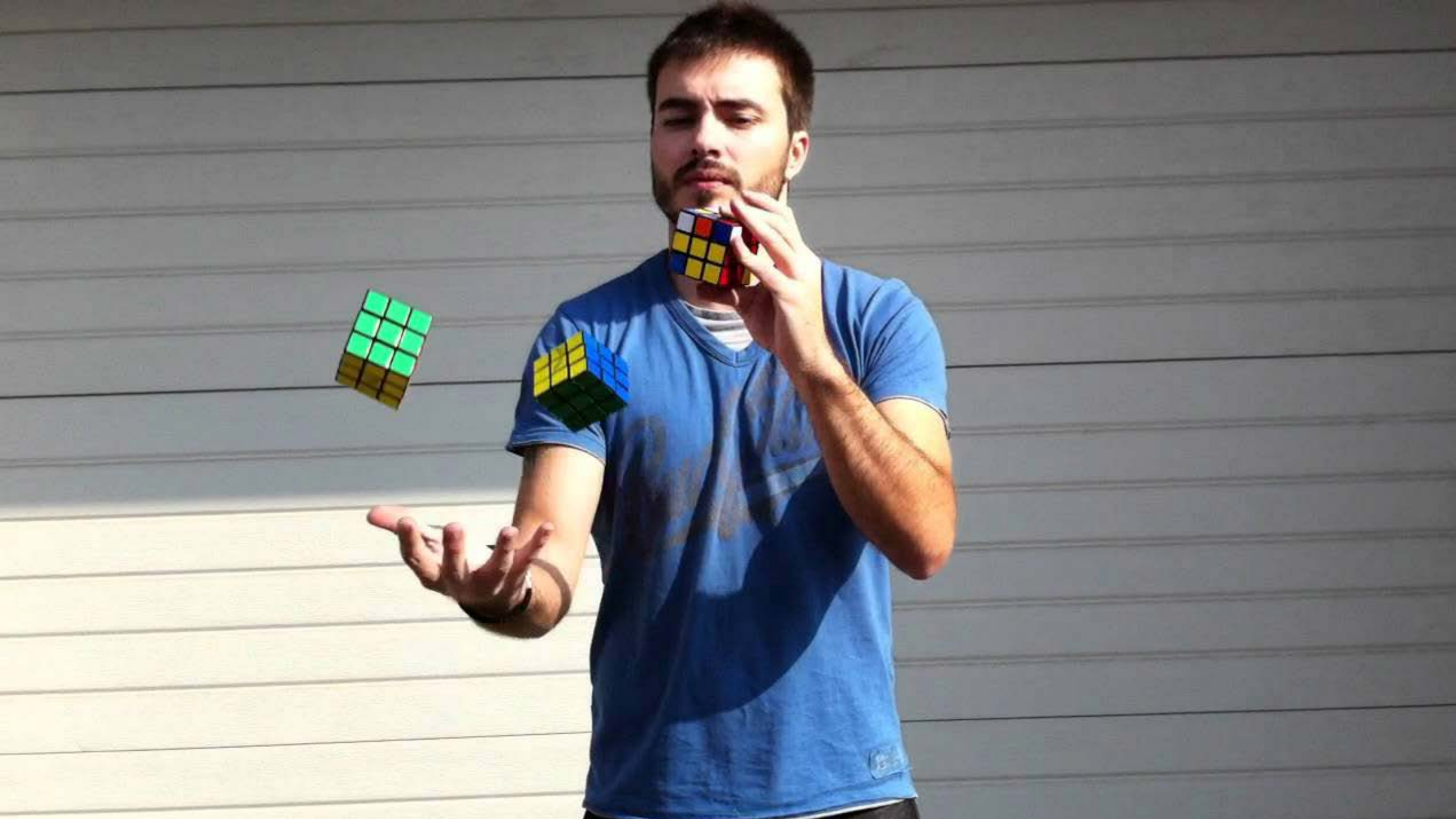


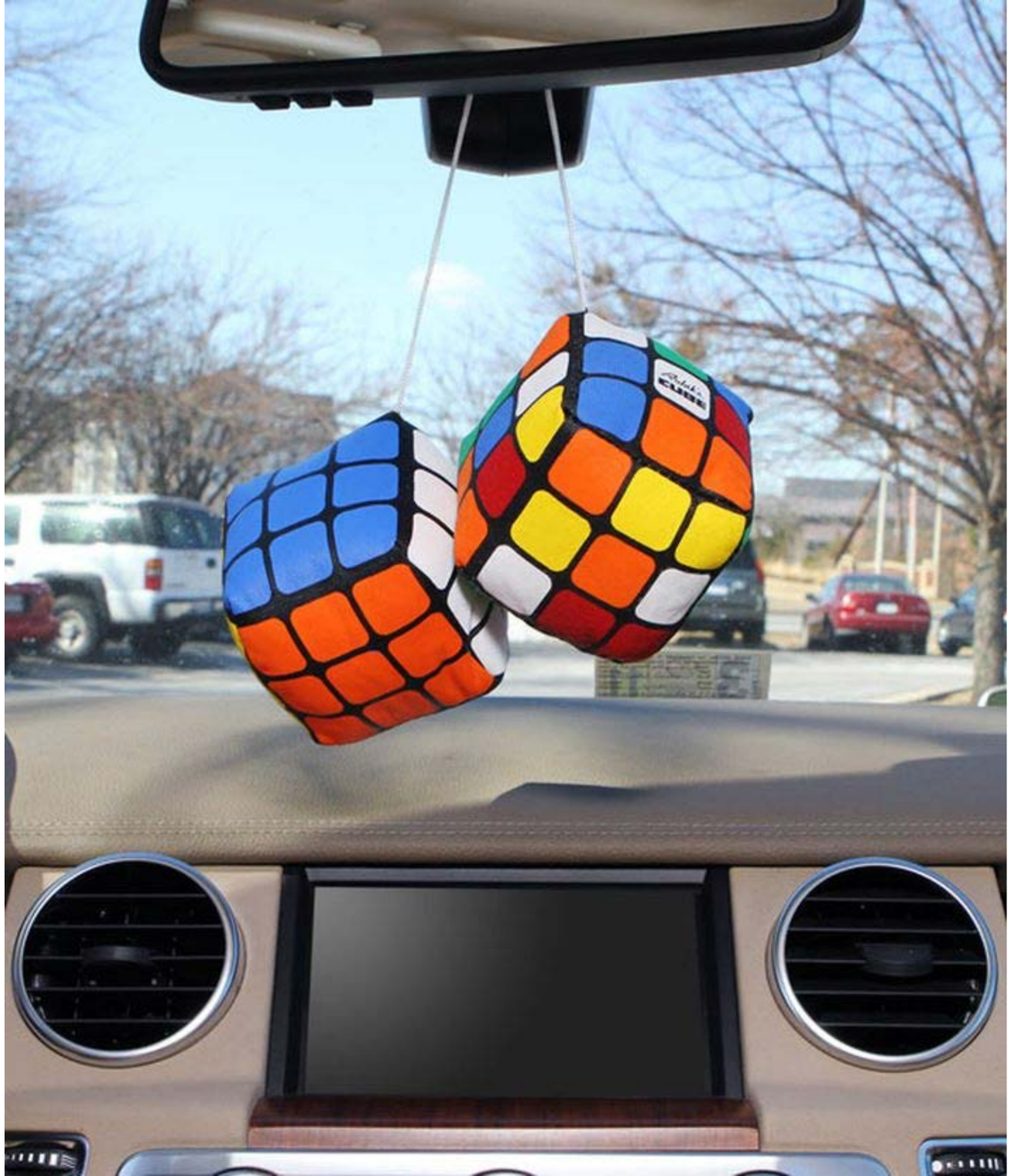

Where are all the robots?

1997

2016

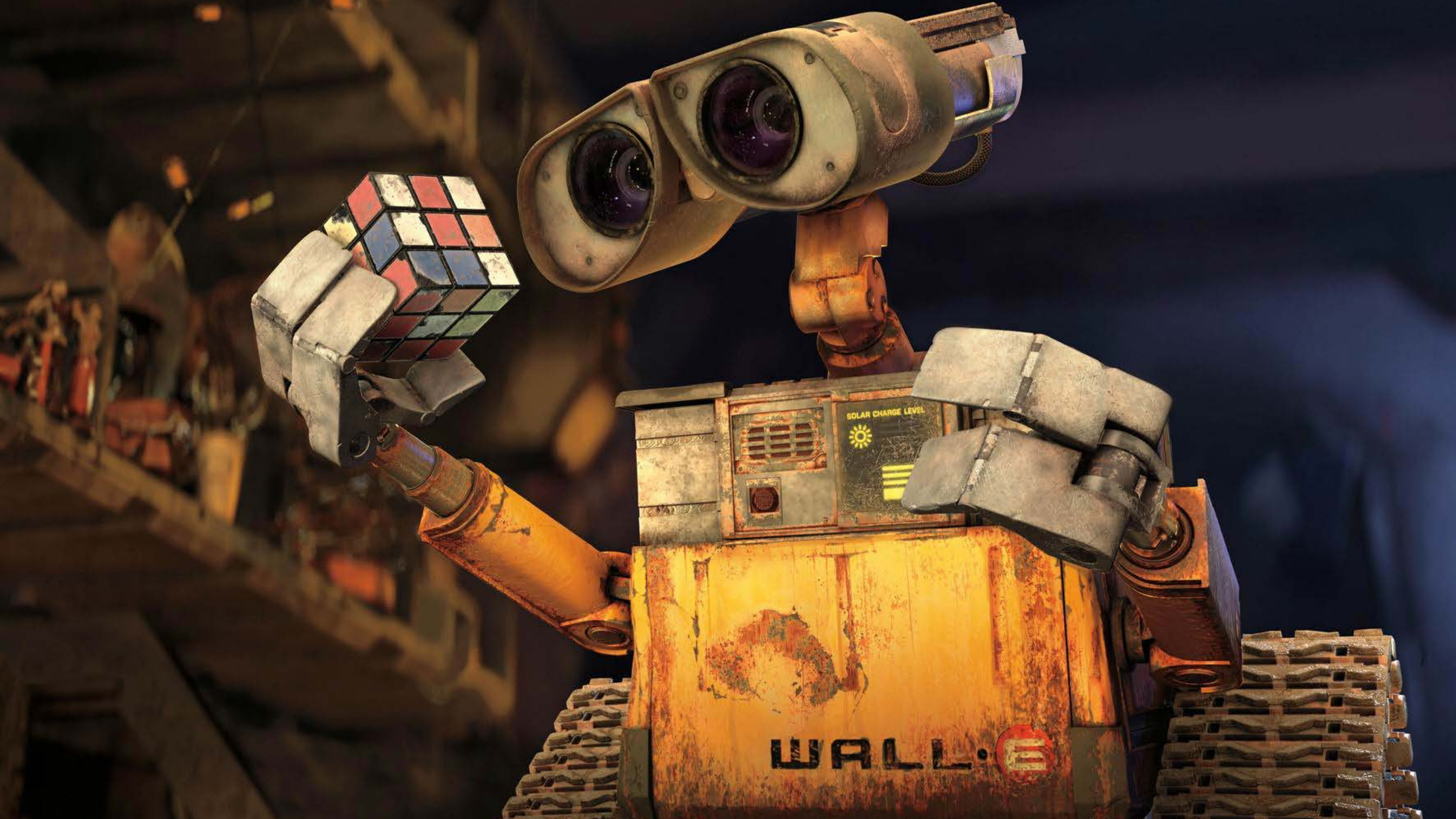

C
D
E
F





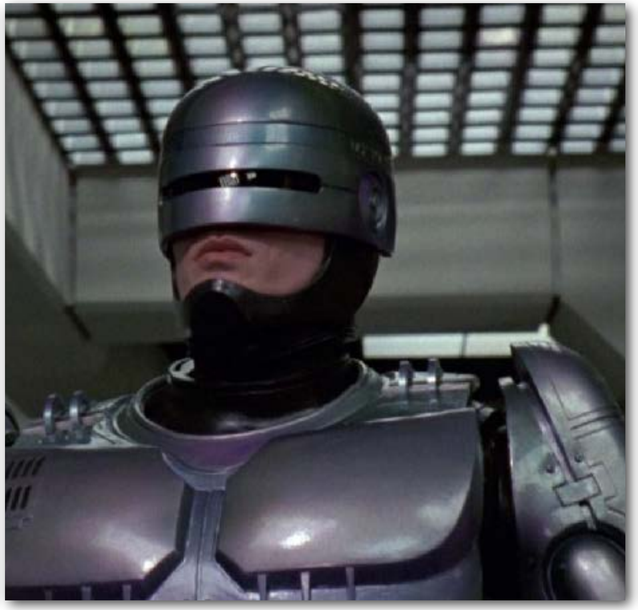
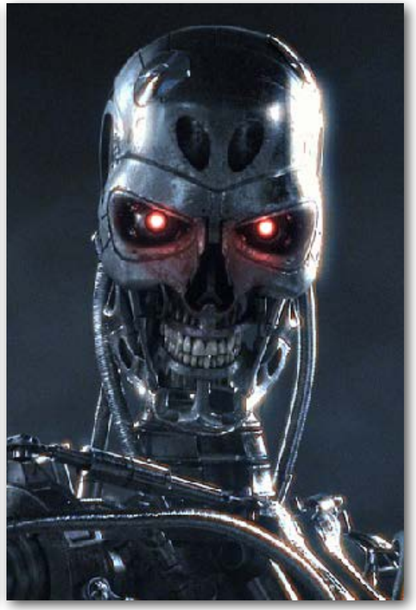
The sense of sight

- Vision is our most impressive sense
- We use it to help with almost everything we do
  - ➥ we can see close, and we can see far
  - ➥ we see shape, texture, color and movement


SOLAR CHARGE LEVEL
WALL·E





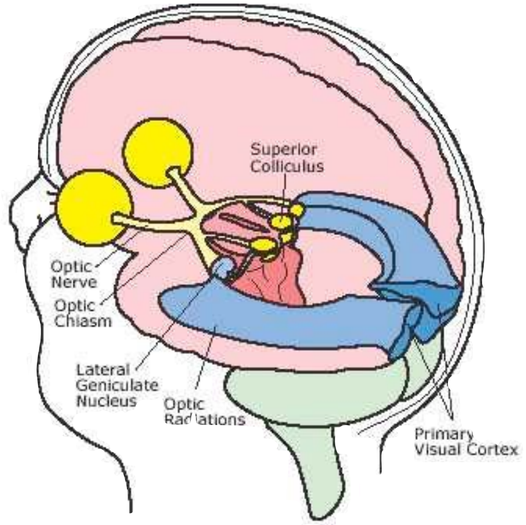




Human vision data sheet

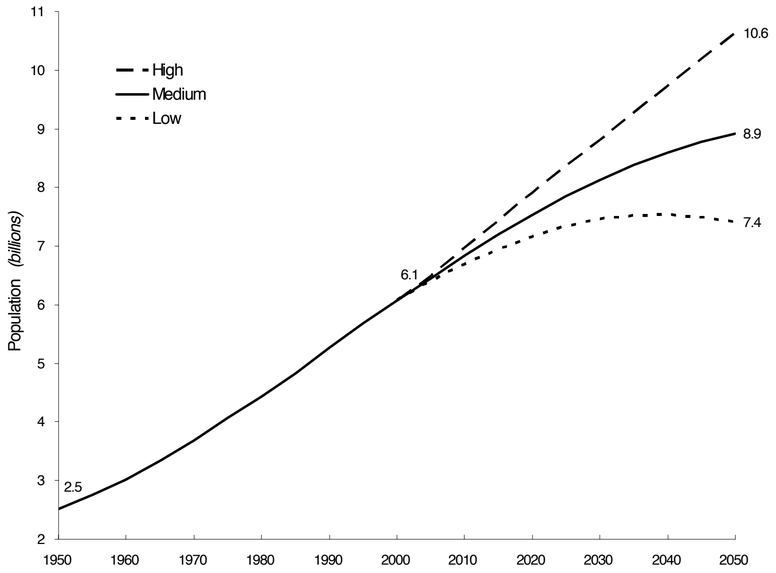
120Mpixel
20bit dynamic range
3 colors
×2

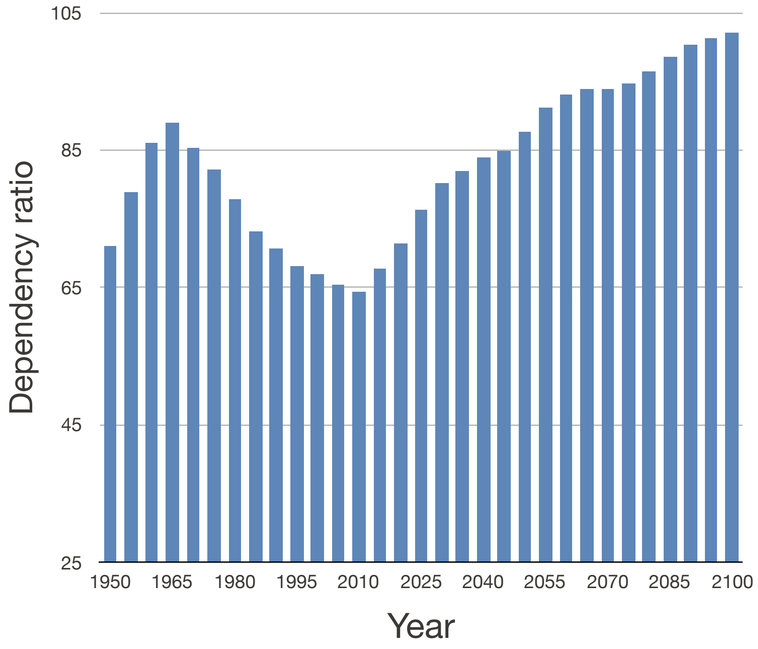
3 gyroscopes
2 accelerometers
×2

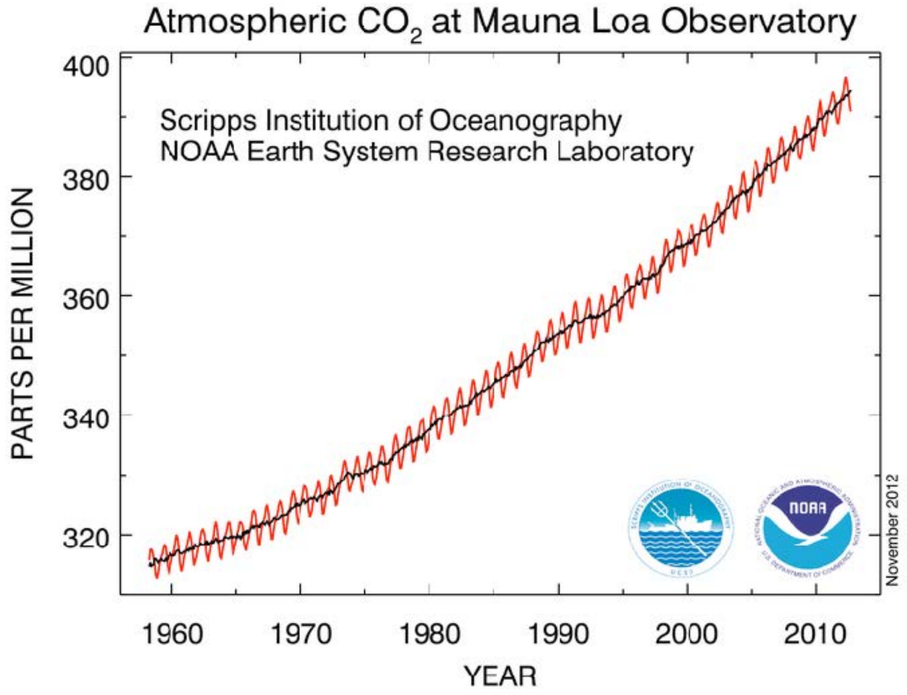
Vision engine
- 3x10^{10} neurons
- 500g
- 6W



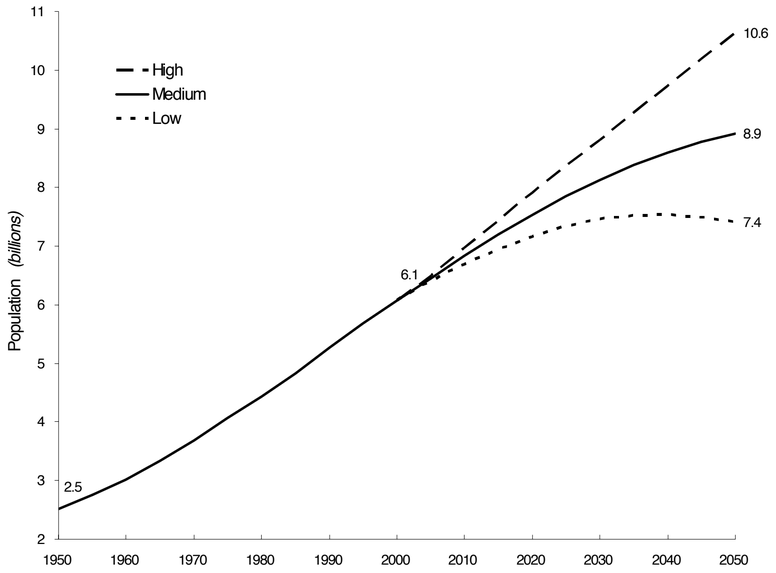
Graphs of our times

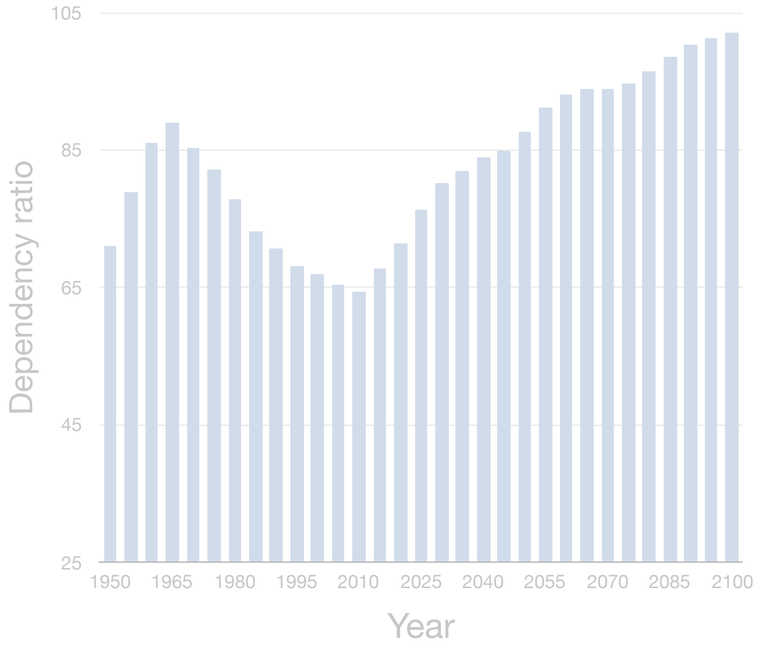


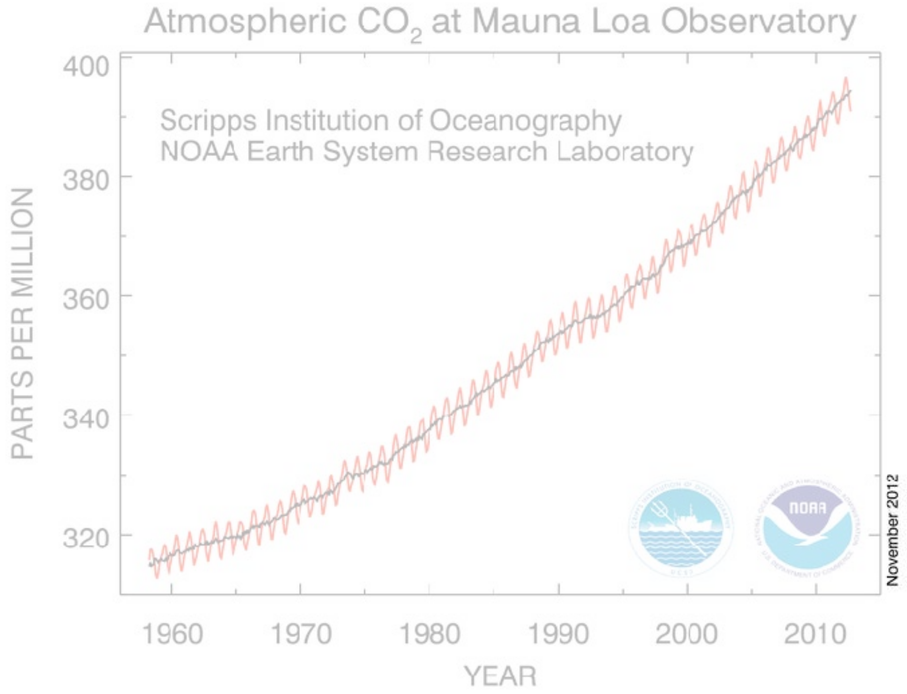




Graphs of our times

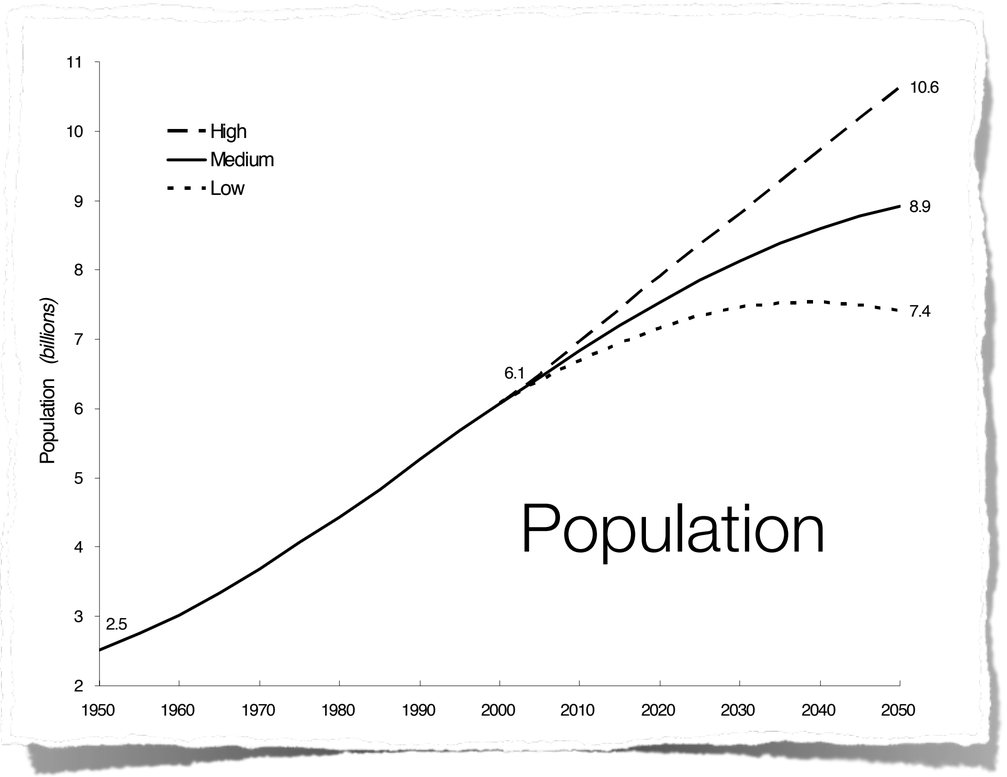






World population

- more food
- more transportation
- more resources (energy, metals, water)



World population

- **more food**
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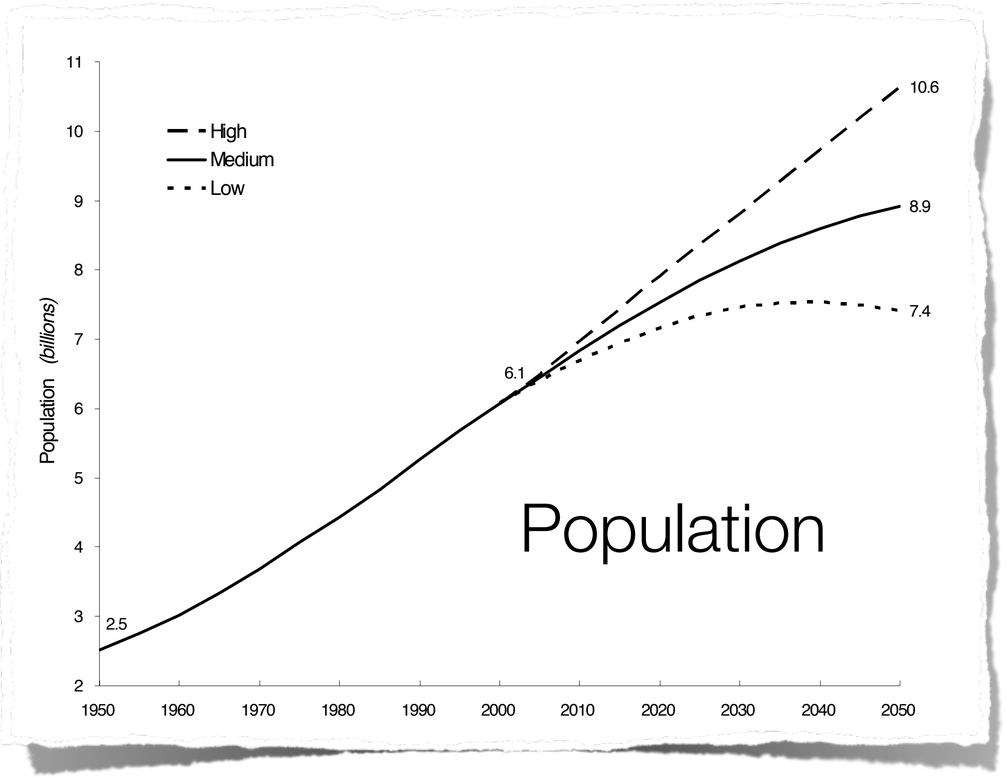

70% increase in food production by 2050


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E30
MINIMUM
30%
ETHANOL


E50
MINIMUM
50%
ETHANOL


E85
MINIMUM
70%
ETHANOL


clean power with
30
FLEX-FUEL
ethanol
3 % ethanol for
flex-fuel vehicles


clean power with
50
FLEX-FUEL
ethanol
50% ethanol for
flex-fuel vehicles


clean power with
85
FLEX-FUEL
ethanol
85% ethanol for
flex-fuel vehicles

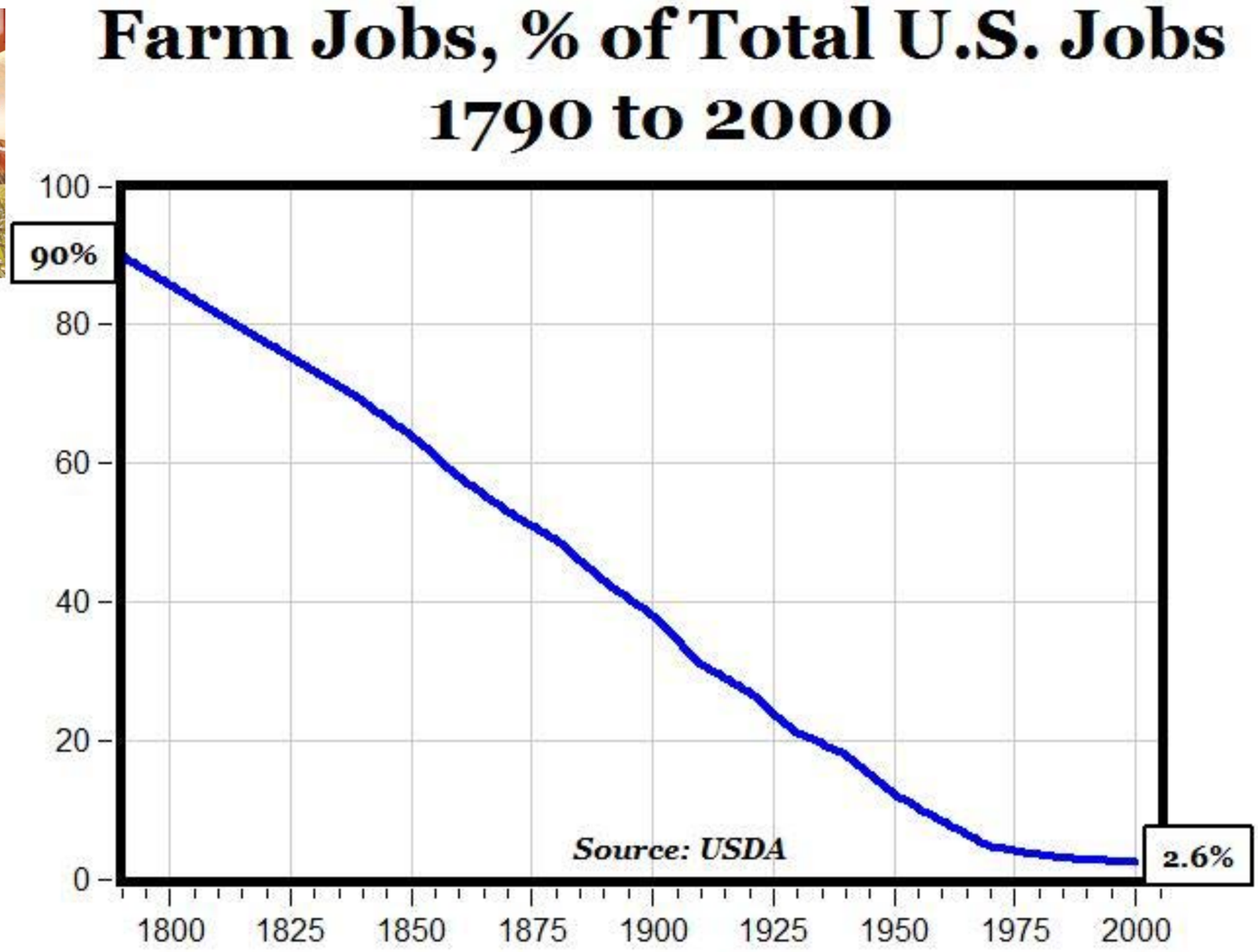
Agricultural revolution(s)

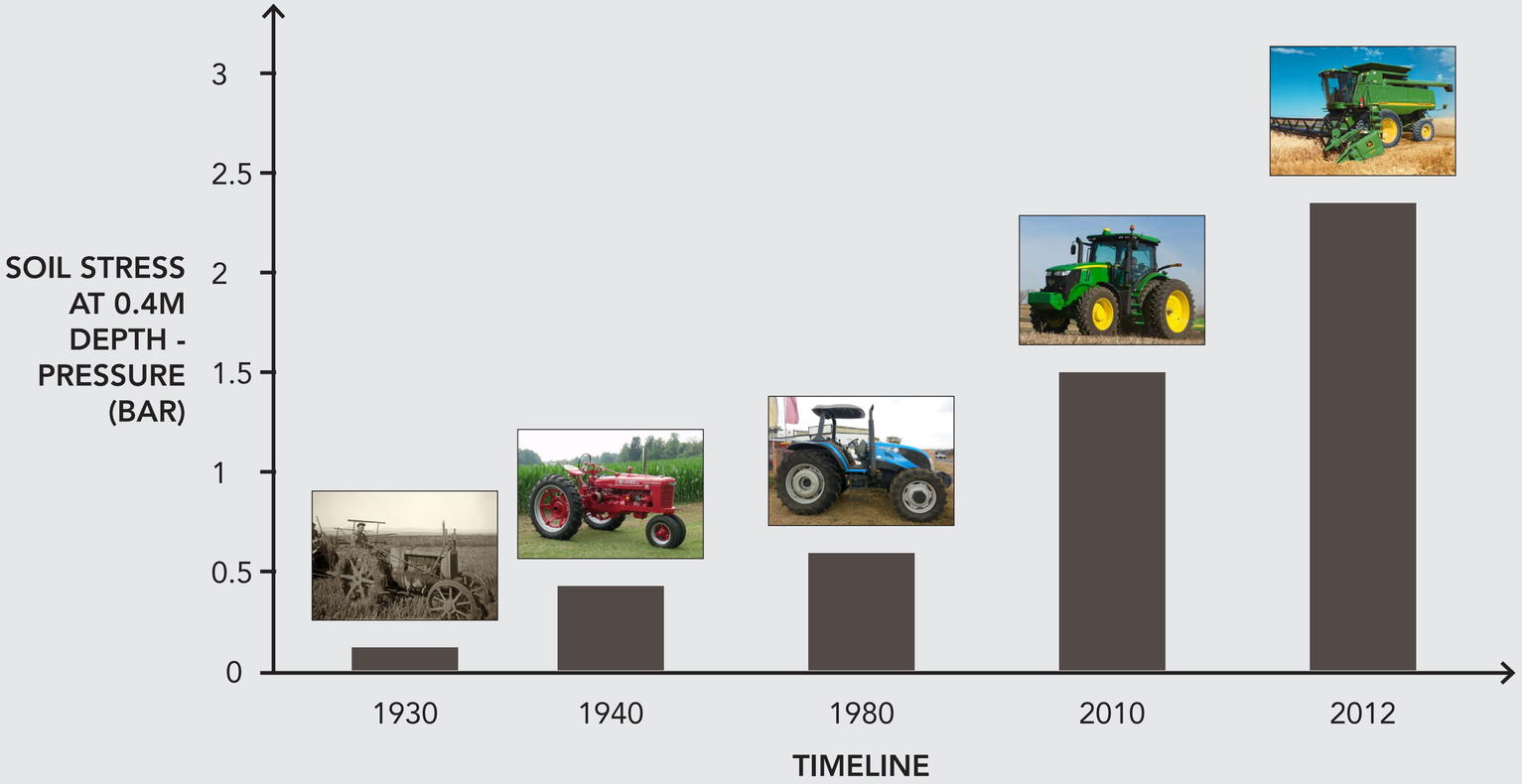
better genetics

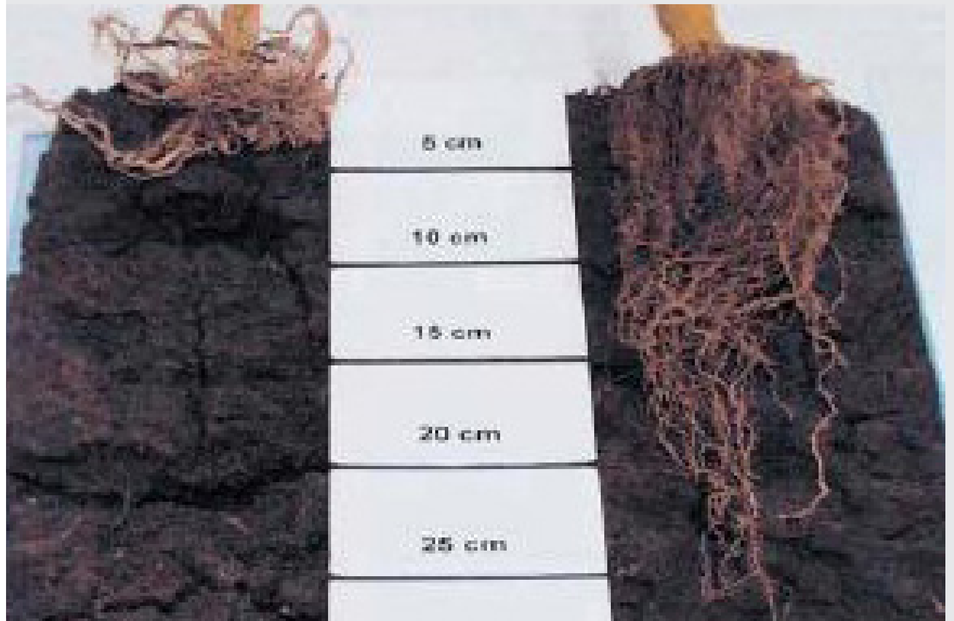
mechanisation

herb/pesticides

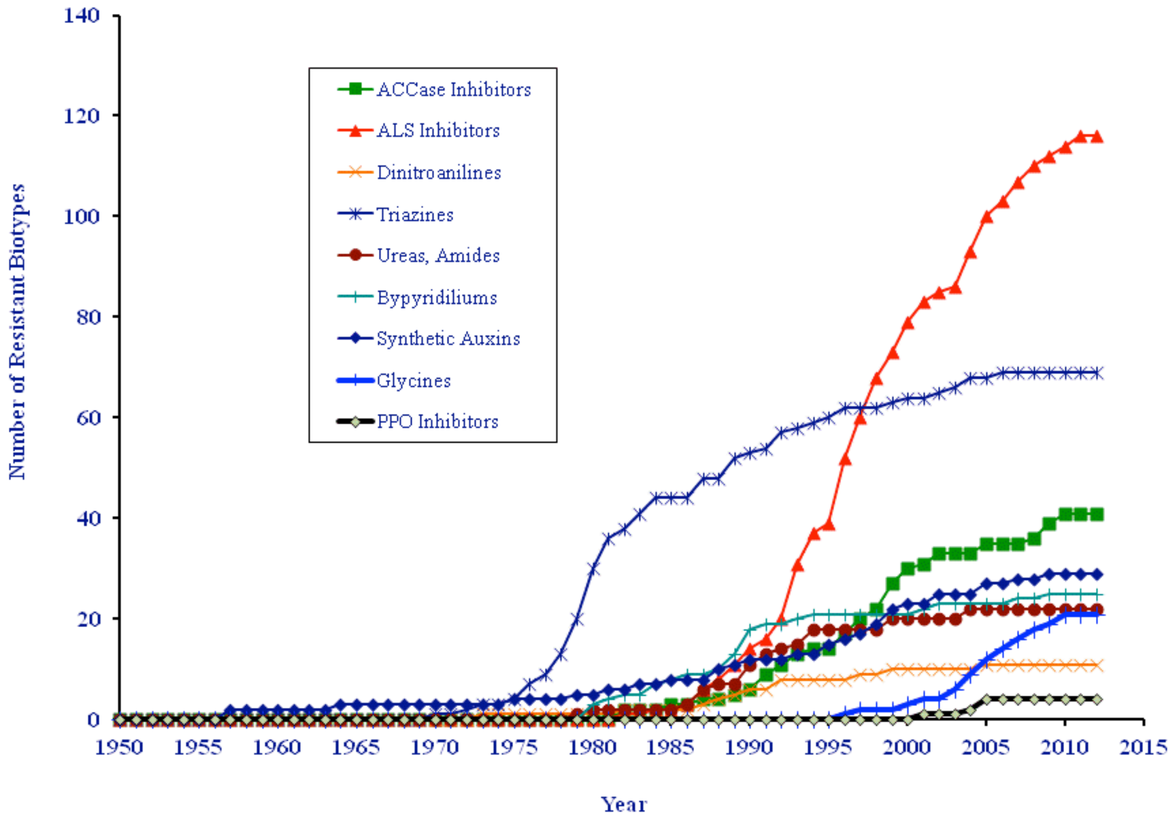
Agricultural revolution(s)




SOIL STRESS AT 0.4M DEPTH - PRESSURE (BAR)
3
2.5
2
1.5
1
0.5
0
1930
1940
1980
2010
2012
TIMELINE

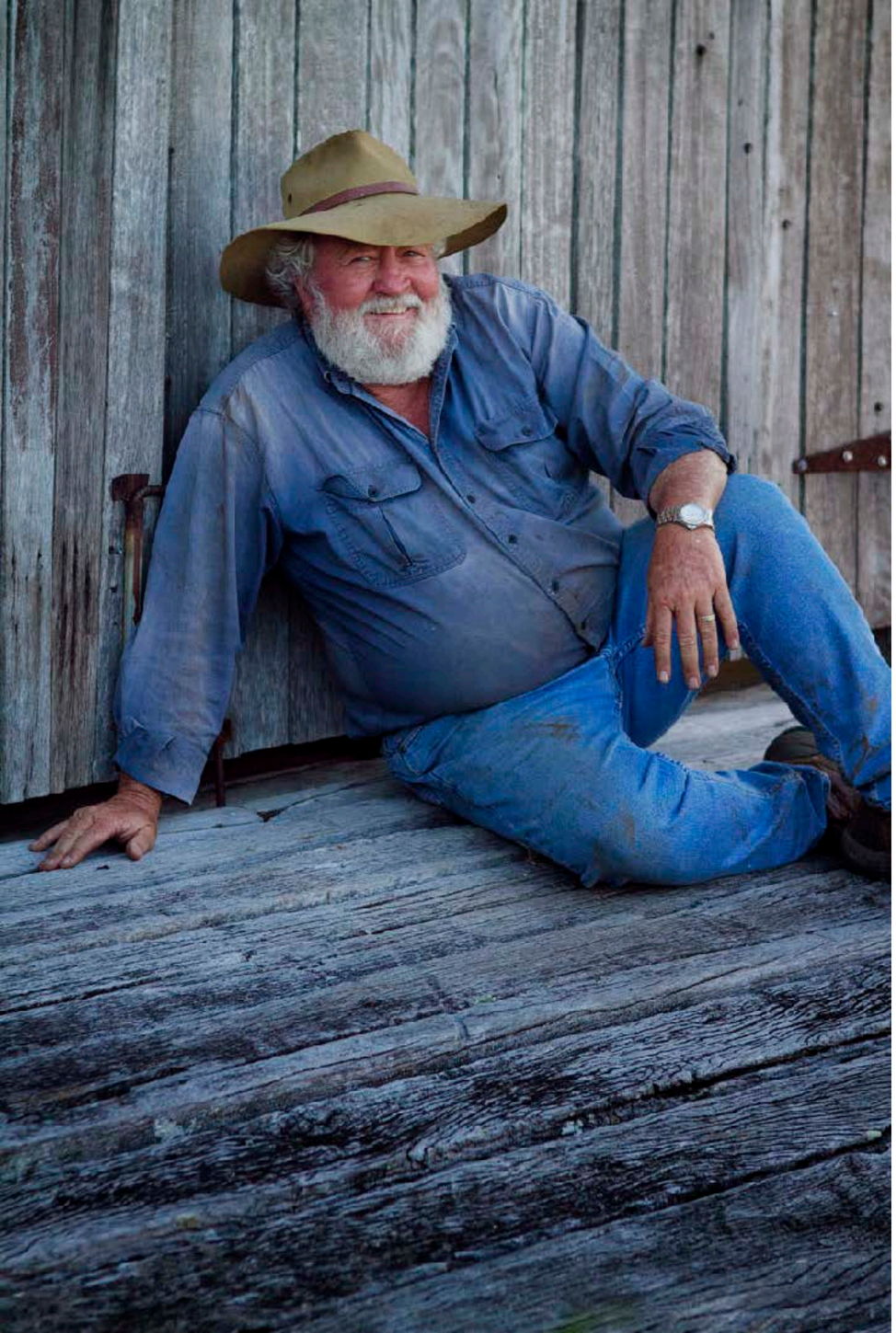

5 cm
10 cm
15 cm
20 cm
25 cm

The weeds are fighting back

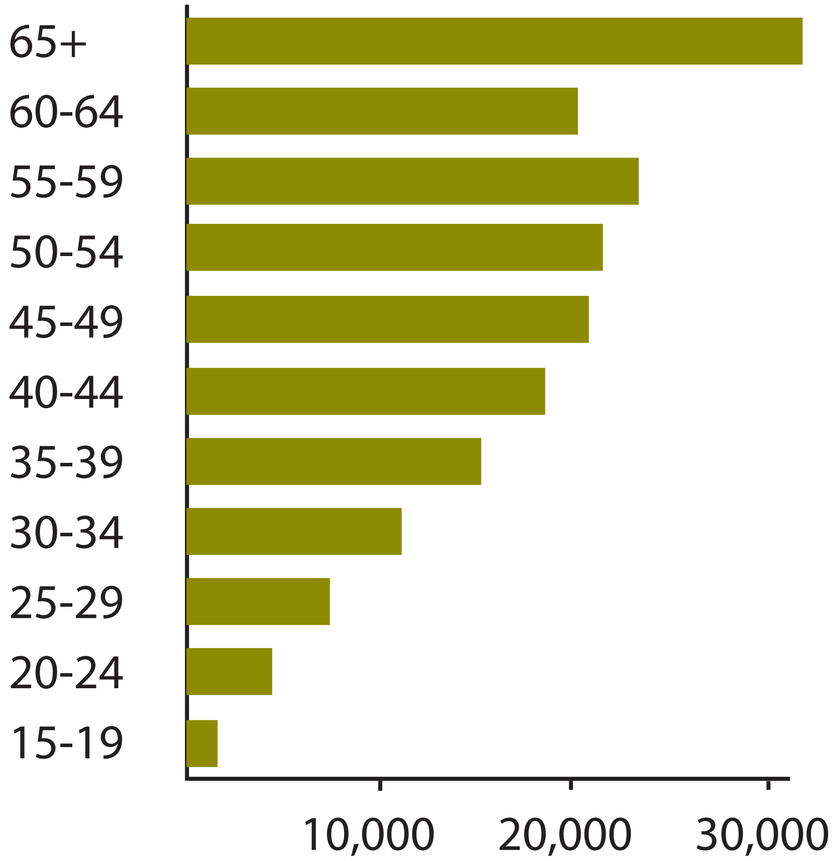


Source: Ian Heap
http://www.weedscience.com

herbicide resistant weeds are on the rise



Farmer population by age group:

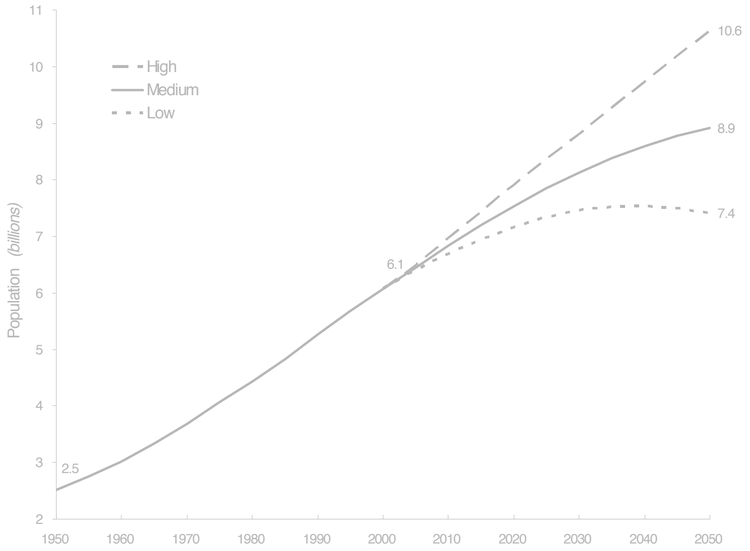


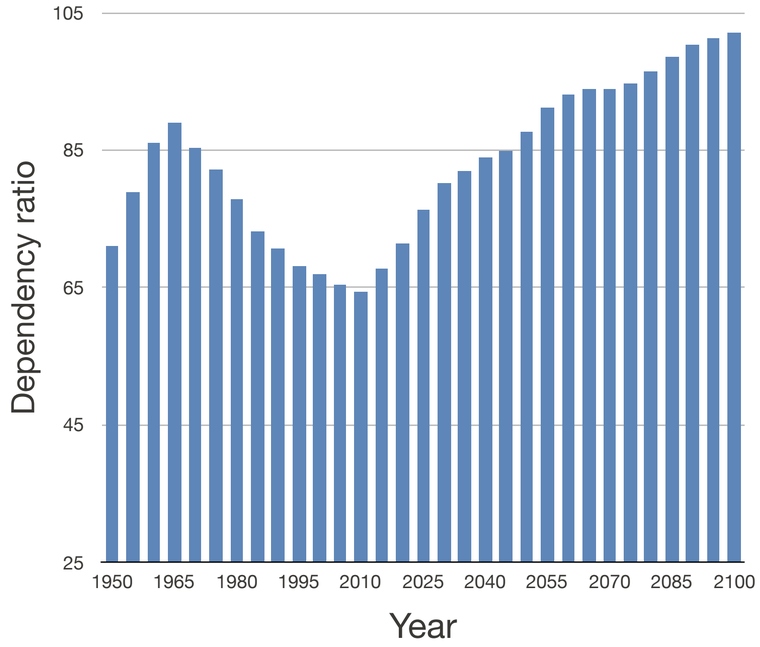
- Australia 2020 Summit, The Future of Rural and Regional Australia, April 2008

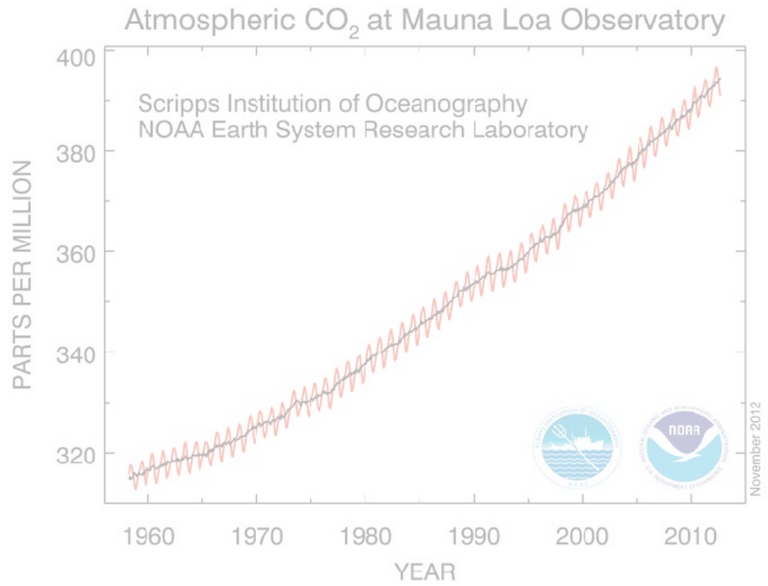
just like we used to do, and did for thousands of years…


x2

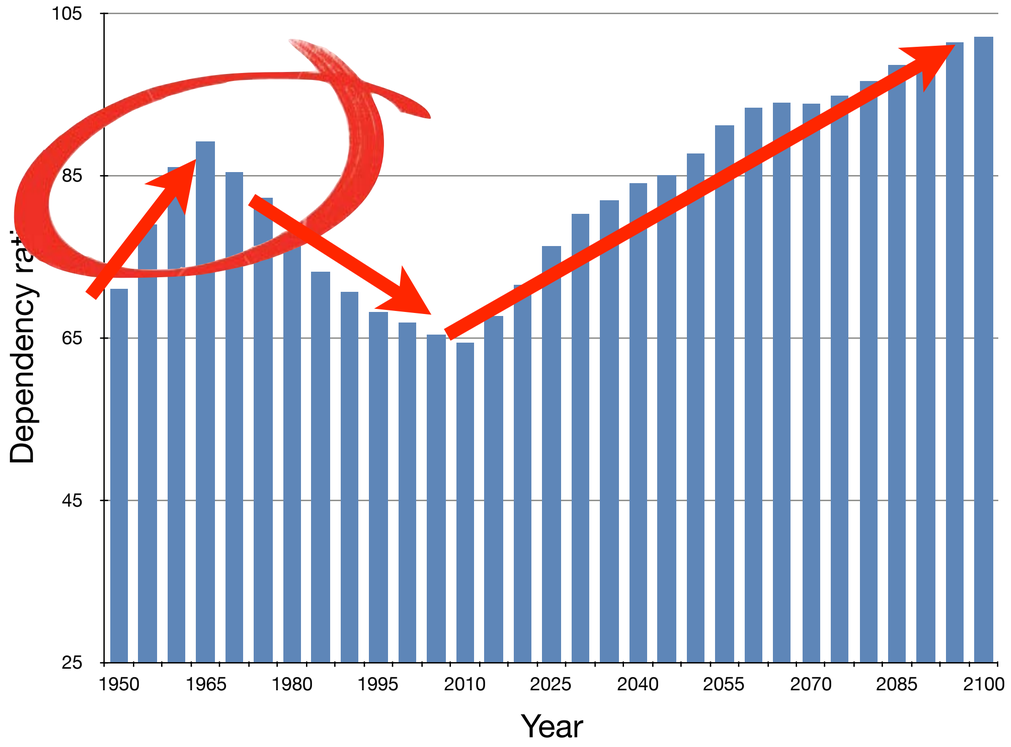
Graphs of our times







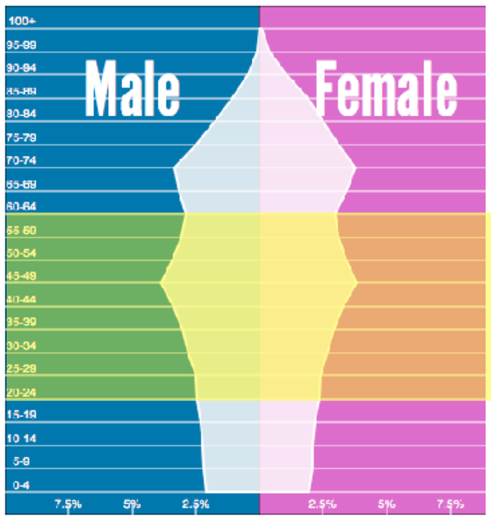
Dependency ratio



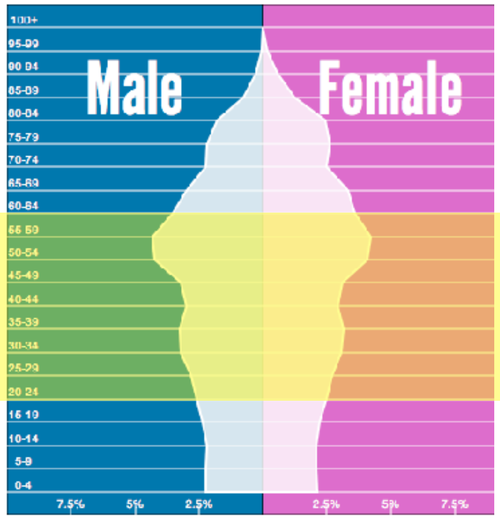
$$\frac{Age(0\text{-}14) + Age(65+)}{Age(15\text{-}64)}$$

- dependents / workers
- low is good
- high means we need more work per person (greater productivity)

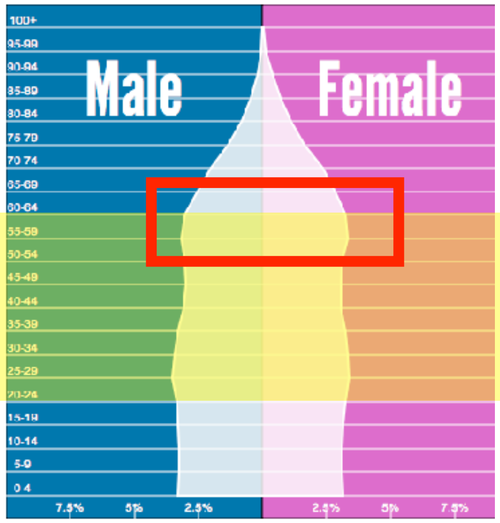
Population pyramids



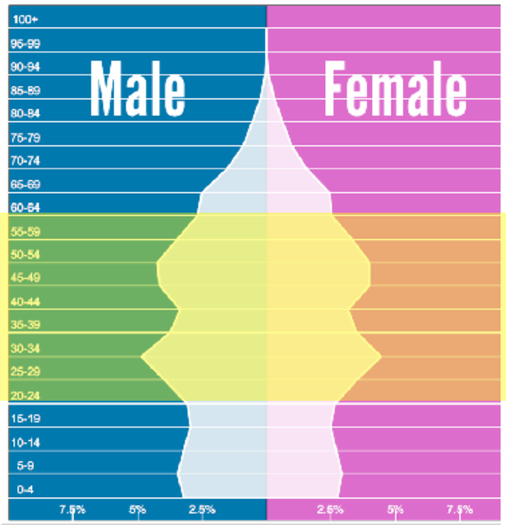
Japan



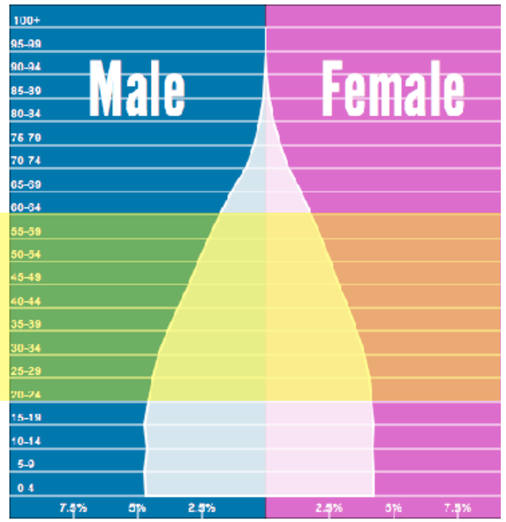
Germany



USA



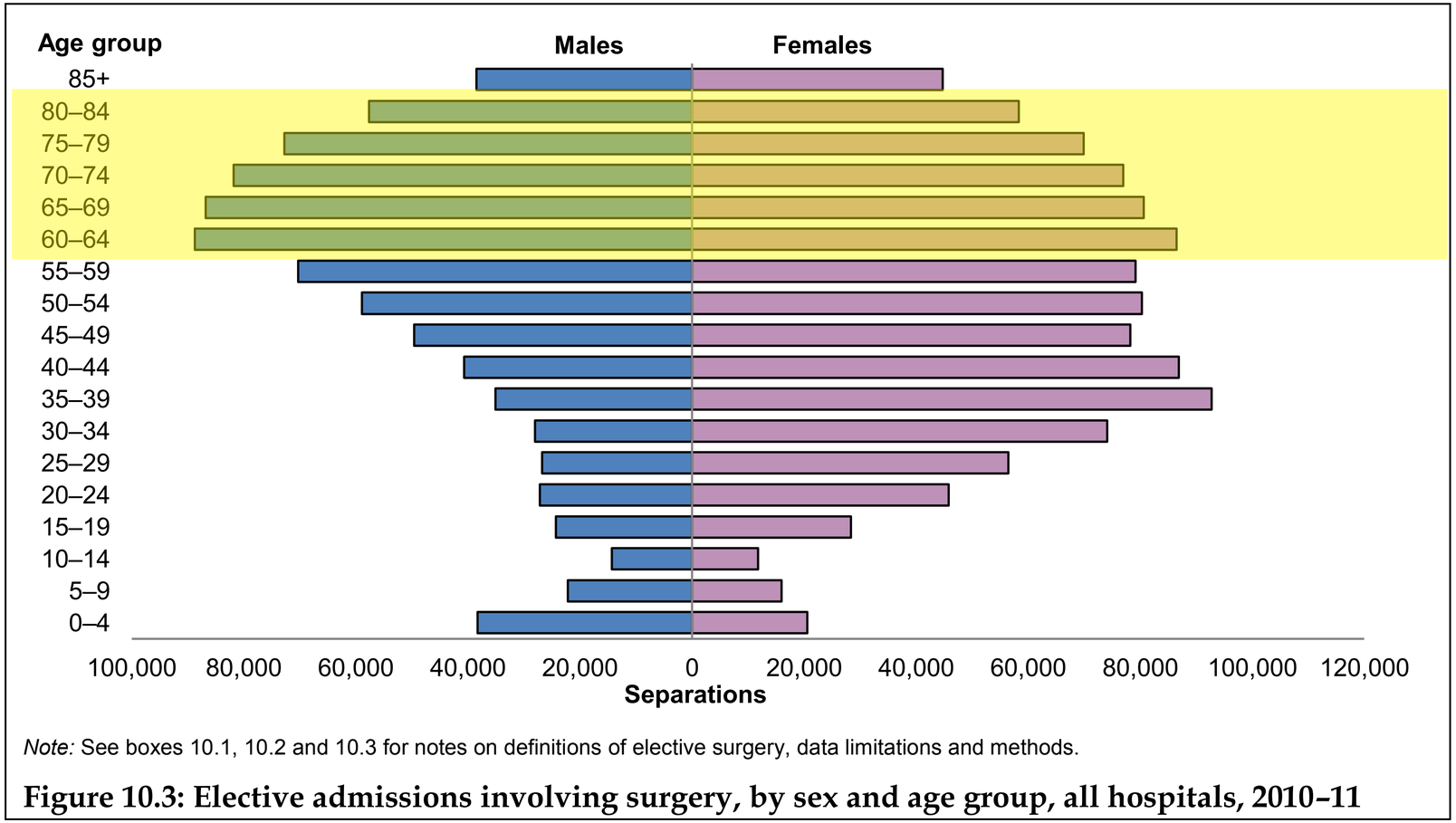
China



India

populationpyramid.net

Health care need



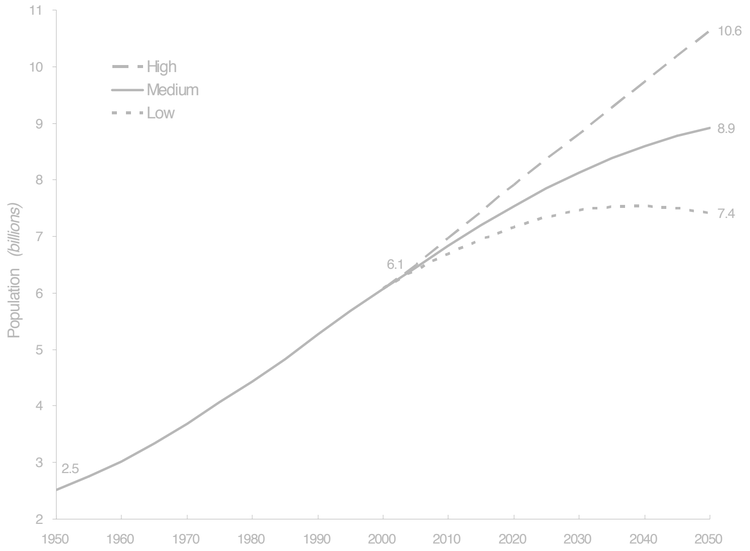
Note: See boxes 10.1, 10.2 and 10.3 for notes on definitions of elective surgery, data limitations and methods.

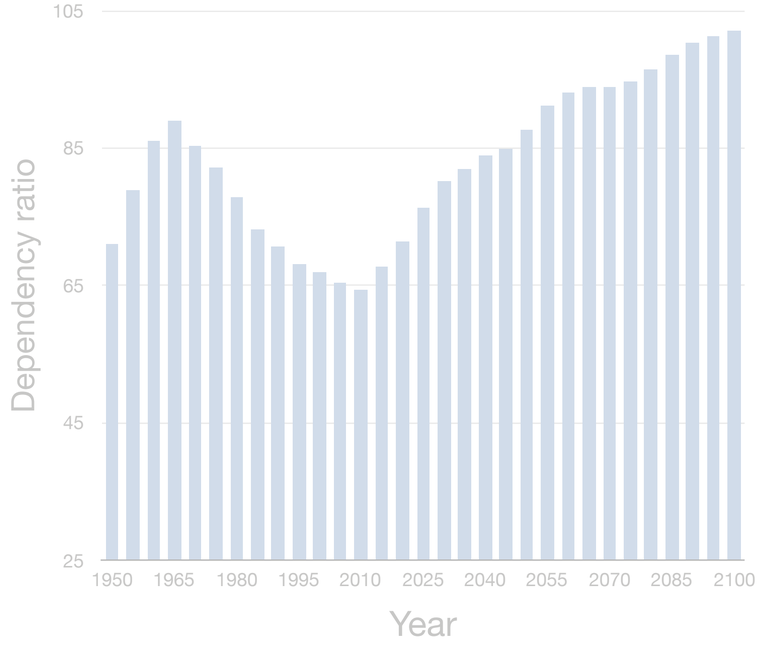
Figure 10.3: Elective admissions involving surgery, by sex and age group, all hospitals, 2010–11

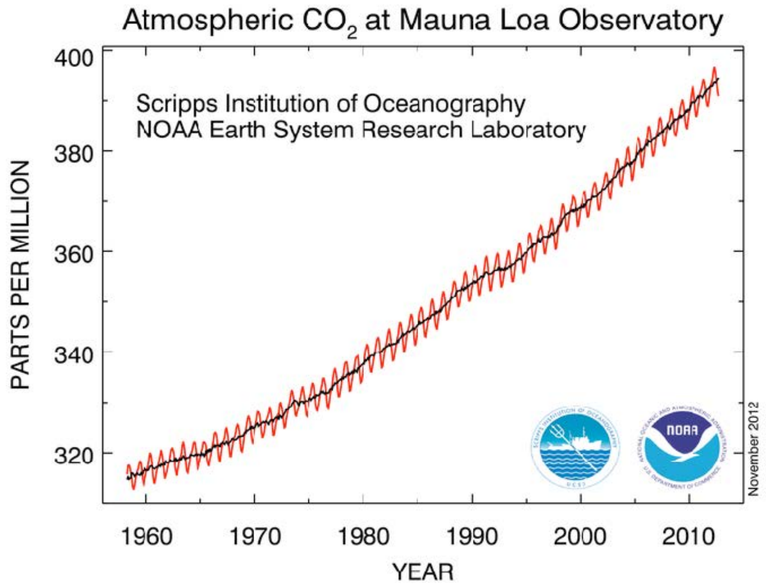
Australian hospital statistics 2010-11


RIBA II

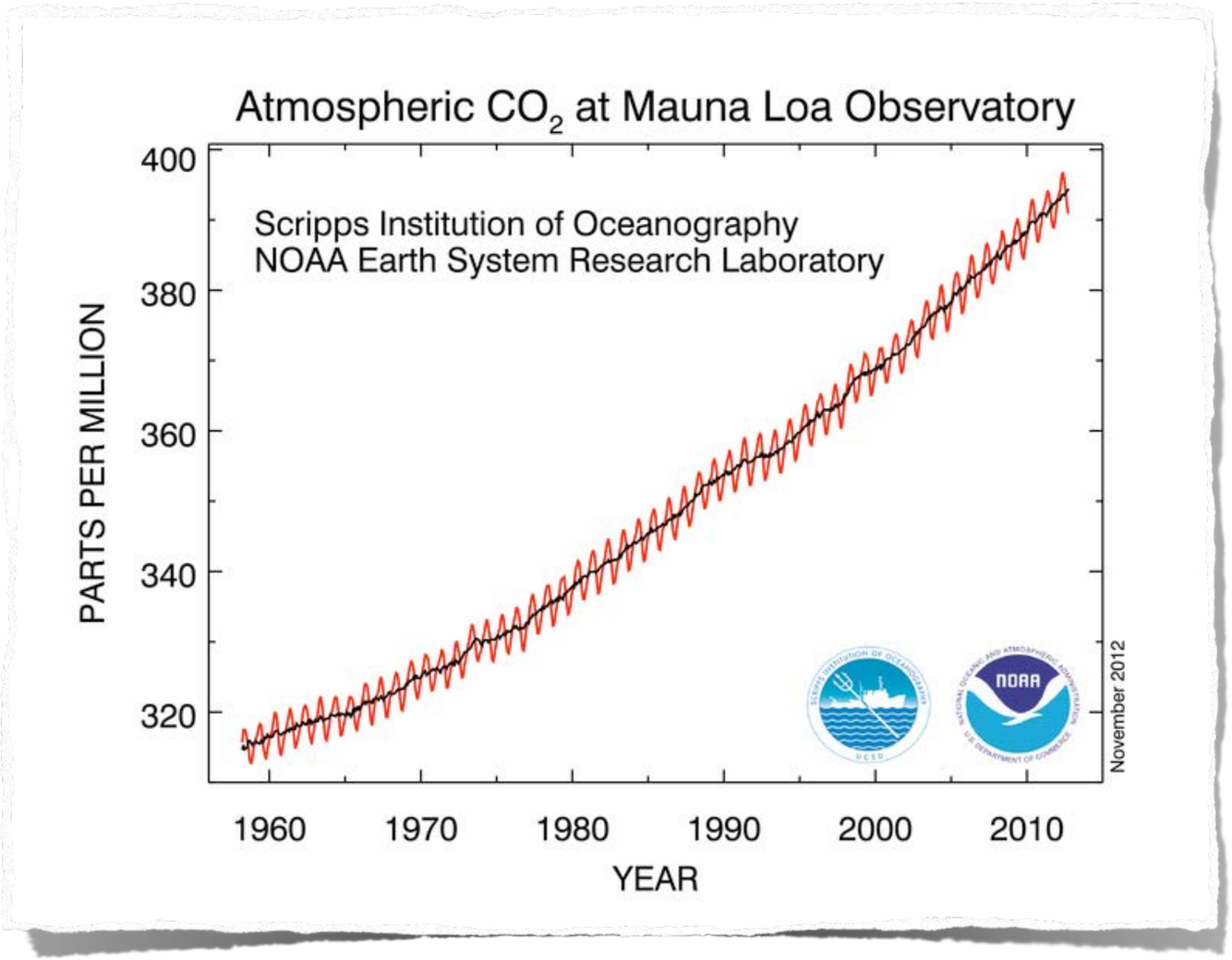
Graphs of our times







Environmental change



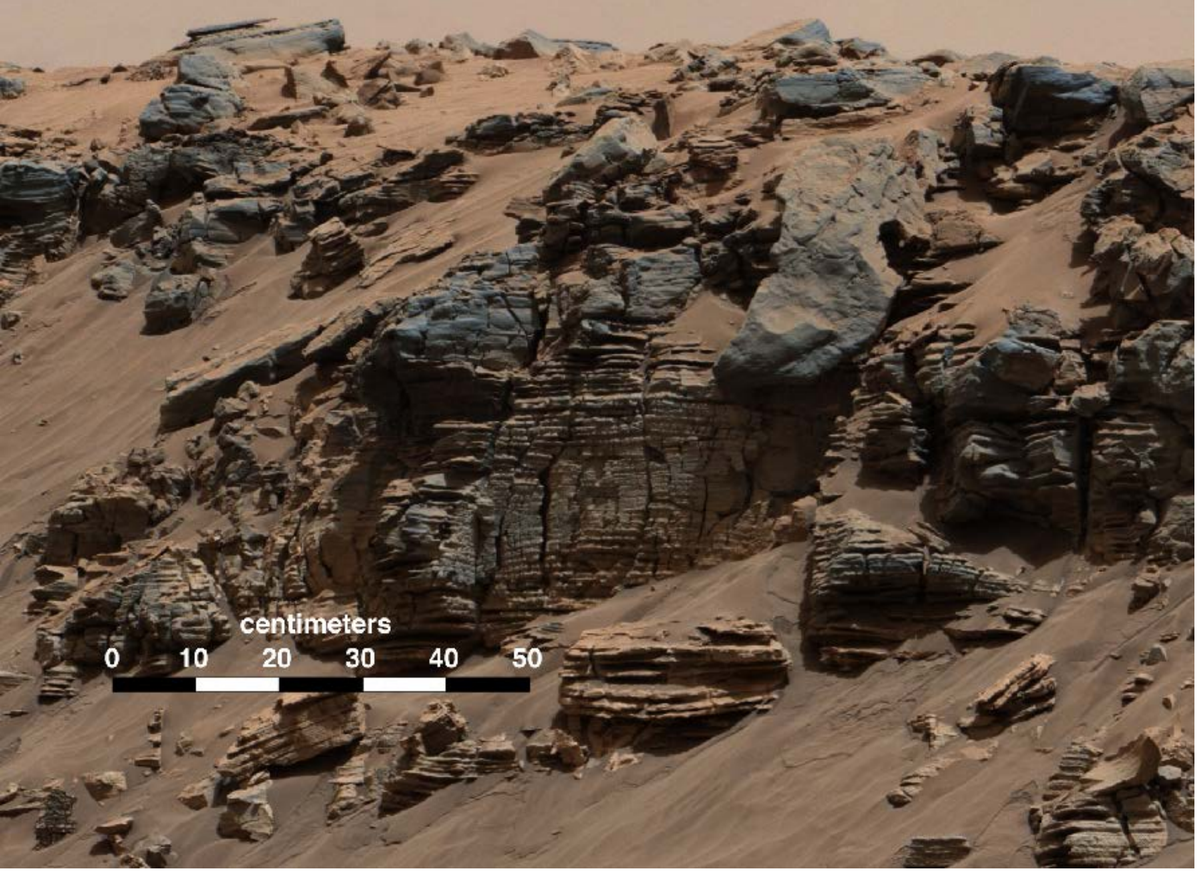
Three laws of asset management

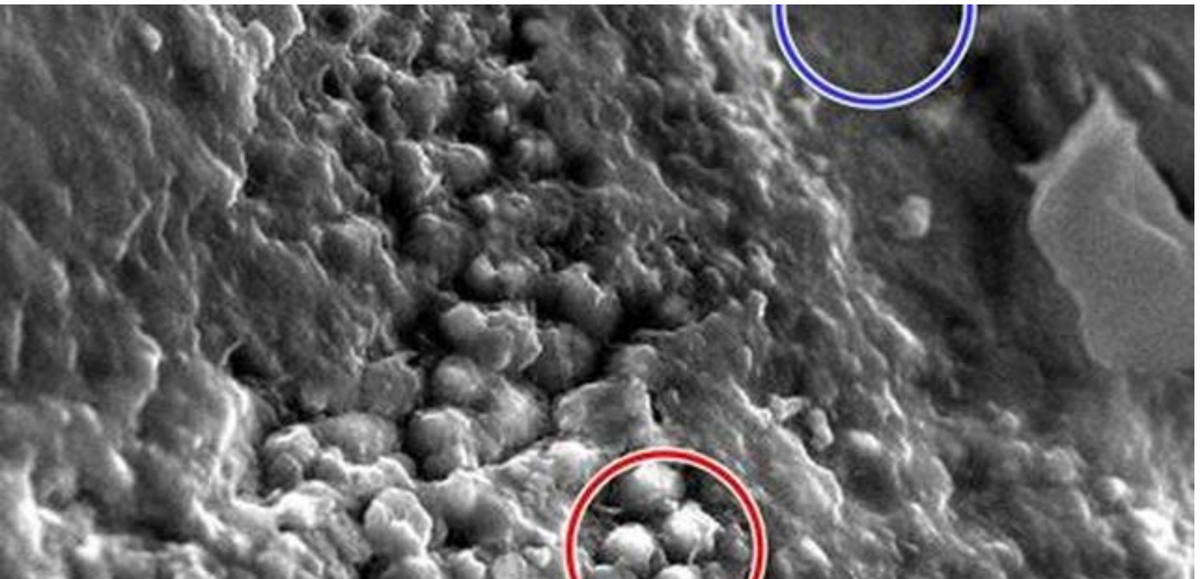
- Inspect
- Inspect
- Inspect

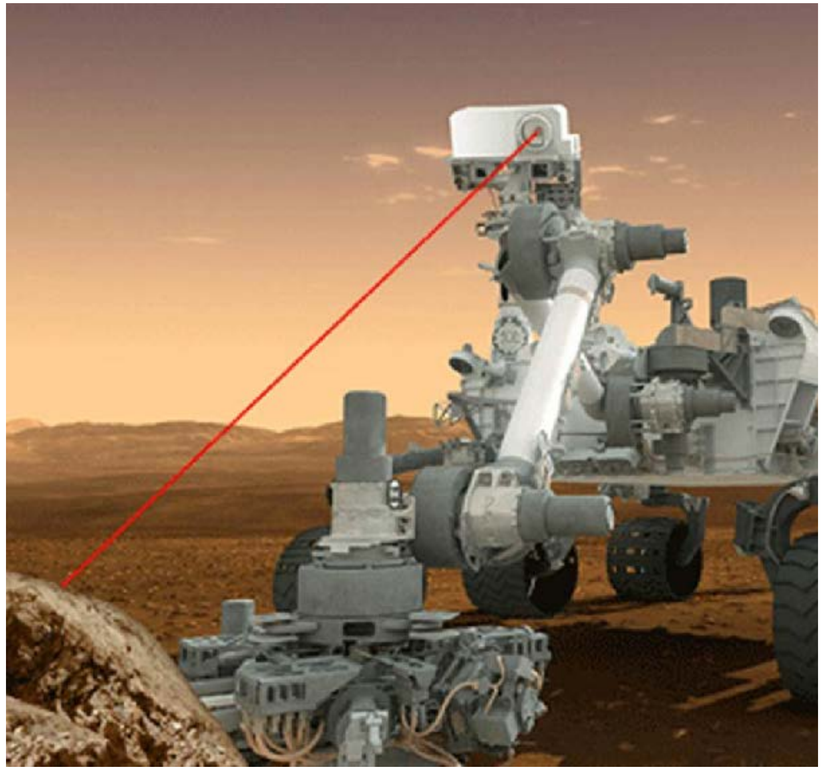




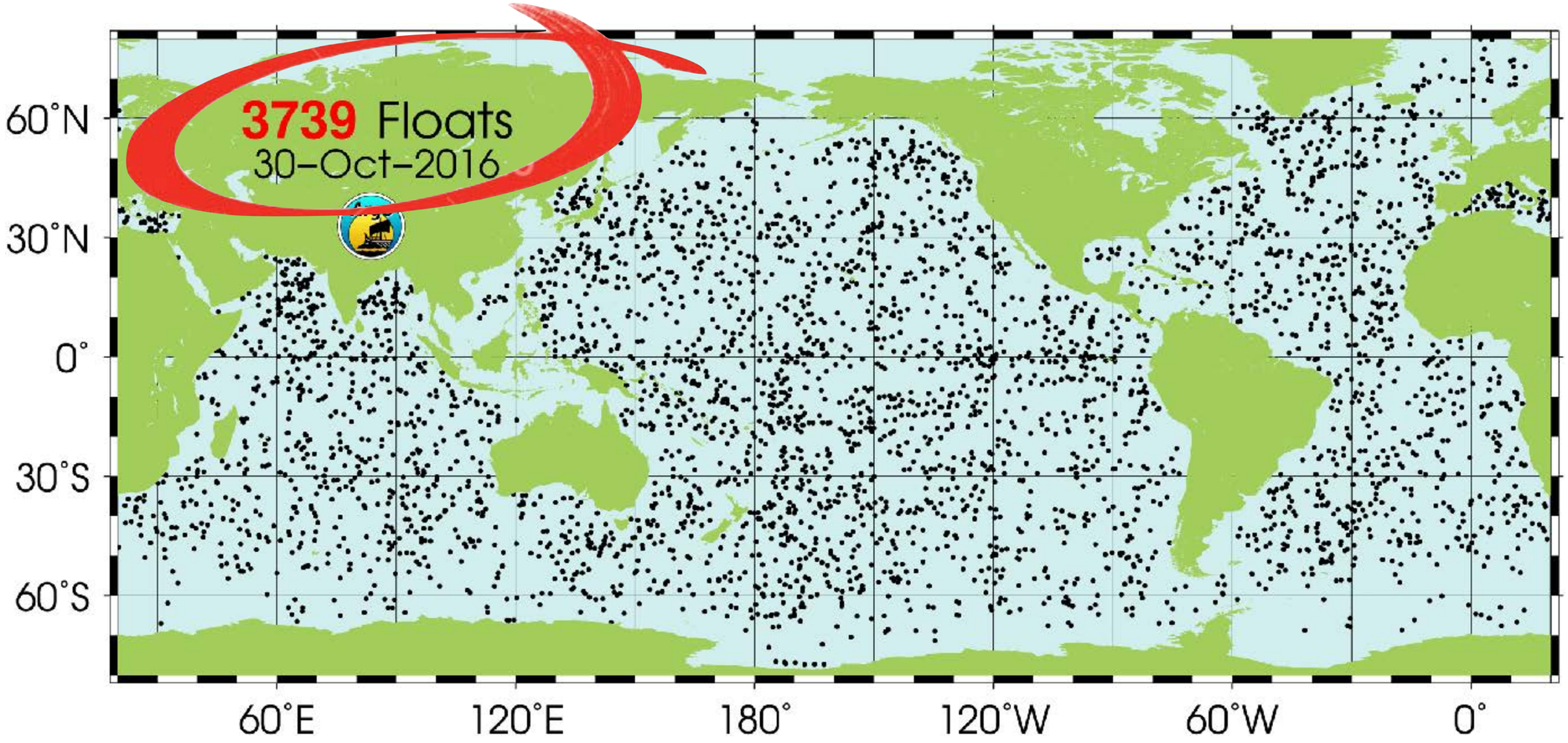




centimeters
0 10 20 30 40 50

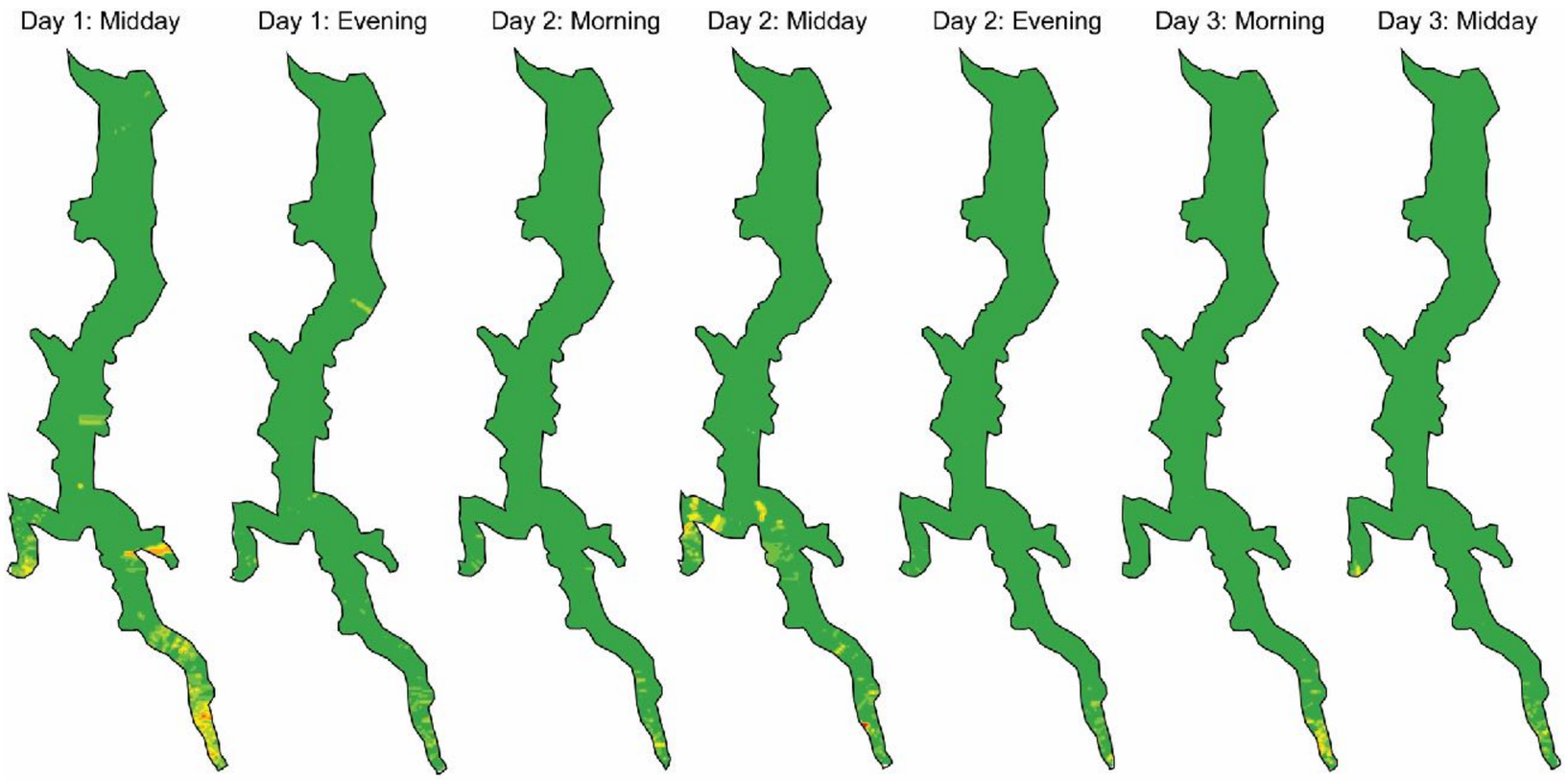


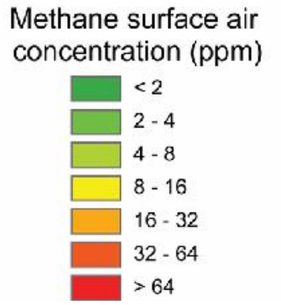


ARGO floats


3739 Floats
30-Oct-2016
60°N
30°N
0°
30°S
60°S
60°E
120°E
180°
120°W
60°W
0°

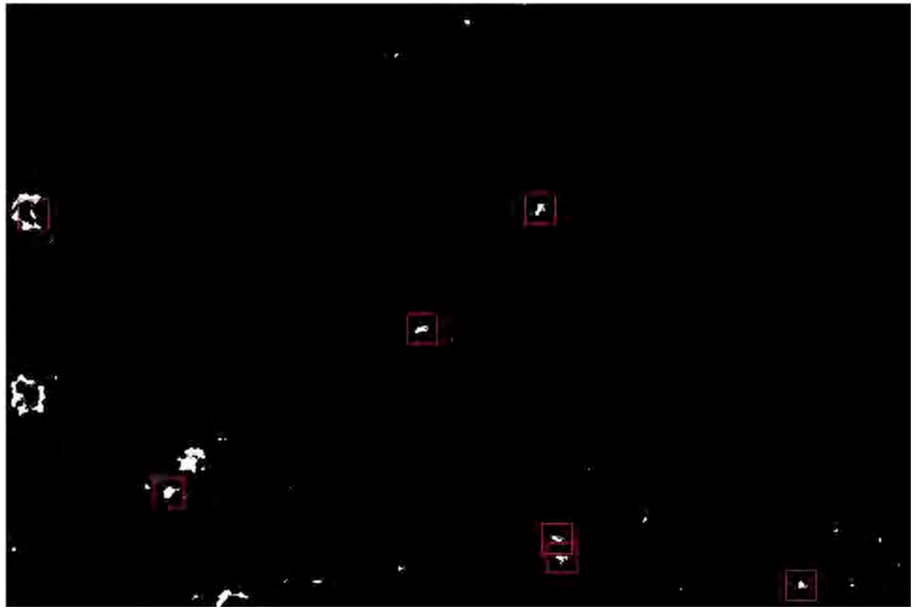
CH4 from water storages

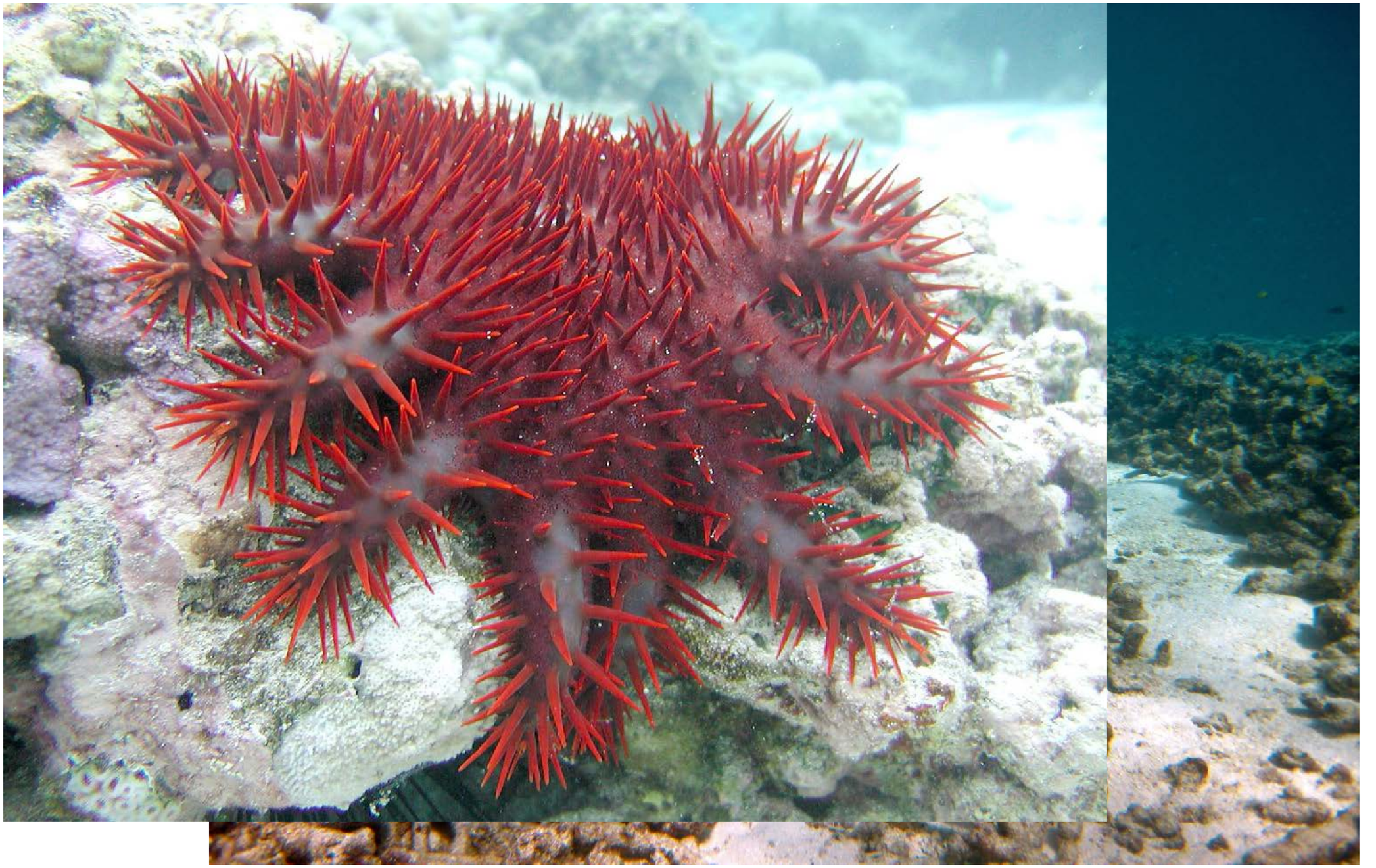


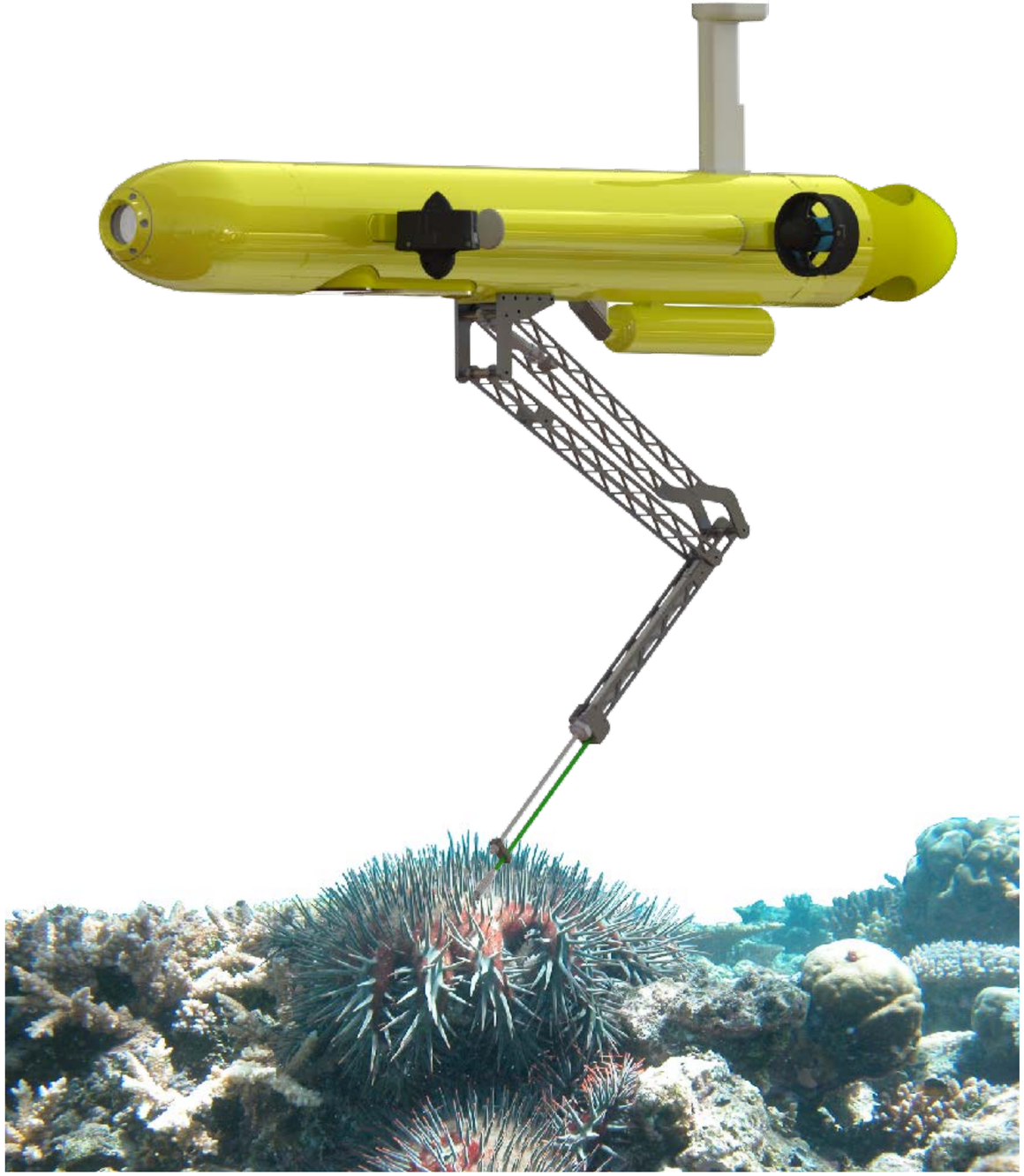


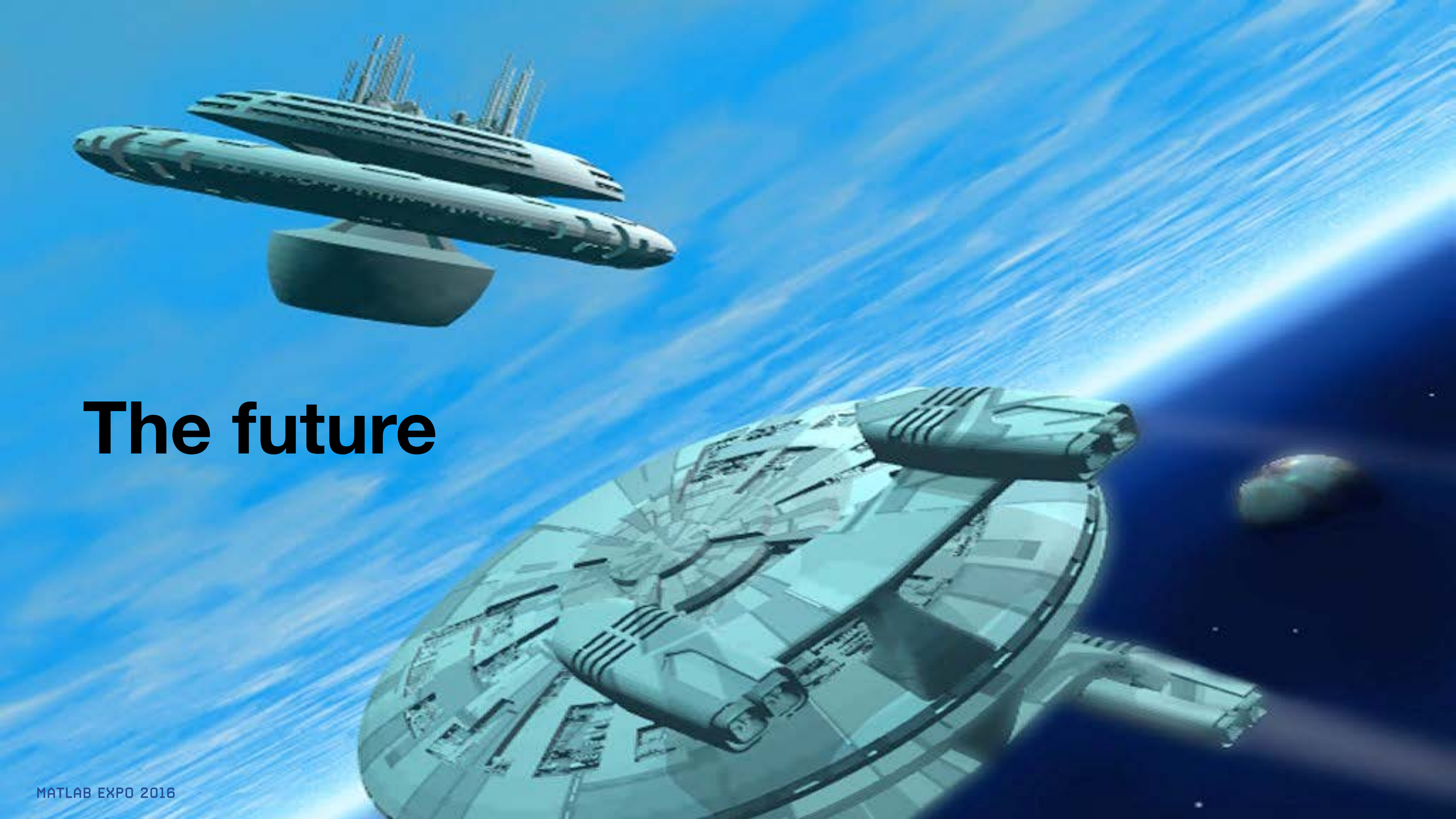
courtesy CSIRO

Dugong population monitoring







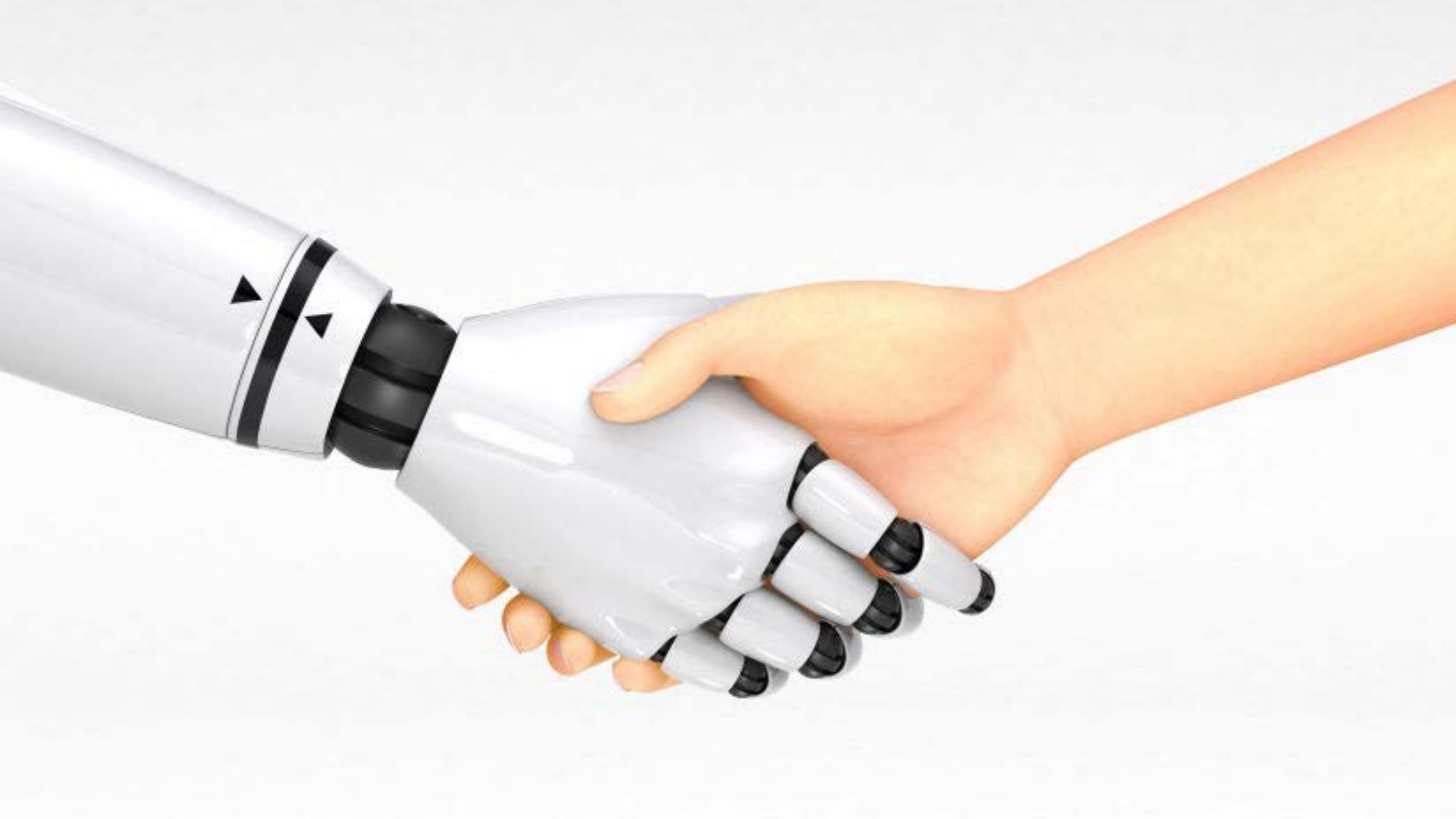

The future

Robotics is emerging as the next generation of high technology business:

“Robotics, $10T’s of new business”

—McKinsey report on disruptive technologies

http://www.mckinsey.com/insights/business_technology/disruptive_technologies




PROPERTY OF TRIANGLE CABLES
PROPERTY OF TRIANGLE CABLES


PHILIPS
MAQUET

Take home messages

- Computers move information, robots move stuff from **A** to **B**
- Robots can work 24/7 and are very precise
  - increase productivity
- Robots don’t look like what you might think
- The applications are almost unlimited
- Robots are getting better and better (quickly)
- In the near future robots will be as “normal” as a smart phone