Our Technological Future

St. Johns County Civic Roundtable
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Bernie Grossman

bernieg2@icloud.com

(904) 451-4418

Our Technological Future

* Our past and present
* Is the Singularity near?
* Artificial Intelligence
* Driverless Cars
* Robotics & Jobs
* Robotic Warfare

* Education &Communication
* Space & Energy
* Medicine & Genetic Engineering
* Virtual Reality
* Computers
* Transportation Systems
* Food
* Climate

Some people are negative about the future of technology

* "What a strange practice it is...that a man should sit down to his breakfast table and, instead of conversing with his wife, and children, hold before his face a sort of screen on which is inscribed a world-wide gossip."

All this technology is making us antisocial

Ben Noble, "Automation is Making Us Dumber...and That's a Good Thing"

# Some people are negative about the future of technology (continued)

* "...this discovery of yours will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves."

Socrates referring to invention of writing. ˜400 BC

* "...with all of the knowledge we could need at our fingertips, are we outsourcing our memory to the internet?" in "Scientists say Google is changing our brains" by Stephanie Thompson in medium.com 10/24/16

* In another 25 years, our current arguments about smart phones and social media will likely seem just as funny as arguments about the dangers of newspapers and writing do today.

I'm excited about the future of technology

* 1820: life expectancy 35 years, extreme poverty 94%, literacy 10%

* today: life expectancy > 70 years, extreme poverty < 10%, literacy > 80%

* improvements due to advances in technology: from the industrial age to today's information age
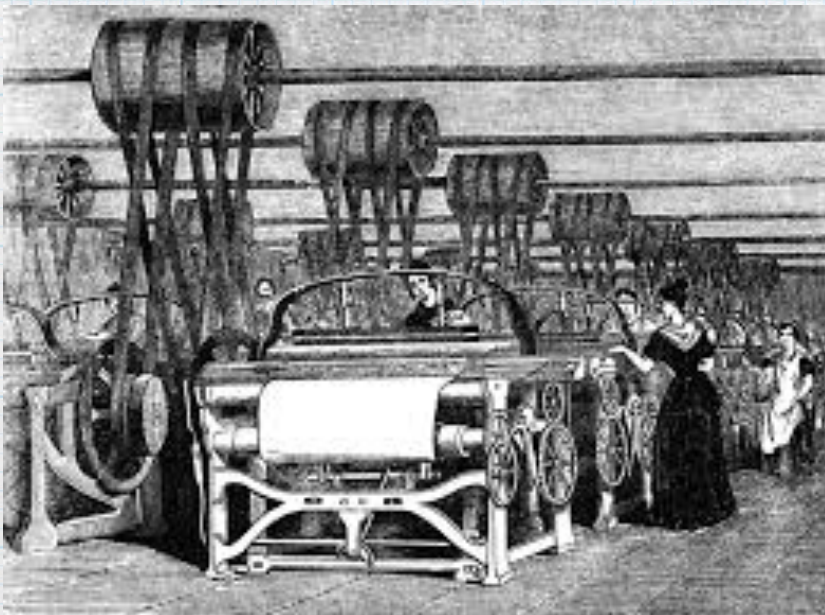
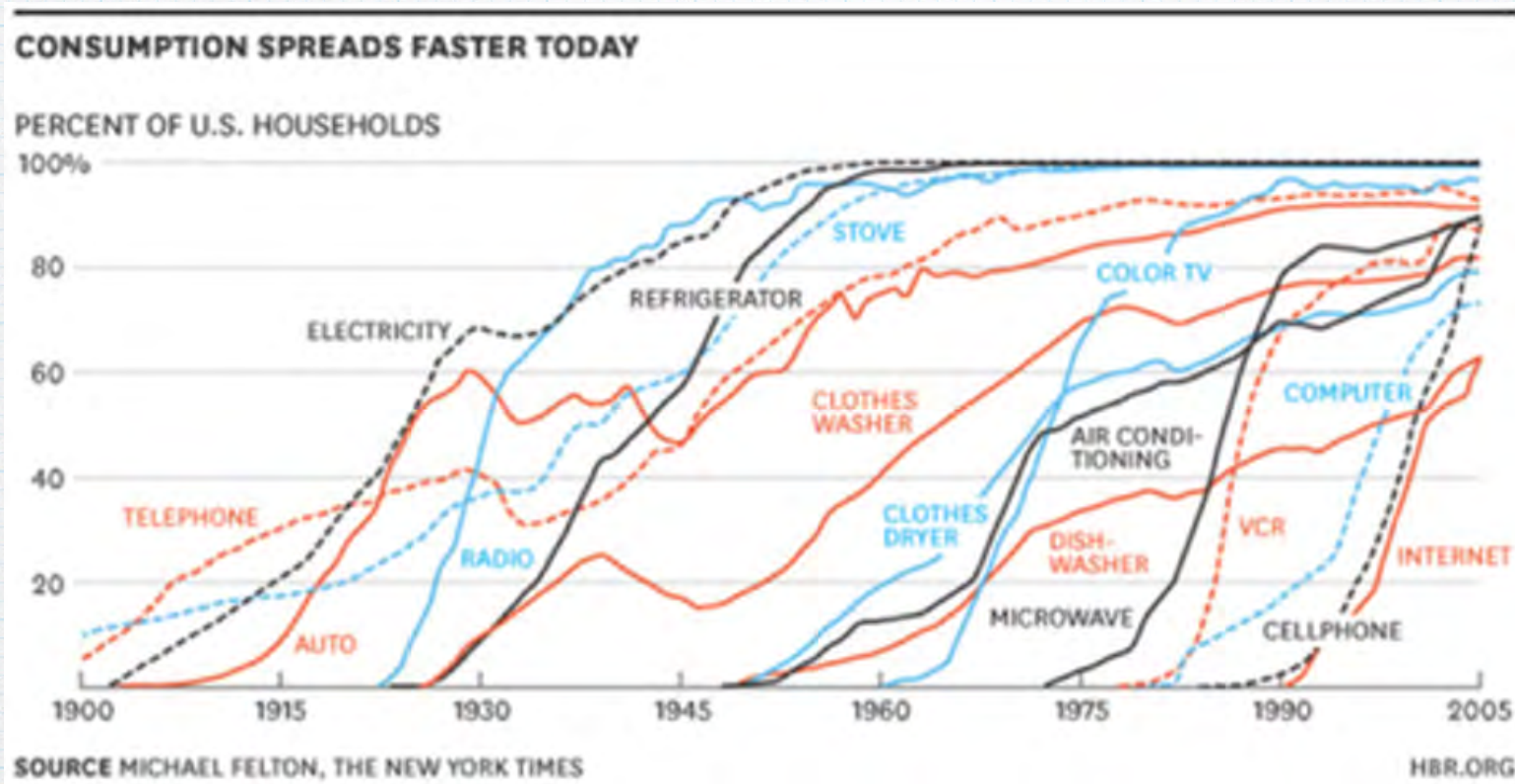# So much technology has come and gone in our lifetimes

Many of these things we had thought were indispensable

The time that it takes us to adapt to new technologies is getting shorter and shorter

* Telephone (1880) .... 40 years

* Radio (1900) .... 30 years

* TV (1925) .... 25 years

* Personal Computer (1980) ...... 16 years

* Mobile Phone (1985) .... 11 years

* World Wide Web (1995) .... 7 years

To perceive the difficulties in predicting the future one just has to look at the immediate past

CONSUMPTION SPREADS FASTER TODAY

PERCENT OF U.S. HOUSEHOLDS

Labels in chart: ELECTRICITY, REFRIGERATOR, STOVE, COLOR TV, TELEPHONE, CLOTHES WASHER, COMPUTER, RADIO, CLOTHES DRYER, AIR CONDITIONING, DISH-WASHER, VCR, INTERNET, AUTO, MICROWAVE, CELLPHONE

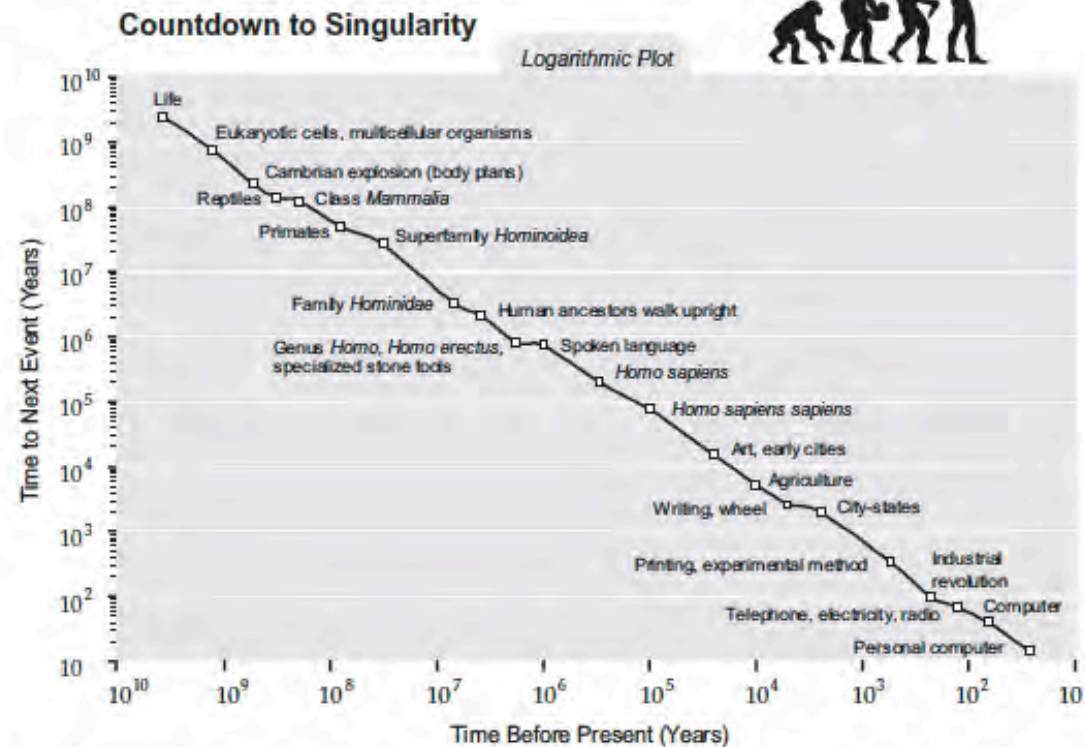SOURCE MICHAEL FELTON, THE NEW YORK TIMES   HBR.ORG

* 15 years ago; no smart phones, no Facebook

* 30 years ago: no PCs, no Internet, no cell phones, no Google

* 60 years ago: no AC, no Washer/Dryer, no color TV, no microwave

* 100 years ago: no cars, no electricity, no telephone for most people
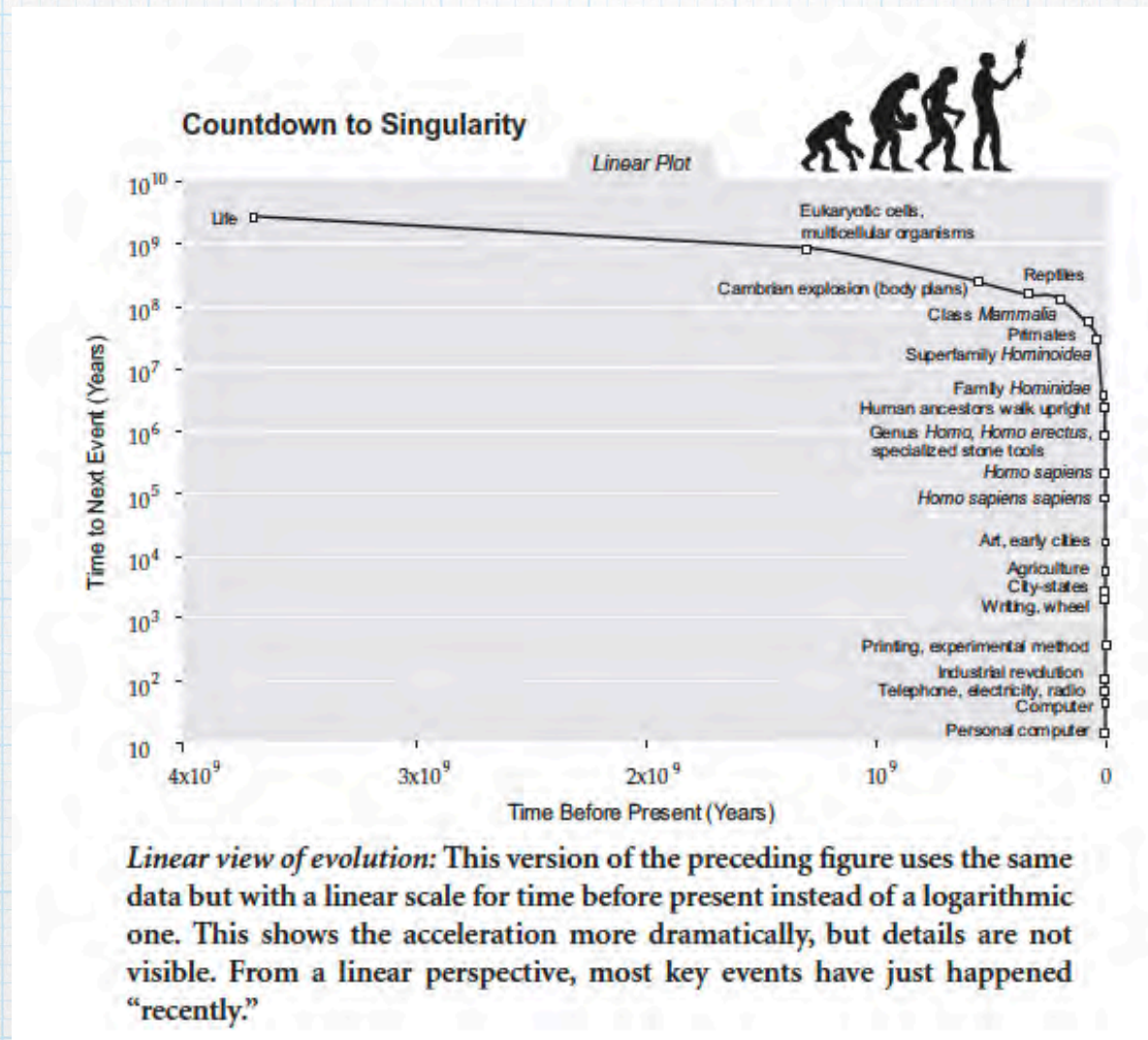
"The Singularity is Near" by Ray Kurzweil
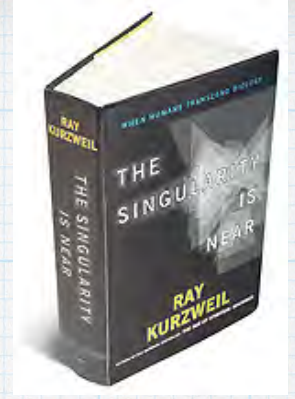
*In Ray Kurzweil's 2005 book "The Singularity Is Near: When Humans Transcend Biology" he postulates that we are already in the very early stages of this transition, and that within just a few decades, life as we know it will be completely different.

*"The Singularity will represent the culmination of the merger of our biological thinking and existence with our technology, resulting in a world that is still human but that transcends our biological roots.

*"There will be no distinction, post-Singularity, between human and machine nor between physical and virtual reality. If you wonder what will remain unequivocally human in such a world, it's simply this quality: ours is the species that inherently seeks to extend its physical and mental reach beyond current limitations."

Exponential Growth of Technology

Countdown to Singularity

Logarithmic Plot

Time to Next Event (Years) vs. Time Before Present (Years)

- Life
- Eukaryotic cells, multicellular organisms
- Cambrian explosion (body plans)
- Reptiles
- Class Mammalia
- Primates
- Superfamily Hominoidea
- Family Hominidae
- Human ancestors walk upright
- Genus Homo, Homo erectus, specialized stone tools
- Spoken language
- Homo sapiens
- Homo sapiens sapiens
- Art, early cities
- Agriculture
- Writing, wheel
- City-states
- Printing, experimental method
- Industrial revolution
- Telephone, electricity, radio
- Computer
- Personal computer

Countdown to Singularity: Biological evolution and human technology both show continual acceleration, indicated by the shorter time to the next event (two billion years from the origin of life to cells; fourteen years from the PC to the World Wide Web).

Exponential Growth of Technology

Countdown to Singularity

Linear Plot

Time to Next Event (Years)

- Life
- Eukaryotic cells, multicellular organisms
- Cambrian explosion (body plans)
- Reptiles
- Class *Mammalia*
- Primates
- Superfamily *Hominoidea*
- Family *Hominidae*
- Human ancestors walk upright
- Genus *Homo*, *Homo erectus*, specialized stone tools
- *Homo sapiens*
- *Homo sapiens sapiens*
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Time Before Present (Years)

Linear view of evolution: This version of the preceding figure uses the same data but with a linear scale for time before present instead of a logarithmic one. This shows the acceleration more dramatically, but details are not visible. From a linear perspective, most key events have just happened "recently."

Is the Singularity Near?

* Man experienced giant leaps in technology in the last century
* Looking to the future it is even faster. Kurzweil has predicted that between 2000 and 2014 we will see a 20th century worth of progress and again by 2021.
* Kurzweil believes that the 21st Century will achieve 1000 times the progress of the 20th century
* We are starting to see a lot of signs quietly hinting that life as we currently know it cannot withstand the leap that's coming next."

* over-arching technology: Artificial Intelligence (AI)

But, in "An Open Letter on Machine Intelligence" leading visionaries have voiced concerns that: ...."we could one day lose control of AI systems via the rise of super-intelligence that do not act in accordance with human wishes – and that such powerful systems would threaten humanity.

What is AI exactly? How does a machine learn?

What is artificial intelligence exactly?

https://www.youtube.com/watch?v=kWmX3pd1f10

Our Technological Future
Driverless Cars?

* Self-driving cars exist today that are safer than human-driven cars in most driving conditions. Over the next 3-5 years they'll get even safer, and will begin to go mainstream.

gregory erskine
@cat_beltane

🐦 Follow

"so what did you do before self-driving cars?"
"we just drove 'em ourselves!"
"wow, no one died that way?"
"oh no, millions of people died"

5:12 PM - 15 Apr 2015

🔁 15,331   ♥ 20,381

Why do we need driverless cars?

* Safety: more that 30,000 fatalities per year in the US (100 per day) and well over a million world wide (3000 per day) - 94% due to human error

* New kind of leisure: passengers will have additional time for reading books, writing email, knitting, practicing an instrument, taking a nap, having a beer.....or working

* Change land use: longer commutes more acceptable.

* Boon to the disabled and elderly. Would greatly enhance the quality of life.

* Clean energy - electric

* Potential to reshape cities

Why do we need driverless cars?

* If self-driving vehicles deliver on their promises, they will save millions of lives over the course of a few decades, destroy and create entire industries, and fundamentally change the human relationship with space and time. All of which is why some of the planet's most valuable companies are pouring billions of dollars into the effort to build driverless cars.

Who is leading the driverless car movement?

* All the major automobile companies are involved, but the acknowledged leader is

* surprisingly .... Google

* Google brings its GPS mapping technology along with artificial intelligence (AI) experience.

* They have had prototype cars on the streets of California since 2012 and have ridden more than 2 million miles in the driverless mode

# Driverless cars -different approaches

* Autonomous from the start. Human only needs to tell vehicle where to go and sit back. (Google, Apple, Uber)

* Incremental approach – gradually add driver assist technologies, with the driver doing less and less hands on. Automatic pilot for cars. (most auto makers, leader - Tesla)
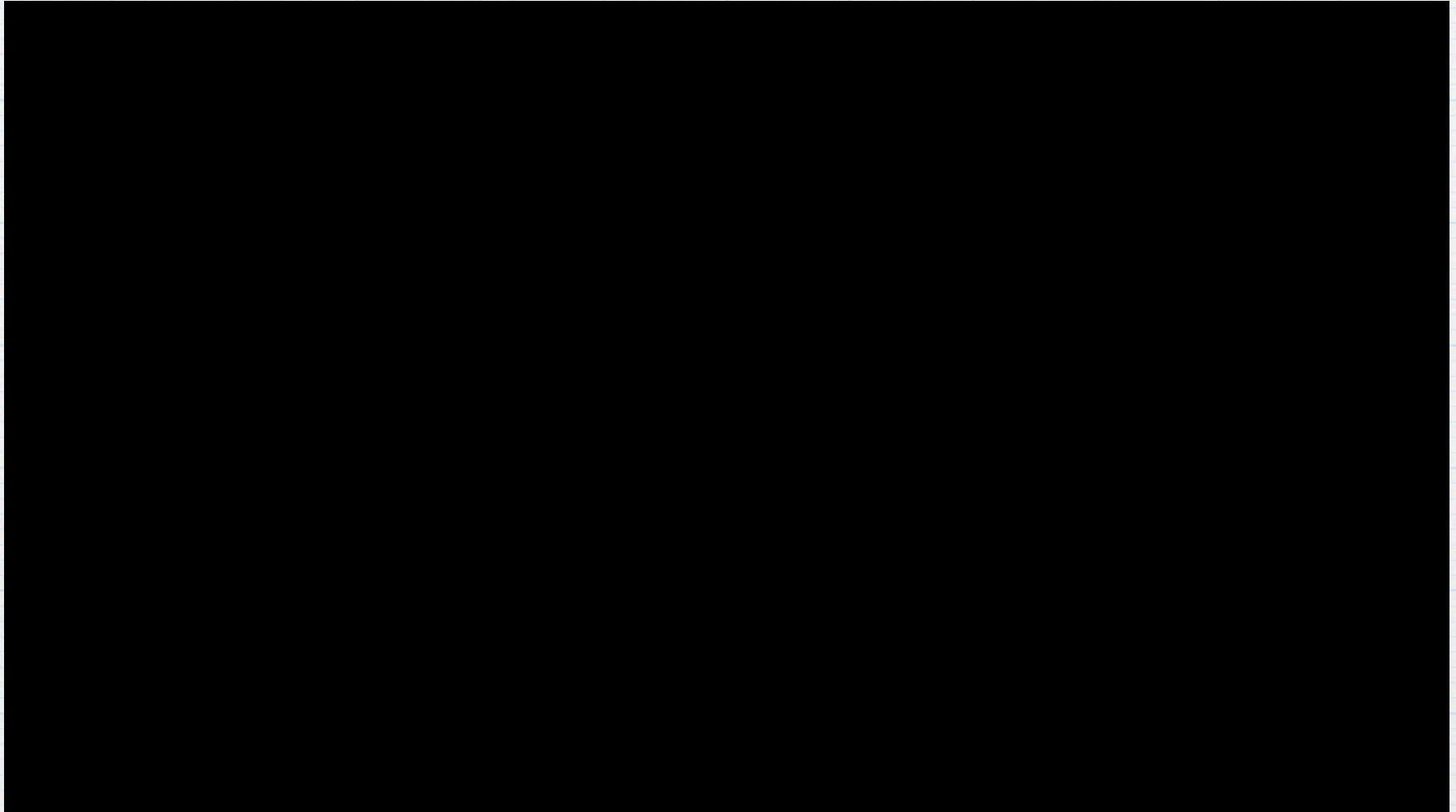
www.theatlantic.com/technology/archive/2015/12/driverless-cars-are-this-centurys-space-race/417672/

The High-Stakes Race to Rid the World of Human Drivers

How do Driverless cars work?

* Cars are loaded with sensors: GPS, video cameras, Radar and LIDAR

* LIDAR: Light + Radar, laser-based imaging system developed by NASA. Used in autonomous vehicles for mapping the surroundings including all moving objects
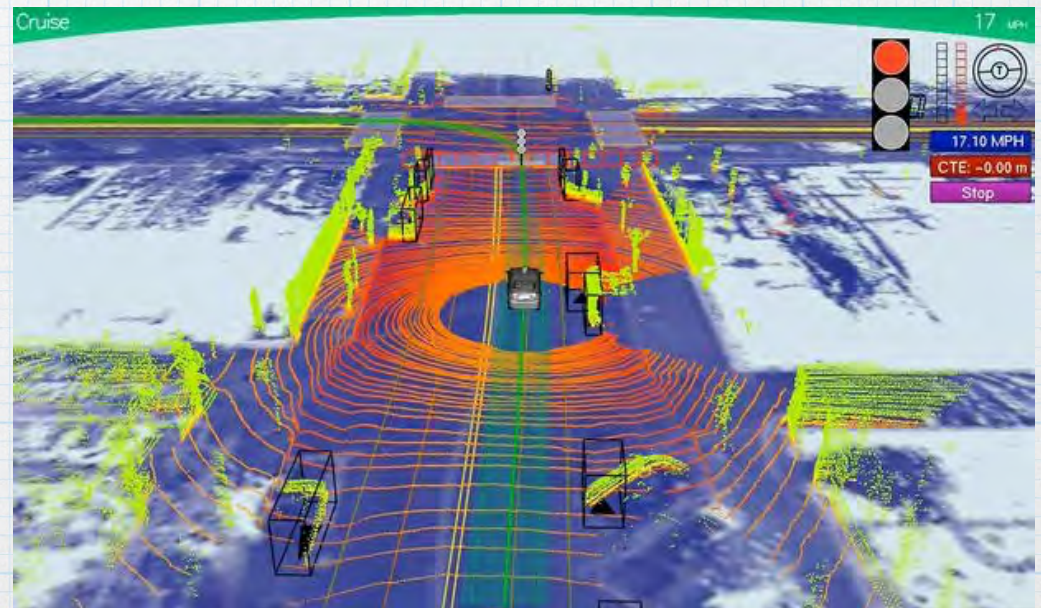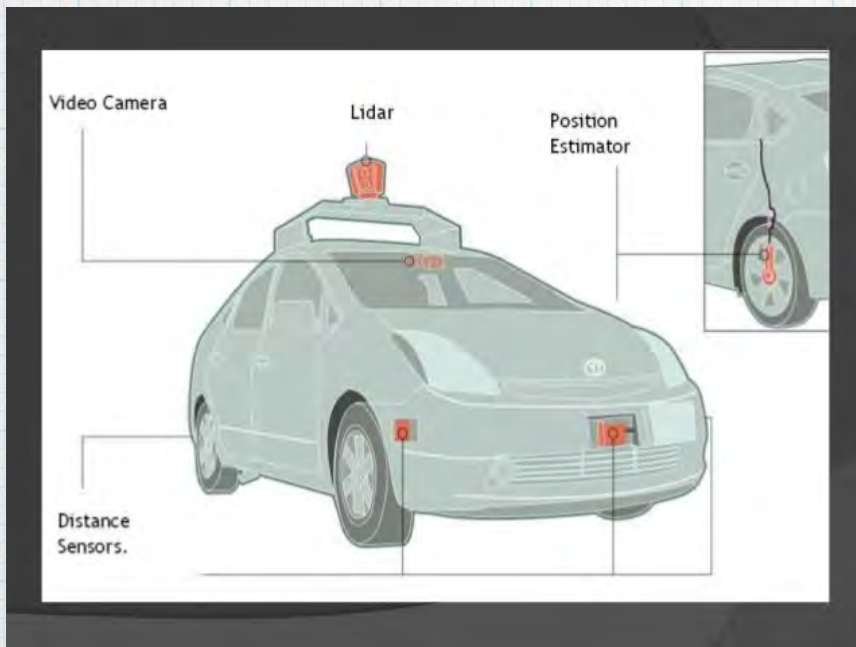
How do driverless cars work?

How Does Google's Driverless Car Work?

https://www.youtube.com/watch?v=ftouPdU1-Bo

What about the downside of driverless cars

Self-Driving Cars Will Improve Our Cities. If They Don't Ruin Them.

If we take action, we can build a dream transportation system around self-driving cars. If we don't, we'll create a nightmare.

Robin Chase — Follow
Now: Author of Peers Inc; co-founder Veniam, vehicle mesh & co-founder former CEO Zipcar. Focus ...
Aug 10 · 16 min read

https://backchannel.com/self-driving-cars-will-improve-our-cities-if-they-dont-ruin-them-2dc920345618#.daxwokwdq

* Simply eliminating the drivers from cars, and keeping everything else about our system the same, will be a disaster.

  * While the number of vehicle miles driven skyrockets, our transportation infrastructure revenues, dependent on the gas tax, parking, fees, and fines will disappear. Estimated $206 billion per year

  * Unemployment will spike as professional drivers will be be laid off in droves. In US: 3.5 million truck drivers, 665,000 bus drivers, 5.5 million people in Auto industry and 1.65 million in dealerships

When will we see these vehicles?

It's happening now!

* Conservative Prediction: 10 Million Self-Driving Cars by 2020

    Forbes, Mar. 3, 2017
    10 Million Self-Driving Cars Will Hit The Road By 2020 -- Here's How To Profit

    Once the first self-driving cars go on sale, who will want to buy an obsolete manual driving one? It would be like eschewing a push button telephone in favor of one with a rotary dial.

* Google's fully autonomous vehicle has amassed millions of miles of testing on public roads in California

    The Wall Street Journal, Oct. 5, 2016
    Google's Self-Driving Car Program Odometer Reaches 2 Million Miles

    Alphabet Inc.'s car program had nearly 60 self-driving vehicles on roads in four states in August

When will we see these vehicles?
It's happening now!

* Ford said that it wants to be first to roll out a completely automated transportation service. By 2021, it expects to make and sell thousands of robotic cars that can ferry passengers to and fro, without any human input other than the destination.

The Washington Post, Aug. 16, 2016

Ford will start selling driverless cars in 2021

* An Otto self-driving truck made it's first delivery: 2000 cases of Budweiser

The New York Times, Oct. 25, 2016

Self-Driving Truck's First Mission: A 120-Mile Beer Run

Otto announced the completion of its first commercial delivery, having delivered its beer load from Fort Collins, Colo., to Colorado Springs, a roughly 120-mile trip on Interstate 25

* Uber has become the first company to make self-driving cars available to the general public in the U.S. through a test program in Pittsburgh

The Wall Street Journal, Sept. 14, 2016

Uber's Self-Driving Cars Debut in Pittsburgh

Up to 1,000 Uber customers will be part of the first real-world test in the U.S. for regular people

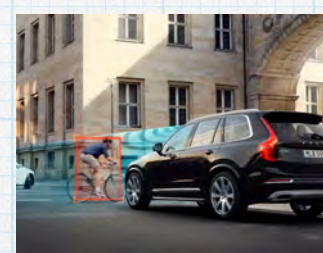# These 19 companies are racing to put driverless cars on the road by 2020

Danielle Muoio, Tech Insider
🕐 Jul. 15, 2016, 12:03 PM   🔥 8,544   💬 1

Tesla is aiming to have its driverless technology ready by 2018.

If Tesla succeeds in building a fully autonomous car by 2020, Uber has declared it will buy 500,000.

Even luxury cars have self-driving concepts

Our Technological Future
Robots and Robotic Warfare

* **Industrial Robots**

* **Agricultural Robots**

* **Mobile Robots**

* **Telerobots**

* **Service Robot**

Service Robots

Opened July 2015

* Futuristic Henn-na Hotel in Japan
* Robotic staff run 90% of operations
* Only 10 humans on the staff
* Humanoid Robots greet and check in guests
* 3 receptionist robots, 4 service and porter robots and several cleaning robots

* There are hospitals in the US where robots deliver trays of food, drugs, clean linens and cart away trash
* Some Lowes stores have a customer-service Robot which is 4 feet tall and shows customers where items are located
* Amazon uses 15,000 robots in warehouses keeping up with orders

Where is this heading?
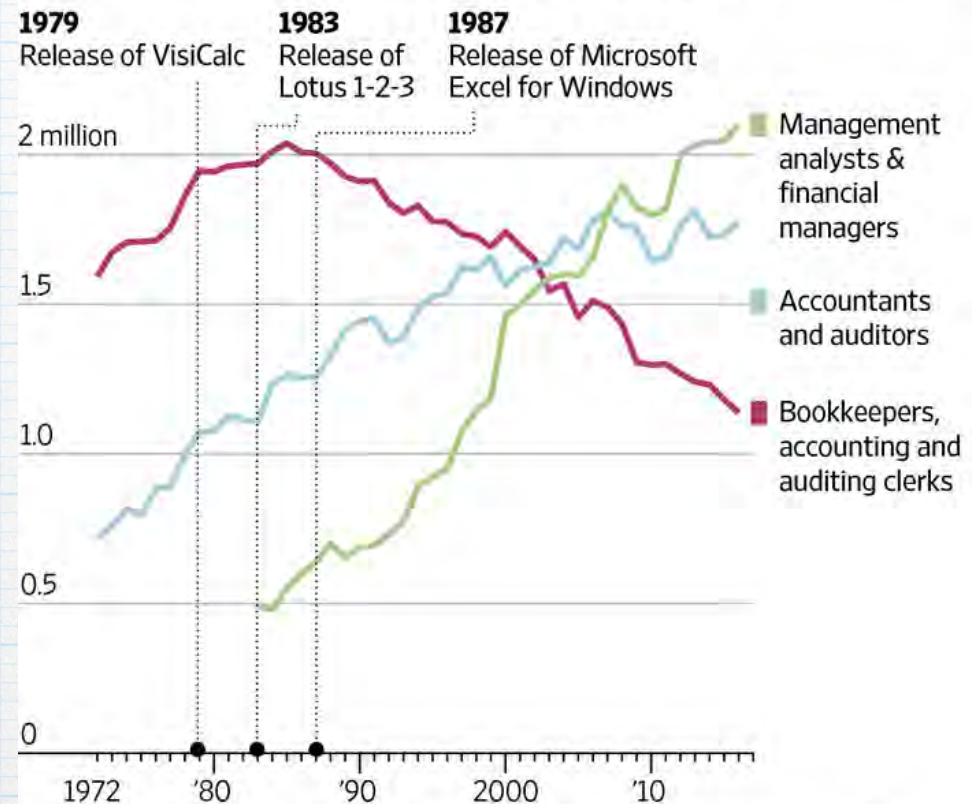Will there be massive job losses to Robots?

Robots and Jobs

The Economist — World politics · Business & finance · Economics · Science & technology

Special report: Artificial Intelligence

The impact on jobs

Automation and anxiety

Will smarter machines cause mass unemployment?

Jun 25th 2016 | From the print edition — *Timekeeper* — Like 1.3K — Tweet

* Predictions that automation will make humans redundant:
    * Industrial revolution: weaving machines, steam engines - protested by Luddites
    * NY Times headline 1928: March of machine makes idle hands
    * JFK: The major challenge of the 1960's was to "maintain full employment at a time when automation .... is replacing men

* Past technology has ended up up creating more jobs than it destroys:
    * 19 century weavers with machines increased the amount of cloth per hour by a factor of 50 and reduced cost by 98%. The number of weavers increased 4 fold from 1830 to 1900 - weavers job changed to maintaining and running machines
    * ATMs reduced number of bank tellers from 20 per branch to 13, but number of branches increased by 43%, net increase in tellers - tellers jobs changed away from routine tasks to sales and customer service that machines can't do.

http://www.economist.com/news/special-report/21700758-will-smarter-machines-cause-mass-unemployment-automation-and-anxiety

Robots and Jobs (continued)

* Another example of where more jobs were created - the introduction of spreadsheets
  * Bookkeeeping jobs plummeted by 44%
  * Accountants and auditors grew 41%
  * Financial managers (which weren't tracked before 1983 have quadrupled
  * The phenomenon of technology making things more efficient, (requiring less resources) causing an increased demand and ultimately an increased use of resources (e.g., electricity or jobs) is Jevons paradox

The Spreadsheet Apocalypse, Revisited

Jobs in bookkeeping plummeted after the introduction of spreadsheet software, but jobs in accounting and analysis took off.

1979 Release of VisiCalc

1983 Release of Lotus 1-2-3

1987 Release of Microsoft Excel for Windows

Legend:
- Management analysts & financial managers
- Accountants and auditors
- Bookkeepers, accounting and auditing clerks

Notes: There is no data for 1982. Changes in occupational definitions in 1983, 2000 and 2011 mean that data is not strictly comparable across time. There was no category for management analysts or financial managers prior to 1983.
Source: Bureau of Labor Statistics

THE WALL STREET JOURNAL.

The Wall Street Journal, Aug. 2, 2017
We Survived Spreadsheets, and We'll Survive AI

Robots and Jobs (continued)

* What determines which jobs will become automated?

  * Machines carrying out manual work is routine

  * Ever smarter machines can perform tasks done by data workers and some routine cognitive tasks

  * Vulnerability to automation is not white or blue collar or routine or not

  * Example: a highly trained radiologist may be in greater danger of being replaced than his own executive assistant - who does so many varied tasks it would be difficult for a machine to replace

Catalogue of fears

Probability of computerisation of different occupations, 2013
(1 = certain)

Job	Probability
Recreational therapists	0.003
Dentists	0.004
Athletic trainers	0.007
Clergy	0.008
Chemical engineers	0.02
Editors	0.06
Firefighters	0.17
Actors	0.37
Health technologists	0.40
Economists	0.43
Commercial pilots	0.55
Machinists	0.65
Word processors and typists	0.81
Real-estate sales agents	0.86
Technical writers	0.89
Retail salespeople	0.92
Accountants and auditors	0.94
Telemarketers	0.99

Source: "The Future of Employment: How Susceptible are Jobs to Computerisation?", by C. Frey and M. Osborne (2013)

Economist.com

# Robotic Warfare

* Over past 20 years, the military has been moving steadily towards more unmanned functions using robots

* Surveillance

* Remote bombing and missiles

* Mine sweeping and IEDs

* Robots have been saving lives

Current Operations

* The military is rapidly moving towards robotic armed forces

* Now, most of the robotic functions are controlled by humans, such as the predator drone


* Future operations will become more autonomous
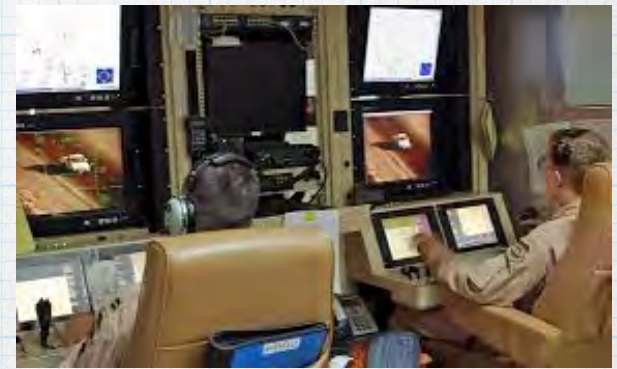
Autonomous Robots

A fully autonomous robot can:

* Gain information about the environment

* Work for an extended period without human intervention

* Move either all or part of itself throughout its operating environment without human assistance

* Avoid situations that are harmful to people, property, or itself unless those are part of its design specifications

* An autonomous robot may also learn or gain new knowledge like adjusting for new methods of accomplishing its tasks or adapting to changing surroundings.

Future Military Robots
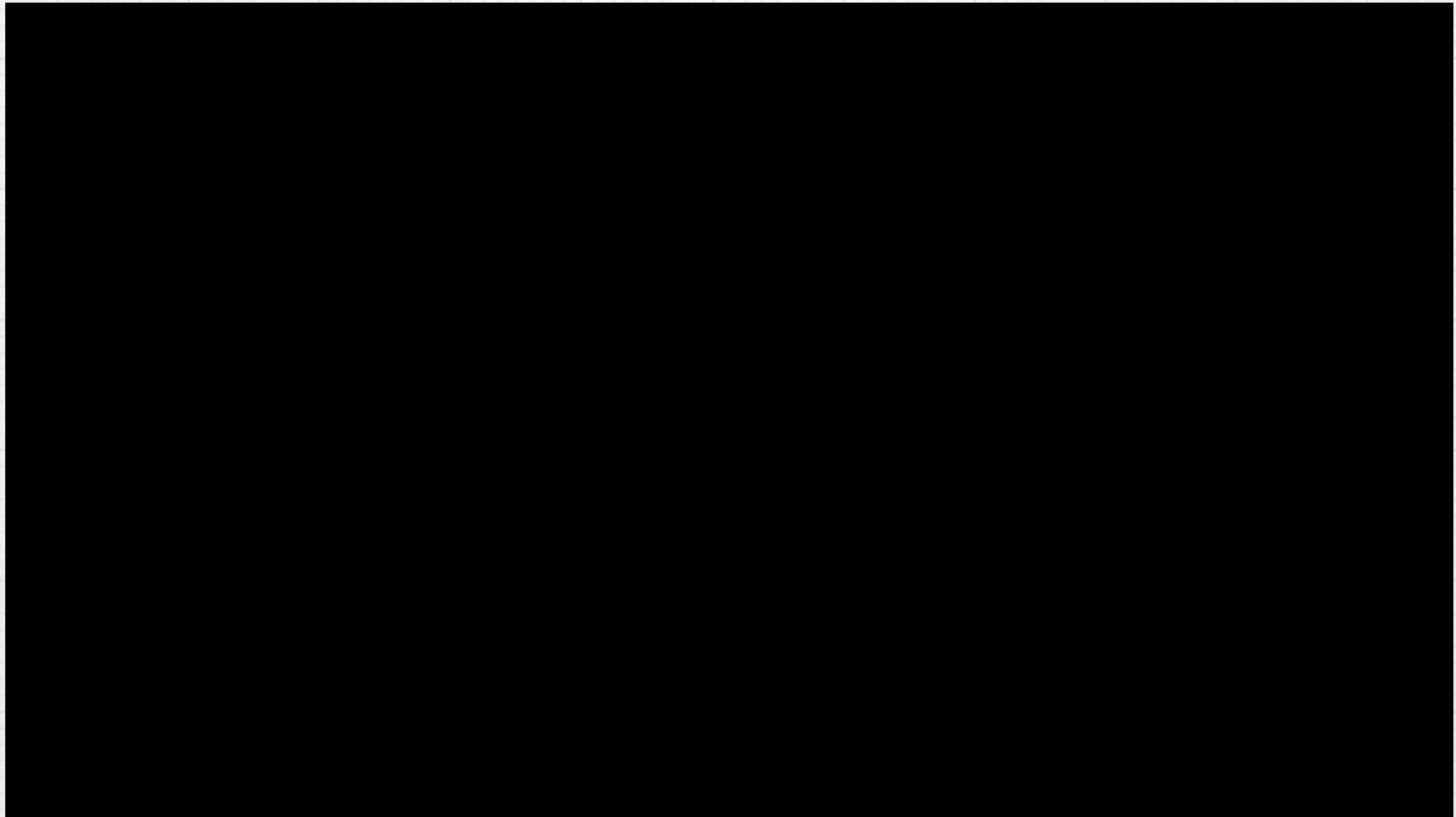
Future Military Robots

Societal Issues of Robotic Warfare

The Washington Post

Innovations | Opinion

Robots could eventually replace soldiers in warfare. Is that a good thing?

By Vivek Wadhwa and Aaron Johnson   October 5

* Autonomous warfare, which function without human interaction is already being used in the military in limited ways
  * Deep learning has revolutionized image classification and recognition and will soon allow these systems to exceed capabilities of an average human soldier

* For now US military says it will keep human in the loop for all life-or-death decisions
  * But what about China, Russia and even rogue nations when they develop autonomous robots?
  * What about the chain of command? Who is responsible if something goes wrong?
  * Should the decision to take human life be made by a machine? The decision to take human life is a moral one; a machine can only mimic moral decisions, and not consider the implications
  * The only way to avoid untenable situations is to create and enforce an international ban on lethal autonomous weapons systems.

* Robotics and artificial intelligence both offer great potential for helping society — from searching collapsed buildings for survivors, to sifting massive data for new treatments for cancer. It is up to us whether we harness their potential to build peace and enrich our lives or to ensure endless war and cheapen human life.
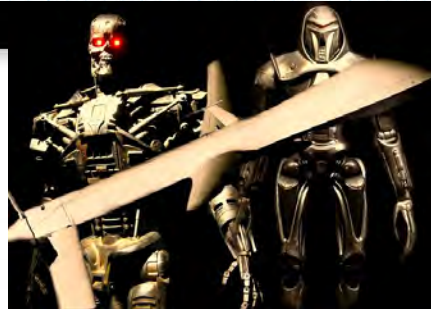
Ethical and Legal Issues of Robotic Warfare

The Atlantic
SUBSCRIBE SEARCH MENU☰

Do Killer Robots Violate Human Rights?

When machines are anthropomorphized, we risk applying a human standard that should not apply to mere tools.

PATRICK LIN | APR 20, 2015 | TECHNOLOGY

http://www.theatlantic.com/technology/archive/2015/04/do-killer-robots-violate-human-rights/390033/

* As bizarre as it sounds, the United Nations just held an arms-control conference to figure out if killer robots might violate the laws of war.

The New York Times

The Opinion Pages | OP-ED CONTRIBUTOR

The Morality of Robotic War

By MICHAEL C. HOROWITZ and PAUL SCHARRE   MAY 26, 2015
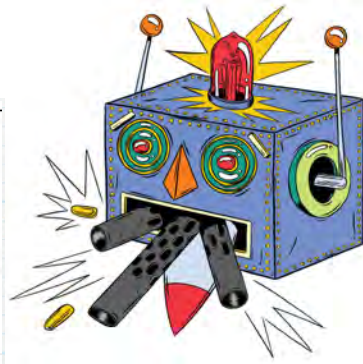
http://www.nytimes.com/2015/05/27/opinion/the-morality-of-robotic-war.html?_r=1

* Weapons with greater autonomy could mean more accuracy and fewer civilian casualties. The appropriate response is not to forgo potentially useful technology, but instead to understand where human judgment is still required, regardless of how advanced the technology becomes.

Future Robotic Warfare

* Are we moving towards a "star wars" type military conflicts of their autonomous robots against ours?

* Is this ethical or legal?
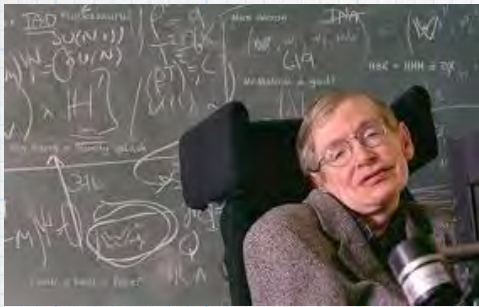
* Can we do anything about it?

One last video about AI

Artificial Intelligence

https://www.youtube.com/watch?v=9TRvOcXUVQw

Artificial Intelligence: further thoughts

Open Letter on Machine Intelligence - Wikipedia

In January 2015, Stephen Hawking, Elon Musk, Bill Gates and dozens of artificial intelligence experts signed an open letter on artificial intelligence calling for research on the societal impacts of AI.

The letter affirmed that society can reap great potential benefits from artificial intelligence, but called for concrete research on how to prevent certain potential "pitfalls": artificial intelligence has the potential to eradicate disease and poverty, but researchers must not create something which cannot be controlled.

The four-paragraph letter, titled Research Priorities for Robust and Beneficial Artificial Intelligence: an Open Letter, lays out detailed research priorities in an accompanying twelve-page document.

Our Technological Future

* I never think of the future, it comes soon enough   -   Albert Einstein
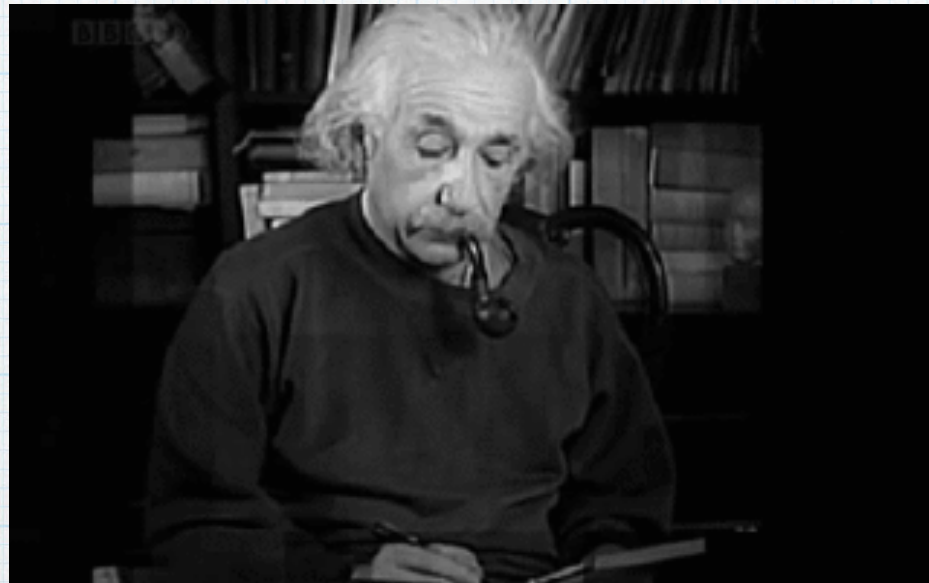
Artificial Intelligence, Self-Driving Cars, Robotic Warfare

* What do you think?

Live long and prosper.