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RAeS London UK - 12 November 2014



Training and Simulation in a More Autonomous and Robotic Future

Andy Fawkes

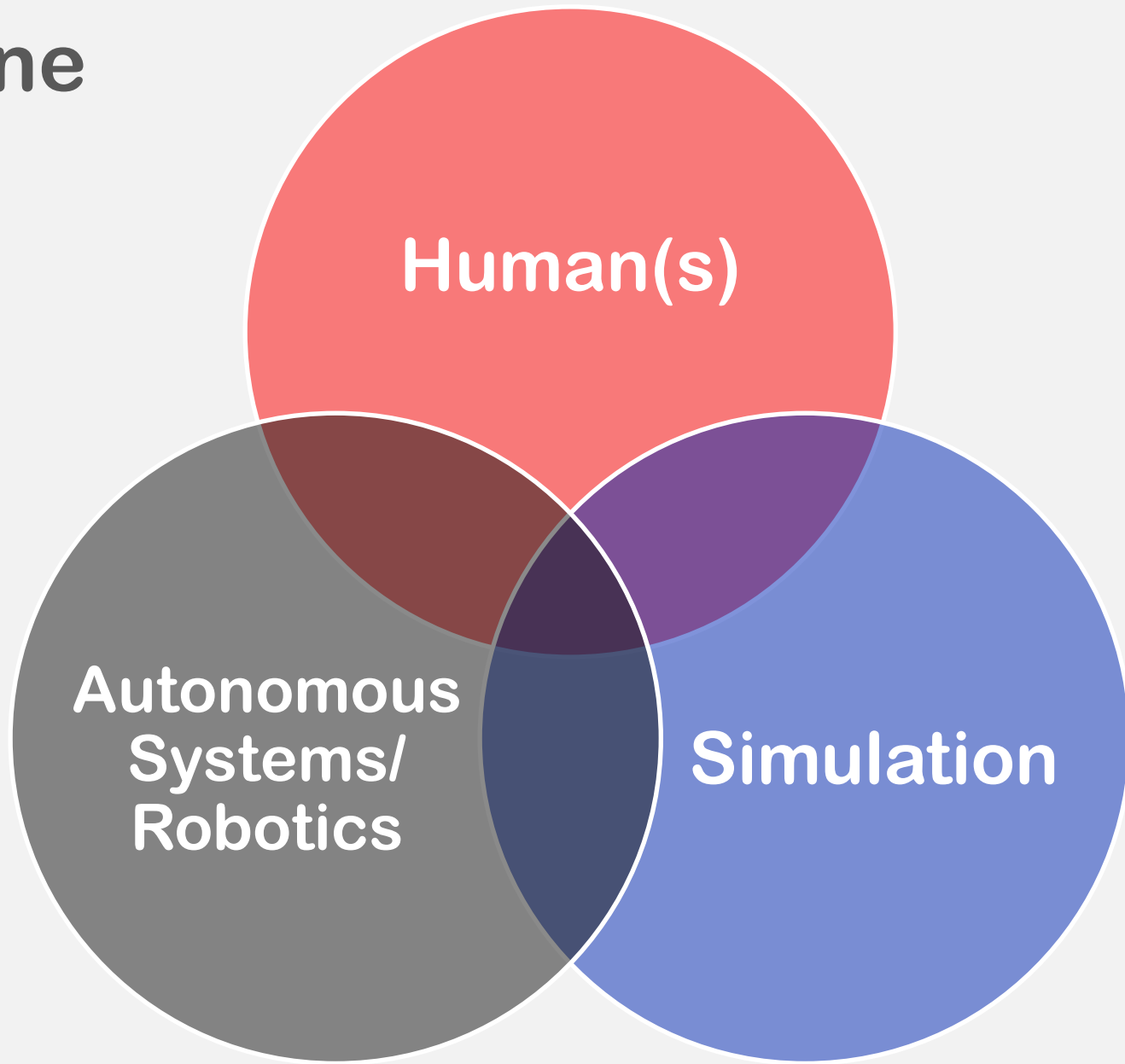
SCI-274

**Workshop on Verification & Validation
of Autonomous Systems**

24 – 25 June 2014



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News > Technology

A third of UK jobs to be replaced by robots and computers in next 20 years



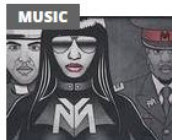
Low-paid, repetitive roles are most at risk, following an established global trend for automated systems to replace human labour

JAMES VINCENT | Monday 10 November 2014

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Advances in robotics and computing could wipe out as much as a third of all UK jobs over the next 20 years, a new report has claimed.

More than 10 million roles are likely to be replaced by automated systems, with repetitive, lower-paid jobs (those earning less than £30,000 a year) five times more likely to be made obsolete than higher-paid jobs.



MUSIC
Nicki Minaj accused of glorifying Nazis in video for latest

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The robots are coming: One in three UK jobs are at 'high risk' of being replaced by machines in the next 20 years

- Lowest paid workers most at risk of being replaced
- Clerical and support roles are endangered, as well as transportation jobs
- Workers and employers must adapt now to the changing demands on the workforce, report warns

By RACHEL RICKARD STRAUS FOR THISISMONEY.CO.UK

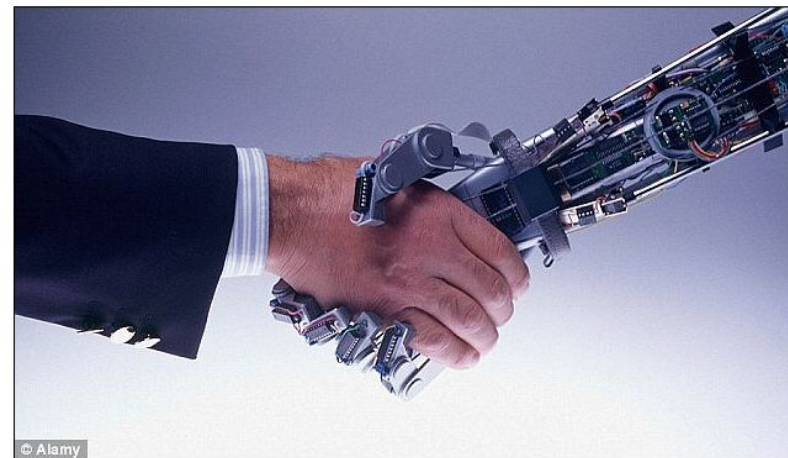
PUBLISHED: 11:23, 10 November 2014 | UPDATED: 13:33, 10 November 2014

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A third of British jobs are at 'high risk' of being replaced by robots in the next 20 years, a report by scientists and economists predicted today.

Jobs facing the most serious threat include office and administrative roles, sales and services jobs, as well as transportation, construction, extraction and production.

The lowest paid workers are most likely to be replaced, the research by Deloitte, Carl Benedikt Frey of the Oxford Martin School and Michael A Osborne at the University of Oxford found. Jobs paying less than £30,000 a year are nearly five times more likely to be replaced by automation than jobs paying over £100,000.



© Alamy

Human touch: Skills such as creativity will be in greater demand while those requiring repetitive processing could be at risk of automation, the study suggested

In London, lower paid jobs are eight times more likely to be replaced. The researchers conducted a similar report last year, which detailed the 100 jobs most and least likely to be replaced by robots.

THINKE

Computerisable				
Rank	Probability	Label	SOC code	Occupation
184.	0.13		19-3051	Urban and Regional Planners
185.	0.13		21-1093	Social and Human Service Assistants
186.	0.13		25-3021	Self-Enrichment Education Teachers
187.	0.13		27-4014	Sound Engineering Technicians
188.	0.14		29-1041	Optometrists
189.	0.14		17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
190.	0.14		29-1071	Physician Assistants
191.	0.15		25-2012	Kindergarten Teachers, Except Special Education
192.	0.15		47-2111	Electricians
193.	0.16		17-2171	Petroleum Engineers
194.	0.16		43-9031	Desktop Publishers
195.	0.16		11-1021	General and Operations Managers
196.	0.17		29-9011	Occupational Health and Safety Specialists
197.	0.17		33-2011	Firefighters
198.	0.17		13-2061	Financial Examiners
199.	0.17		47-1011	First-Line Supervisors of Construction Trades and Extraction Workers
200.	0.17		25-2022	Middle School Teachers, Except Special and Career/Technical Education
201.	0.18		27-3031	Public Relations Specialists
202.	0.18		49-9092	Commercial Divers
203.	0.18		49-9095	Manufactured Building and Mobile Home Installers
204.	0.18		53-2011	Airline Pilots , Copilots, and Flight Engineers
205.	0.19		25-3011	Adult Basic and Secondary Education and Literacy Teachers and Instructors
206.	0.2		19-1041	Epidemiologists
207.	0.2		39-4831	Funeral Service Managers, Directors, Morticians, and Undertakers
208.	0.21		15-1179	Information Security Analysts, Web Developers, and Computer Network Architects
209.	0.21		15-2011	Actuaries
210.	0.21		33-9011	Animal Control Workers
211.	0.21	0	39-6012	Concierges
212.	0.22		15-1799	Computer Occupations, All Other

311.	0.54		31-9011	Massage Therapists
312.	0.54		41-3011	Advertising Sales Agents
313.	0.55		49-3022	Automotive Glass Installers and Repairers
314.	0.55		53-2012	Commercial Pilots
315.	0.55		43-4051	Customer Service Representatives
316.	0.55		27-4011	Audio and Video Equipment Technicians
317.	0.56		25-9041	Teacher Assistants
318.	0.57		45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers
319.	0.57		19-4031	Chemical Technicians
320.	0.57		47-3015	Helpers—Pipelayers, Plumbers, Pipefitters, and Steamfitters
321.	0.57	1	13-1051	Cost Estimators

The Future of Employment: How Susceptible are Jobs to Computerisation? (in the next 20 years)

Carl Benedikt Frey and Michael A. Osborne
September 17, 2013

Rank	Probability	Label	SOC code	Occupation
1.	0.0028		29-1125	Recreational Therapists
702.	0.99		41-9041	Telemarketers

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Computer passes 'Turing Test' for the first time after convincing users it is human

A "super computer" has duped humans into thinking it is a 13-year-old boy, becoming the first machine to pass the "iconic" Turing Test, experts say



Alan Turing Photo: AFP

theguardian

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Robot doctors, online lawyers and automated architects: the future of the professions?

Advances in technology have long been recognised as a threat to manual labour. Now highly skilled, knowledge-based jobs that were once regarded as safe could be at risk. How will they adapt to the digital age?



Tom Meltzer

The Guardian, Sunday 15 June 2014 19.00 BST



Technology is set to challenge traditionally safe professions. Photograph: Alamy

2029: the year when robots will have the power to outsmart their makers

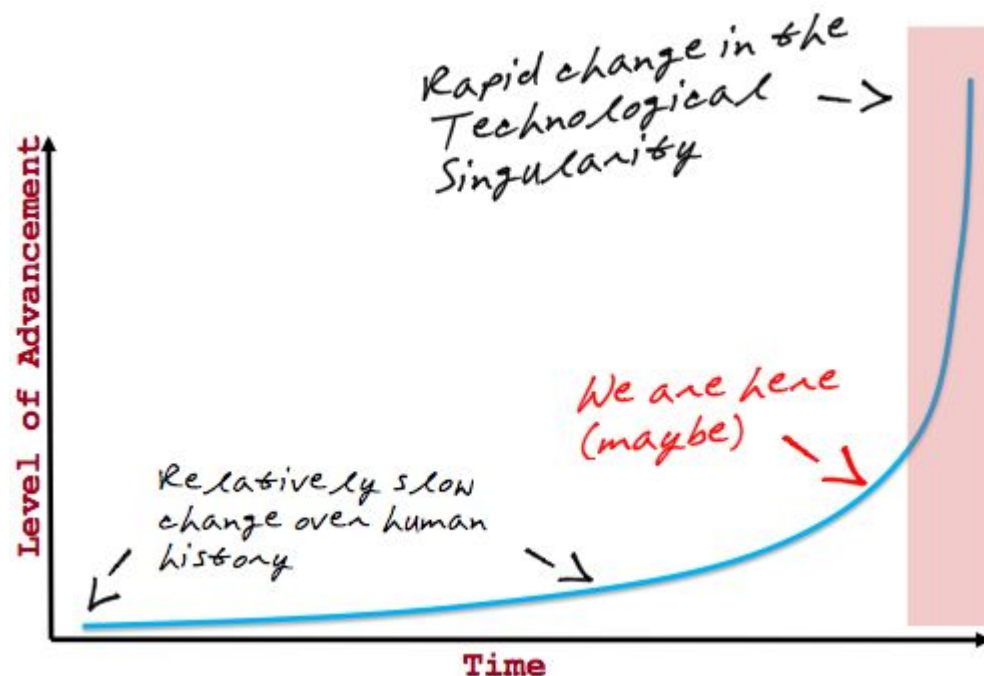
Ray Kurzweil, Google expert in artificial intelligence, predicts that by 2029 robots will make jokes and flirt

Nadia Khomani
The Observer, Saturday 22 February 2014 21.00 GMT
[Jump to comments \(361\)](#)



Garry Kasparov versus Deep Blue in 1997. The computer won - as Ray Kurzweil predicted. Photograph: Stan Honda/AFP/Getty Images

Computers will be cleverer than humans by 2029, according to Ray Kurzweil, Google's director of engineering.



Baby X, The Intelligent Toddler Simulation

BABY X

**FIRST
WORDS**

Two Views of Technology



Nothing New in the World - BOAC VC10 Automatic Landing (1968)



Pilots of the Future?



- What will they do?
- Who will they be?
- Where will they be?
- How will they train?
- Will we need them?

Physical or Cognitive Jobs/Tasks

- **Robot**
 - “a machine that automates a physical task”
 - (credit Nick Hawes, University of Birmingham)
- **Computer**
 - a machine that automates a cognitive task

Passenger Plane Flies 800 km Without a Pilot

NewScientist

Passenger plane piloted from the ground



Rolls-Royce Remote-Controlled Ships Concept

theguardian

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[Business](#) > [Rolls-Royce](#)

Rolls-Royce plans remote-controlled ships with no captain or crew on board

British engineering company claims huge cargo carriers will be cheaper, greener and safer than fully manned vessels

Rupert Neate

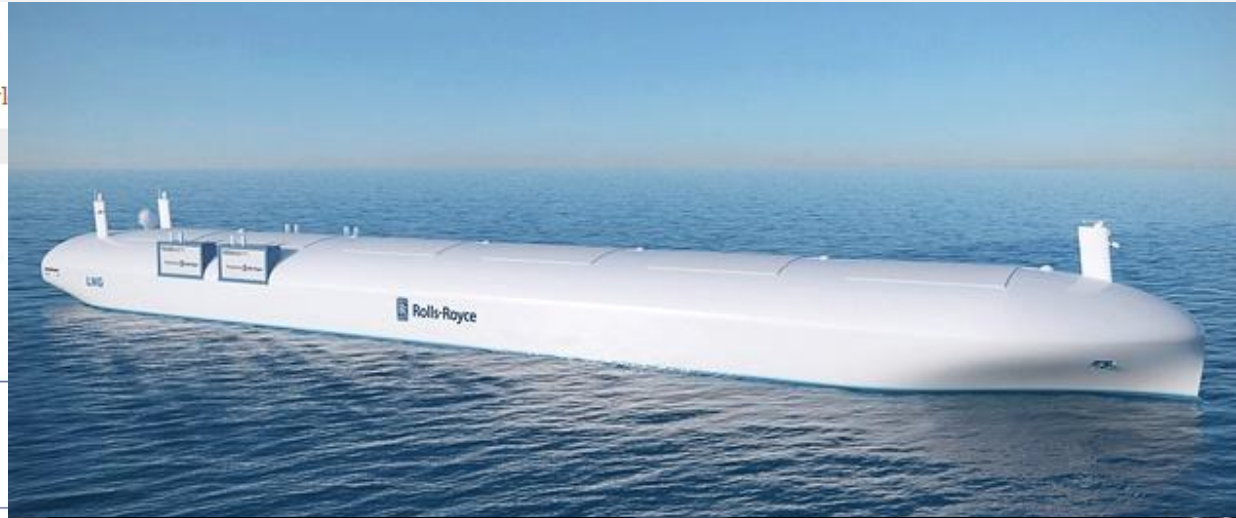
The Guardian, Friday 30 May 2014 20.12 BST

 [Jump to comments \(74\)](#)

A fleet of giant cargo ships, up to almost a quarter of a mile long and wider than a motorway, are to crisscross the world's oceans without a captain or crew on board.

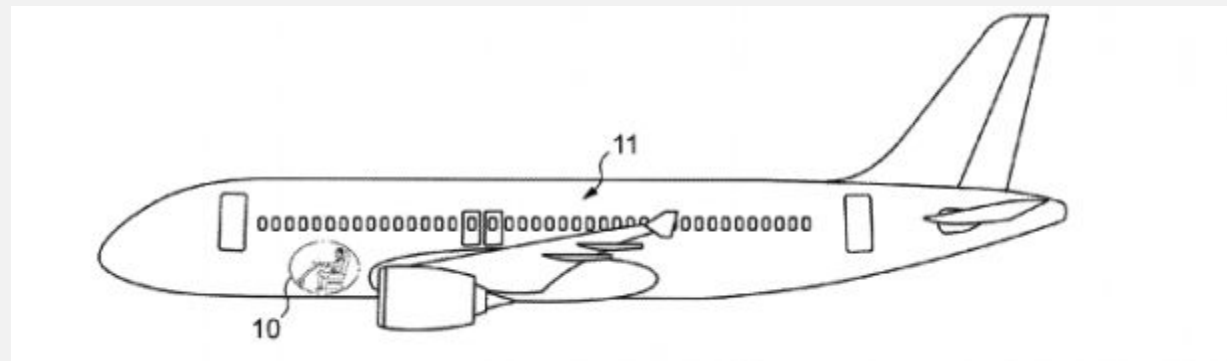
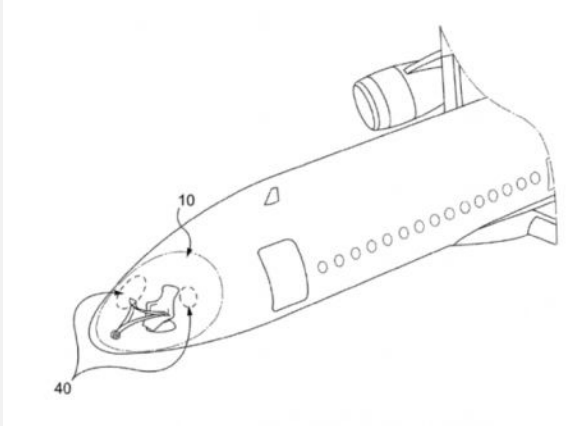
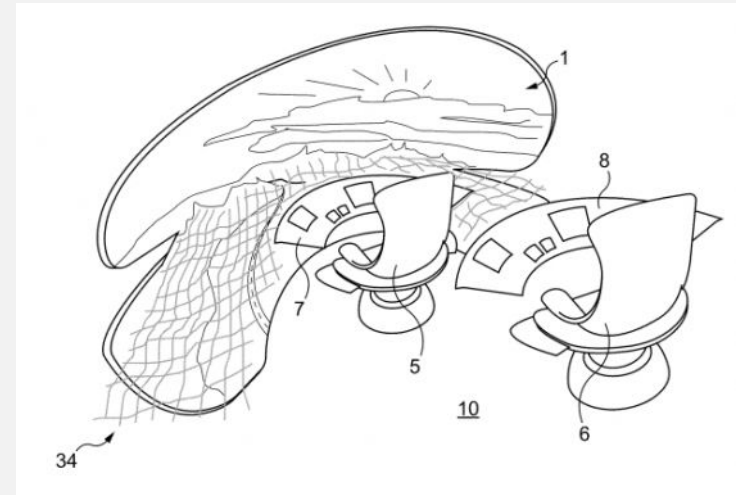
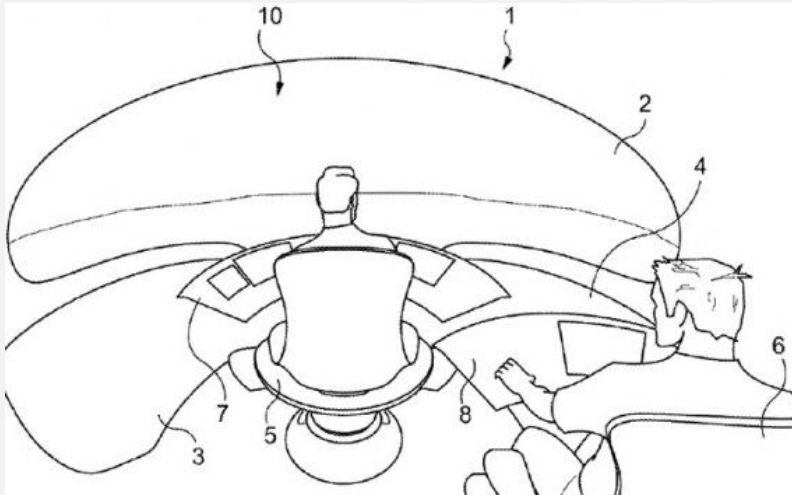
The remote-controlled vessels, which could set sail within the decade, are the latest development in the growing trend for unmanned vehicles, with drone aircraft already flying and Google planning to introduce driverless cars.

Rolls-Royce, the British engineering company developing the ships, claims the unmanned ships will be cheaper, greener and safer than those with a full complement of captain and crew.



THINKE

Airbus Windowless Cockpit Patent

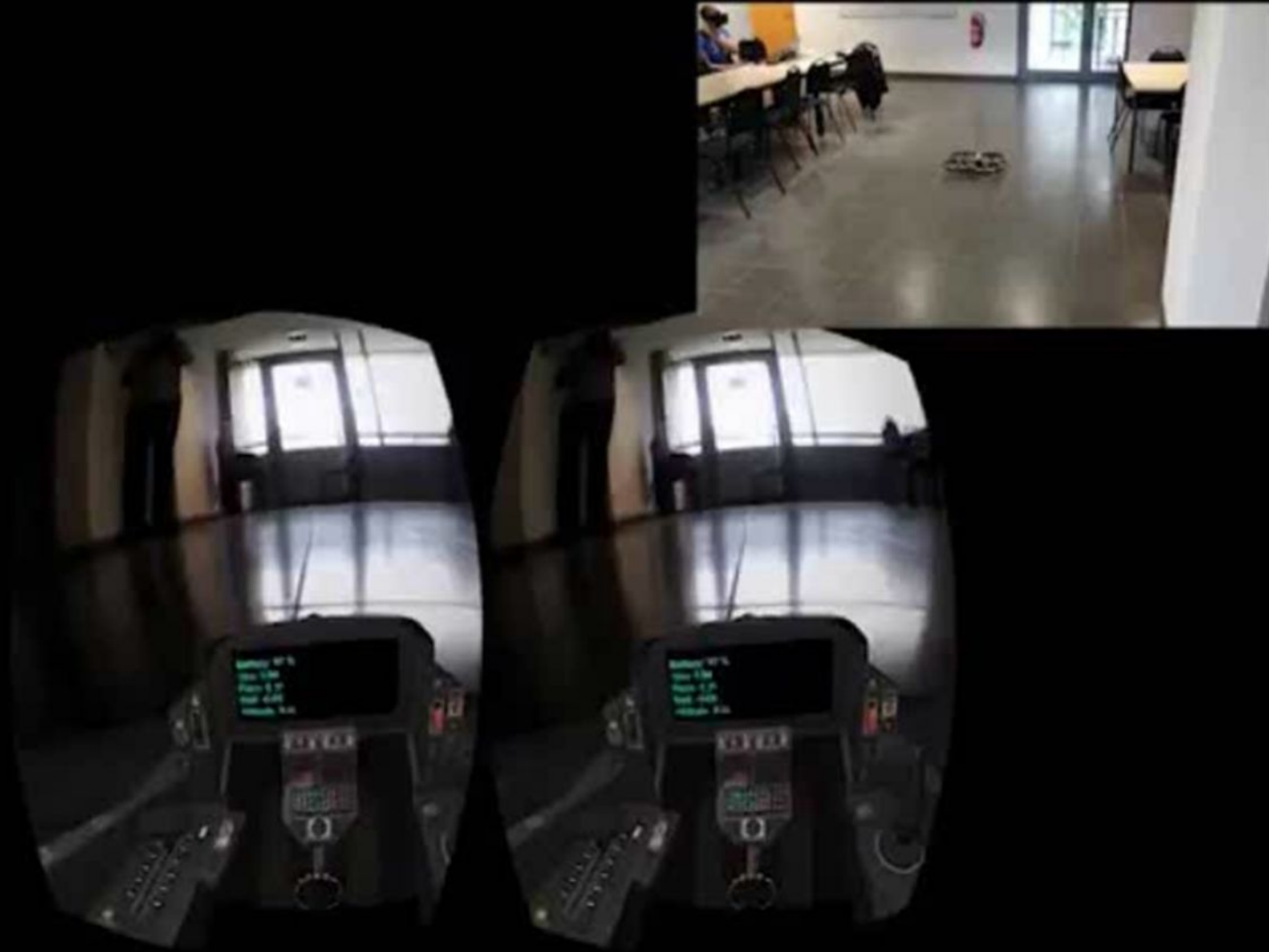


Airgonay Drone Club - French Alps



Rift Drone

AR.Drone 2.0 + Oculus Rift + Unity + Xbox 360 Controller



What Kind of Pilots?

NewStatesman
Online comment site of the year

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Comment | Blogs | UK politics | [International politics](#) | Environment | Polls |

Return to: [Politics](#) | [International politics](#)

If you can play a video game, can fly a drone

These eyes in the sky are so popular, everyone from farmers to thieves wants one.

BY MICHAEL BROOKS | PUBLISHED 13 JUNE, 2012 - 15:03



A Predator drone takes off on a training flight. Photograph: Getty Images

Mind Control



GIZMODO

Search

"Mind-Controlled" Airplanes Might Just Be A Thing



Pranav Dixit

Filed to: MIND-CONTROL 6/01/14 5:58pm

9,630 🔥 2 ★ ▼



A [mind-controlled](#) iPhone? Sure, we'll take it. A [mind-controlled](#) Samsung Galaxy Note 10.1? Why not? A mind-controlled airplane powered by the pilot's brainwaves? Hold on for a moment while we look for the nearest emergency exit.

Using your mind to control an airplane sounds bonkers, but according to this [CNET report](#), researchers are working on just that. A team from the Technische Universität München (TUM) in Germany strapped electroencephalography electrodes to the heads of participants, put them in a flight simulator - not a real aircraft, thank heavens - and instructed them to control the plane using only their minds.

Even though few of the participants had any cockpit experience, the experiment was apparently a success since they were all able to fly so well that they could have gotten a pilot's licence.

THINKE

Mind Reading

'Mind-Reading' Scientists Reconstruct Human Faces From Brain Scans

The Huffington Post | By Jacqueline Howard

Posted: 04/01/2014 8:57 am EDT | Updated: 04/01/2014 4:59 pm EDT



648



Images



Reconstructions



Yale University

Facial images shown to men and women while they were undergoing fMRI scans (above), and the reconstructed images based off of that MRI data (below).





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POLITICS

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Drone Pilots: "Overpaid, Underworked, and Bored"

Photo essay: Military drone operators put their "Top Gun" dreams on hold to spend their days spying from the skies.

—By **Elijah Solomon Hurwitz** | Tue Jun. 18, 2013 6:30 AM EDT

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Mike, an MQ-9 Reaper pilot, sips coffee on his 20-minute morning commute to Holloman Air Force Base outside Alamogordo, New Mexico.

WEDNESDAY, MAY 19, 2010 06:01 PM +0100

Does cockpit automation foster boredom?

Sometimes we're extremely busy, sometimes it's quiet. Duties ebb and flow. We deal with it

PATRICK SMITH

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TOPICS: AIR TRAVEL, ASK THE PILOT, BUSINESS, LIFE NEWS



How Does a UAS Pilot Feel at the End of the Day?



Communication and Trust



Google's Self-Driving Cars – May 14

SOURCE: GOOGLE



Robot Pilot (Oct 14)



U.S. Navy's X-47B Drone & F/A-18 Hornet Conduct Combined Manned & Unmanned Ops (Aug 14)



Cultural Challenges of Introducing Autonomous Systems?



Docklands Light Railway
Autonomous (opened 1987)
100m Annual Passenger Journeys
“Greenfield Development”

Central Line
Driver Operated (1992 Stock)
260m Annual Passenger Journeys
“Brownfield Development”



Question

- do we need to think more about training autonomous systems and robots to work with people and vice versa?



What about Simulation?

Question – Can/Should we Train Autonomous Systems/Robots in Simulation?



Question

- Could the autonomous behaviours in simulations be exploited in controlling autonomous systems and robots?



Boston Dynamics

THINKE

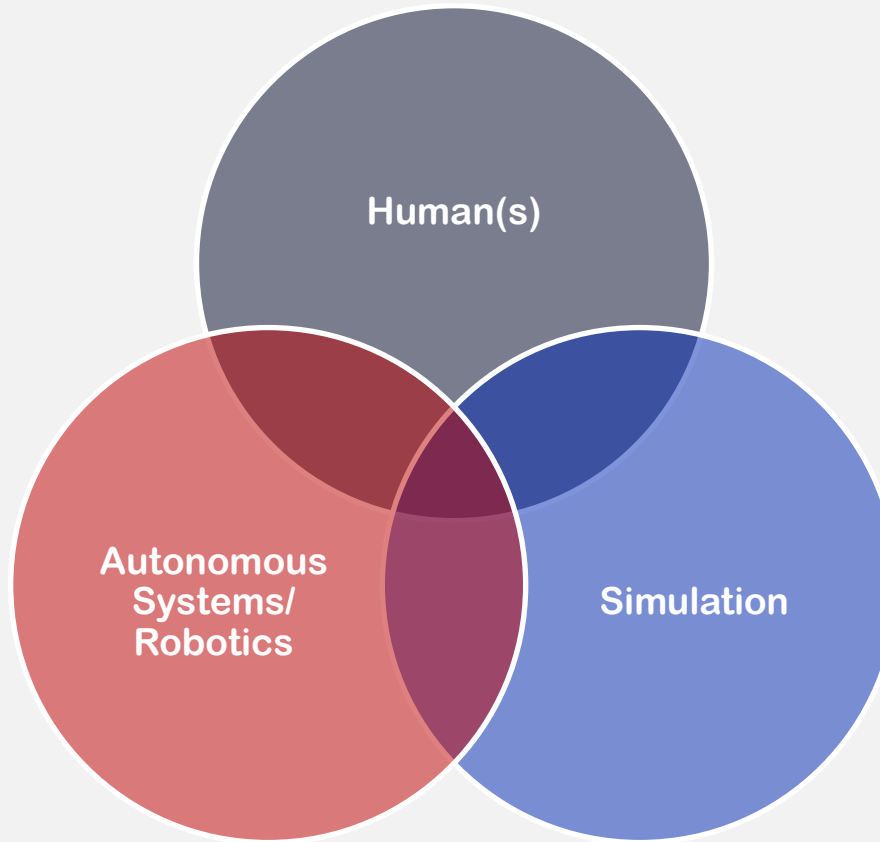
Simulation as an Autonomous System

- Live Simulation
 - real people operating real systems
 - *can be augmented with autonomous effects*
- Virtual Simulation
 - real people operating simulated systems
 - *autonomous behaviours enhance the experience*
- Constructive Simulation
 - simulated people operating simulated systems
 - *high levels of autonomy between human interventions*

DoD Four Levels of Autonomy

Level	Name	Description
1	Human Operated	A human operator makes all decisions. The system has no autonomous control of its environment although it may have information-only responses to sensed data.
2	Human Delegated	The vehicle can perform many <u>functions</u> independently of human control when delegated to do so. This level encompasses automatic controls, engine controls, and other low-level automation that must be activated or deactivated by human input and must act in mutual exclusion of human operation.
3	Human Supervised	The system can perform a wide variety of <u>activities</u> when given top-level permissions or direction by a human. Both the human and the system can initiate behaviors based on sensed data, but the system can do so only if within the scope of its currently directed tasks.
4	Fully Autonomous	The system receives <u>goals</u> from humans and translates them into tasks to be performed without human interaction. A human could still enter the loop in an emergency or change the goals, although in practice there may be significant time delays before human intervention occurs.

Convergence



- A Valid and Verified Autonomous System must Include Human(s) &
- Simulation has a Key Role in Developing, Testing and Training the Autonomous System/Robot and Human(s), Separately and Together

Live-Synthetic Balance

?



Human-Robotic Balance

?



Who is Driving Technology?



Exciting Times!

Simulation

Computing

Games

Sensors

Robotics

Psychology

Training

Virtual Reality

Performance Arts

Telepresenc
e

Education



Artificial
Intelligence

Mobile

Internet

Bored Pilots (How to Irritate People 1968)





Questions?

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