

Thinking Computationally in a Digital World

@ProfTomCrick

<http://proftomcrick.com>

29 June 2018



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<http://community.computingatschool.org.uk>



Successful Futures

Independent Review of Curriculum
and Assessment Arrangements in Wales

Professor Graham Donaldson CB
February 2015

Recommendation

3. The purposes of the curriculum in Wales should be that children and young people develop as:
 - ambitious, capable learners, ready to learn throughout their lives
 - enterprising, creative contributors, ready to play a full part in life and work
 - ethical, informed citizens of Wales and the world
 - healthy, confident individuals, ready to lead fulfilling lives as valued members of society.



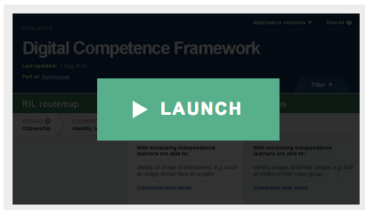
GUIDANCE

Digital Competence Framework

Last updated: 1 Sep 2016

Part of: [Curriculum](#)

The Framework encapsulates the skills that will help learners thrive in an increasingly digital world.



Digital competence is one of 3 cross-curricular responsibilities, alongside literacy and numeracy. It focuses on developing digital skills which can be applied to a wide range of subjects and scenarios.

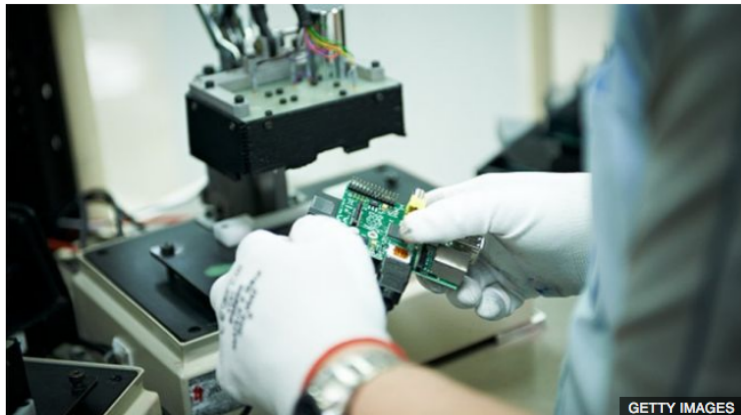
The Framework, which has been developed by practitioners from Pioneer Schools, supported by external experts, has 4 strands of equal importance, each with a number of elements.

£4m to improve school results in science and technology

🕒 7 January 2017 | [Wales politics](#)



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More than £4m will be spent to raise standards in science and technology in Welsh schools.



Curriculum for Wales blog

A curriculum for life

[Home](#)[Participation guidelines](#)[← Previous](#) [Next →](#)

News about ‘what matters’ in the new curriculum – Science and Technology

Posted on [February 1, 2018](#)

[Darllenwch y dudalen hon yn Gymraeg](#)

During the latest stage of curriculum development, Pioneer schools have been asking the question of ‘what matters?’ within the six Areas of Learning and Experience (AoLEs). Here, Professor Tom Crick talks about ‘what matters’ in the Science and Technology AoLE.

What Do I Do?

- **Disaggregating “digital education”:**

What Do I Do?

- **Disaggregating “digital education”:**

- Computer science education;
- Cross-curricular digital competencies;
- Technology-enhanced learning;
- Effective digital pedagogies;
- Digital infrastructure and delivery;
- Digital culture: students, staff,...society?
- Public (mis)understanding of digital and tech.

Terminological Diversions





computer science is|



computer science is **hard**

computer science is **not a science**

computer science is **it worth it**

computer science is **fun**

computer science is

computer science is **so hard**

computer science is **boring**

computer science is **not programming**

computer science is **not engineering**

computer science **issues**

Google Search

I'm Feeling Lucky

ALAN TURING YEAR

2012











The Educational Challenge

What does being
“digitally competent” mean for a
4/8/12/16 year old?



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Black Star
@ChuckNyce116

Follow



15 years of playing on Xbox live. The first time we have ever met, and he's a groomsman in my wedding. Online friends are real life friends.



11:27 PM - 16 Nov 2017

The Societal Challenge

What does being
“digitally competent” mean for a
20/40/60/80 year old?



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Purpose

“A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world.”

Computing Programmes of Study (2013)

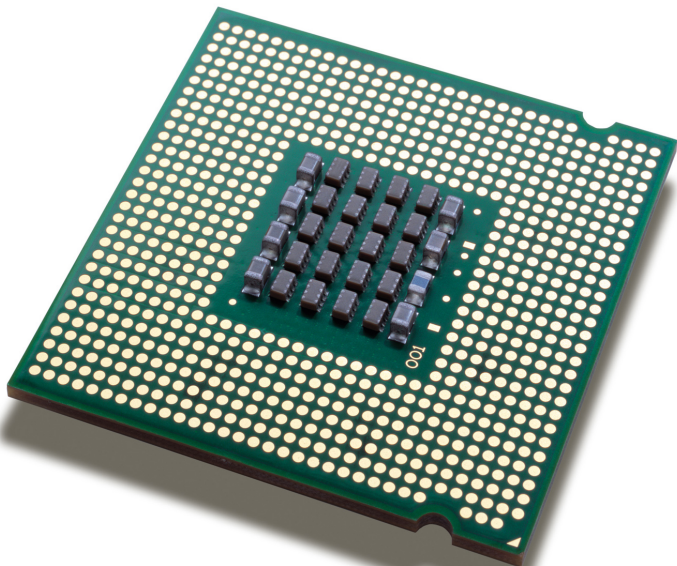


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```
#include <stdio.h>
main()
{ printf ("Hello World!\n");
```





ICT victory for the coding campaigners



Rory Cellan-Jones

Technology correspondent

🕒 13 January 2012 | Technology | 📄



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Back from Las Vegas, I find that it has been a bumper week for technology news in the UK. Ofcom has revised the terms under which 4G mobile broadband will be rolled out, ensuring that 98% of the country will get coverage - though worries remain about how far the UK has fallen behind.

Virgin has doubled the speeds available to its broadband customers. And the US movie streaming giant Netflix has launched in the UK, providing new competition to Lovefilm.



More from Rory

Are teachers ready for the coding revolution?

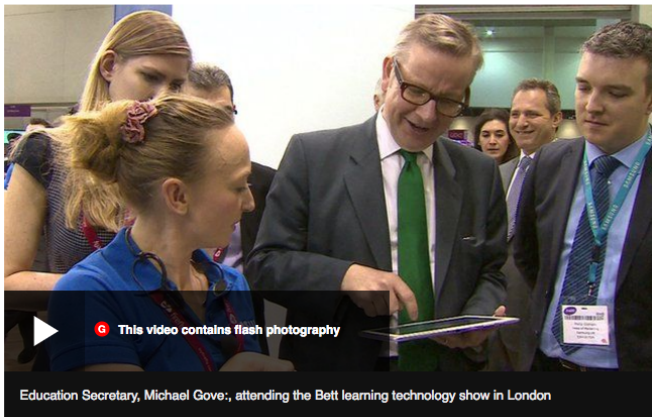


Rory Cellan-Jones
Technology correspondent

🕒 23 January 2014 | Technology | 💬



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Coding at school: a parent's guide to England's new computing curriculum

From the start of the new term, children as young as five will be learning programming skills in the classroom



This article is 3 years old

5,551 129

Stuart Dredge

@stuardredge

Thursday 4 September 2014 12.32 BST



Coding is on the curriculum for primary and secondary school pupils in the UK. Photograph: Alamy

Why Estonia Has Started Teaching Its First-Graders To Code



Parmy Olson, FORBES STAFF

I cover agitators and innovators in mobile. [FULL BIO](#)

Opinions expressed by Forbes Contributors are their own.

Estonia, a small country with a population of 1.3 million people, punches above its own weight when it comes to advancements in tech. It was the [birthplace of Skype](#), one of the first countries to have a government that was [fully e-enabled](#), and now it has launched a nationwide scheme to teach school kids from the age of seven to 19, how to write code. The idea isn't to start churning out app developers of the future, but people who have smarter relationships with technology, computers and the Web .



Estonia wants its kids to be [\[+\]](#)

UK schools

+ Add to myFT

Curriculum experts say coding is essential in a digital economy

Developing computational thinking helps students to better understand the world around them



Save to myFT

MAY 4, 2016 by **Jane Bird**

Many of us happily drive a car without understanding what goes on under the bonnet. So is it necessary for children to learn how to program computers? After all, some experts say coding is one of the human skills that will become obsolete as artificial intelligence grows.

Computational Thinking

“Computational thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent.”

Jeannette M. Wing (2008)



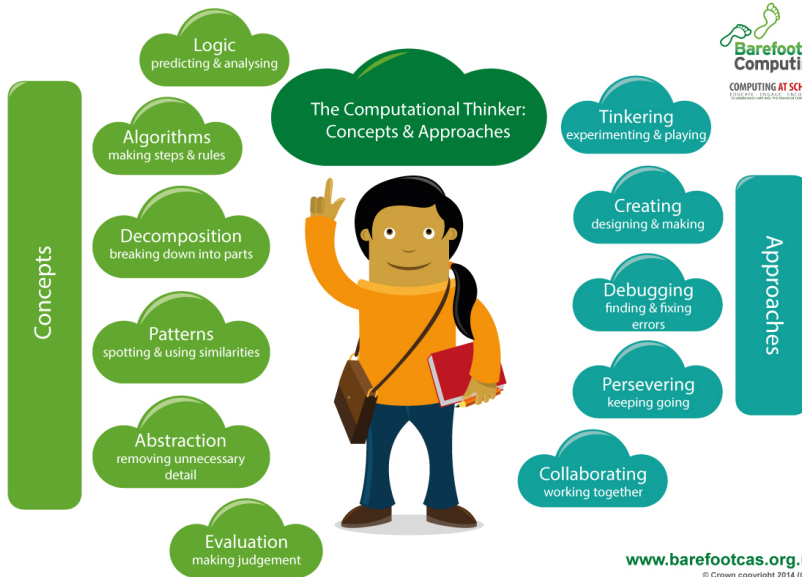
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A word cloud centered around the phrase "Computational thinking". The words are arranged in a roughly triangular shape, with "Computational thinking" being the largest and most central. Other words include "Automation", "Abstraction", "Parallelisation", "Simulation", "Decomposition", "Algorithm Design", "Data Analysis", "Pattern Generalisation", "Data Representation", "Data Collection", and "Pattern Recognition".

Automation
Abstraction Parallelisation Simulation
Decomposition Algorithm Design Data Analysis
Pattern Generalisation Data Representation
Data Collection **Computational thinking**
Pattern Recognition



Computer Science without a computer



Benefits of Computational Thinking

- Confidence in dealing with **complexity**;
- **Persistence** in working with difficult problems;
- Tolerance for **ambiguity**;
- The ability to deal with **open-ended problems**;
- The ability to **communicate and work with others** to achieve a common goal or solution.



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Challenges of Teaching Programming

- “*But not everyone will be a programmer!*”
- Are we actually teaching problem-solving?



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- Depth vs. breadth: *language(s), tools, software carpentry*



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- Real-world context and applications
- Nurturing curiosity



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- It's easier to:
 - read code than write code
 - edit code than to start with a blank screen



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- Pair programming is a powerful tool
- Promoting debugging as a key skill (failure is good!)



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- **Importance of high-quality pedagogies for learning and assessment**



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Catalysts for Policy Change

"I was flabbergasted to learn that today computer science isn't even taught as standard in UK schools. Your IT curriculum focuses on teaching how to use software, but gives no insight into how it's made."

Eric Schmidt, Executive Chairman, Google (August 2011)



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Nesta...

DECODING LEARNING:

THE PROOF, PROMISE AND POTENTIAL OF DIGITAL EDUCATION

Rosemary Luckin,
Brett Bligh, Andrew Manches,
Shaaron Ainsworth,
Charles Crook, Richard Noss
November 2012





After the reboot: computing education in UK schools



Press release

Government plans to make the UK one of the most digitally-skilled nations

From: [Department for Culture, Media & Sport, The Rt Hon Karen Bradley MP, The Rt Hon Robert Halfon MP and Department for Education](#)
First published: 1 October 2016
Part of: [Further education and training](#)

Government has announced plans to make training in basic digital skills free for adults lacking relevant qualifications.



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Digital Skills Committee



Committee hears from some of the UK's leading technology specialists

Lords ask whether a digital skills deficit is harming UK plc

Committee to question Microsoft, Google and technology experts

Watch / Listen



Watch Baroness Morgan of Huyton, Chair, talk about the role of the Committee



Sci & Tech Committee @CommonsSTC · 3h

We've published a report calling on the Govt to improve training in [#DigitalSkills](#)
goo.gl/CrnKZH

“The evidence is clear
that the UK faces a
digital skills crisis.”

- page 3

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42



19



Pupils need internet lessons to thrive online, say Lords

By Judith Burns
Education reporter

🕒 21 March 2017 | Education & Family | 📄

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Learning to survive in a world dominated by the internet should be as important for children as reading and writing, says a House of Lords report.

Lessons about online responsibilities, risks and acceptable behaviour should be mandatory in all UK schools, the Lords Communications Committee argues.

[Home](#)

Policy paper

UK Digital Strategy

From: [Department for Culture, Media & Sport](#) and [The Rt Hon Karen Bradley MP](#)
Part of: [Further education and training](#), [Research and development](#), [Broadband investment](#), and [UK economic growth](#)
First published: 1 March 2017

This strategy sets out how we will build on our success to date to develop a world-leading digital economy that works for everyone.

Policy paper

The Grand Challenges

Updated 21 May 2018

Contents

Artificial Intelligence and data

Ageing society

Clean growth

Future of mobility



There is no separate
digital economy.
We have an economy
that is digital.

Neelie Kroes

European Commission vice-president



How algorithms rule the world

The NSA revelations highlight the role sophisticated algorithms play in sifting through masses of data. But more surprising is their widespread use in our everyday lives. So should we be more wary of their power?

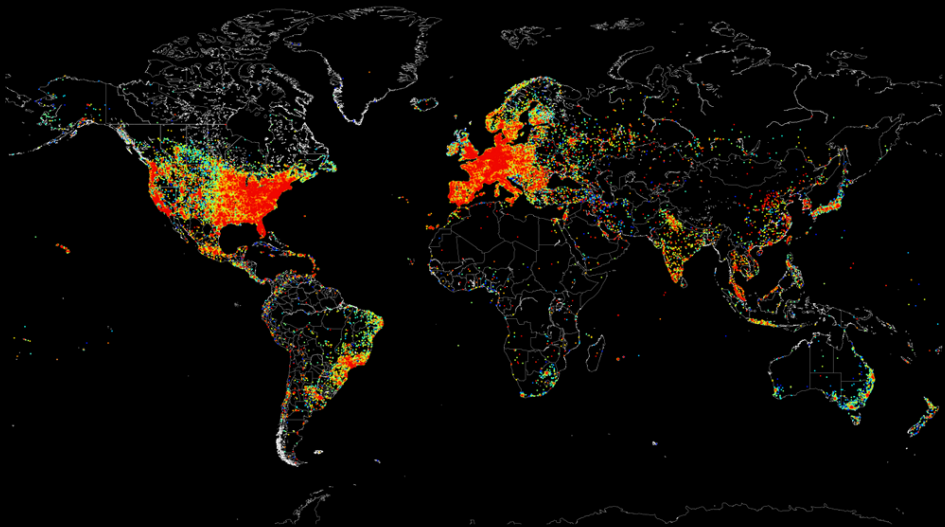
Leo Hickman

Monday 1 July 2013
18.32 BST



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Comments 233





Last updated: November 11, 2015 6:01 pm

TalkTalk warns cyber attack costs could rise to £35m

Daniel Thomas, Telecoms Correspondent

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Filing history

People

Registered office address

**1 Moyes Cottages Bentley Hall Road, Capel St. Mary, Ipswich,
Suffolk, United Kingdom, IP9 2JL**

Company status

Active

Company type

Private limited Company

Incorporated on

29 December 2016

Surveillance

'Extreme surveillance' becomes UK law with barely a whimper

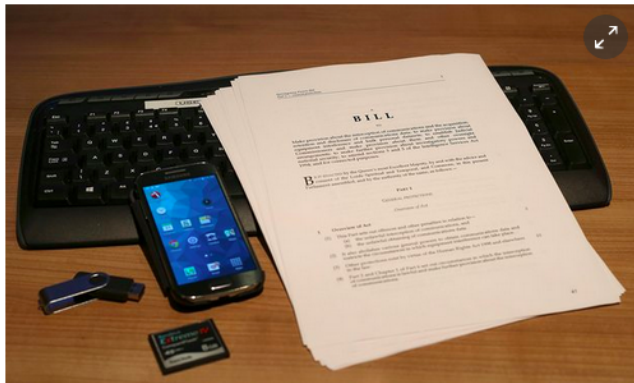
Investigatory Powers Act legalises range of tools for snooping and hacking by the security services

Ewen MacAskill

Saturday 19 November 2016 07.00 GMT



3,679



📷 The Investigatory Powers Act was passed on Thursday. Photograph: Philip Toscano/PA

UK to censor online videos of 'non-conventional' sex acts

Campaigners label bill targeted at online pornography a 'prurient' intervention that will take Britain's censorship regime back to pre-internet era

Damien Gayle


 @damiengayle

Wednesday 23 November 2016
09.43 GMT




2,956



 The proposal would force internet service providers to block sites hosting content that would not be certified for commercial DVD sale by the British Board of Film Classification. Photograph: Dominic Lipinski/PA

Web users in the UK will be banned from accessing websites portraying a range of non-conventional sexual acts, under a little discussed clause to a government bill currently going through parliament.

Fake news clampdown: Google gives €150,000 to fact-checking projects

Funding comes amid debate about role of the search engine in spreading bogus content some say influenced US election

Jasper Jackson

 @JaspJackson

 email

Thursday 17 November 2016 14:58 GMT



 Google has come under criticism along with Facebook for their part in the spread of fake news. Photograph: Josh Edelson/AFP/Getty Images

Google has given €150,000 to three UK organisations working on fact-checking projects to help journalists and the public avoid falling for fake stories and bogus claims.

Why not ban cars, Amber Rudd? It'd be more effective than banning encryption

Op-ed: Another terrorist attack, another government attempt at backdooring WhatsApp.

SEBASTIAN ANTHONY - 27/3/2017, 12:59



February 16, 2016

A Message to Our Customers

The United States government has demanded that Apple take an unprecedented step which threatens the security of our customers. We oppose this order, which has implications far beyond the legal case at hand.

This moment calls for public discussion, and we want our customers and people around the country to understand what is at stake.

[Answers to your questions about privacy and security >](#)

The Need for Encryption

Smartphones, led by iPhone, have become an essential part of our lives. People use them to store an incredible amount of personal information, from our private conversations to our photos, our music, our notes, our calendars and contacts, our financial information and health data, even where we have been and where we are going.

Turkey blocks use of Twitter after prime minister attacks social media site

Recep Tayyip Erdoğan threatens to 'root out' social media network where wiretapped recordings have been leaked



📷 Two weeks ago Recep Tayyip Erdoğan suggested that a total ban on all social media sites like Facebook or Twitter was in his thoughts. Photograph: Adem Altan/AFP/Getty Images

Netizen Report: Bangladesh Bans Facebook and Chat Apps on 'Security Grounds'

Posted 20 November 2015 4:43 GMT



Demonstrators call for capital punishment for war criminals in Bangladesh, 2013. Photo by Mehdi Hasan Khan via Wikimedia (CC BY-SA 3.0)



Written by
Netizen Report Team

Read this post in [English](#), [Español](#)

**Censorship, Regulation, Violent Threats,
War & Conflict**

Netizen Report

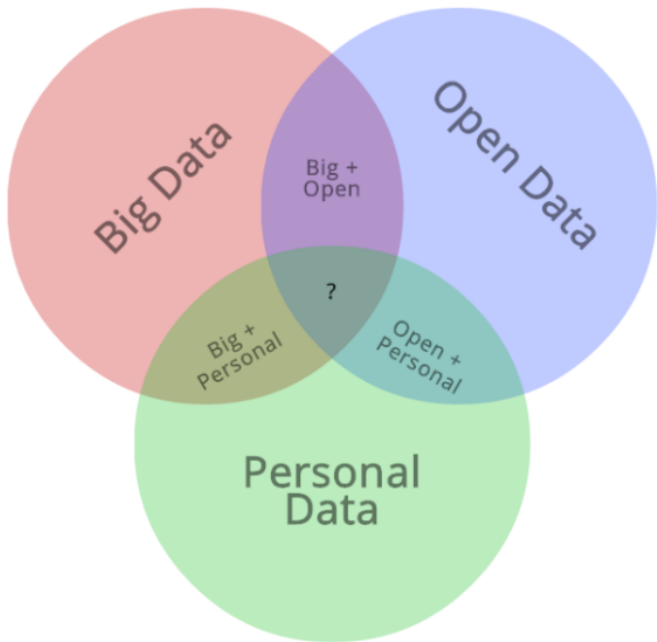
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MARKETERS COLLECTING
OUR PERSONAL DATA
SO THEY CAN CREATE
MORE RELEVANT
ADVERTISING FOR US.



The digital proletariat

Should internet firms pay for the data users currently give away?

And, as a new paper proposes, should the data-providers unionise?

Print edition | Finance and economics >

Jan 11th 2018



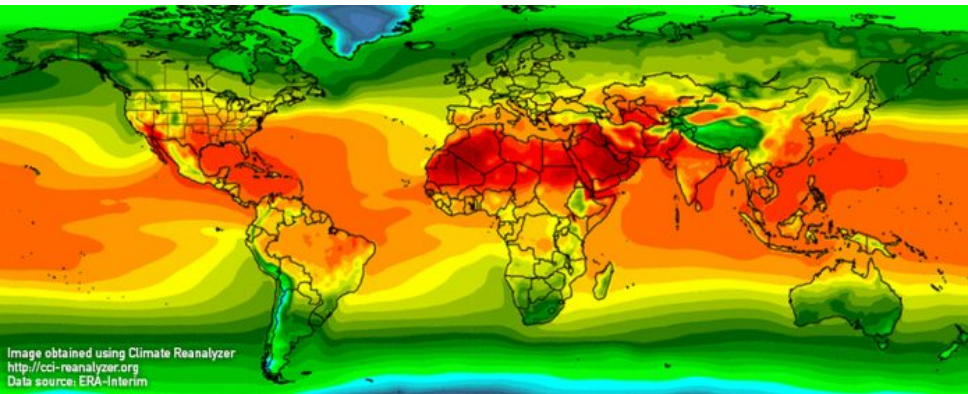
Our Interdisciplinary World

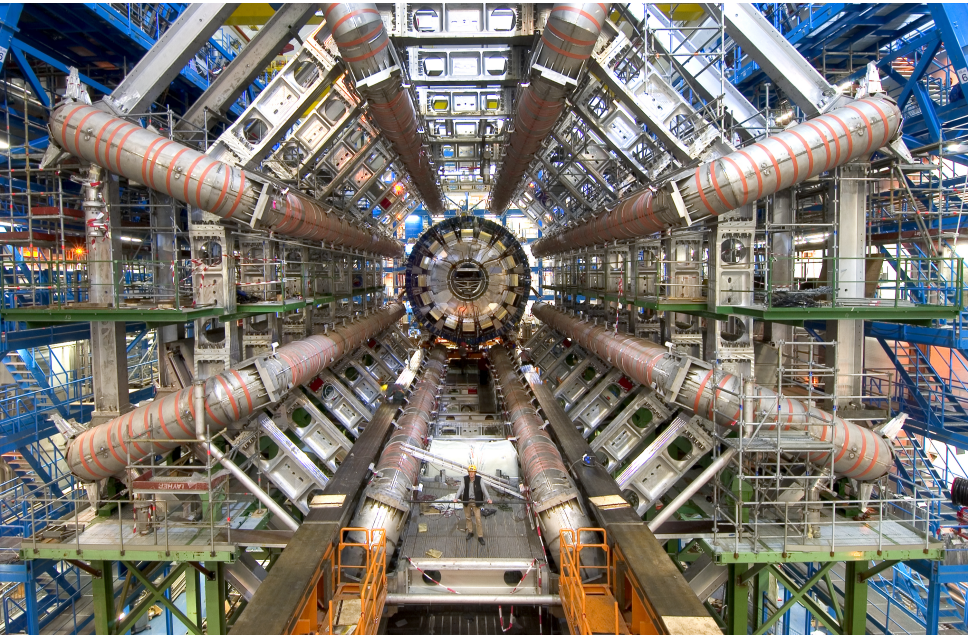
“[Computational techniques] have moved on from assisting scientists in doing science, to transforming both how science is done and what science is done.”

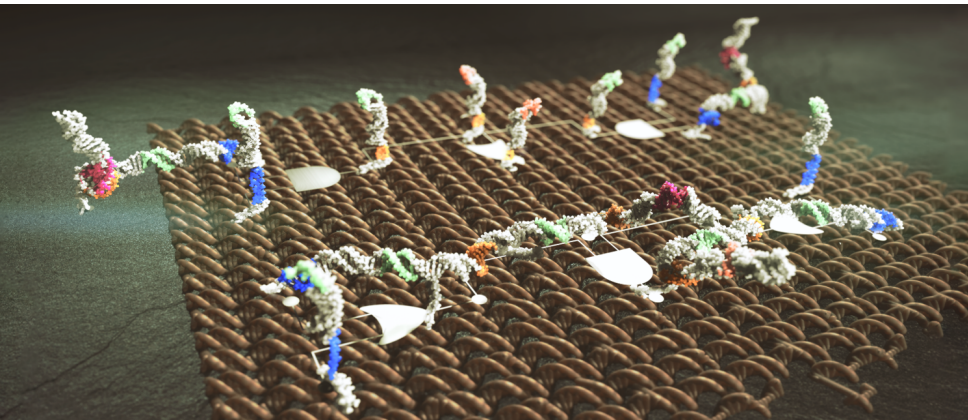
“Science as an open enterprise”, **Royal Society** (2012)



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NEWS

Computational chemists take Nobel prize

BY EMMA STOYE | 9 OCTOBER 2013

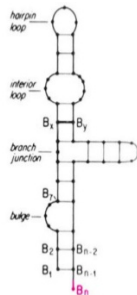
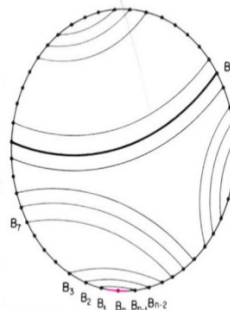
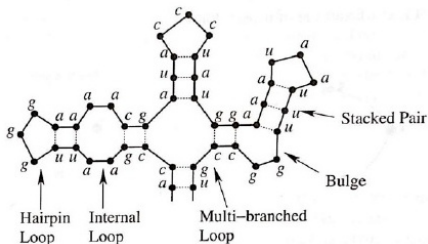


‘Secret handshake’ that joined up quantum physics with classical molecular mechanics grabs science’s top gong

The 2013 Nobel prize in chemistry has been awarded to [Martin Karplus](#) of Harvard University, US, [Michael Levitt](#) of Stanford University, US, and [Arieh Warshel](#) of the University of Southern California, US, for ‘the development of



AGACCAACCTGGCCAACATGGTGAATCCCATCTCTAC.AAAAATACAAA
 ||||| |||||||||||||||| |||||||||| ||||||||||
 AGACCAGCCTGGCCAACATGGTGAACCTCCATCTCTACTGAAAATACAAA



Are your medical records in danger?



Nick Trigg
Health correspondent

🕒 28 January 2014 | [Health](#) | 🗨️



Householders across England have started receiving leaflets about a new NHS scheme called **Care.data**.

More from Nick

Feeding the Machine: Policing, Crime Data, & Algorithms



— *William & Mary Bill of Rights J.* — (2017 Forthcoming).

17 Pages - Posted: 21 Aug 2017

[Elizabeth E. Joh](#)

University of California, Davis - School of Law


Date Written: August 16, 2017

Abstract

Discussions of predictive algorithms used by the police tend to assume the police are merely end users of big data. Accordingly, police departments are consumers and clients of big data -- not much different than users of Spotify, Netflix, Amazon, or Facebook. Yet this assumption about big data policing contains a flaw. Police are not simply end users of big data. They generate the information that big data programs rely upon. This essay explains why predictive policing programs can't be fully understood without an acknowledgment of the role police have in creating its inputs. Their choices, priorities, and even omissions become the inputs algorithms use to forecast crime. The filtered nature of crime data matters because these programs promise cutting edge results, but may deliver analyses with hidden limitations.

Keywords: police, policing, Fourth Amendment, big data, predictive policing, algorithm, crime data, criminal justice

Measuring UK crime gangs: a social network problem

Giles Oatley¹ · Tom Crick¹ 

Received: 22 December 2014 / Revised: 13 May 2015 / Accepted: 27 May 2015
© Springer-Verlag Wien 2015

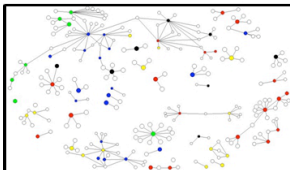
Abstract This paper describes the output of a study to tackle the problem of gang-related crime in the UK; we present the intelligence and routinely-gathered data available to a UK regional police force, and describe an initial social network analysis of gangs in the Greater Manchester area of the UK between 2000 and 2006. By applying social network analysis techniques, we attempt to detect the birth of two new gangs based on local features (modularity,

Keywords Gangs · Gun crime · Scale-free networks · Small-world networks · Social distance · Communities · Crime policy

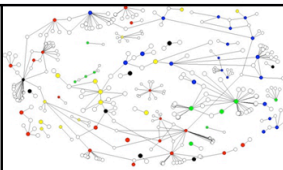
1 Introduction

There have been numerous studies of criminal networks

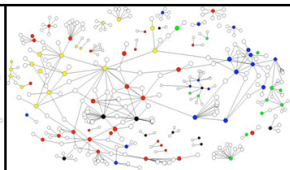
Year 2000



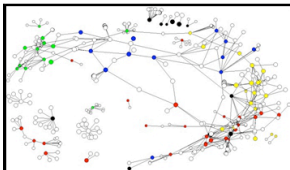
Year 2001



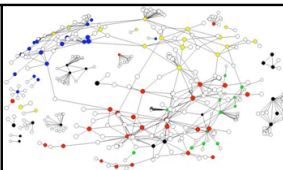
Year 2002



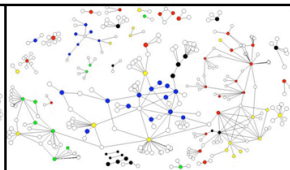
Year 2003



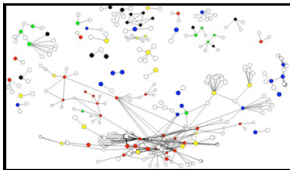
Year 2004



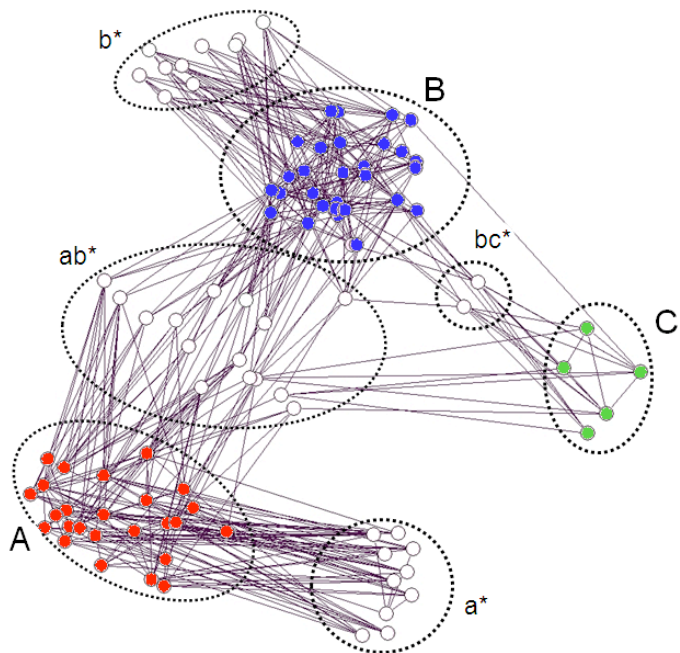
Year 2005

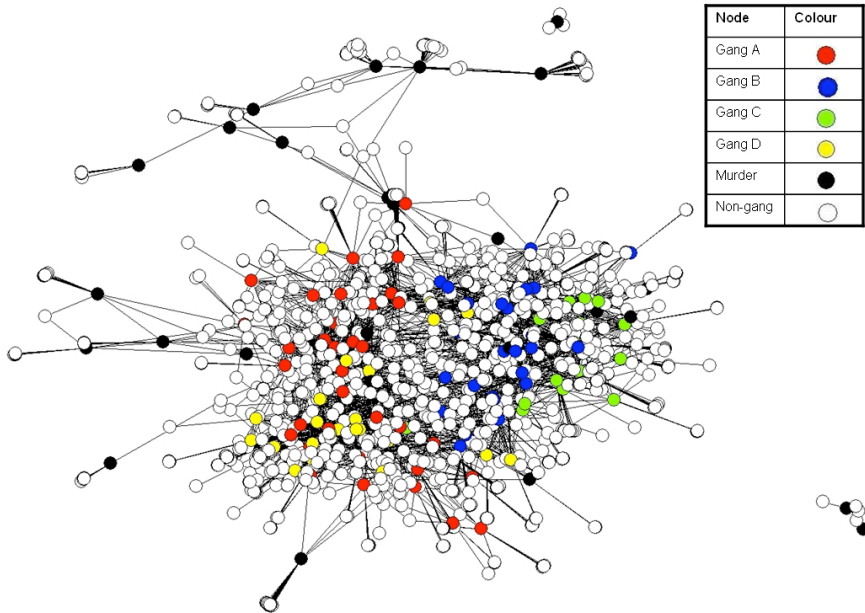


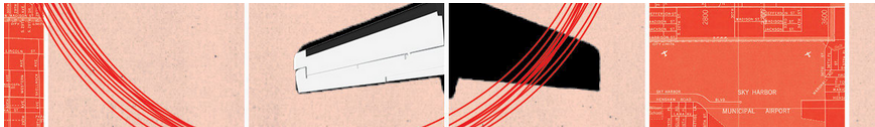
Year 2006



Node	Colour
Gang A	●
Gang B	●
Gang C	●
Gang D	●
Murder	●
Non-gang	○







BuzzFeed News Trained A Computer To Search For Hidden Spy Planes. This Is What We Found.

From planes tracking drug traffickers to those testing new spying technology, US airspace is buzzing with surveillance aircraft operated for law enforcement and the military.

Originally posted on August 7, 2017, at 6:33 p.m.

Updated on August 8, 2017, at 3:47 p.m.



Peter Aldhous

BuzzFeed News Reporter

F.C.C. Plans Net
Neutrality Repeal in a
Victory for Telecoms

2.



LOSING LONDON
Where Brexit Hurts:
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3.



Warning Signs About
Another Giant Bitcoin
Exchange

4.



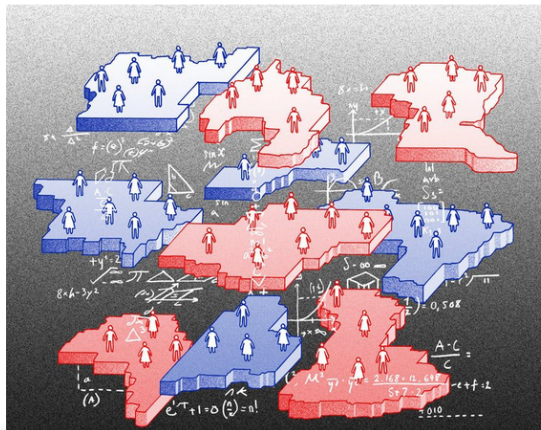
North Korean Troops
Violated Truce While
Chasing Defector, U.N.
Command Says

Sunday Review

How Computers Turned Gerrymandering Into a Science

Gray Matter

By JORDAN ELLENBERG OCT. 6, 2017



Gray Matter

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Ian MacFarlane October 8, 2017

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The dating app knows me better than I do, but these reams of intimate information are just the tip of the iceberg. What if my data is hacked - or sold?

● [Getting your data out of Tinder is really hard - but it shouldn't be](#)



Judith Duportail

[@judithduportail](#)

Tuesday 26 September 2017 07:10 BST

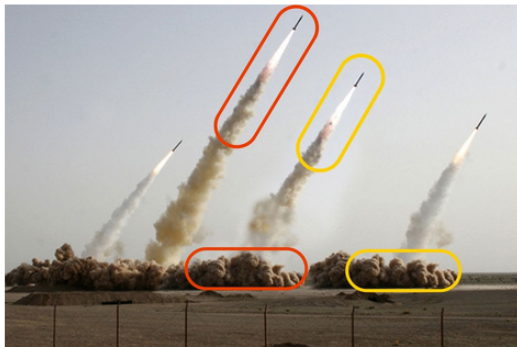


A July 2017 study revealed that Tinder users are excessively willing to disclose information without realising it. Photograph: Alamy

Adobe is using machine learning to make it easier to spot Photoshopped images

New research uses AI to automate traditional digital forensics

By [James Vincent](#) on June 22, 2018 11:00 am



A famous **edited image of a missile launch** released by the Iranian government in 2008. (This



Future Society

Are Engineers Responsible for the Consequences of Their Algorithms?

by Alexandra Ossola on September 8, 2017 🔥 1699

📷 Sonii Naaz/EyeEm/Getty Images

China to build giant facial recognition database to identify any citizen within seconds

Project aims to achieve an accuracy rate of 90 per cent but faces formidable technological hurdles and concerns about security

PUBLISHED : Thursday, 12 October, 2017, 9:01pm

UPDATED : Friday, 13 October, 2017, 4:10pm

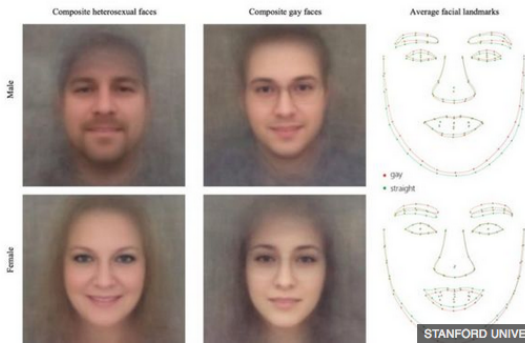
COMMENTS: 99



Technology

Row over AI that 'identifies gay faces'

🕒 11 September 2017 | [Technology](#)



The study created composite faces judged most and least likely to belong to homosexuals

As machine learning becomes more powerful, the field's researchers increasingly find themselves unable to account for what their algorithms know — or how they know it.

[illegible]

Opinion **Driverless vehicles**

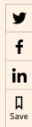
Can autonomous cars pass their driving test?

The self-driving car felt like being on a roller coaster, one that could end up killing you

LESLIE HOOK

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Uber to buy 24,000 Volvo cars for driverless fleet



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Latest on Driverless vehicles >**fastFT**

Uber to buy 24,000 Volvo cars for driverless fleet

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GREATER
LONDON
AUTHORITY

PM2.5 map and exposure data

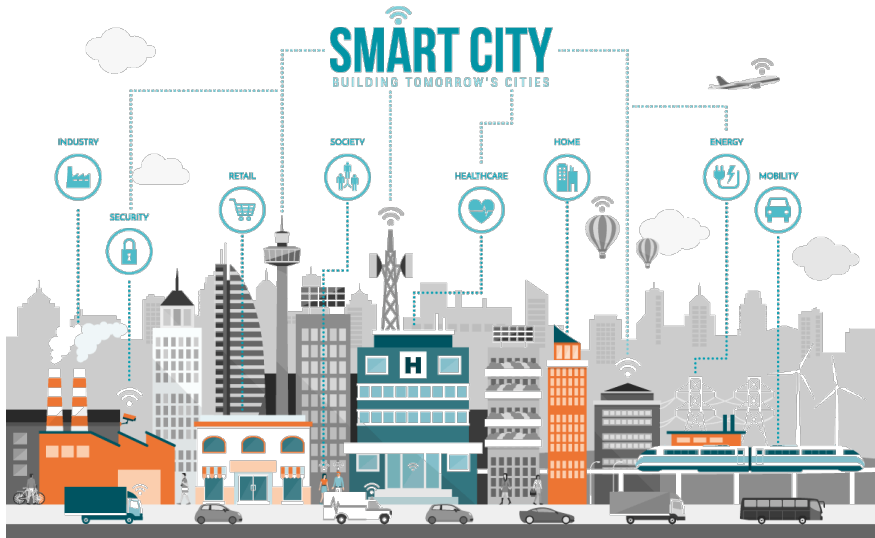
🕒 Created 2 months ago, modified a month ago

This report contains an introduction to PM_{2.5}, summarises our current understanding of PM_{2.5} concentrations and exposure, discusses the findings of research undertaken by the GLA and TfL into the extent of PM_{2.5} pollution in London, and assesses the potential for meeting World Health Organisation guidelines by 2030. Our analysis found that at present all Londoners are exposed to concentrations higher than WHO air quality guidelines, but, if PM_{2.5} reduction measures within the Mayor's Transport Strategy and London Environment Strategy are accompanied by co-operation on a national and international level, the guideline limit is achievable by 2030.

The accompanying map is the annual mean PM_{2.5} concentration in Greater London for 2013 by Output Area, also provided is the data behind this map, which includes the annual average PM_{2.5} concentration of each Output Area (OA) in Greater London. You may need to use the OA data mapping available from the [London Datastore](#) to identify specific output areas.

SMART CITY

BUILDING TOMORROW'S CITIES



Context Context Context

- Relevancy and currency to engage students...impact on our lives?

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- Thinking across the curriculum – STEM, humanities, PSHE, etc;
- **Crucial:** legal, social, professional, ethical, ecological, environmental, economic...

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- Supporting practitioners;
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- **Quality teachers \implies quality education**
- Student-centered: what is the learning experience going to look like?
- **Bigger goal:** digitally competent and confident citizens?

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