UNIVERSITY OF CAMBRIDGE

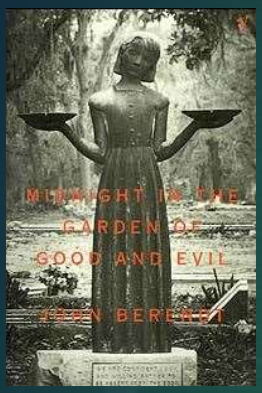
The Psychometrics Centre

MPhil SDP 2018 Psychometics 2

Modern Psychometrics, 13th February

Professor John Rust

The psychometric analysis of digital footprints



- Online prediction
  - Your digital footprint consists of items
  - that can be analysed psychometrically
  - This predicts your behaviour
- Online control
  - These predictions determine
  - what you see (and don't see)
  - This determines your behaviour

Psychometric revolutions

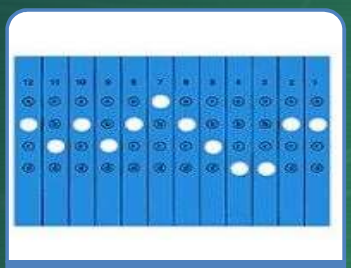
Innovation	Intended consequences
• Examinations • Mental Tests • Online testing • Adaptive Testing	• Meritocracy • Diagnosis • Instant results • Efficiency

Taking our eyes off the ball

Innovation	Unintended consequences
• Examinations • Mental Tests • Online testing • Adaptive Testing	• Discrimination • Eugenics • Cyber insecurity • Artificial Intelligence

Psychographics – early days (1950-1975)

Questionnaire



Scoring

Store results

Openness

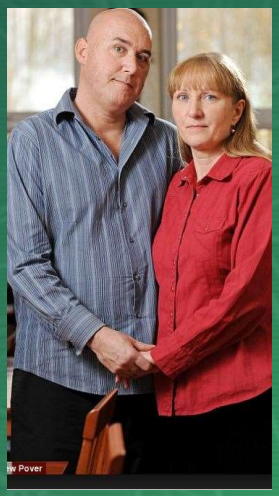
Openness-to-Experience

I am always on the lookout for new ideas to explore

Conventionalism

Conventionality

Stick with tried and tested ways of doing things



Conscientious

Detail conscious

If you get the details right everything will come out fine.

Seeing the bigger picture

I prefer to leave boring details to others

Disorganised

Extraversion

Extraversion

I can be the life and soul of any party

Introversion

I have my best ideas when I am left alone

Introversion

Agreeableness

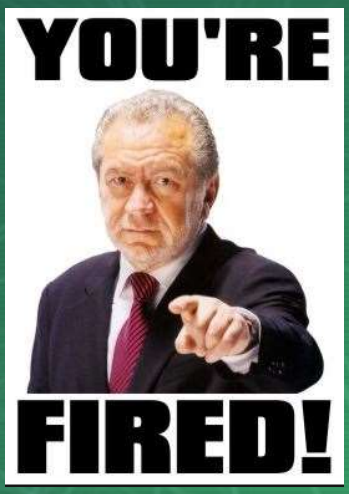
Tendermindedness

I will always try and help my friends when they need me

Disagreeable

I have a special ability to make tough decisions when needed

Toughmindedness



Neurotic

Emotional

I get anxious when I have to make difficult decisions

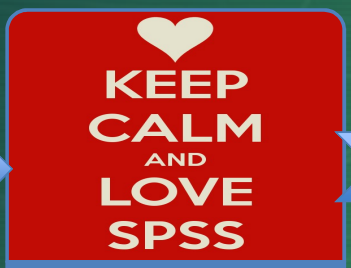
Unemotional

I am more able than most to cope with disaster

Stable

1975-1995

Questionnaire

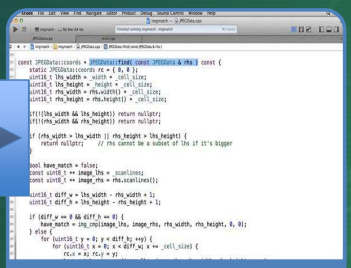


Score

Store results

The century turns

Questionnaire



Scoring

Store results

Prudence

Proficiency

Careful and sensible when carrying out given tasks

Carelessness

May be careless in dealing with mundane tasks

Foolishness

Fortitude

Work-orientation

An effective and confident orientation to hard work

Absenteeism

Can dislike working under pressure

Inconstancy

Temperance

Patience

Slow to anger and calm in the face of adversity

Hostility

Sometimes impatience with the foibles of others

Anger

Justice

Fair-mindedness

Balanced and impartial in decision making

Subversion

Tends to be suspicious of the intentions of others

Envy

Faith

Loyalty

Shows obedience to others and a sense of duty

Disloyalty

Might ignore the advice of those who know better

Infidelity

Charity

Generosity

Honest and open in dealings with other

Covetousness

Occasionally prone to elaborate or distort the truth

Greed

Hope

Initiative

Resourceful and enthusiastic about the future

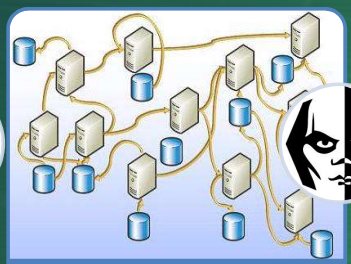
Inertia

Somewhat pessimistic about the future

Desolation

Personality testing today

Questionnaire



Scoring

Store results

Computer Adaptive Testing (CAT) using Concerto

- An open-source development platform for online psychometric tests
- Allows users to create various online assessments, from simple surveys to sophisticated IRT-based adaptive tests.
- Based on the open-source statistical language 'R'
- Free for academic and commercial use
- Used by research and commercial organisations throughout the world

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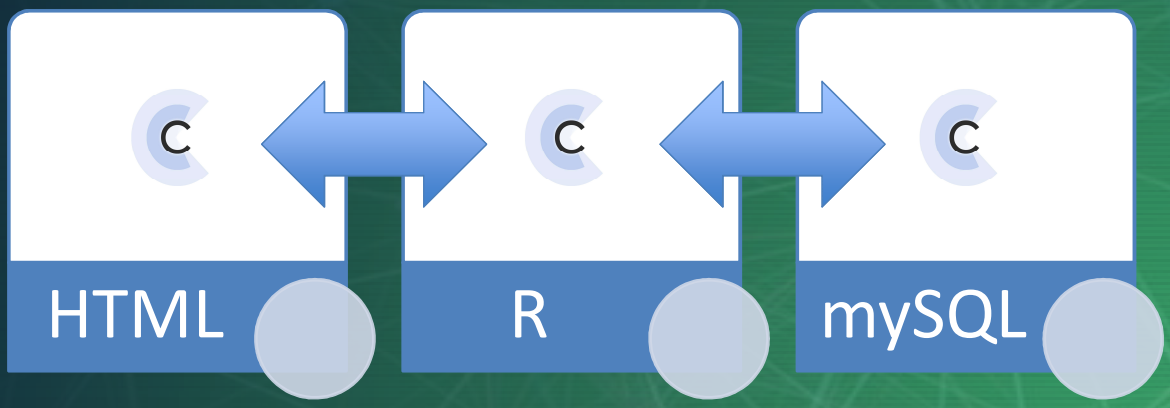
CONCERTO

Concerto – three open source elements



The CAT is out of the bag

Utopias and Dystopias

B. F. Skinner, Walden Two (1948)

"Utopian society is possible, but only through behavioural engineering. Human beings are sometimes selfish, greedy and mean. Human nature must be changed, engineered so that people are non-competitive, happy and harmonious. Positive rewards can change both outward behaviour and inner motives. People can be 'conditioned' to live together in peace and harmony."

George Orwell, 1984 (1948)

"For, after all, how do we know
- that two and two make four?
- or that the force of gravity works?
- or that the past is unchangeable?

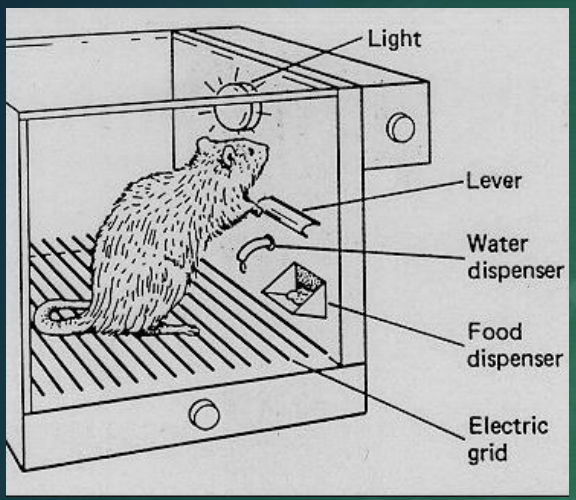
If both the past and the external world exist only in the mind, and if the mind itself is controllable – what then?"

Futures for the internet

Communication

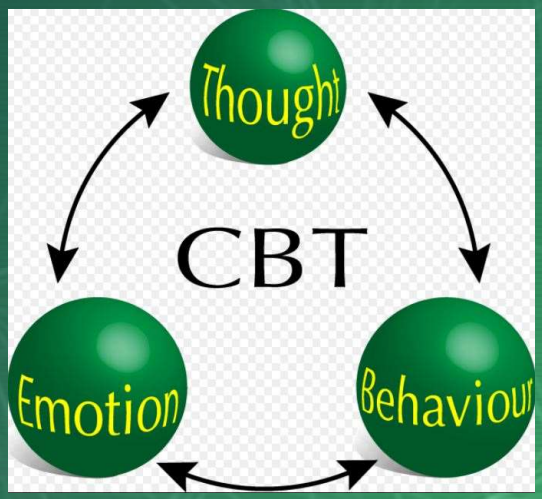
Big Brother

Psychology: "The prediction and control of behaviour" *(B. F. Skinner, 1904-1990)*



Cognitive Behavioural Therapy (CBT)

- "CBT is based on the belief that thought disorders and maladaptive behaviours play a role in the development and maintenance of psychological disorders."
- Who decides what counts as a 'though disorder' or 'maladaptive behaviour'?
- E.g. Is 'Not being able to see the obvious advantages of a communist system' a thought disorder?



The nudge initiative in politics

- "Improving decisions about Health, Wealth and Happiness" (Thaler and Sunstein, 2008)
- Soft paternalism: to encourage people to remedy 'incorrect behaviour' by covert means: E.g.
  - Not saving enough for retirement
  - Eating too much junk food
  - Smoking
  - Not getting vaccinated
  - Excessive use of energy
  - Not recycling your rubbish

The UK Behavioural Insights Team

- House of Lords Report (2011) "(Nudges) prompt choices without getting people to consider their options consciously, and therefore do not include openly persuasive interventions such as media campaigns and the straightforward provision of information"
- Cabinet Office (2014) "The Behavioural Insights Team, often called the 'Nudge Unit', applies insights from academic research in behavioural economics and psychology to public policy and services."

Those at risk

- Health
  - Eating disorders
  - Lifestyle
  - Depression
- Behaviour
  - Dangerous driving
  - Substance abuse
  - Bullying

Those who place others at risk

- Criminals
- Terrorists
- Cyber-criminals
- Sex offenders
- Fraudsters
- 'Insider Threat'

Utilizing cyberspace for the public good

Records of health, education, crime, tax, credit, spending, travel, work, genaeology, internet and mobile use, location, webcams

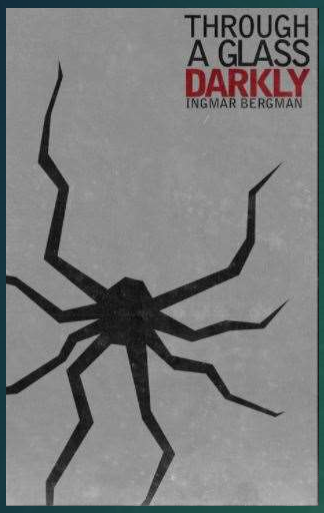
All along the digital superhighway, you will be nudged

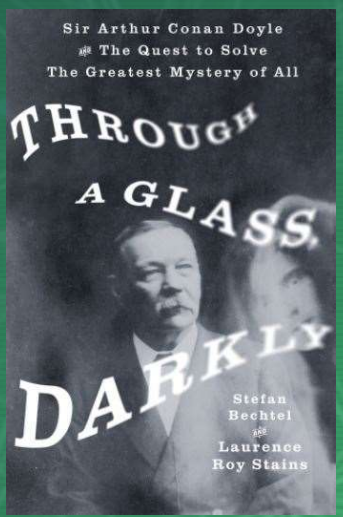
- In the interests of your health, welfare and the environment.
- And to protect society, should you in any way present a threat
- "If you have nothing to hide you have nothing to fear"
  (William Hague, UK Foreign Minister, 2013)

What and where is Cyberspace?

- "There is no need for cyberspace. All Internet related things can be handled with existing conceptual categories. The Internet has nothing to do with technology. It is just a person talking to another person, using a different technology". *(Souls writing on the net, Giancarlo Livraghi, 2001)*
- "Cyberspace is an interactive domain made up of digital networks that is used to store, modify and communicate information. It includes the internet, but also the other information systems that support our businesses, infrastructure and services". *(UK Cyber Security Strategy, 2011)*
- "For now we see through a glass, darkly; but then face to face. Now I know in part, but then shall I know even as also I am known*". (St Paul , Letter to the Corinthians 13: 12-13)*

Seeing through a glass darkly





Digital footprints are psychometric item pools

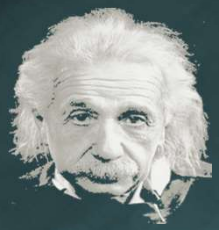
• **Private traits and attributes are predictable from digital records of human behavior** by M. Kosinski, D. Stillwell, T. Graepel, PNAS, 2013. (IF: 9.1) 2015.
  –Online, the 21st most discussed paper of 2013 (Altmetric)

• **Personality, Gender, and Age in the Language of Social Media: The Open-Vocabulary Approach** by A. Schwartz, J. …. M. Kosinski, D. Stillwell, M.E.P. Seligman, L.H. Ungar, PLoS ONE, 2013.

• **Computer-based personality judgments are more accurate than those made by humans** by W. Youyou, M. Kosinski, D. Stillwell, Proceedings of the National Academy of Sciences (PNAS), 2015,1
  –Online, the 22nd most discussed paper of 2015 (Altmetric).

What we can predict from your digital footprint

BIG5 Personality

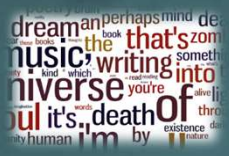


Intelligence

Life Satisfaction

Political Views

Religious Views



Use of Language

Use of addictive substances

Parents' relationship status

Interest/Profession

Relationship status

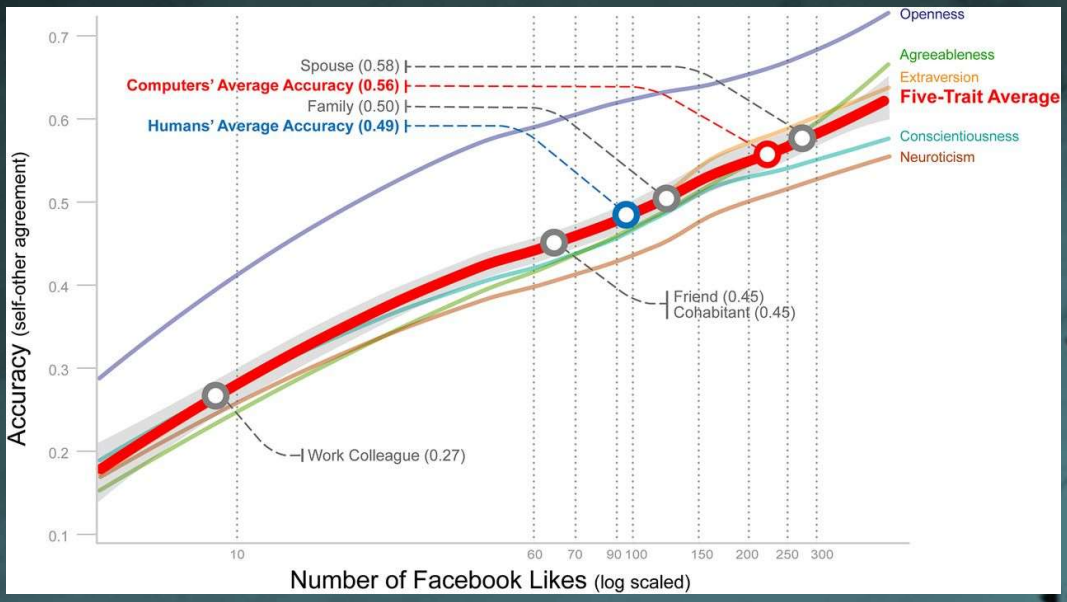
Sexual orientation

Ethnic Origin

Gender

Age

Wu, Y., Kosinski, M. & Stillwell, D. (2015) Computer-based personality judgements are more accurate than those made by humans. Proceedings of the National Academy of Sciences (PNAS)



IQ

High	Low
The Godfather	Jason Aldean
Mozart	Tyler Perry
Thunderstorms	Sephora
The Daily Show	Chiq
To Kill a Mockingbird	Bret Michaels
Lord of the Rings	Harley-Davidson
Science	Bebe

Extraversion

Introversion

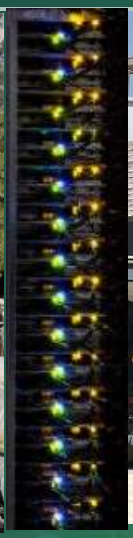
Men

Women

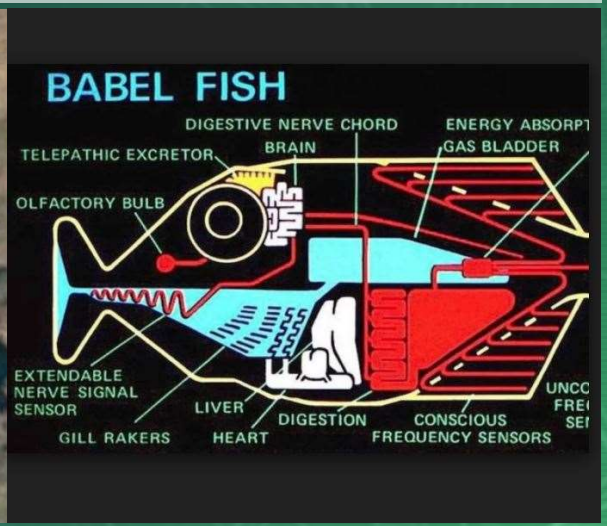
On-line digital footprints

- Demonstrates your habits, lifestyle & desires
- Shows where you and your friends are
- Assesses your needs, hopes and expectations
- Predicts what you will do, or not do,
- and can control you behaviour,
- with or without your knowledge,
- or consent.

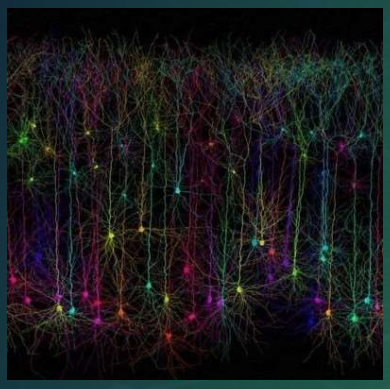
The Oracle



Real-time Translation

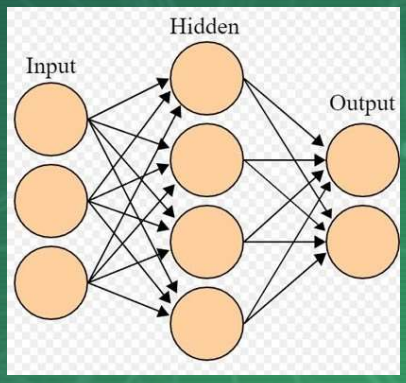


Machine Learning: Lighting the fire



Neural Networks

Prometheus



Inside the Black Box

AI and what the machine can learn

- Using
  - What you look at or search for online
  - Where you are
  - What you write in texts, tweets and emails
  - The images and videos you paste
- Machines can learn:
  - Your gender, age, ethnicity, sexual orientation, income. health
  - Your mood, beliefs and attitudes
  - Your expectations, what you want, and are going to do
- And can respond to masses of people simultaneously in real time
- This presents both opportunities and challenges

Machines learn to make actuarial predictions

- Promotion at work:
  - This group of people were all promoted in the company
  - This group of people failed to get promoted in the company
  - Here are the personality profiles and CVs of both groups.
  - Find an algorithm that predicts promotion from these profiles
- Credit Risk:
  - This group of people were lent some money and paid it back
  - This group of people defaulted when aske to pay back their loans.
  - Here are the postcodes of each group
  - Find an algorithm that predicts credit risk from a persons postcode.
- Sentencing:
  - This group of people reoffended after release from prison
  - This group of people went straight after being released form prison
  - Here are the prior convictions of both groups
  - Find an algorithm that predicts likelihood of reoffending form a convicts record.

What is inside the black box?

- Promotion at work:
  - Gender
- Credit Risk:
  - Poverty
- Sentencing:
  - Race
- What is missing?
  - Psychology

How much can we trust an algorithm?

Racism is Poisoning Online Ad Delivery, Says Harvard Professor

Google searches involving black-sounding names are more likely to serve up ads suggestive of a criminal record than white-sounding names, says computer scientist

Insurance

Millions of Britons paying 'ethnic minority penalty' for car insurance

Drivers in areas with high density of minority ethnic households are each charged up to £450 a year more, says study

ALGORITHMIC INEQUITY 7/8/15 1:33 PM

Google showed women ads for lower-paying jobs

Supreme Court vs. Neighborhood Segregation

In a surprising move on Thursday, the United States' highest court ruled that policies even inadvertently relegating minorities to poor areas violate the Fair Housing Act.

Machine Bias

The Tiger Mom Tax: Asians Are Nearly Twice as Likely to Get a Higher Price from Princeton Review

A blot on the profession

Discrimination in medicine against women and members of ethnic minorities has long been suspected,[1] but it has now been proved. St George's Hospital Medical School has been found guilty by the Commission for Racial Equality of practising racial and sexual discrimination in its admissions policy.[4] The commission decided not to serve a non-

reassuring as it
other schools.
The commis
about this par
schools can avo
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XAI

"As a society, we must be able to look into the 'black box' of big data analytics in order to ensure that any particular analytics application can be safely installed and will benefit us all".

European Data Protection Supervisor Opinion, July 2015
"Meeting the Challenges of Big Data"

Our second lives in Cyberspace

Light at the end of the tunnel

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Students
Projects
Concerto
Collaboration
Services
Contact Us
News
Follow @CamPsych
2,606 followers
Like
You and 4.4k others like this.
G+1
54
Upcoming events
IRT and CAT using Concerto (3 days)
Mar 08, 2017
Cambridge, UK
Mplus course in Structural Equation Modelling (3 days)
Mar 14, 2017
Cambridge, UK
Certificates of Occupational Test Use, Level A and B (5-day course)
Mar 27, 2017
Cambridge, UK
SEM in R: (with MLM) (up to 6 days)
Apr 24, 2017
Cambridge, UK
Upcoming events
CONCERTO
Develop your own online adaptive test using our open-source platform
Find out more
Apply Magic Sauce
Translates individuals' digital footprints into detailed psychological profiles
Find out more
Workshops and training courses
Psychometrics Seminars