



500MB

daily data output per person, globally, in 2012

IBM

62 GB

daily data output per person, globally, **in 2025**

The Economist, 2017



The Economist

MAY 6TH-12TH 2017

Crunch time in France

Ten years on: banking after the crisis

South Korea's unfinished revolution

Biology, but without the cells

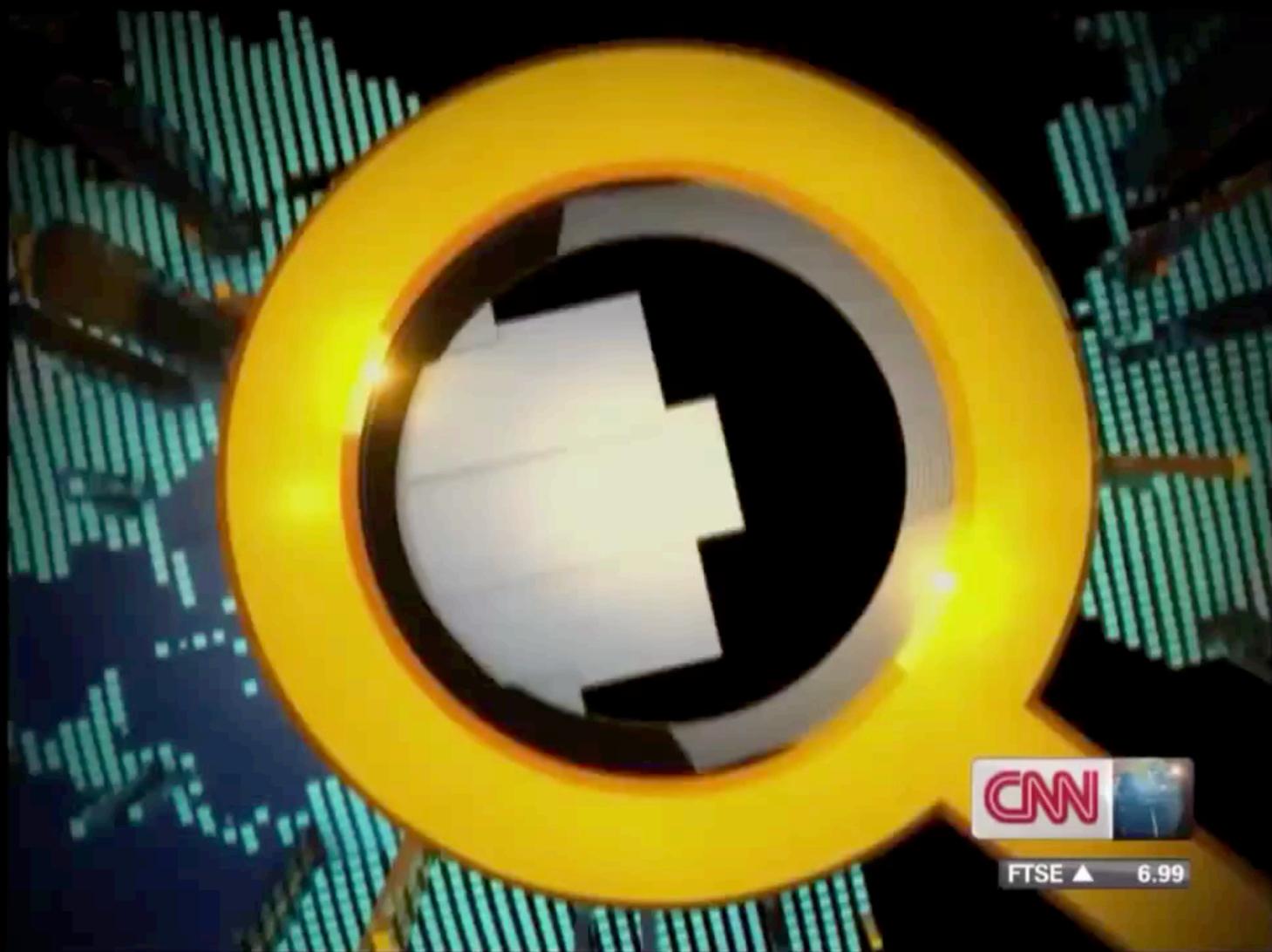
The world's most valuable resource



MasterCard

VISA

What can be
gleaned from our
digital footprints?



FTSE ▲ 6.99





Cambridge
Analytica



TED CRUZ

Ted Cruz's Secret Weapon: Your Facebook Likes

Sections 

The Washington Post
Democracy Dies in Darkness

27 October 2016 

Sign In

Politics

Trump's plan for a comeback includes building a 'psychographic' profile of every voter



THE
NEW YORKER

NEW EVIDENCE EMERGES OF STEVE BANNON AND CAMBRIDGE ANALYTICA'S ROLE IN BREXIT

By Jane Mayer November 17, 2018



Mr. Mark Zuckerberg

UNITED STATES SENATE
HEARING ON THE
ANTITRUST ASPECTS OF
GOOGLE'S BUSINESS PRACTICES
ON APRIL 23, 2020

Determining user personality characteristics from social networking system communications and characteristics

Abstract

A social networking system obtains linguistic data from a user's text communications on the social networking system. For example, occurrences of words in various types of communications by the user in the social networking system are determined. The linguistic data and non-linguistic data associated with the user are used in a trained model to predict one or more personality characteristics for the user. The inferred personality characteristics are stored in connection with the user's profile, and may be used for targeting, ranking, selecting versions of products, and various other purposes.

Images (3)



US8825764B2

US Grant

- Download PDF
- Find Prior Art
- Similar

Inventor: [Michael Nowak](#), [Dean Eckles](#)

Current Assignee: [Facebook Inc](#)

Original Assignee: [Facebook Inc](#)

Priority date: [2012-09-10](#)

Family: [US \(3\)](#)

Date	App/Pub Number	Status
2012-09-10	US13608943	Active
2014-03-13	US2014007402A1	Application

How does it work?

$$\begin{aligned}
\bar{J}^\mu &= \frac{\partial}{\partial \bar{x}^\nu} (\bar{\mathcal{D}}^{\mu\nu}) = \frac{\partial}{\partial \bar{x}^\nu} \left(\frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial \bar{x}^\nu}{\partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \right) \\
&= \frac{\partial^2 \bar{x}^\mu}{\partial \bar{x}^\nu \partial x^\alpha} \frac{\partial \bar{x}^\nu}{\partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial^2 \bar{x}^\nu}{\partial \bar{x}^\nu \partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \\
&\quad + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial \bar{x}^\nu}{\partial x^\beta} \frac{\partial \mathcal{D}^{\alpha\beta}}{\partial \bar{x}^\nu} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial \bar{x}^\nu}{\partial x^\beta} \mathcal{D}^{\alpha\beta} \frac{\partial}{\partial \bar{x}^\nu} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \\
&= \frac{\partial^2 \bar{x}^\mu}{\partial x^\beta \partial x^\alpha} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial^2 \bar{x}^\nu}{\partial \bar{x}^\nu \partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \\
&\quad + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial \mathcal{D}^{\alpha\beta}}{\partial x^\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial \bar{x}^\nu}{\partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \frac{\partial \bar{x}^\rho}{\partial x^\sigma} \frac{\partial^2 x^\sigma}{\partial \bar{x}^\nu \partial \bar{x}^\rho} \\
&= 0 + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \frac{\partial^2 \bar{x}^\nu}{\partial \bar{x}^\nu \partial x^\beta} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \\
&\quad + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} J^\alpha \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \frac{\partial \bar{x}^\rho}{\partial x^\sigma} \frac{\partial^2 x^\sigma}{\partial x^\beta \partial \bar{x}^\rho} \\
&= \frac{\partial \bar{x}^\mu}{\partial x^\alpha} J^\alpha \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] + \frac{\partial \bar{x}^\mu}{\partial x^\alpha} \mathcal{D}^{\alpha\beta} \det \left[\frac{\partial x^\sigma}{\partial \bar{x}^\rho} \right] \left(\frac{\partial^2 \bar{x}^\nu}{\partial \bar{x}^\nu \partial x^\beta} + \frac{\partial \bar{x}^\rho}{\partial x^\sigma} \frac{\partial^2 x^\sigma}{\partial x^\beta \partial \bar{x}^\rho} \right)
\end{aligned}$$



Hello Kitty

What is the gender of an
average hello kitty fan?

REEL

[Home](#)[Playlists](#)

Kitty has been the love of my life.

Meet Hello Kitty's biggest fan

29 JANUARY 2019 | CULTURE

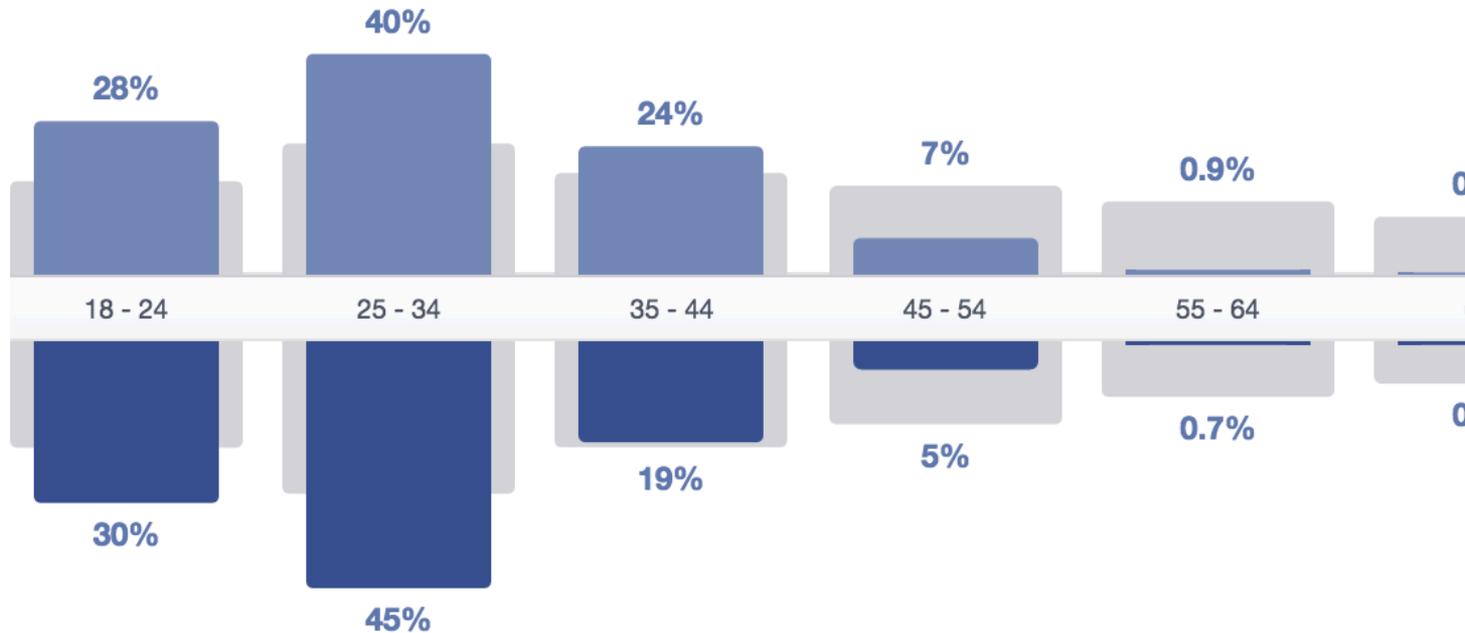
Masao Gunji, 67, was recognised by the Guinness World Records last November for having the largest collection of Hello Kitty memorabilia.

Age and Gender

Self-reported information from people in their Facebook profiles. Information only available for people aged 18 and older.

99% Women
54% All Facebook

1% Men
46% All Facebook



Job Title

Likely industries where people work based on self-reported data on Facebook.

Job Title	Selected Audience	Compare ▼
Sales		
Food Preparation and Services		
Personal Care		
Construction and Extraction		
Architecture and Engineering		
Military		
Veterans (US)		

Device Users

How the selected audience accessed Facebook in the last 30 days, based on user activity and environment

Desktop Only

Desktop &
Mobile

Mobile Only

Computer

iPhone/iPod

iPad

Android

Blackberry



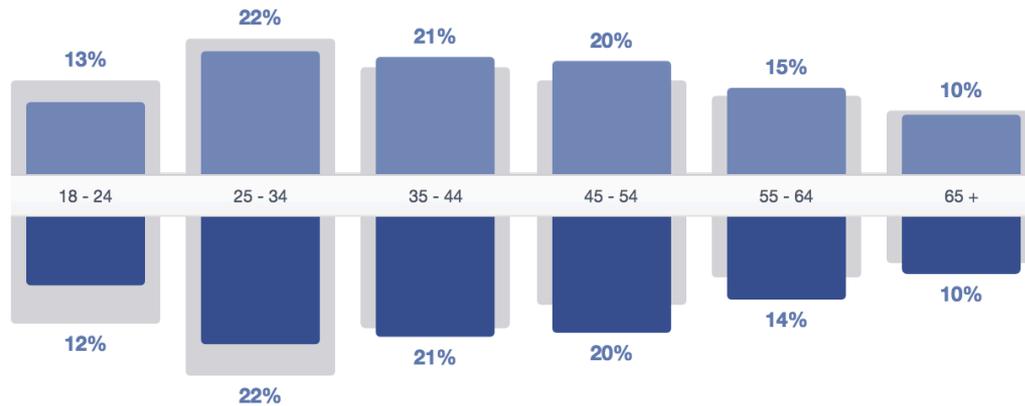


Age and Gender

Self-reported information from people in their Facebook profiles. Information only available for people aged 18 and older.

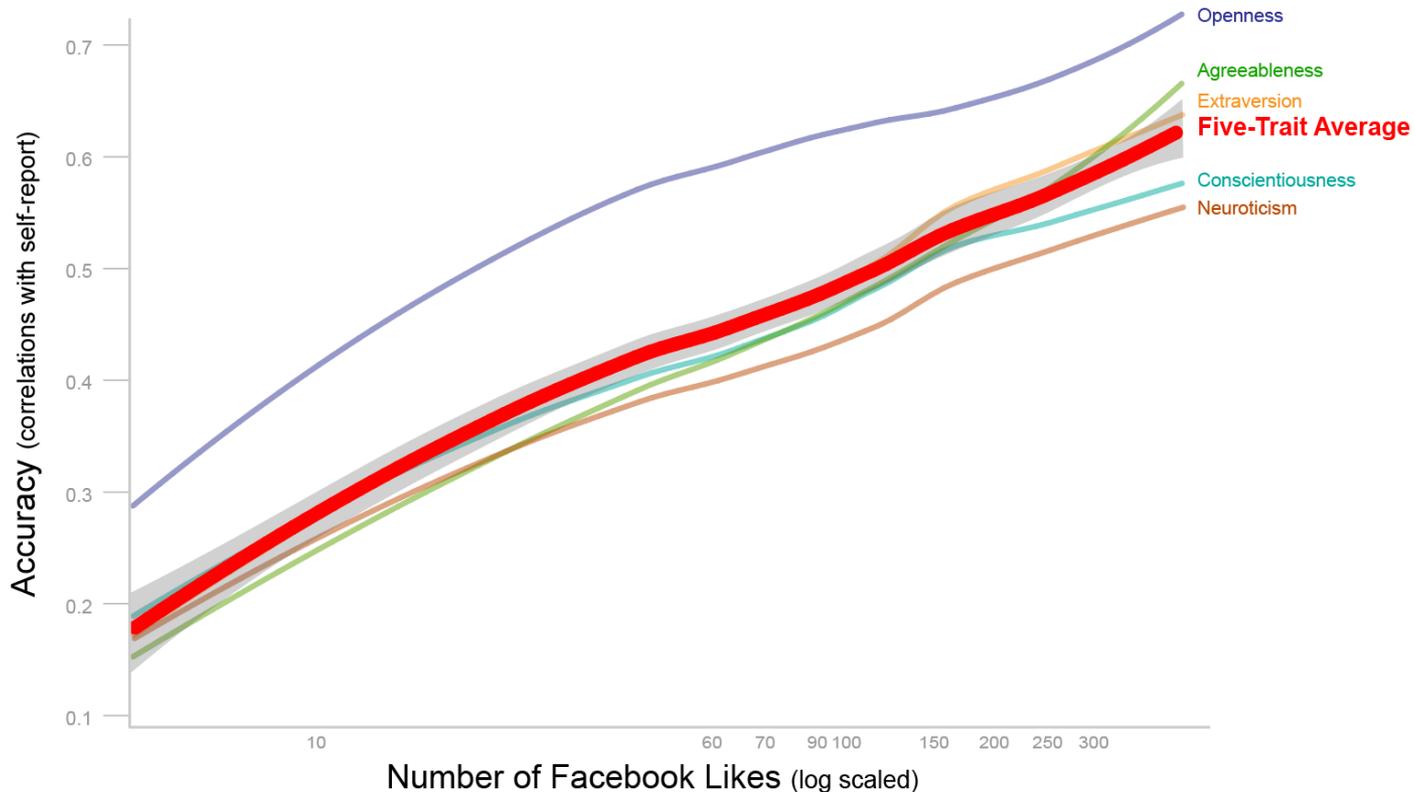
■ 48% Women
55% All Facebook

■ 53% Men
45% All Facebook

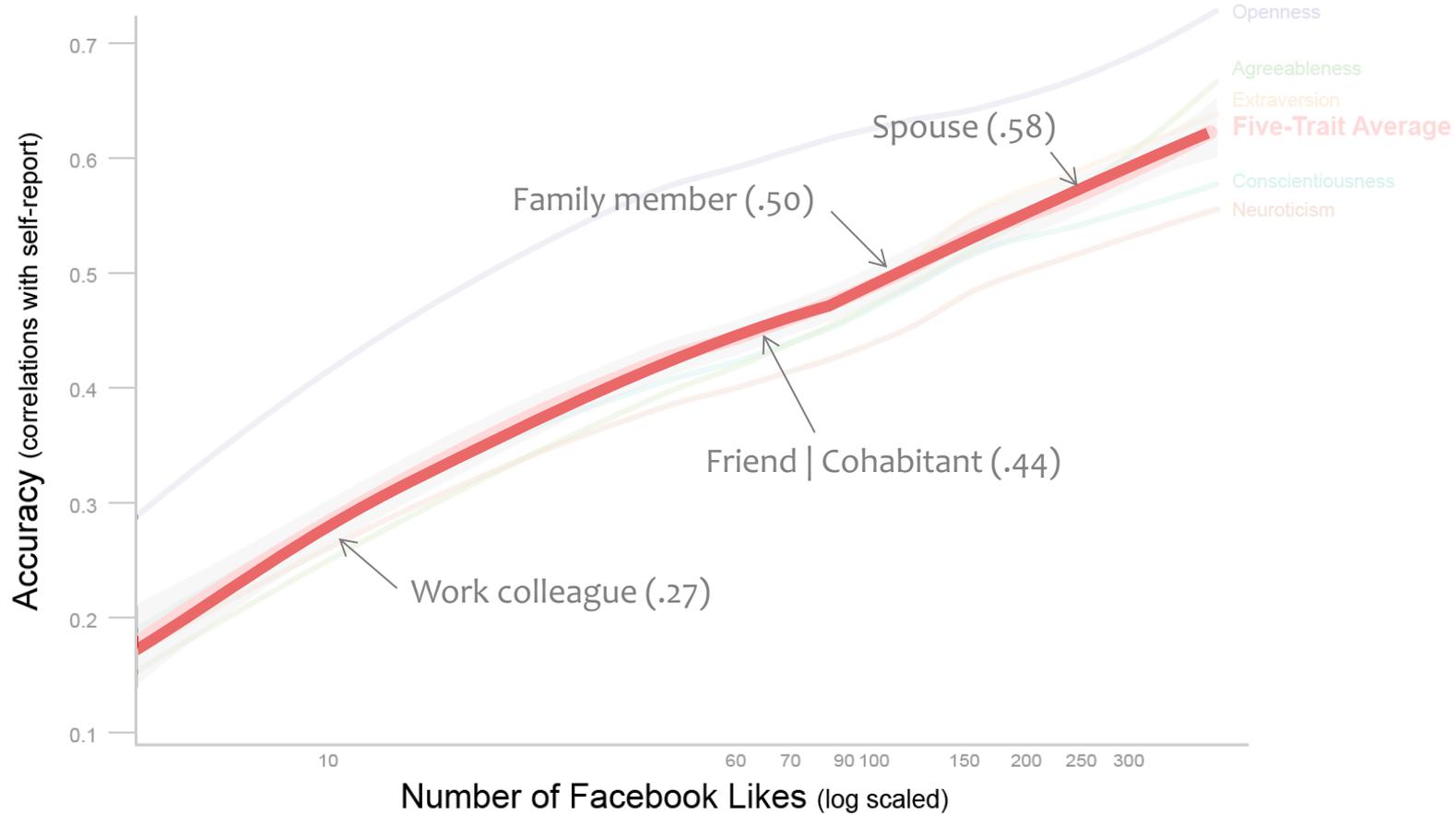


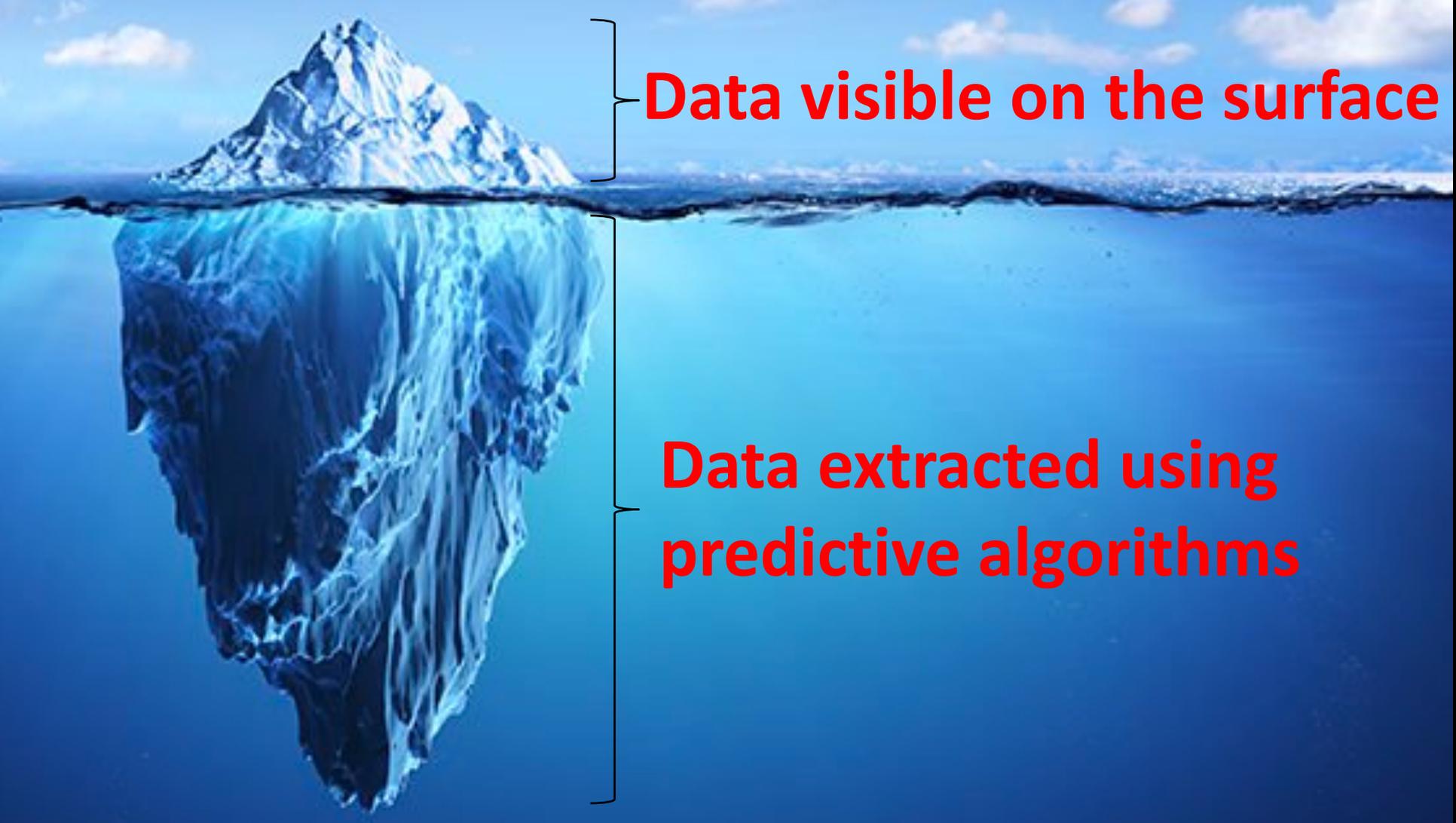
How accurate are
such predictive
models?

Predicting Personality from Facebook Likes



Predicting Personality from Facebook Likes





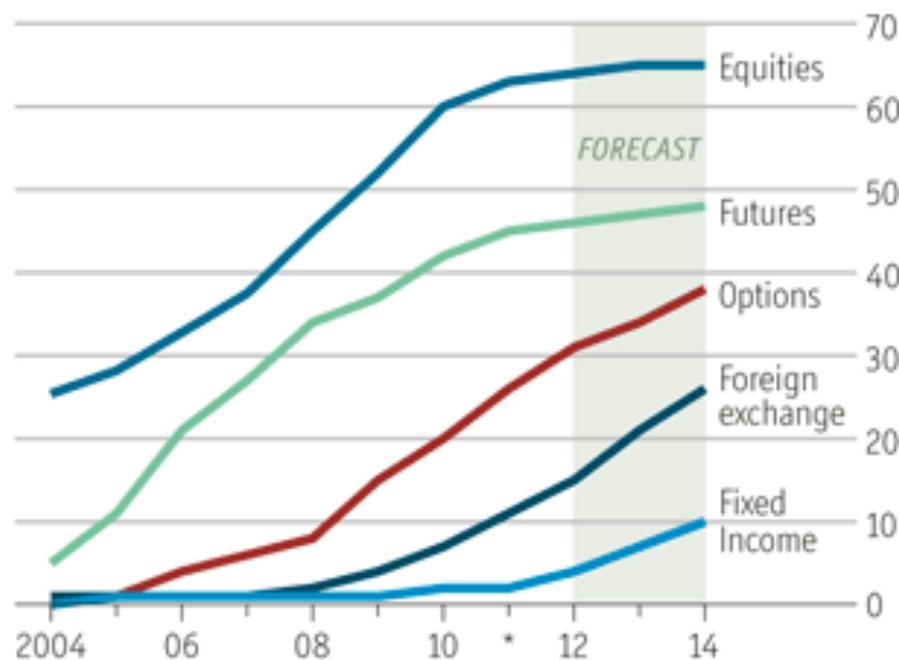
Data visible on the surface

**Data extracted using
predictive algorithms**

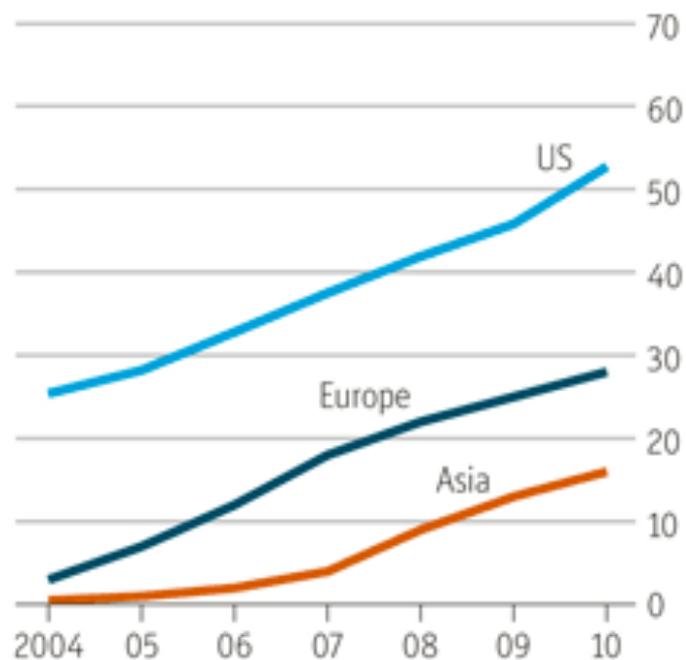
Are you surprised
by these findings?

Rise of the machines

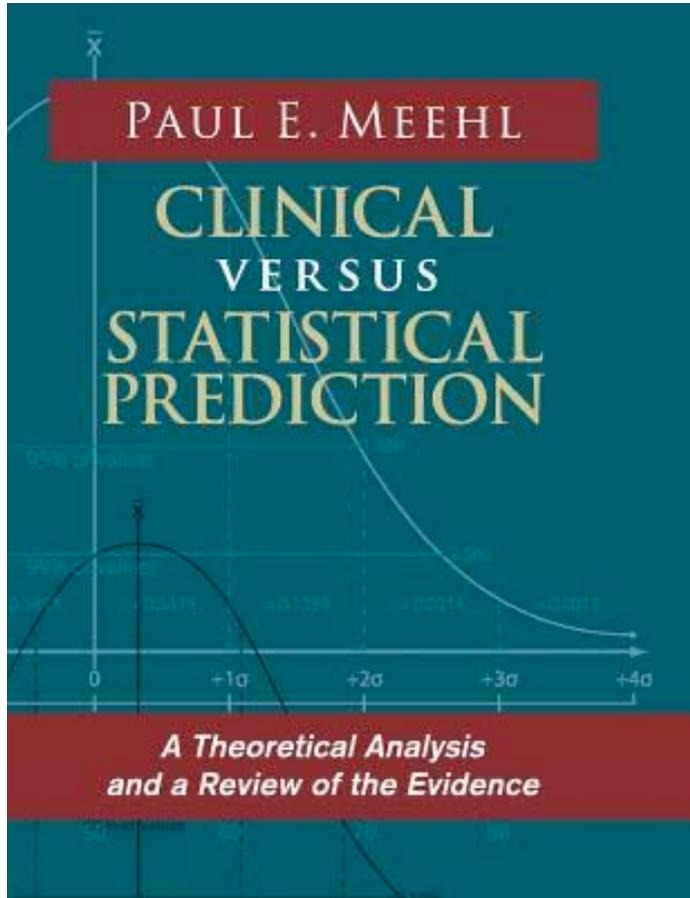
Algorithmic trading, % of total trading



Source: Aite Group



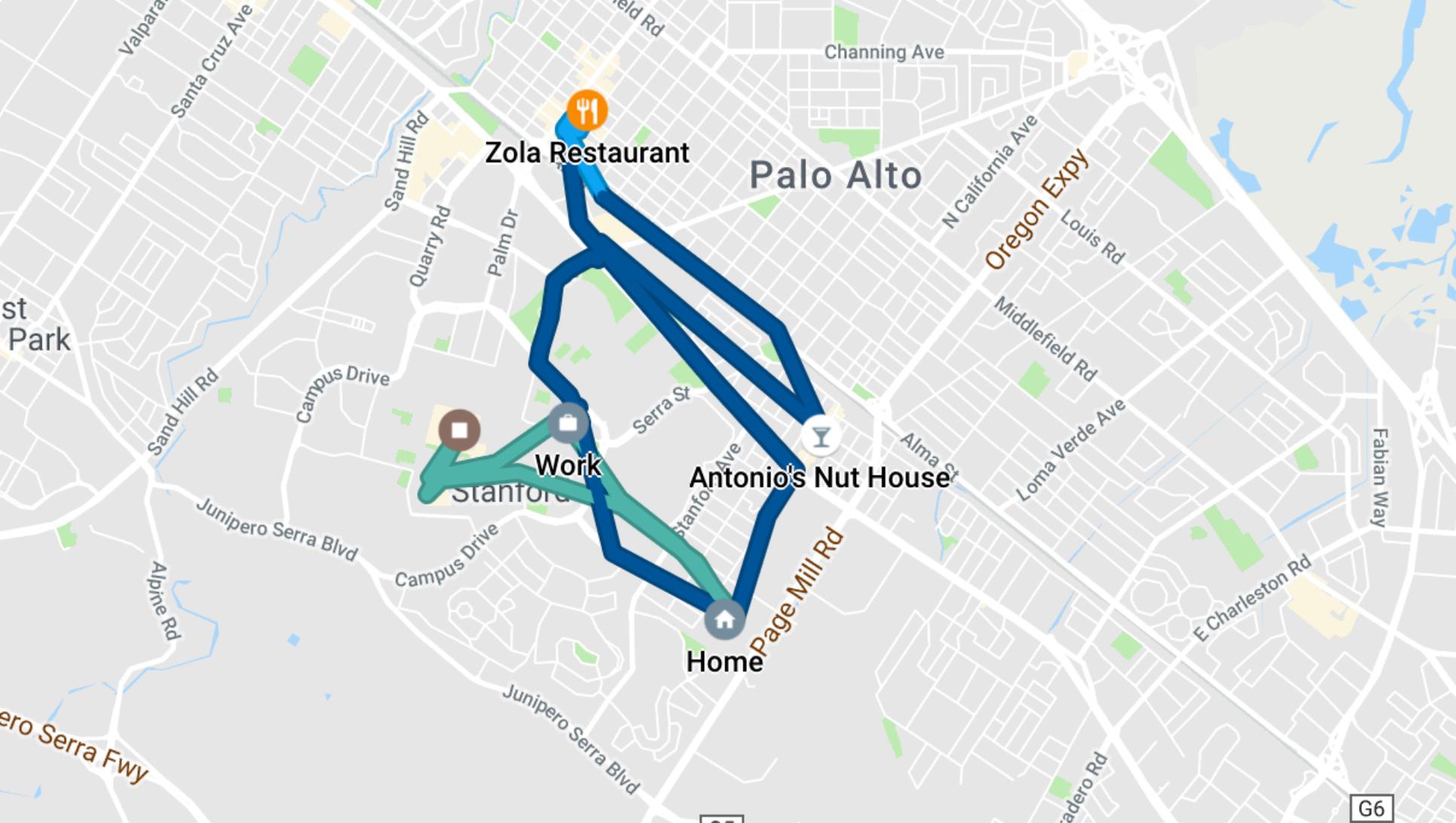
*Estimate



... mechanical prediction
will always outperform
the clinical diagnosis ...

1954

What types of data
can be used to
reveal your
intimate traits?



Zola Restaurant

Palo Alto

Work

Antonio's Nut House

Home



Ari's Take



PLAYLIST

Low Volume Funk

It's so funky and it's low volume. Come on, yeah. The Vulpack rides together!

Created by: **Ari Herstand** · 42 songs, 3 hr 3 min

PLAY



FOLLOWERS

423,329

Q Filter

Download

TITLE

ARTIST

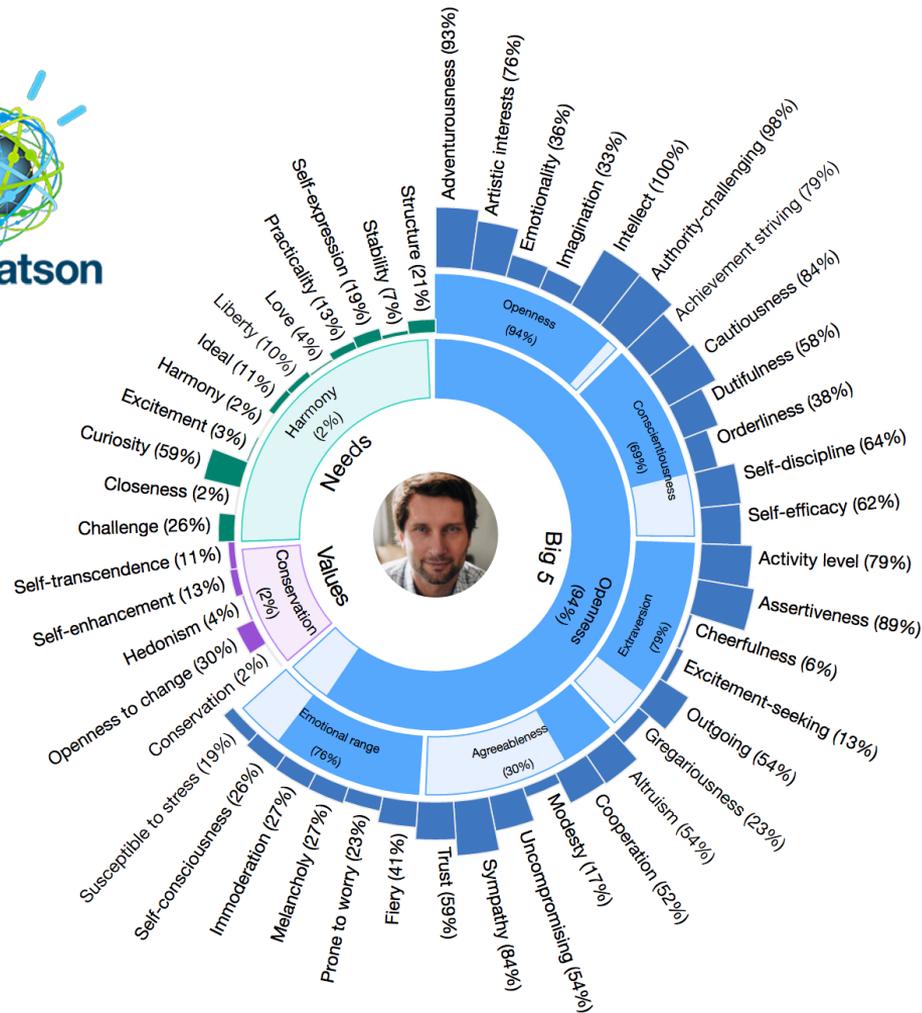
ALBUM

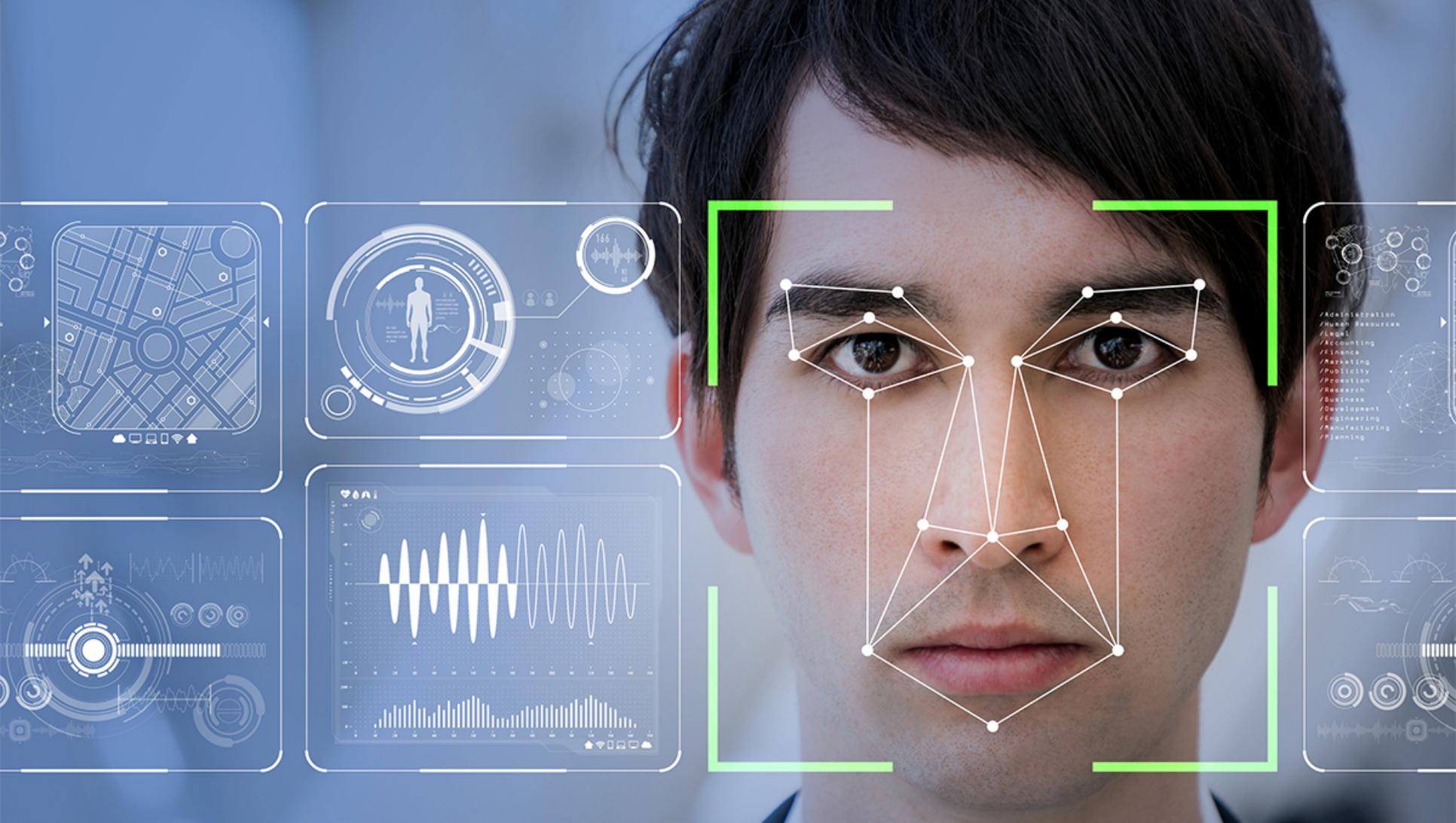


✓	Animal Spirits	Vulpeck	The Beautiful Game	2017-05-11	3:11
✓	Break Away	Bobby Caldwell, Ja...	Cool Uncle	2017-05-11	3:44
✓	The Bird	EXPLICIT Anderson .Paak	Malibu	2017-05-11	3:38
+	Use Me	Bill Withers	Still Bill	2017-05-11	3:48
+	Oh, Loretta	Sex on Toast	Oh, Loretta	2017-05-11	4:29



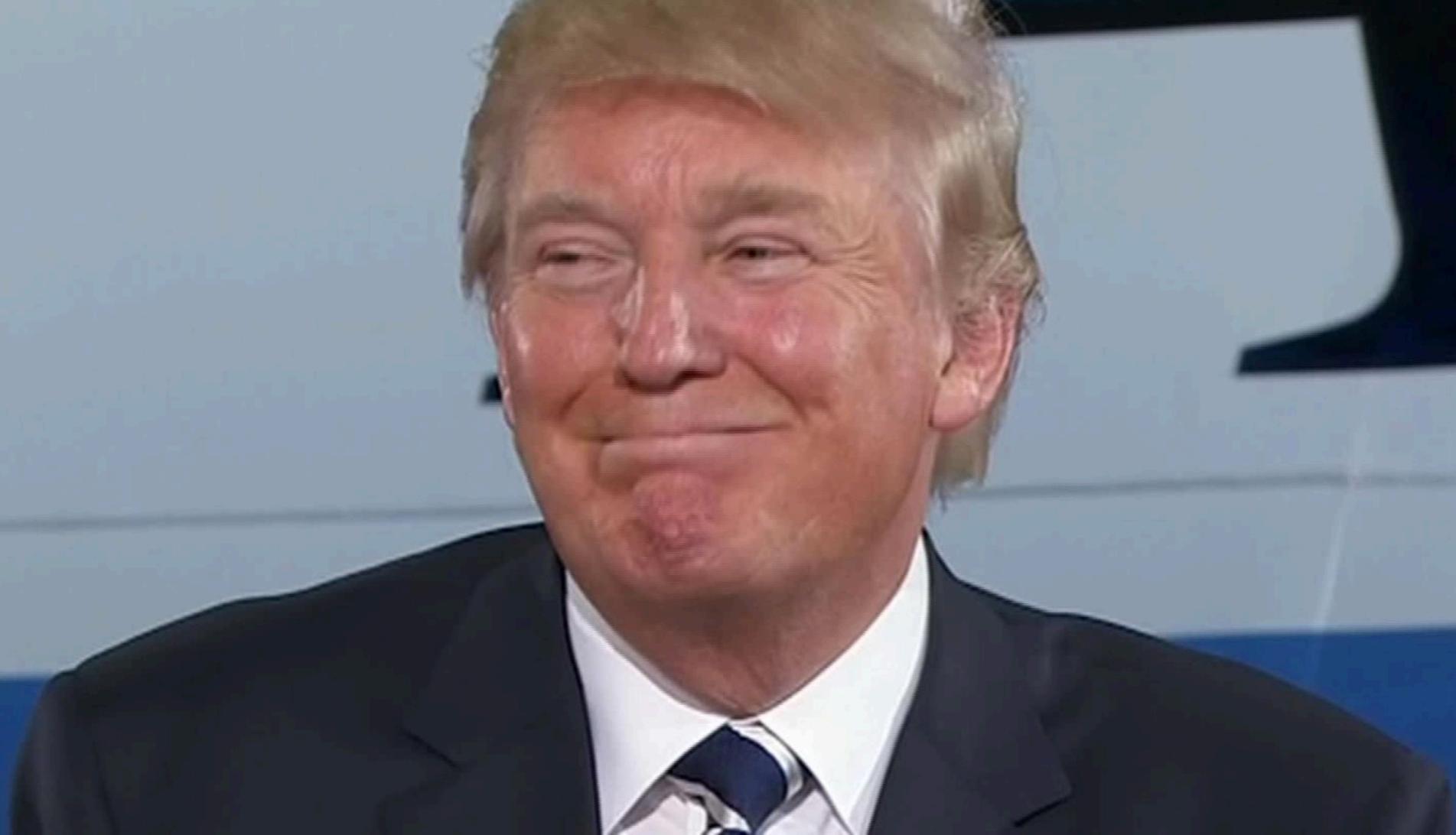














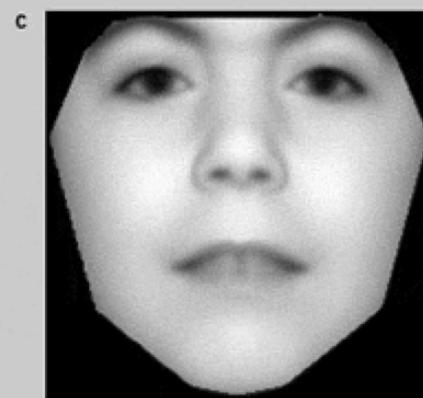




Angelman



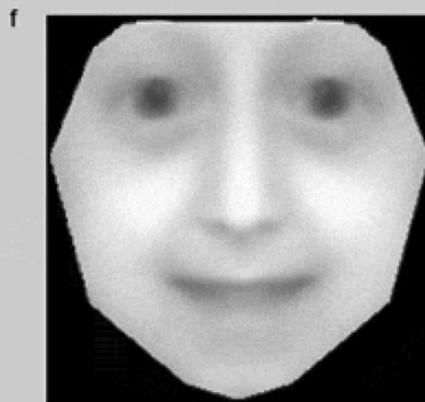
Apert



Cornelia de Lange



Fragile X



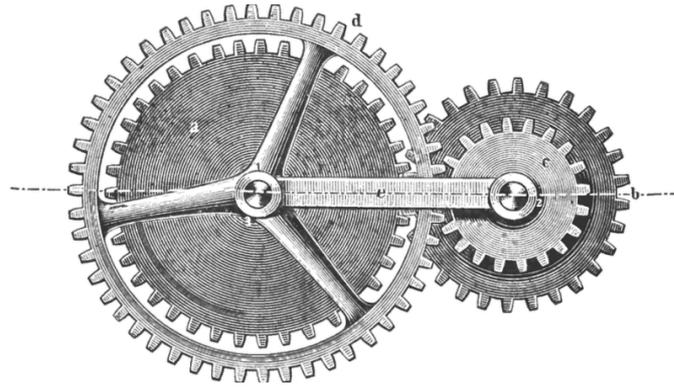
Progeria



Treacher-Collins

Ferry, Q., Steinberg, J., Webber, C., FitzPatrick, D. R., Ponting, C. P., Zisserman, A., & Nellåker, C. (2014). Diagnostically relevant facial gestalt information from ordinary photos. *eLife*, 2014(3).





Three types of mechanisms linking psychological traits and facial features

(Astley, Stachowiak, Clarren, & Clausen, 2002; Berry, 1991; Berry & Brownlow, 1989; Ferry et al., 2014; Lefevre, Lewis, Perrett, & Penke, 2013; Lukaszewski & Roney, 2011; Löhmus, Sundström, & Björklund, 2009; Penton-Voak, Pound, Little, & Perrett, 2006; Todorov, Said, Engell, & Oosterhof, 2008; Zebrowitz & Collins, 1997; Zebrowitz, Collins, & Dutta, 1998; Whitehouse et al., 2015)

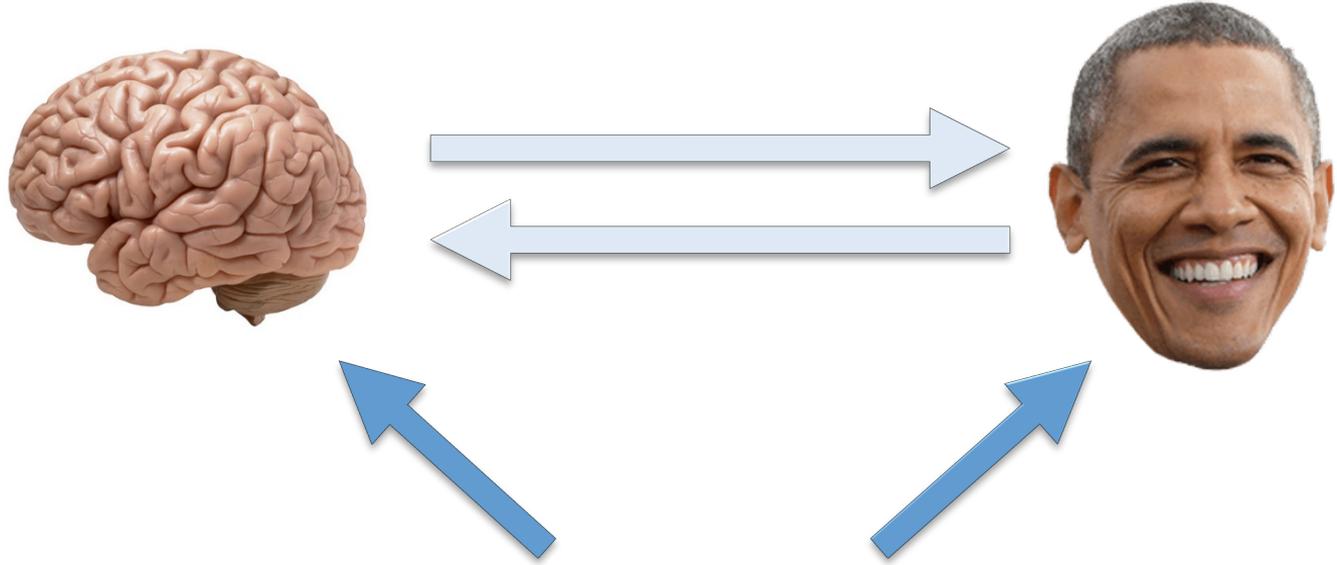








(e.g., Lukaszewski & Roney, 2011)



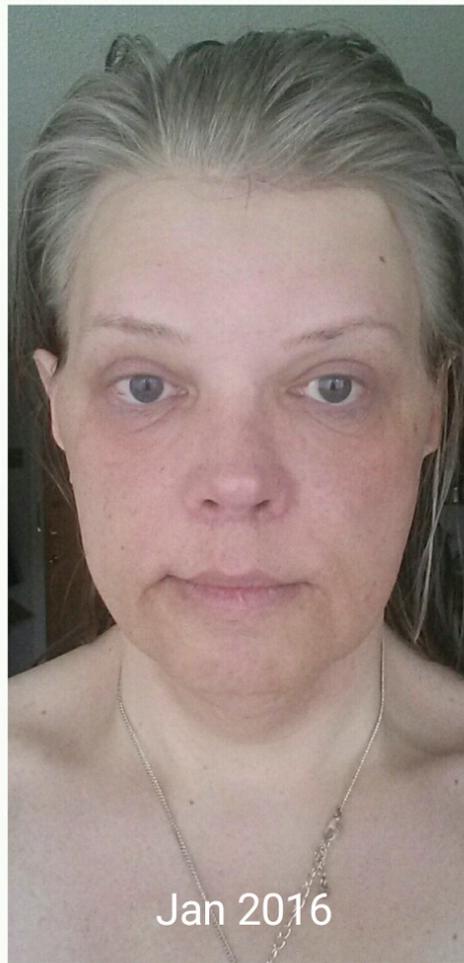
Factors affecting faces & brains





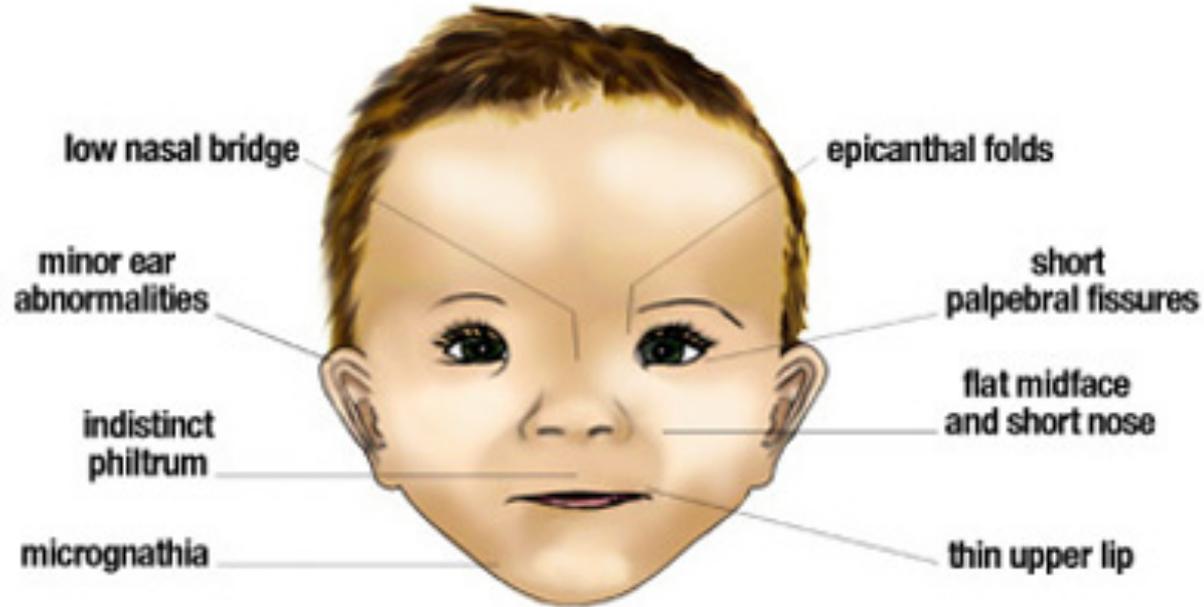


May 2014



Jan 2016

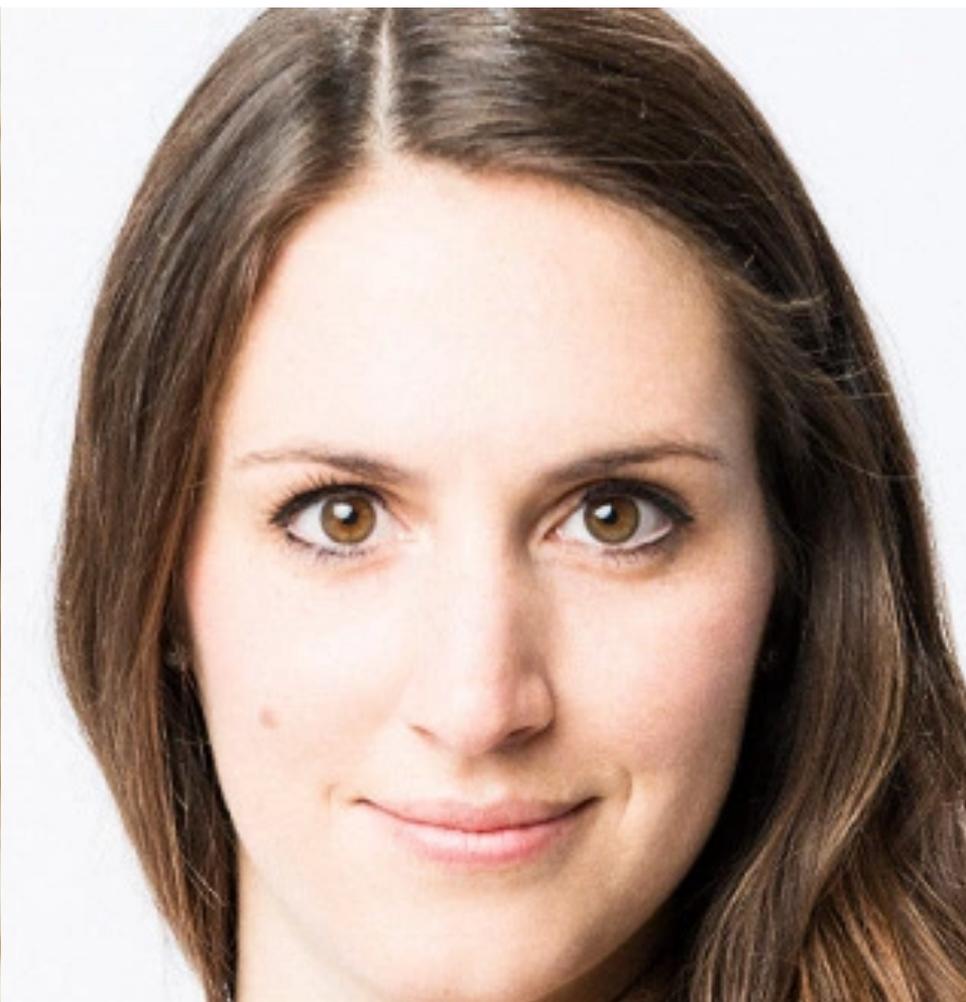
FETAL ALCOHOL SYNDROME



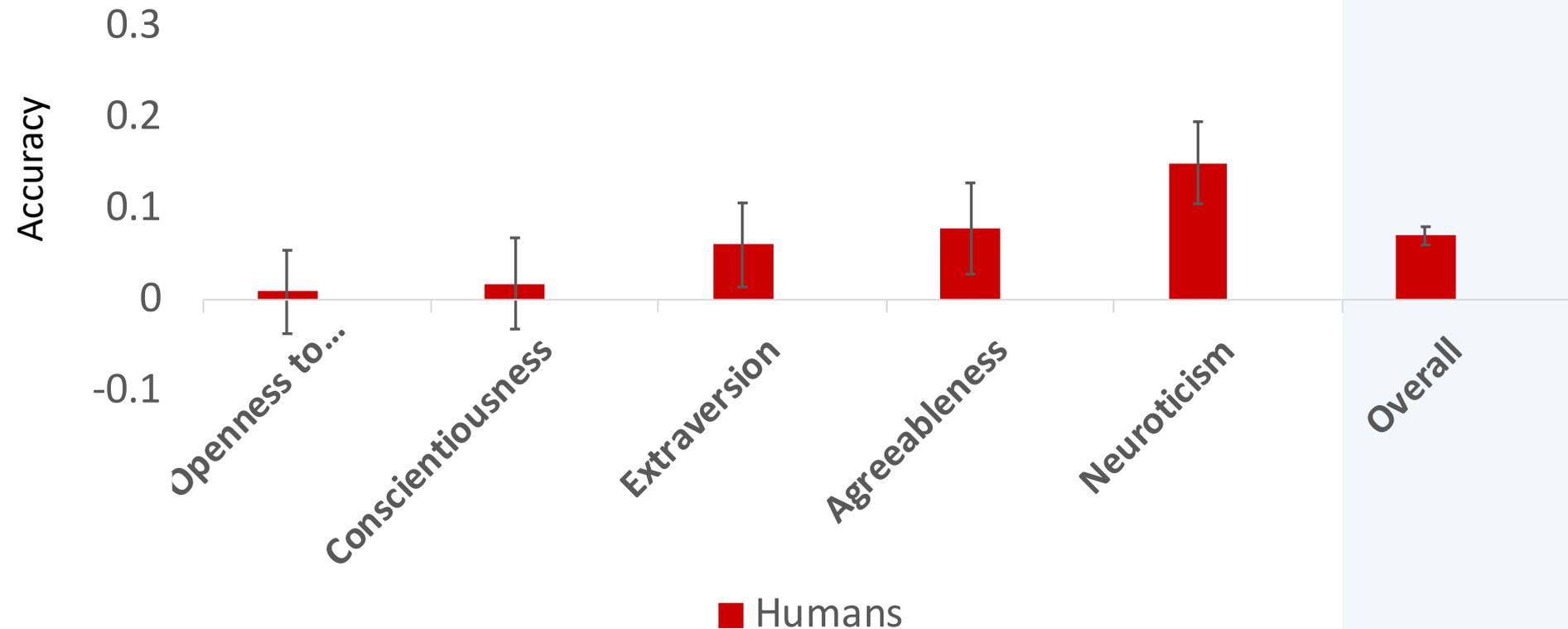
Astley SJ, Stachowiak J, Clarren SK, Clausen C (2002). Application of the fetal alcohol syndrome facial photographic screening tool in a foster care population. *Journal of Pediatrics*.



What intimate traits can be gleaned from our faces?



Human Judges' Accuracy



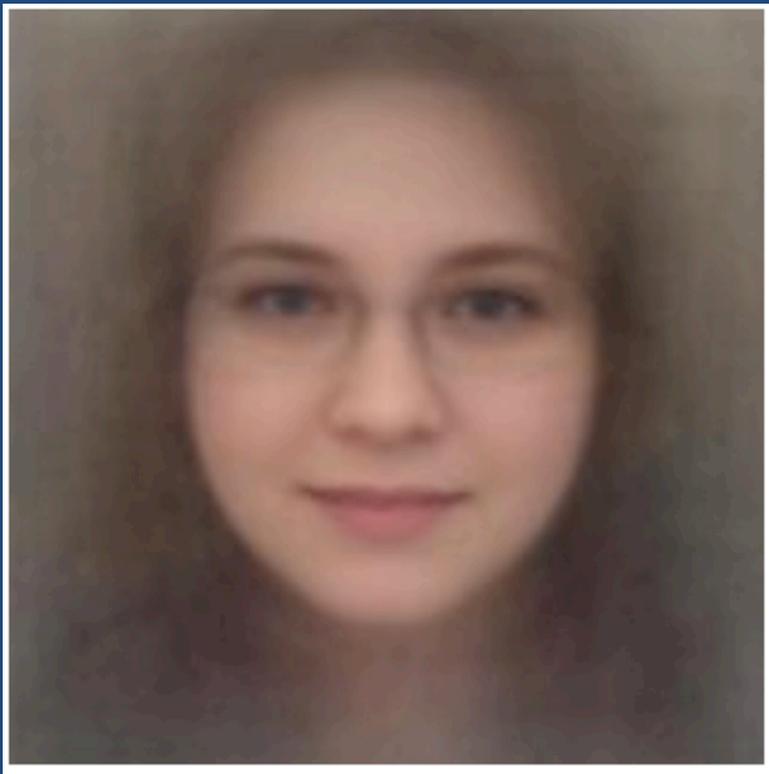
Top Faces: 10



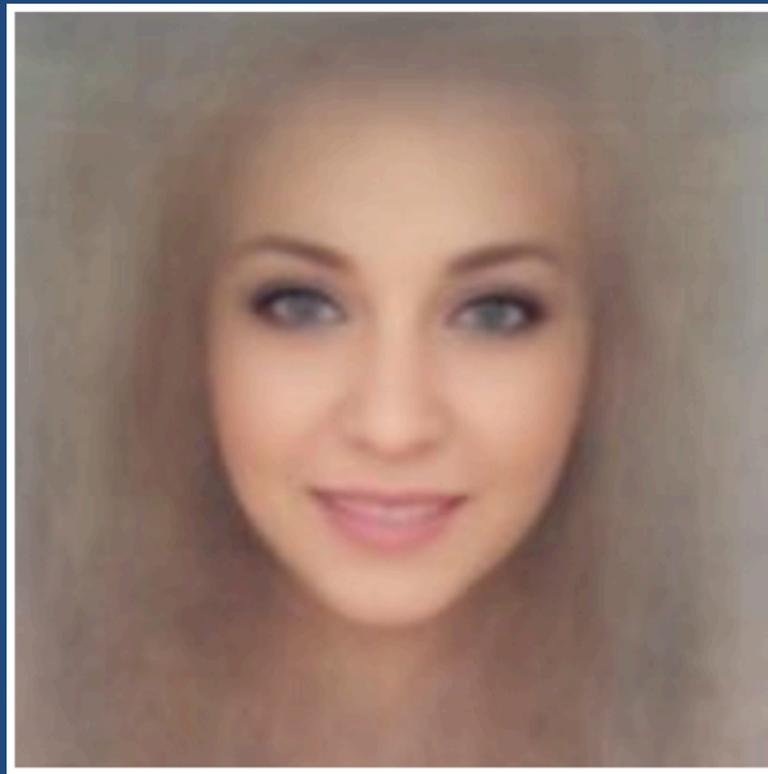
Top Faces: 10



Khambatta & Kosinski (in prep). DNNs are more accurate than humans at predicting personality from facial images.



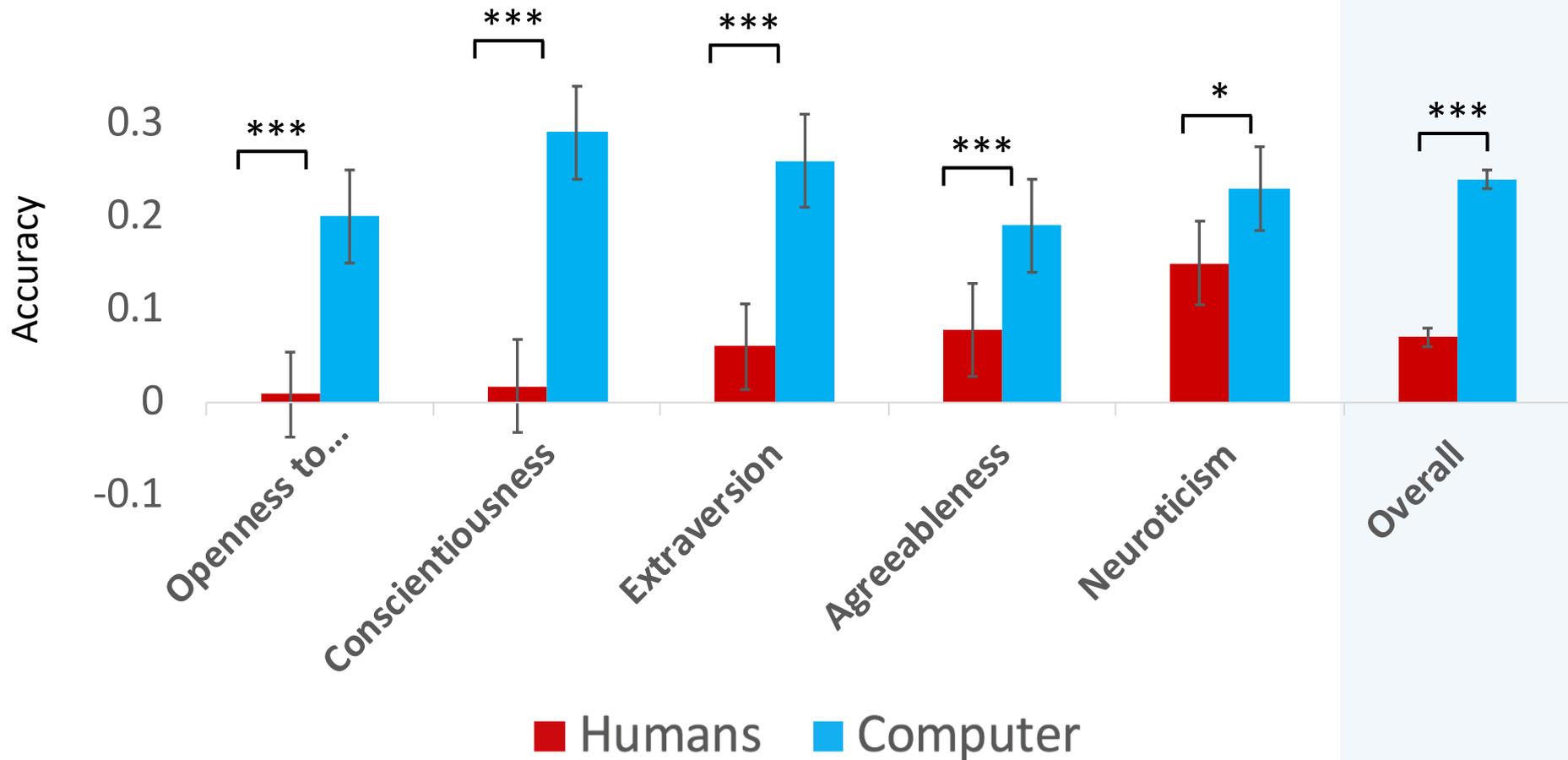
Most Introverted



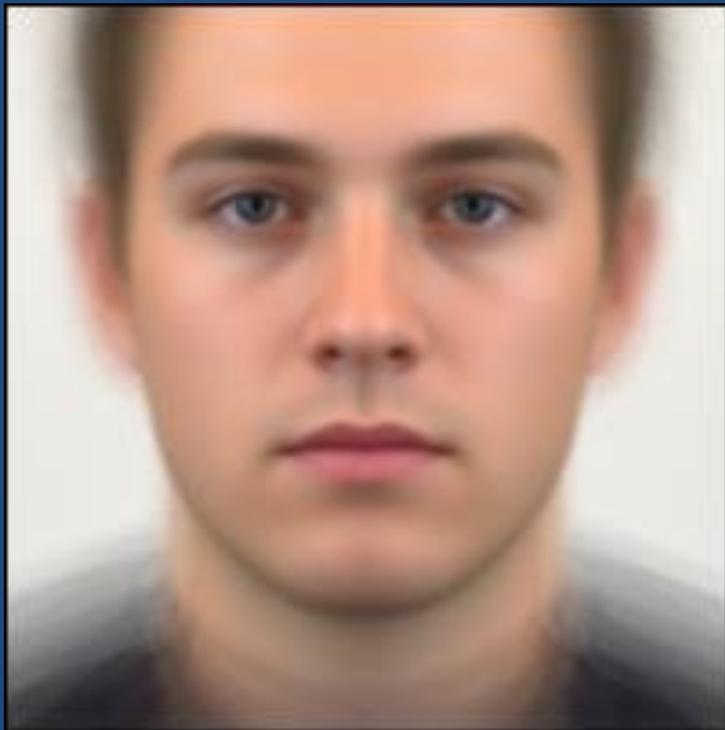
Most Extroverted

Khambatta & Kosinski (in prep). DNNs are more accurate than humans at predicting personality from facial images.

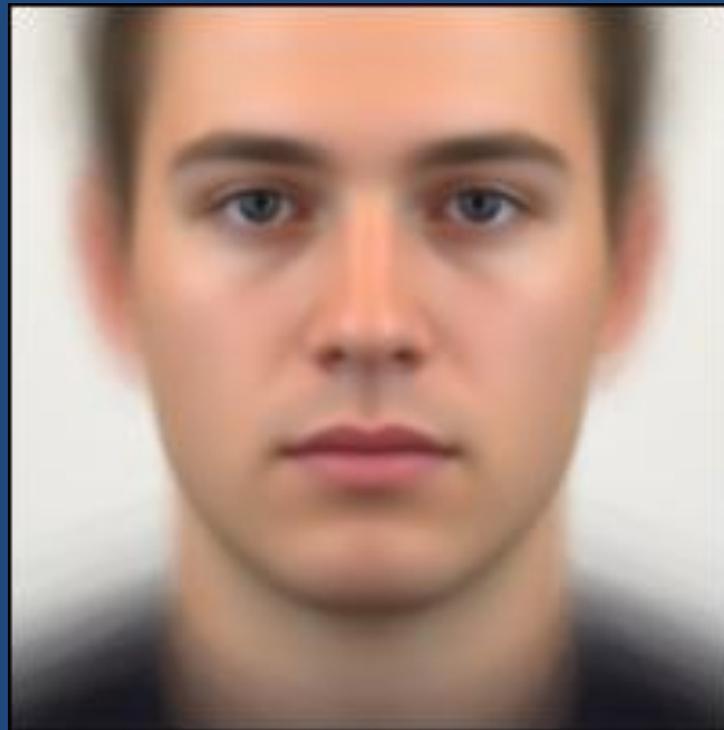
Human Judges vs Deep Neural Network



$\beta = .17, t(12,990) = 10.18, p < .001$

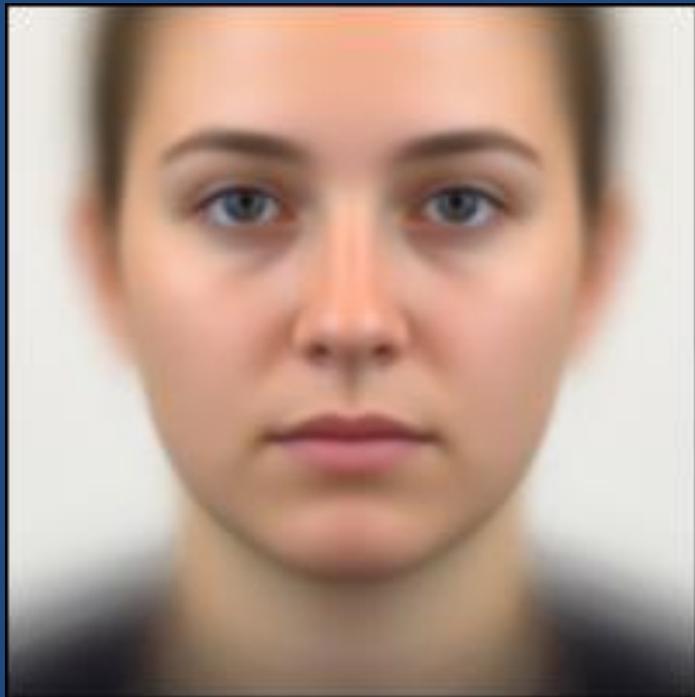


Conservative

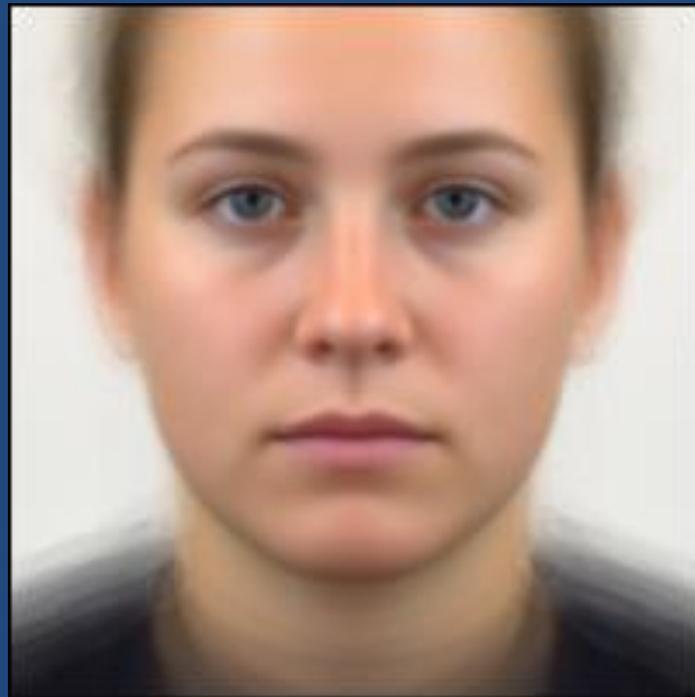


Liberal

Kosinski, Khambatta, Wang (in prep). Predicting political views from facial images.



Liberal

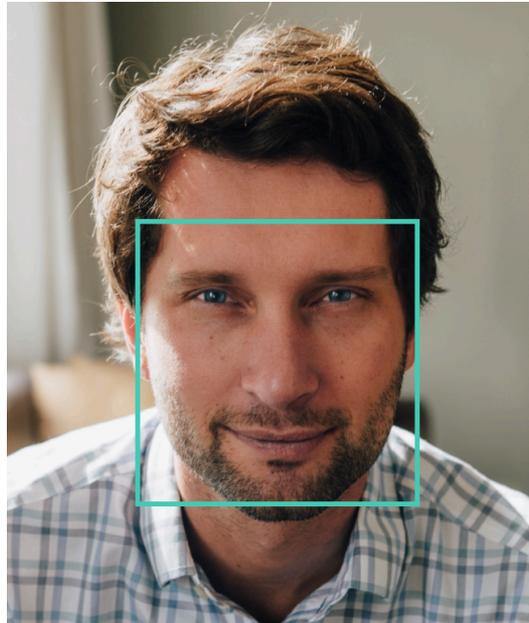


Conservative

Kosinski, Khambatta, Wang (in prep). Predicting political views from facial images.



Cognitive Services



```
Detection Result:  
JSON:  
[  
  {  
    "faceRectangle": {  
      "left": 558,  
      "top": 686,  
      "width": 899,  
      "height": 899  
    },  
    "scores": {  
      "anger": 0.00009627592,  
      "contempt": 0.00526537234,  
      "disgust": 0.00002383919,  
      "fear": 0.0000227332748,  
      "happiness": 0.6947198,  
      "neutral": 0.299442232,  
      "sadness": 0.0004173915,  
      "surprise": 0.00003286575  
    }  
  }  
]
```

Science is what we understand well
enough to explain to a computer.

Art is everything else we do.



The End of Privacy





Arbuckle Dining Pavilion

4.3 ★★★★★ · 23 reviews

Cafe



Directions



SAVE



NEARBY



SEND TO YOUR PHONE



SHARE

Campus cafeteria features a range of familiar global cuisine at the counter, plus outdoor seating.

Comfort food · Quick bite · Fast service

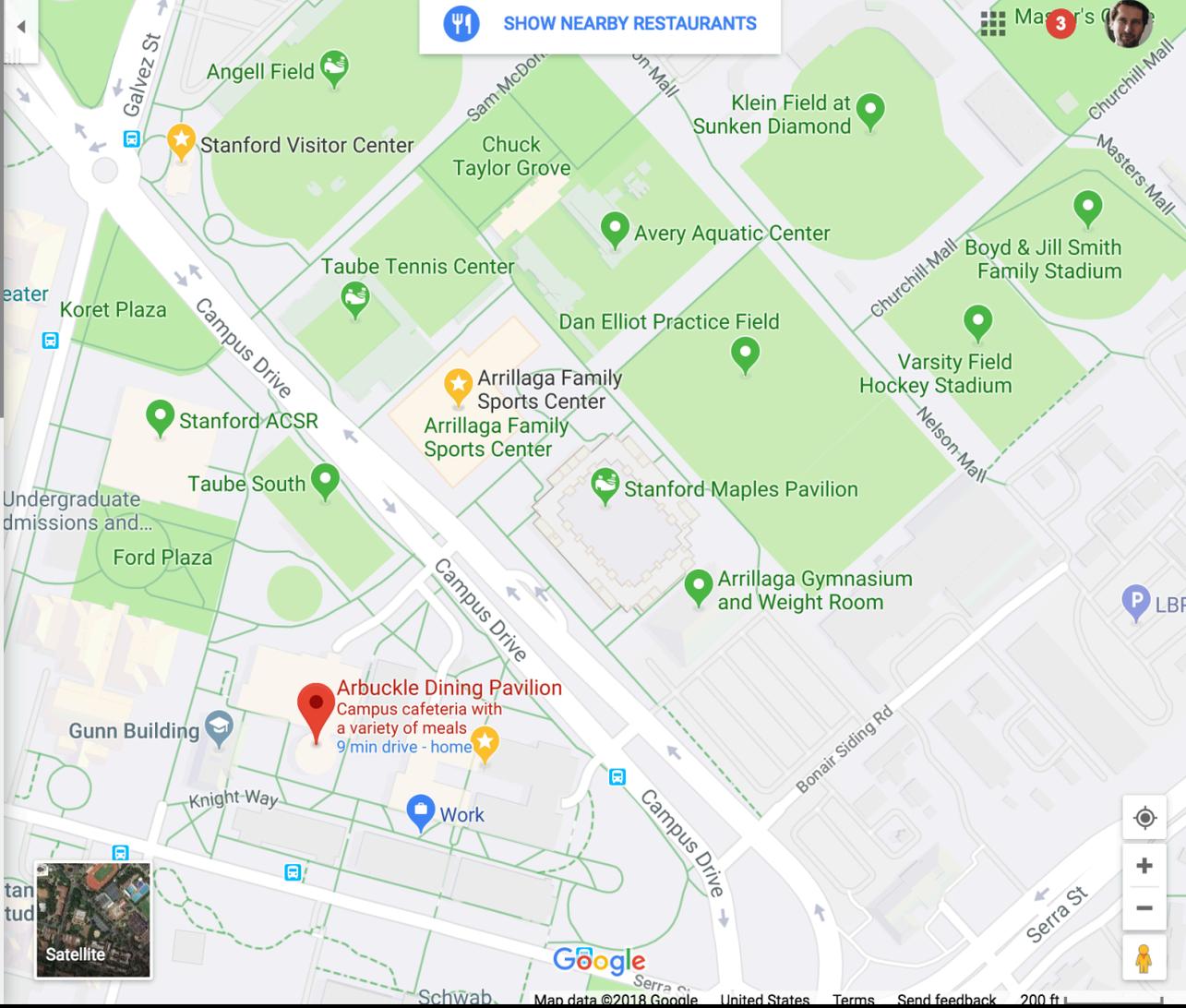
You visited 1 year ago

655 Knight Way, Stanford, CA 94305

Located in: Stanford Graduate School of Business

gsb.stanford.edu

(650) 725-7718



SHOW NEARBY RESTAURANTS





TWEETS
234

FOLLOWING
175

FOLLOWERS
4,559

LIKES
69

MOMENTS
0

Edit profile

Michal Kosinski

@michalkosinski

Professor at Stanford University
Graduate School of Business.
Computational Psychologist and Big
Data Scientist.

Stanford

michalkosinski.com

Joined June 2009

Tweets

Tweets & replies

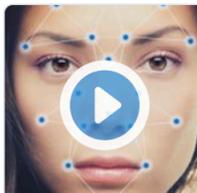
Media

Pinned Tweet



Michal Kosinski @michalkosinski · Mar 25

The End o Privacy @cebit

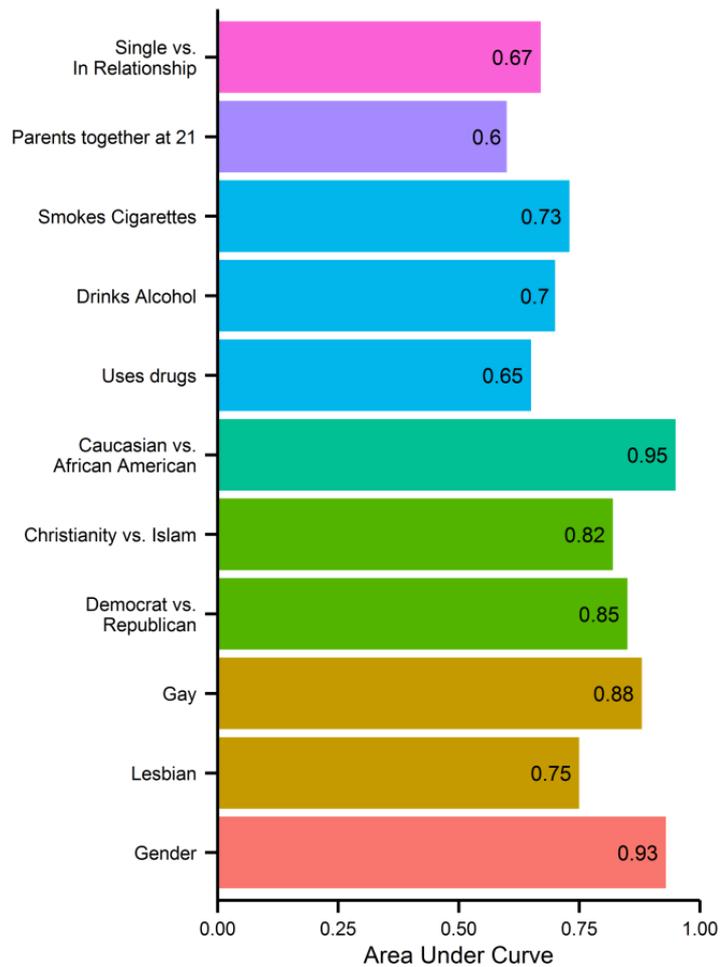


Keynote "The End of Privacy", Dr. Michal Kosinski

CeBIT Global Conferences - 23 March 2017: Keynote
"The End of Privacy" / Dr. Michal Kosinski, Stanford
University, United States (USA) <http://bit.ly/2nqZrDv>

youtube.com

Who cares?

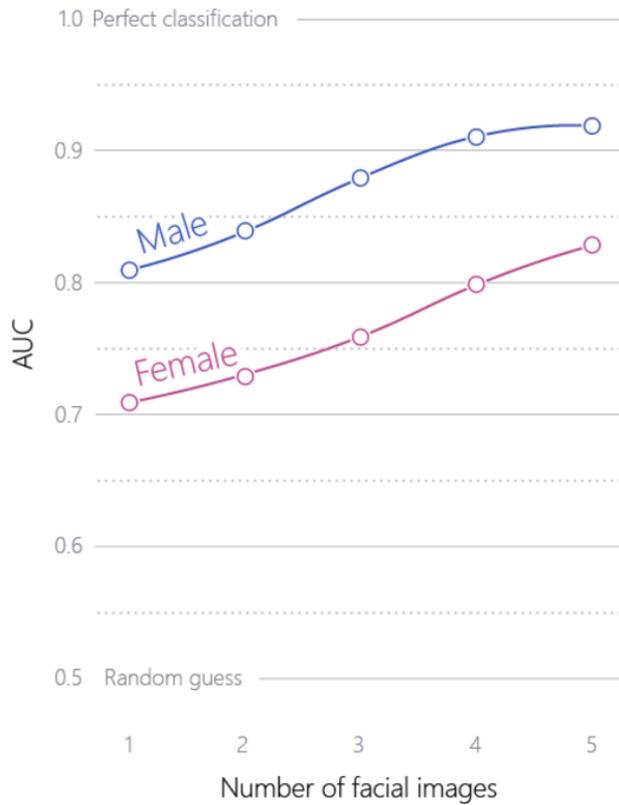


Kosinski, Stillwell & Graepel (2013) Private traits and attributes are predictable from digital records of human behavior. PNAS.



AI 'dreaming' about faces of homosexual and heterosexual males

Wang & Kosinski (2018). DNNs are more accurate than humans at detecting sexual orientation from facial images. JPSP

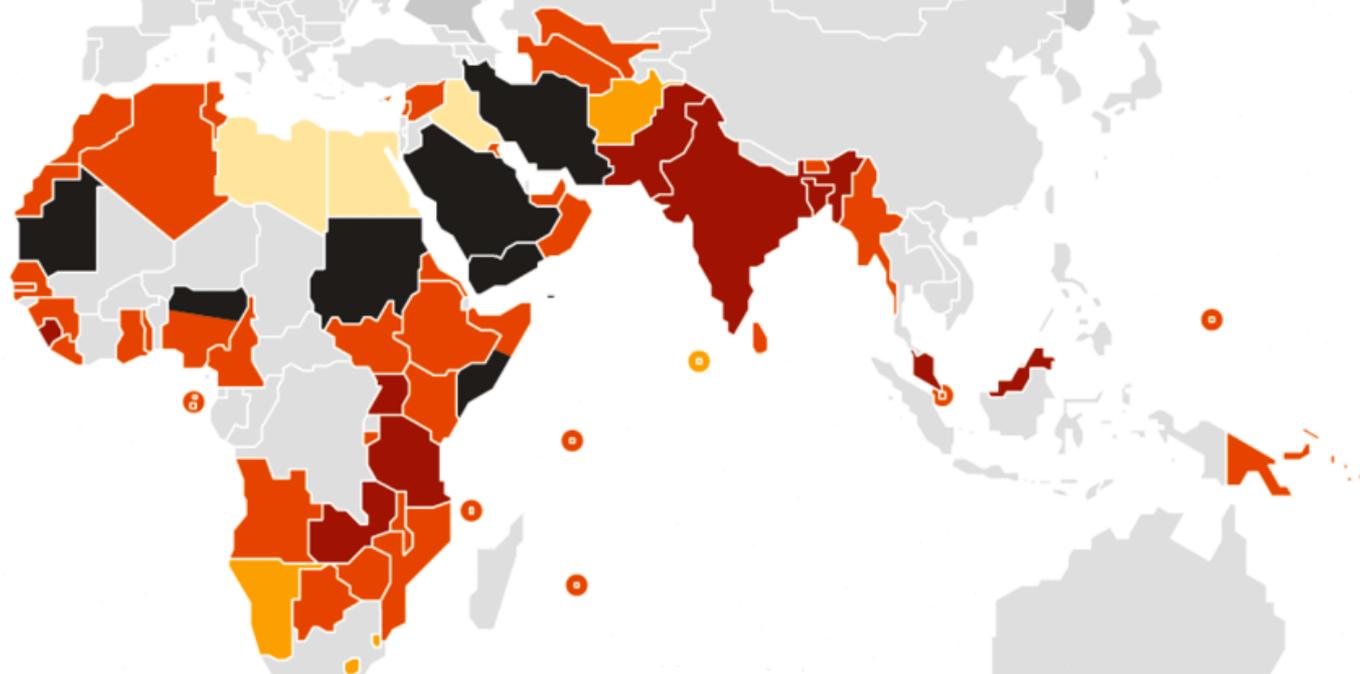


Sexual orientation: Classification accuracy vs. the number of facial images per person.

Where homosexuality is illegal

2013

RUSSIA†



Imprisonment				
Death penalty	14 years to life	Up to 14 years	No indication of length	Unclear*

Source: ILGA

* Legislation not specifically homophobic but can be used as such/persecution by religious courts
† "Propaganda law" restricting freedom of expression and association





Thank you!

michalk@stanford.edu