

The Power of Algorithms for Good and for Evil

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Department of Computer & Information Sciences

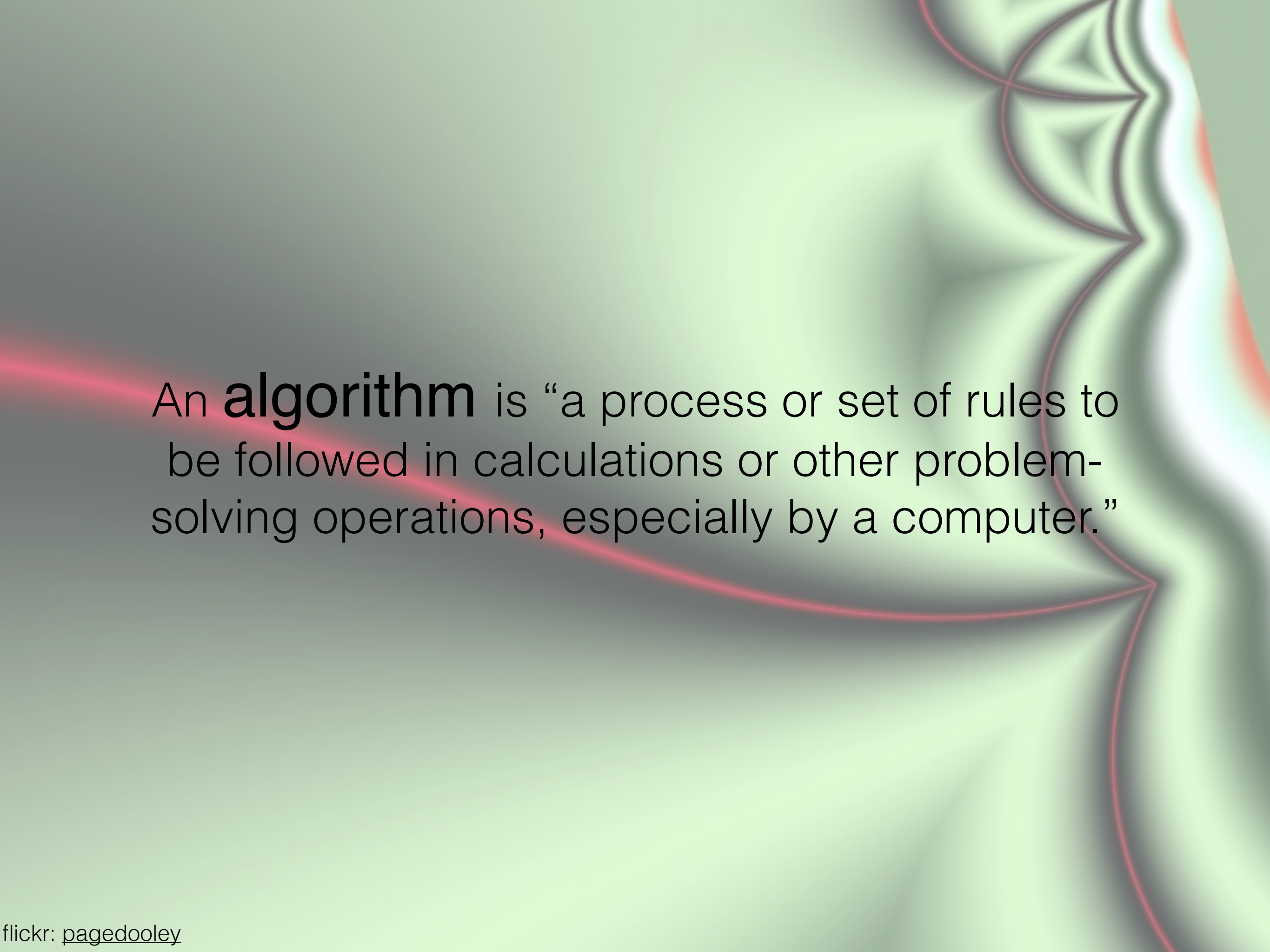
#privilegealert

I am a

- white
- straight
- cisgender
- middle class
- highly educated
- American

lady

I'm doing the best I can when I talk about issues of race, class, gender, and other sensitive topics. But you should *always feel free* to call me out (publicly or privately).



An **algorithm** is “a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.”

Some algorithms are relatively neutral, like sorting algorithms



Bubble sort

Merge sort, breadth first

But, many algorithms
are based on data



And data is political

Brainstorm: data exhaust

We generate data every day, whether we know it or not.

For example, I wear a FitBit, so I generate data every time I take a step. I consciously chose to wear this, but there are other times I am unconsciously generating data. It is incidental to what I'm doing, and streams off me as "data exhaust."

Take a few minutes and make a list of all the places you generate data on a normal day.

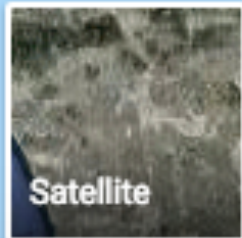
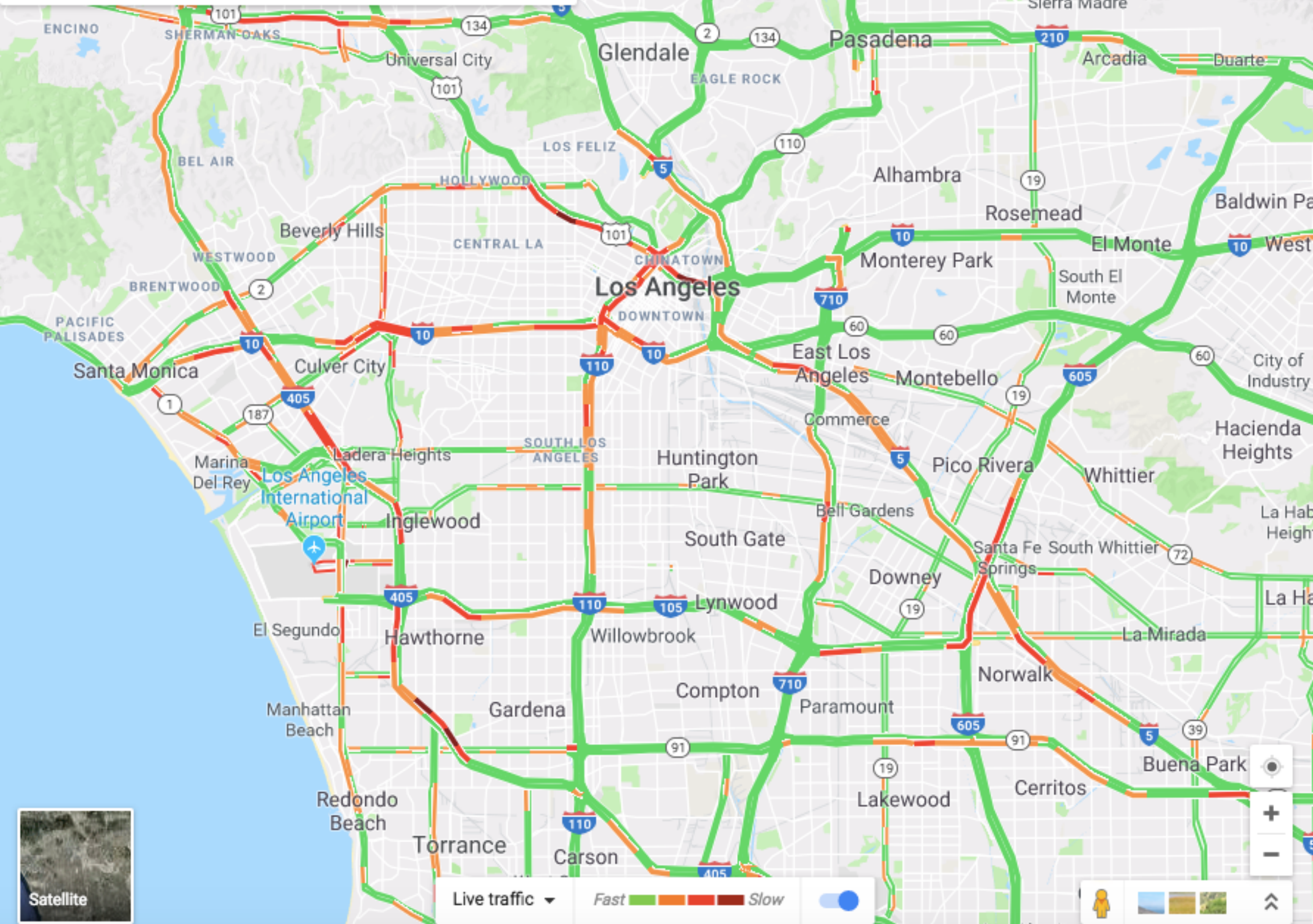








Search Google Maps



Satellite

Live traffic

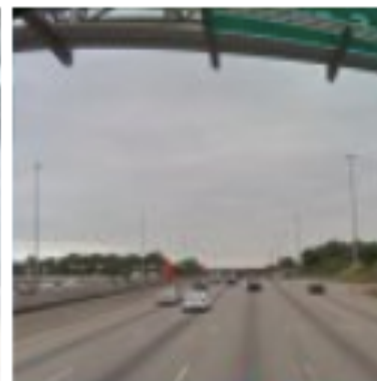
Fast Slow



Select all images with a

bus

Click verify once there are none left.



VERIFY



BlueDot studies how infectious diseases disperse worldwide through analysis of big data

2003

SARS spreads from Hong Kong to Toronto, causing an outbreak that cripples the city with 44 deaths and \$2 billion in losses

After completing his training as a physician specializing in infectious diseases and public health in New York City, Dr. Kamran Khan returns to Toronto just before the city's SARS outbreak begins.

2008

BioDiaspora is launched as a scientific research program at *St. Michael's Hospital* in Toronto

To understand how infectious diseases can spread worldwide, Dr. Khan launches BioDiaspora – a scientific research program to study how the world's population is connected through commercial air travel.

OCEAN HEALTH INDEX

A healthy ocean sustainably delivers a range of benefits to people now and in the future. The Ocean Health Index is the comprehensive framework used to measure ocean health from global to local scales.

<http://www.oceanhealthindex.org/>

GLOBAL ASSESSMENT

A measure of ocean health across countries and high seas regions.

GLOBAL SCORES

METHODOLOGY

INDEPENDENT ASSESSMENTS

OHI+ is an assessment tool customized by stakeholders to meet local management needs.

OHI+ ASSESSMENTS

CONDUCT AN ASSESSMENT

 California

Moulton Niguel Water District

Forecasting Water Demand in California When Every Drop Counts

December 2016



Objectives

- ▶ Develop a “proof of concept” water demand forecasting model using flow data at the microzone level for potential future scaling to other retailers in the California Data Collaborative, a unique water manager-led public private partnership that brings together utilities across the state to leverage data to help water managers ensure reliability.

ANNALS OF CRIME NOVEMBER 27, 2017 ISSUE

THE SERIAL-KILLER DETECTOR

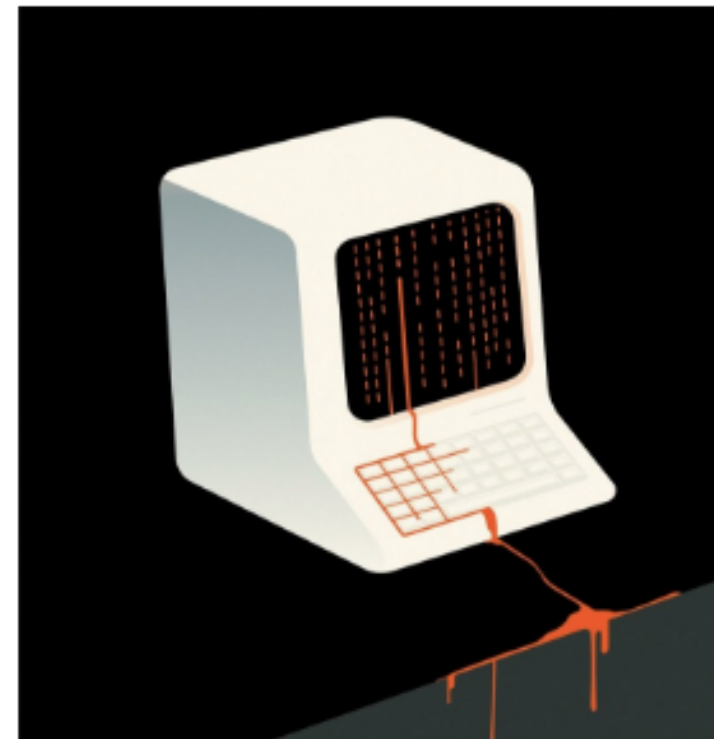
A former journalist, equipped with an algorithm and the largest collection of murder records in the country, finds patterns in crime.



By Alec Wilkinson

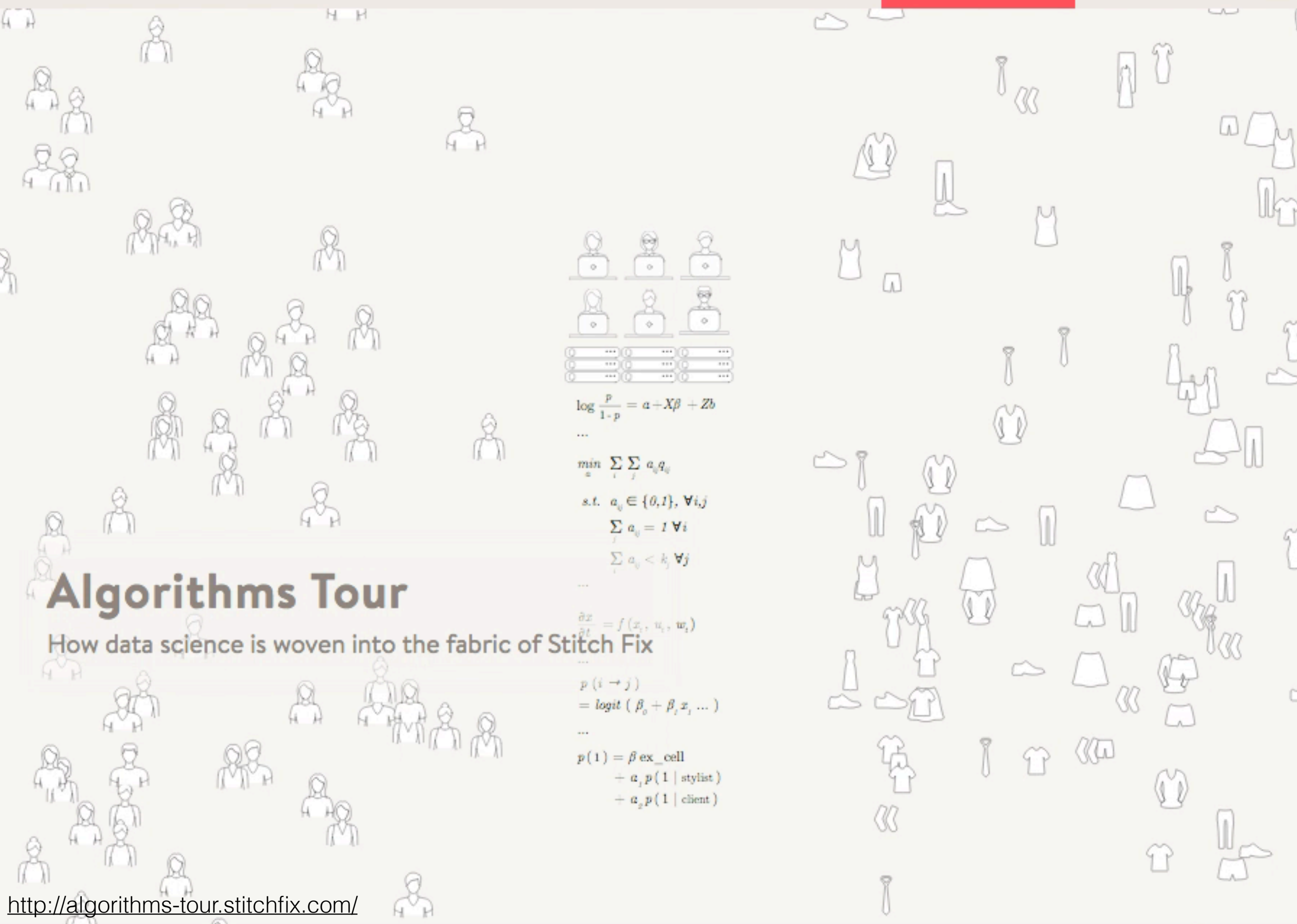


Thomas Hargrove is a homicide archivist. For the past seven years, he has been collecting municipal records of murders, and he now has the largest catalogue of killings in the country—751,785 murders carried out since 1976, which is roughly twenty-seven thousand more than appear in F.B.I. files. States are supposed to report murders to the Department of Justice, but some report inaccurately, or fail to report altogether, and Hargrove has sued some of these states to



Hargrove estimates that two thousand serial killers are at large in the U.S.

Illustration by Harry Campbell



$$\log \frac{p}{1-p} = a + X\beta + Zb$$

...

$$\min_a \sum_i \sum_j a_{ij} q_{ij}$$

$$\text{s.t. } a_{ij} \in \{0,1\}, \forall i,j$$

$$\sum_j a_{ij} = 1 \forall i$$

$$\sum_i a_{ij} < k_j \forall j$$

...

$$\frac{\partial z}{\partial t} = f(x, u, w, \dots)$$

...

$$p(i \rightarrow j) = \text{logit}(\beta_0 + \beta_1 x, \dots)$$

...

$$p(1) = \beta \text{ ex_cell} + \alpha_1 p(1 | \text{stylist}) + \alpha_2 p(1 | \text{client})$$

Algorithms Tour

How data science is woven into the fabric of Stitch Fix

OCT 28, 2013 @ 11:43 AM 42,089

Kroger Knows Your Shopping Patterns Better Than You Do



Tom Groenfeldt, CONTRIBUTOR

I write about finance and technology. [FULL BIO](#) ✓

Opinions expressed by Forbes Contributors are their own.

Kroger [KR -1.63%](#), the Cincinnati-based grocery store chain, calls the 11 million pieces of direct mail it sends to customers each quarter “snowflakes” -- because if any two are the same, it is a fluke. The redemption rate is over 70 percent within six weeks of the mailing.

Kroger is the nation’s largest traditional grocery chain with more than 2,400 stores and \$80.8 billion in sales last year, second only to Wal-Mart in grocery sales. It was named “Retailer of the Year” by **Progressive** [PGR -0.08%](#) Grocer magazine. “They have made significant investments in a best-in-class loyalty program, strong private label, and reinvested in their stores and technology,” Neil Stern at McMillanDoolittle said of the award, as reported by Progressive Grocer.



AND, A SHORT DISTANCE AWAY...

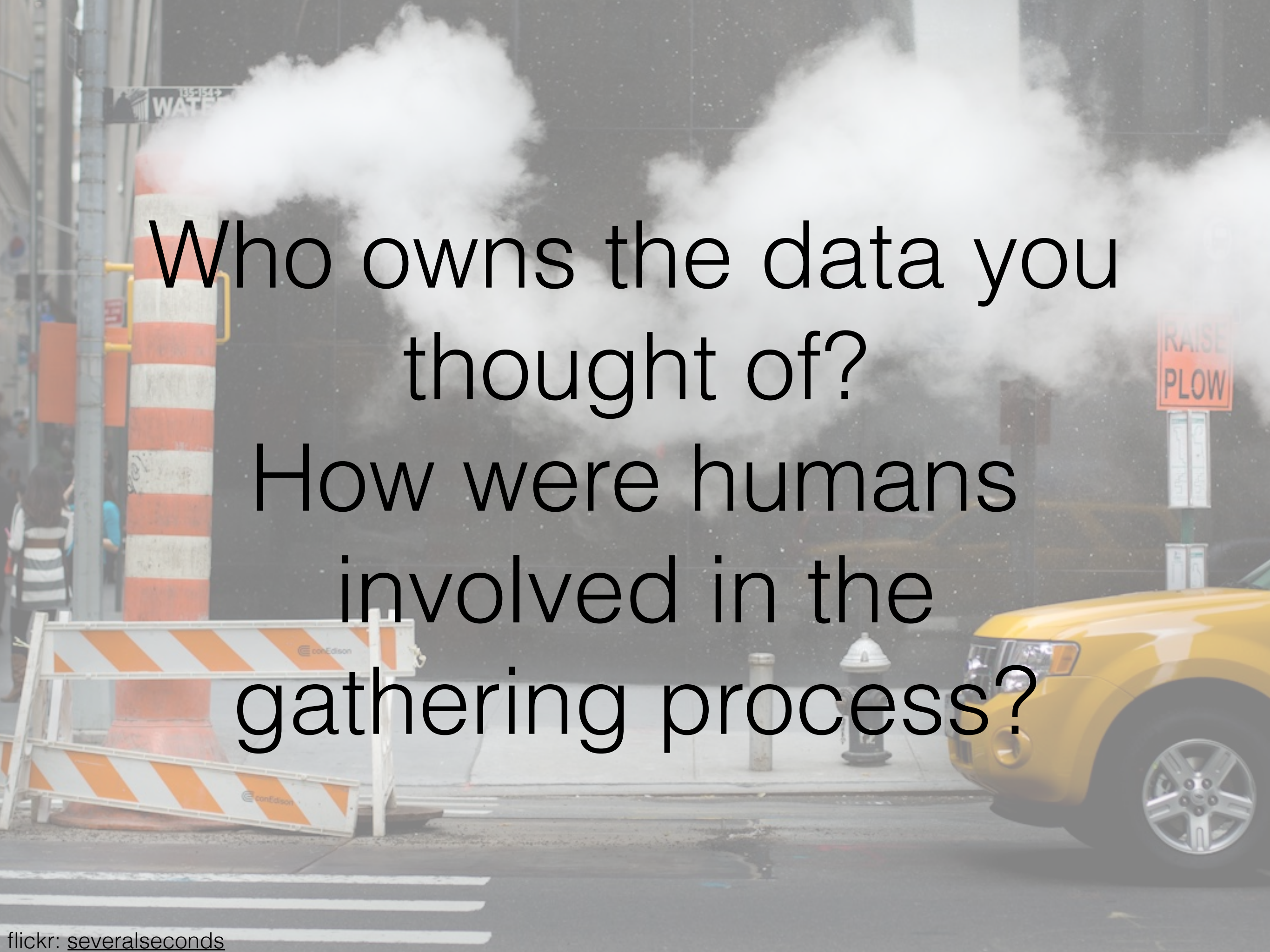
MY FAULT--ALL MY FAULT! IF ONLY I HAD STOPPED HIM WHEN I **COULD** HAVE, BUT I **DIDN'T**--AND NOW --UNCLE BEN-- IS DEAD...



AND A LEAN, SILENT FIGURE SLOWLY FADES INTO THE GATHERING DARKNESS, AWARE AT LAST THAT IN THIS WORLD, WITH GREAT POWER THERE MUST ALSO COME -- GREAT RESPONSIBILITY!



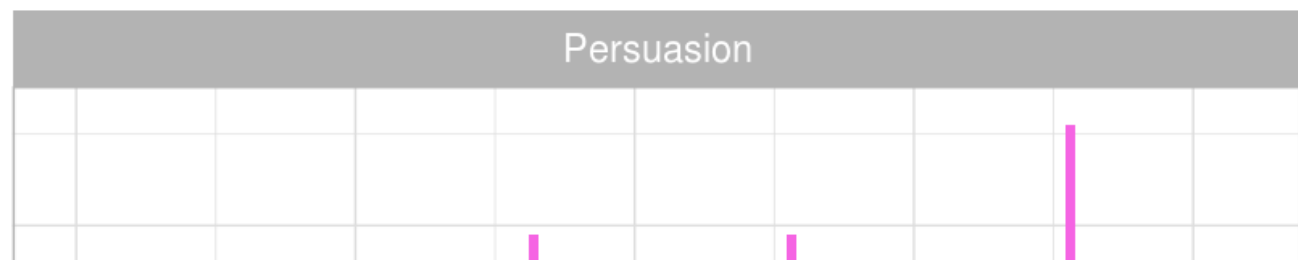
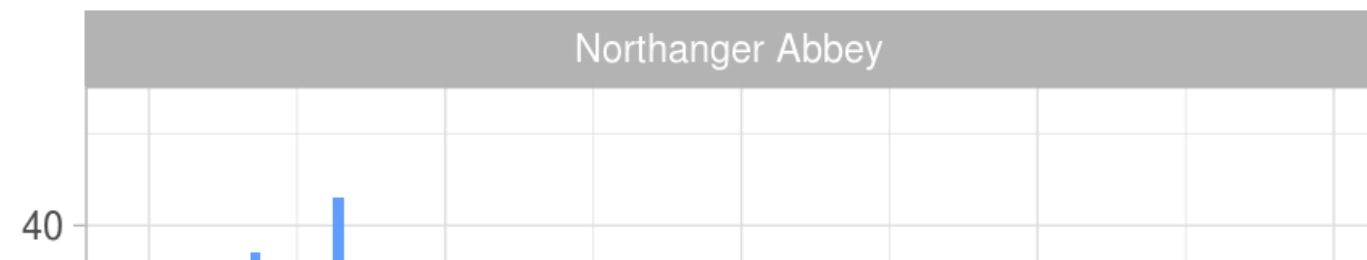
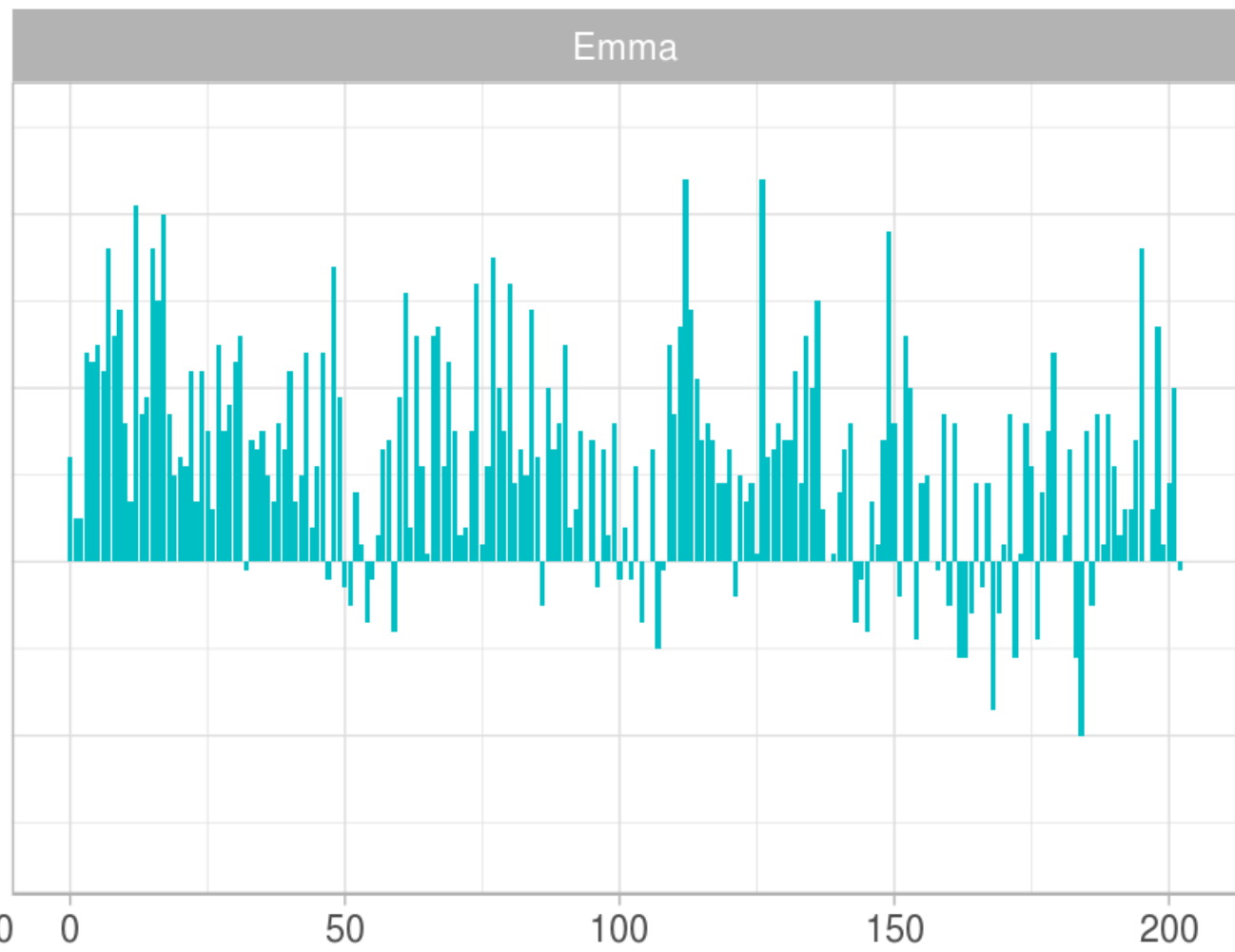
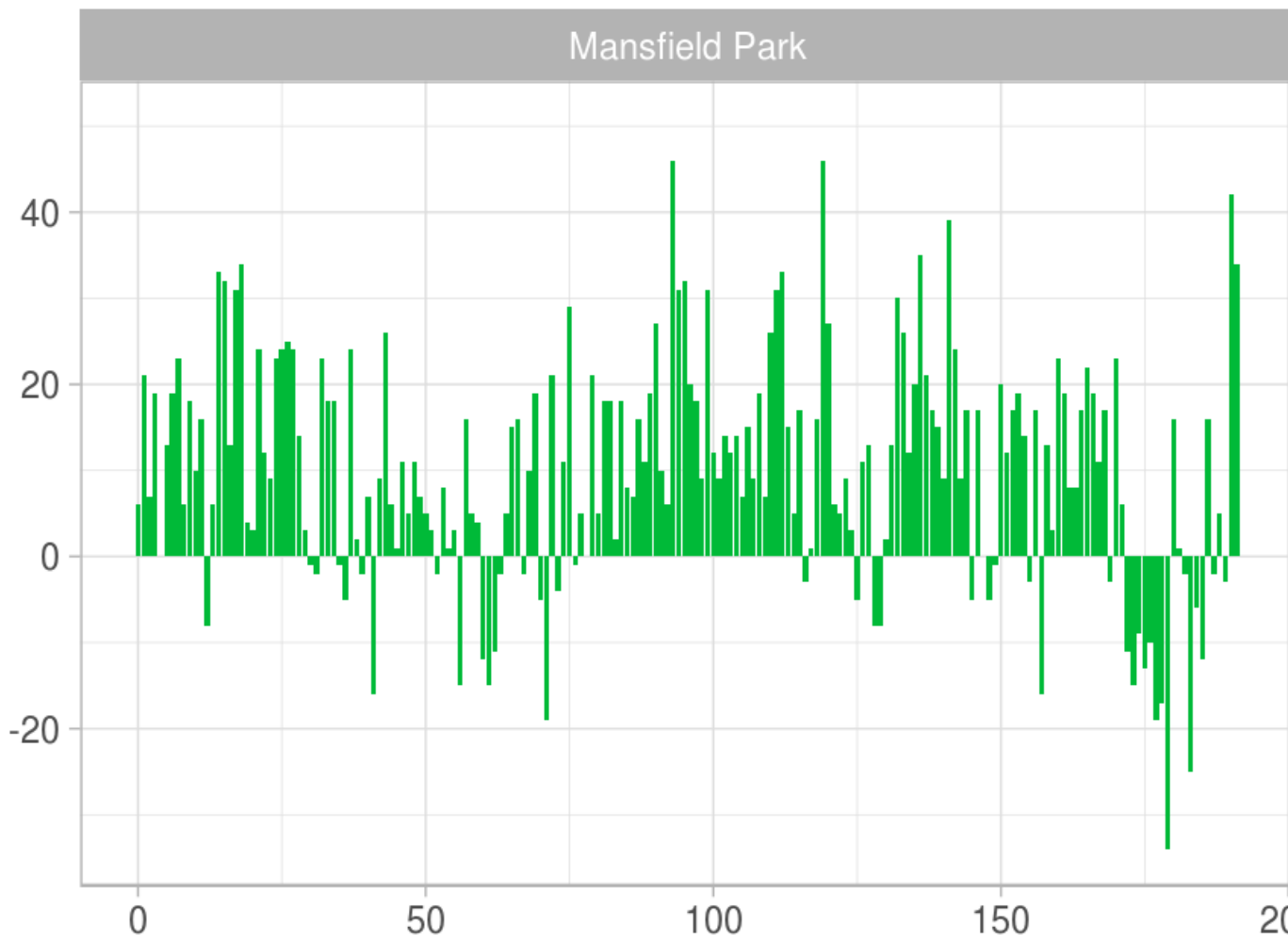
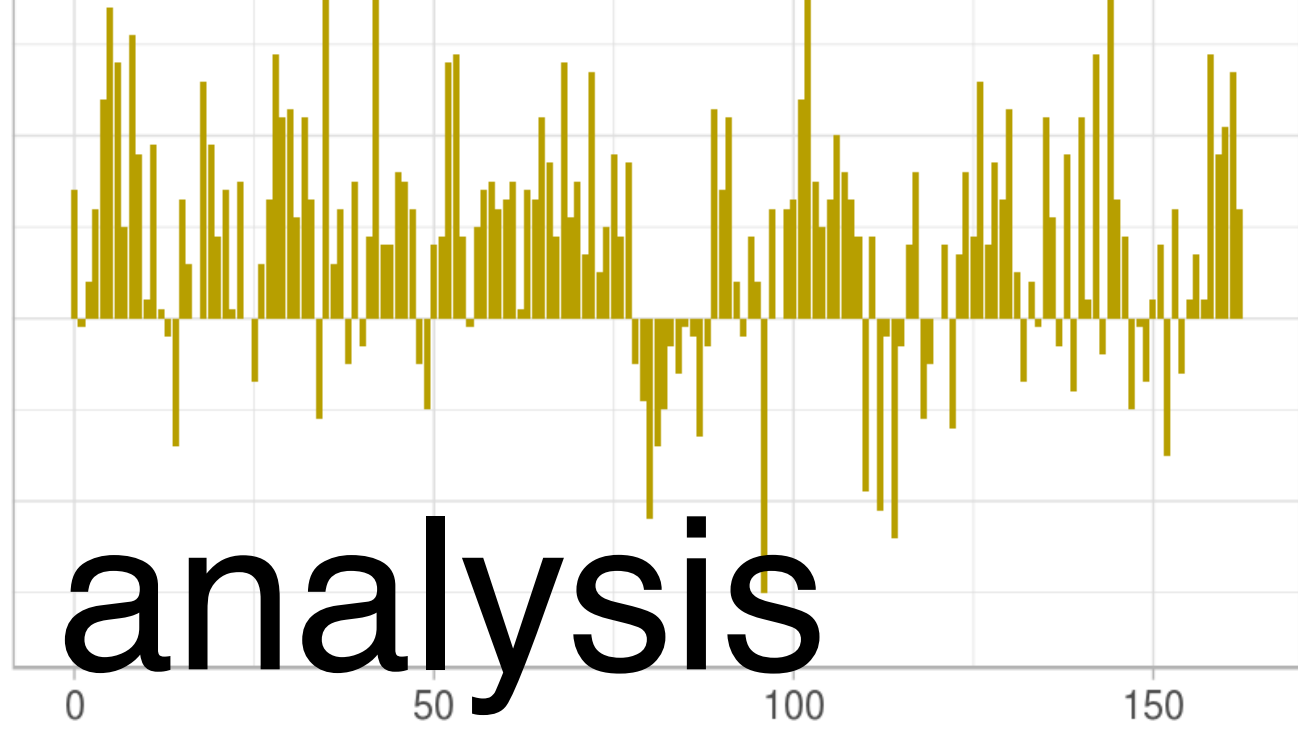
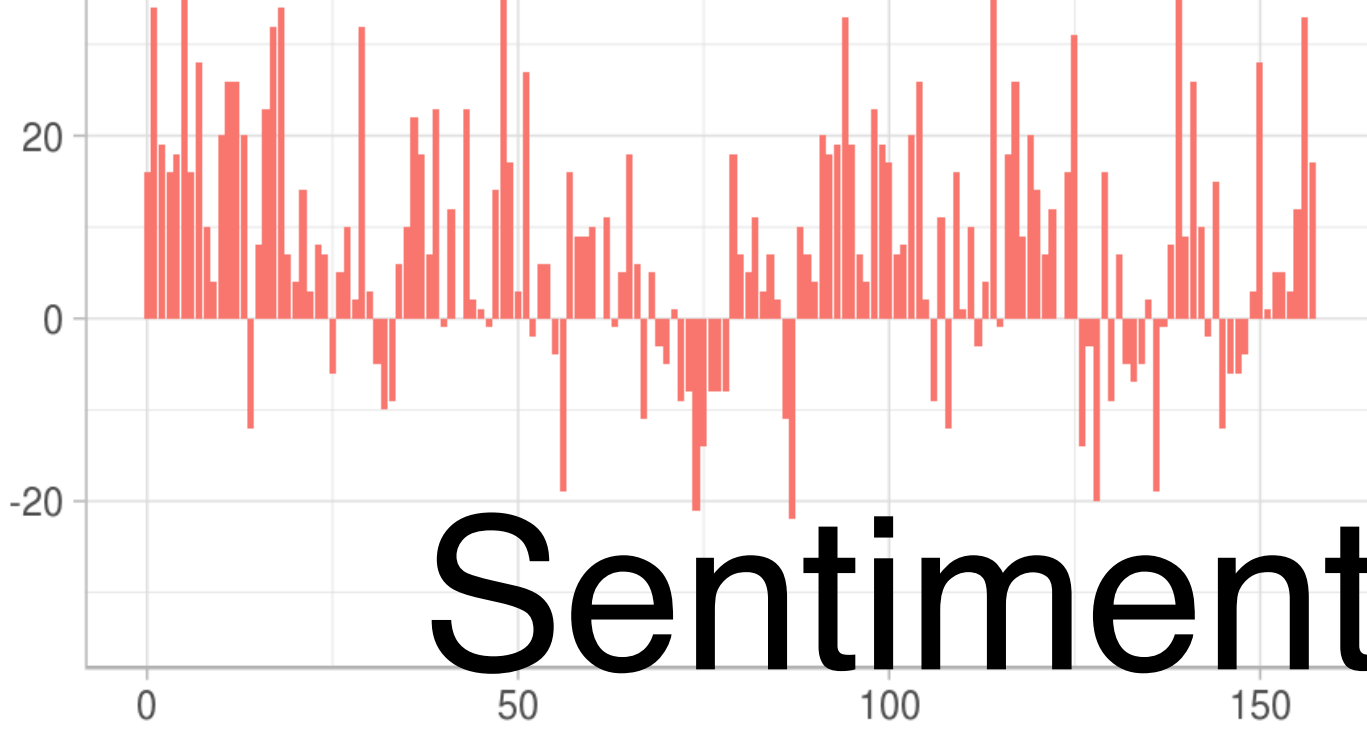
AND SO A LEGEND IS BORN AND A NEW NAME IS ADDED TO THE ROSTER OF THOSE WHO MAKE THE WORLD OF FANTASY THE MOST EXCITING REALM OF ALL!

A street scene with steam rising from a manhole. In the foreground, there are orange and white striped construction barriers with the 'conEdison' logo. To the right, a yellow taxi is partially visible. In the background, a 'RAISE PLOW' sign is mounted on a utility pole. The text 'Who owns the data you thought of?' is overlaid in the center of the image.

Who owns the data you
thought of?

How were humans
involved in the
gathering process?

Sentiment analysis



When I fed it "I'm Christian" it said the statement was positive:

Text: i'm christian

Sentiment: 0.10000000149011612

When I fed it "I'm a Sikh" it said the statement was even more positive:

Text: i'm a sikh

Sentiment: 0.30000001192092896

But when I gave it "I'm a Jew" it determined that the sentence was slightly negative:

Text: i'm a jew

Sentiment: -0.20000000298023224

The problem doesn't seem confined to religions. It similarly thought statements about being homosexual or a gay black woman were also negative:

Text: i'm a gay black woman

Sentiment: -0.30000001192092896

Text: i'm a straight french bro

Sentiment: 0.20000000298023224

Being a dog? Neutral. Being homosexual? Negative:

Text: i'm a dog

Sentiment: 0.0

Text: i'm a homosexual

Sentiment: -0.5

Text: i'm a homosexual dog

Sentiment: -0.6000000238418579

Being a dog? Neutral. Being homosexual? Negative:

Text: i'm a dog

Sentiment: 0.0

Where did this data come
from?

Text: i'm a homosexual

Sentiment: -0.5

Text: i'm a homosexual dog

Sentiment: -0.6000000238418579

Update 10/25/17 3:53 PM: A Google spokesperson [responded](#) to Motherboard's request for comment and issued the following statement: "We dedicate a lot of efforts to making sure the NLP API avoids bias, but we don't always get it right. This is an example of one of those times, and we are sorry. We take this seriously and are working on improving our models. We will correct this specific case, and, more broadly, building more inclusive algorithms is crucial to bringing the benefits of machine learning to everyone."

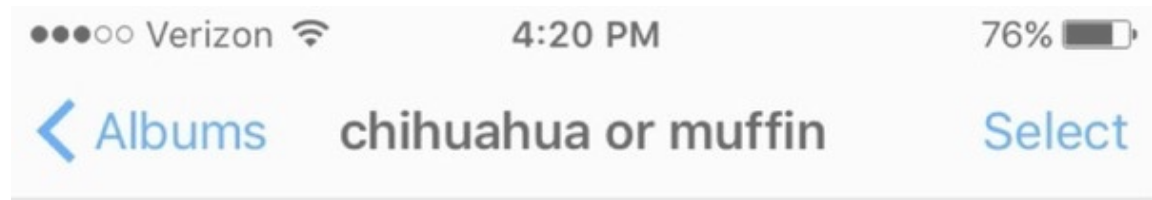


Image recognition



Jacky Alcine

@jackyalcine

Follow



Google Photos, y'all fucked up. My friend's not a gorilla.



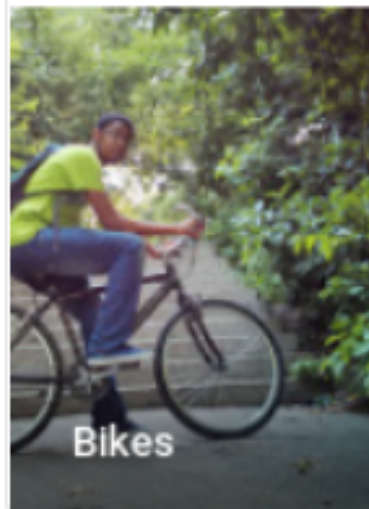
Skyscrapers



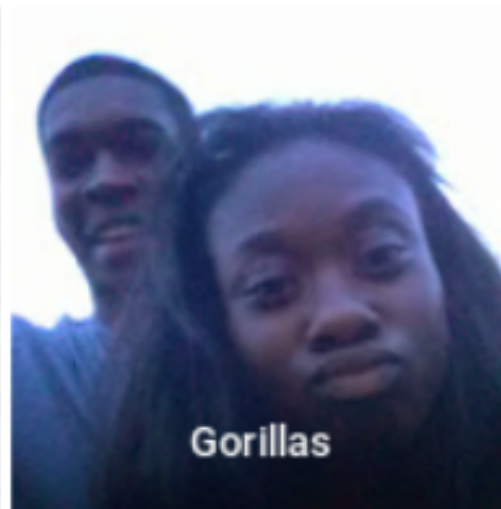
Airplanes



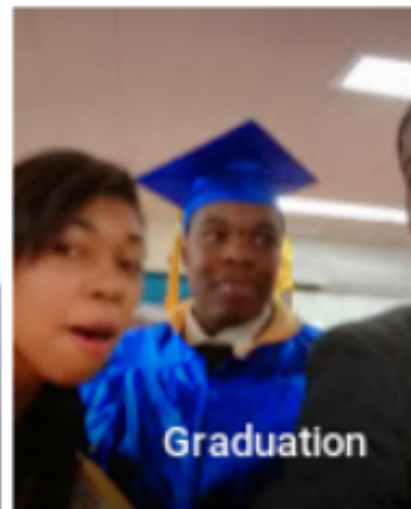
Cars



Bikes



Gorillas



Graduation

7:22 PM - 28 Jun 2015

3,174 Retweets 2,026 Likes



223



3.2K



2.0K



Molly Mulshine. A major flaw in Google's algorithm allegedly tagged two black people's faces with the word 'gorillas' <http://www.businessinsider.com/google-tags-black-people-as-gorillas-2015-7>



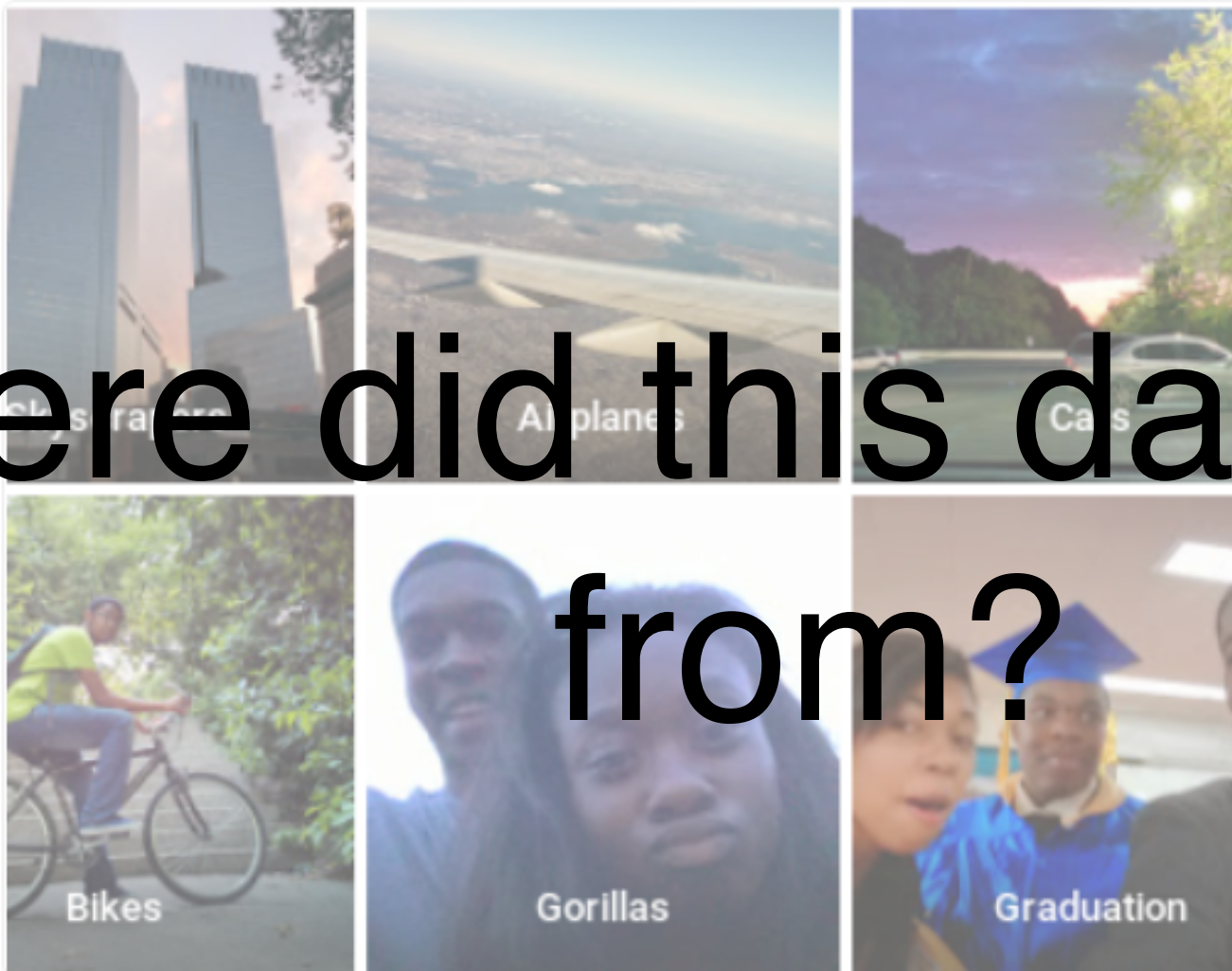
Jacky Alcine

@jackyalcine

Follow



Google Photos, y'all fucked up. My friend's not a gorilla.



Where did this data come from?

7:22 PM - 28 Jun 2015

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223

3.2K



2.0K



Prediction/ Classification





Bernard Parker, left, was rated high risk; Dylan Fugett was rated low risk. (Josh Ritchie for ProPublica)

Machine Bias

There's software used across the country to predict future criminals. And it's biased against blacks.

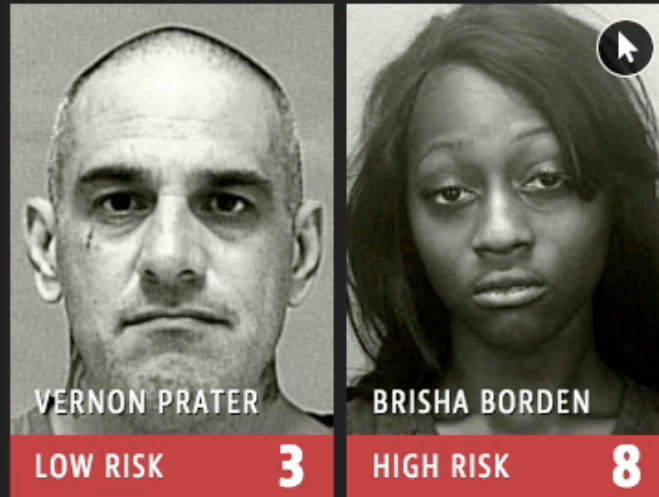
by Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, ProPublica

May 23, 2016

Arizona, Colorado, Delaware, Kentucky, Louisiana, Oklahoma, Virginia, Washington and Wisconsin, the results of such assessments are given to judges during criminal sentencing.

Rating a defendant's risk of future crime is often done in conjunction with an evaluation of a defendant's rehabilitation needs. The Justice Department's National Institute of Corrections now encourages the use of such combined assessments at every stage of the criminal justice process. And a landmark sentencing **reform bill** currently pending in Congress would mandate the use of such assessments in federal prisons.

Two Petty Theft Arrests



Borden was rated high risk for future crime after she and a friend took a kid's bike and scooter that were sitting outside. She did not reoffend.

In 2014, then U.S. Attorney General Eric Holder warned that the risk scores might be injecting bias into the courts. He called for the U.S. Sentencing Commission to study their use. "Although these measures were crafted with the best of intentions, I am concerned that they inadvertently undermine our efforts to ensure individualized and equal justice," he said, adding, "they may exacerbate unwarranted and unjust disparities that are already far too common in our criminal justice system and in our society."

The sentencing commission did not, however, launch a study of risk scores. So ProPublica did, as part of a larger examination of the powerful, largely

hidden effect of algorithms in American life.

We obtained the risk scores assigned to more than 7,000 people arrested in Broward County, Florida, in 2013 and 2014 and checked to see how many were charged with new crimes over the next two years, the **same benchmark used** by the creators of the algorithm.

The score proved remarkably unreliable in forecasting violent crime: Only 20 percent of the people predicted to commit violent crimes actually went on to do so.

When a full range of crimes were taken into account — including misdemeanors such as driving with an expired license — the algorithm was somewhat more accurate than a coin flip. Of those deemed likely to re-offend, 61 percent were arrested for any subsequent crimes within two years.

We also turned up significant racial disparities, just as Holder feared. In forecasting who would re-offend, the algorithm made mistakes with black and white defendants at

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Where did this data come from?



MACHINE BIAS



Facebook (Still) Letting Housing Advertisers Exclude Users by Race

After ProPublica revealed last year that Facebook advertisers could target housing ads to whites only, the company announced it had built a system to spot and reject discriminatory ads. We retested and found major omissions.

by Julia Angwin, Ariana Tobin and Madeleine Varner, Nov. 21, 2017, 1:23 p.m. EST



Facebook CEO Mark Zuckerberg speaks in San Jose, California, in October 2016. (David Paul Morris/Bloomberg via Getty Images)

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FEATURE

Policing the Future

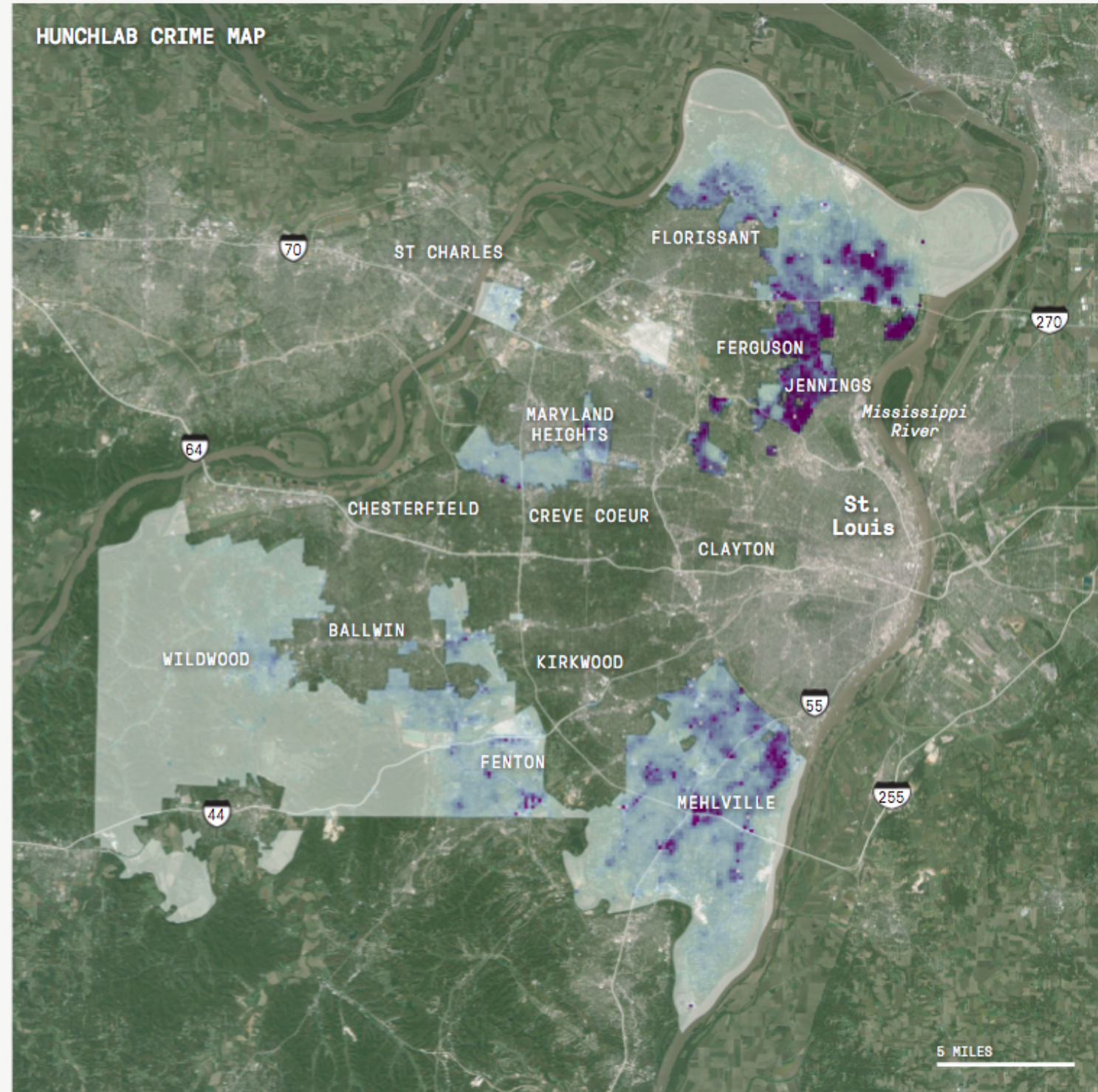
In the aftermath of Michael Brown's death, St. Louis cops embrace crime-predicting software.



Maurice Chammah, with additional reporting by Mark Hansen. Policing the Future.
<https://www.themarshallproject.org/2016/02/03/policing-the-future>

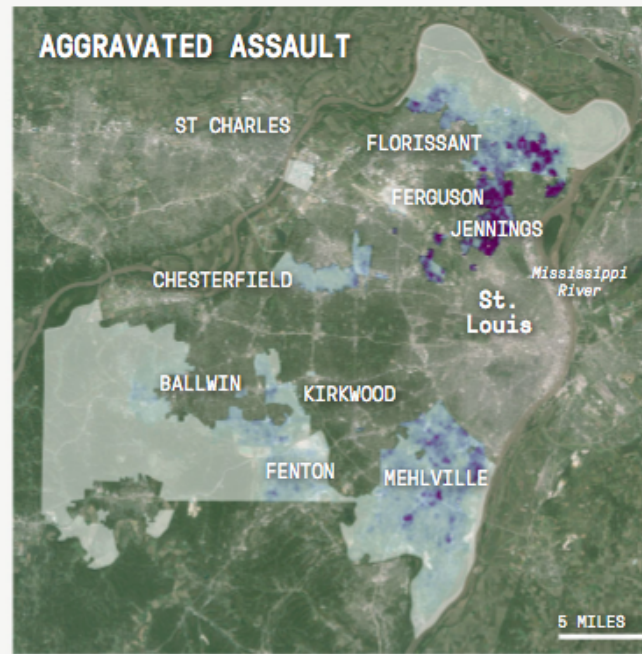
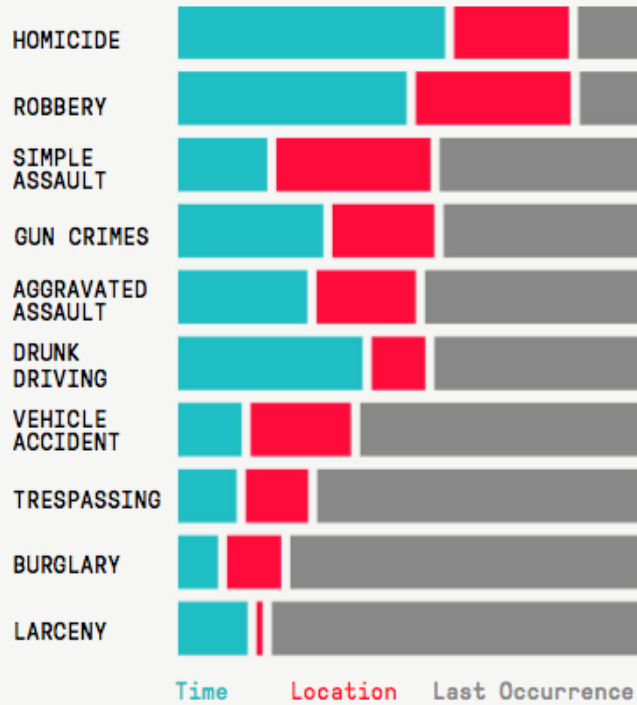
Where the St. Louis County Police Patrol

Dozens of small, local municipal agencies handle policing in parts of St. Louis County. The St. Louis County Police Department covers areas not policed by the "munis," including the city of Jennings, Mo. The **DARKER AREAS** in the map show the areas within their jurisdiction that HunchLab has identified as high risk.

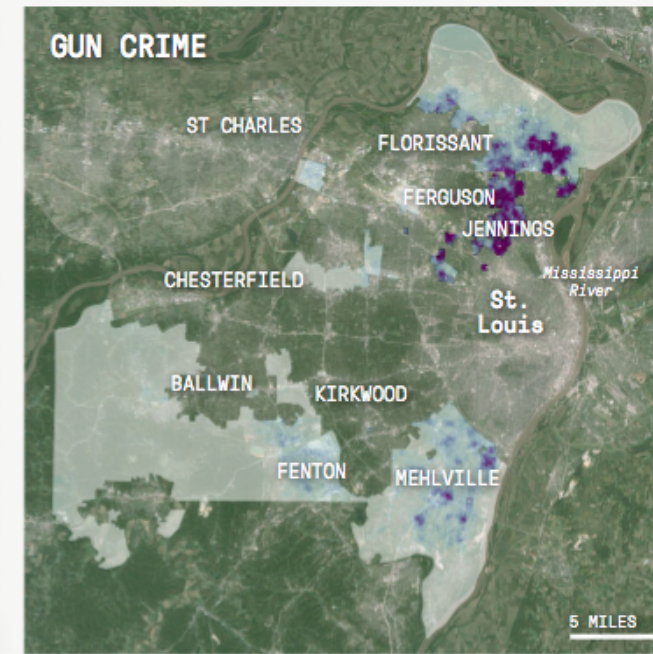


SOURCE: HUNCHLAB

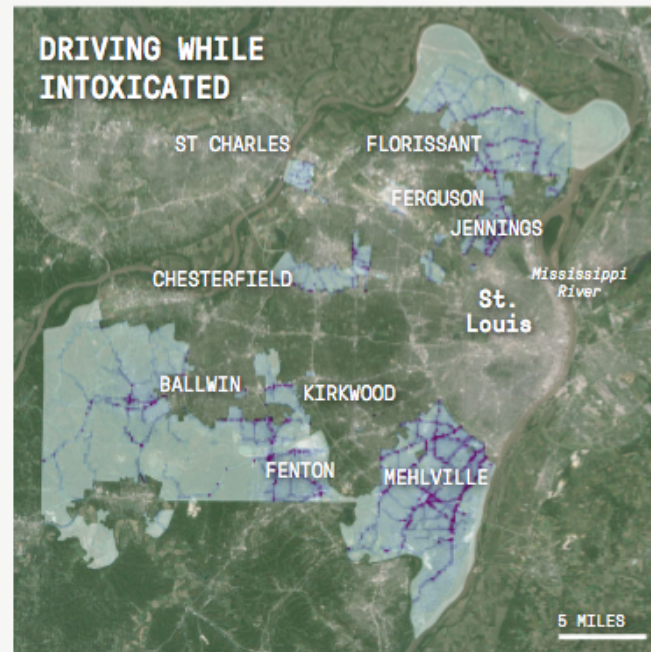
In St. Louis, the HunchLab algorithm took the 10 crimes that the police department had selected, calculated the risk-level for each, and combined them to determine where patrols would have the most impact.



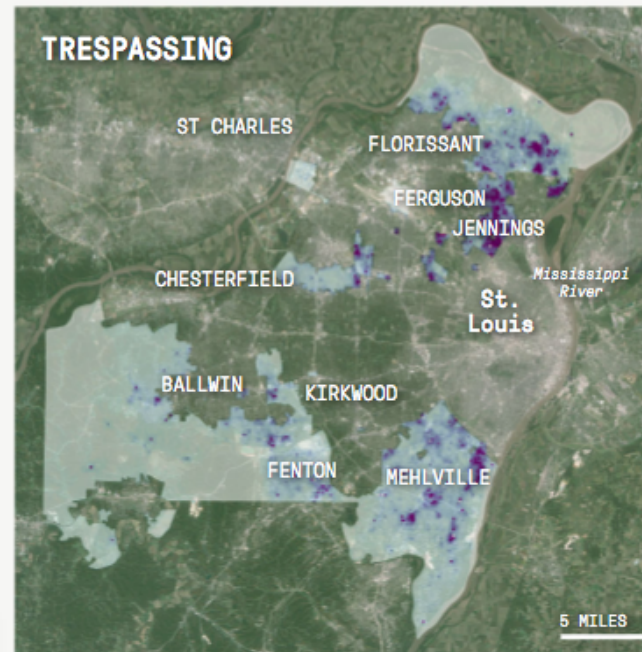
Aggravated assault (assault with a dangerous weapon) makes up 18.5 percent of the overall risk score assigned to a cell. The darkest regions on this map represent cells with a 1 in 320 chance of at least one aggravated assault taking place there during the shift.



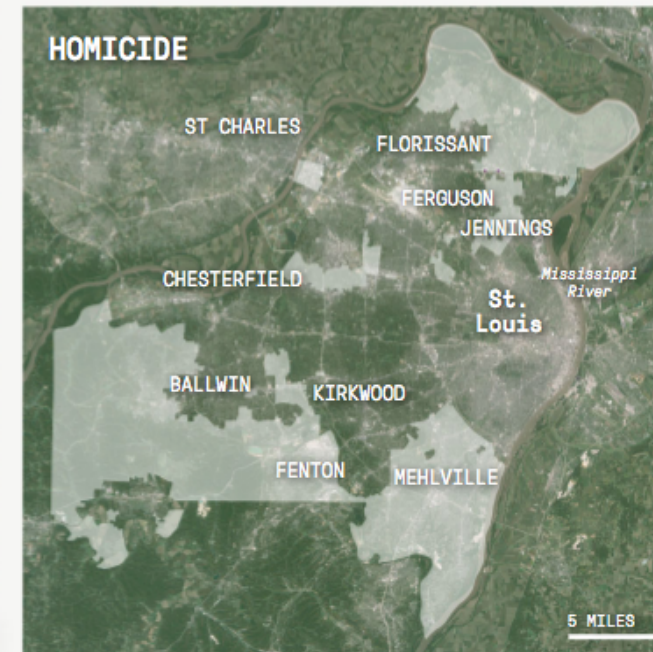
Gun crime (all homicides, robberies, and aggravated assaults with a firearm) makes up about 16.5 percent of the overall risk score. The darkest regions represent a 1 in 850 chance of at least one gun crime taking place.



Driving while intoxicated makes up 10 percent of the total risk score. The darkest regions represent a 1 in 1,300 chance of at least one DWI taking place.



Trespassing makes up about 10 percent of the total risk score. The darkest regions represent cells a 1.7 percent chance of at least one act of trespassing taking place.

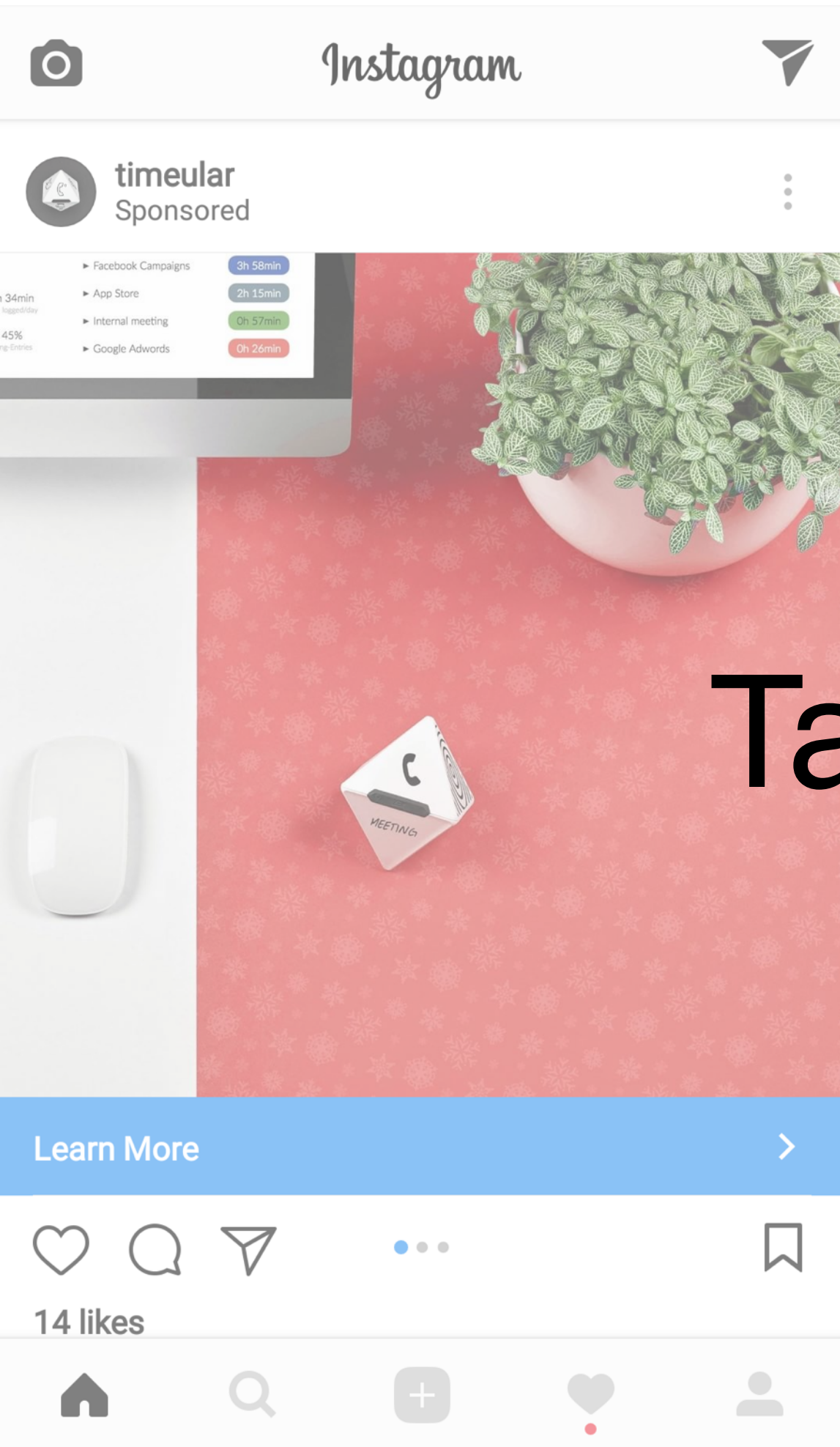


Homicides make up 0.66 percent of the total risk score assigned to a cell. The two darkest cells on this map present a 3 percent chance of at least one homicide taking place.

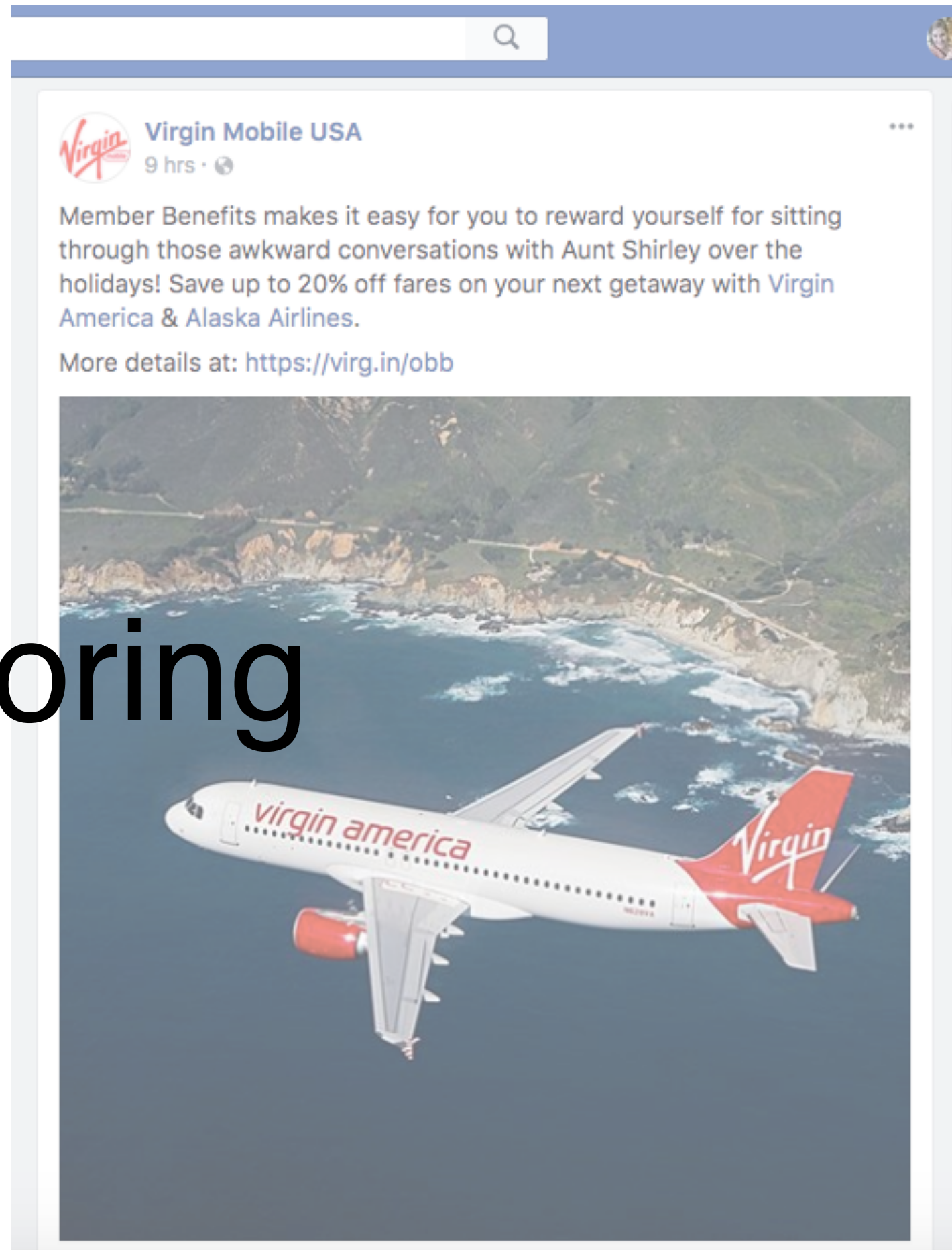
SOURCE: HUNCHLAB

Maurice Chammah, with additional reporting by Mark Hansen. Policing the Future.

<https://www.themarshallproject.org/2016/02/03/policing-the-future>



Tailoring



Racial bias alleged in Google's ad results

Names associated with blacks prompt link to arrest search



Ad related to latanya sweeney ⓘ

Latanya Sweeney Truth
www.instantcheckmate.com/
Looking for **Latanya Sweeney**? Check **Latanya Sweeney's Arrests**.

Ads by Google

Latanya Sweeney, Arrested?
1) Enter Name and State. 2) Access Full Background Checks Instantly.
www.instantcheckmate.com/

Latanya Sweeney
Public Records Found For: Latanya Sweeney. View Now.
www.publicrecords.com/

La Tanya
Search for La Tanya Look Up Fast Results now!
www.ask.com/La+Tanya

(c)

checkmate

LATANYA SWEENEY
1420 Centre Ave
Pittsburgh, PA 15219
DOB: Oct 27, 1959 (53 years old)

Criminal History
This section contains positive criminal, arrest, and criminal records for the subject of this report. While our database does contain hundreds of millions of arrest records, different countries have different rules regarding what information they will and will not release. We share with you as much information as we possibly can, but a clean state here should not be interpreted as a guarantee that Latanya Sweeney has never been arrested. Cleanly means that we were not able to locate any matching arrest records in the data that is available to us.

Possible Matching Arrest Records

| Name | County and State | Offense | View Details |
|--|------------------|---------|--------------|
| No matching arrest records were found. | | | |

(d)

LATANYA SWEENEY

Web page results of ads that appeared on-screen when Harvard professor Latanya Sweeney typed her name in a google search. Ads featured services for arrest records. Sweeney conducted a study that concluded searches with "black sounding" names are more likely to get results with ads for arrests records and other negative information.

By [Hiawatha Bray](#) | GLOBE STAFF FEBRUARY 06, 2013

(limited) transparency from companies

Your information Close ^

About you **Your categories**

The categories in this section help advertisers reach people who are most likely to be interested in their products, services, and causes. We've added you to these categories based on information you've provided on Facebook and other activity.

- Birthday in April
- Away from family
- Away from hometown
- US politics (very liberal)
- Gmail users
- Close friends of expats
- Facebook access (mobile): smartphones and tablets
- African American (US)
- Facebook access (mobile): Samsung Android mobil... devices
- Frequent Travelers
- Android: 360 degree media supported
- Facebook access (mobile)

[See More](#)

Ads Personalization

Make the ads you see more useful to you when using Google services (ex. Search, YouTube).

TOPICS YOU LIKE TOPICS YOU DON'T LIKE (0)

Remove topics you don't like and add ones you do to make the ads you see more useful to you. Topics will also be added as you use some Google services (ex: when you watch a video on YouTube). We're working to include topics from other Google services.

| | | |
|----------------------------------|---------------------------|-------------------------|
| Arts & Entertainment | Autos & Vehicles | Beauty & Fitness |
| Blues | Books & Literature | Business & Industrial |
| Business & Productivity Software | Business News | Cats |
| Classical Music | Comics & Animation | Computers & Electronics |
| Cooking & Recipes | Coupons & Discount Offers | Credit Cards |
| Cycling | Education | Enterprise Technology |
| Fashion & Style | Finance | Fitness |
| Folk & Traditional Music | Food & Drink | Hair Care |

[+ NEW TOPIC](#) [VIEW 23 MORE](#)

<https://www.facebook.com/ads/preferences>

<https://adssettings.google.com/authenticated>

What do others think of you?

See a profile of what your browsing history suggests about you. Paste URLs from your web history into the box below. (Help)

Browsing history

Submit

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This service is currently under development. Stay tuned...

data releases contain many more fields. It was found that 87% (216 million of 248 million) of the population in the United States had reported characteristics that likely made them unique based only on {5-digit ZIP, gender, date of birth}. About half of the U.S. population (132 million of 248 million or 53%) are likely to be uniquely identified by only {place, gender, date of birth}, where place is basically the city, town, or municipality in which the person resides. And even at the county level, {county, gender, date of birth} are likely to uniquely identify 18% of the U.S. population. In general, few characteristics are needed to uniquely identify a person.



How unique are you?

Enter your ZIP code, date of birth, and gender to see how unique you are (and therefore how easy it is to identify you from these values).

Date of Birth

Gender Male Female

5-digit ZIP

Submit

[About](#) | [Samples](#) | [Harvard](#) | [Harvard Multi Years](#)



Dr. Latanya Sweeney



Dr. Jake Porway





Adam Harvey **CVDAZZLE**
<https://cvdazzle.com/>



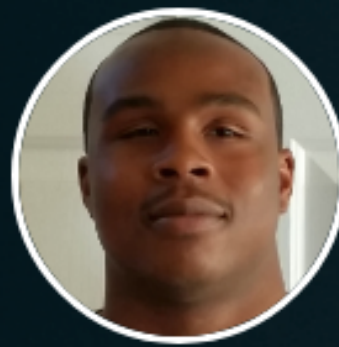
Data for Black Lives

Data as protest. Data as accountability. Data as collective action.

Sign up for more information.

Data for Black Lives seeks to mobilize scientists around racial justice issues. At our conference in November, we will convene over two hundred data scientists, computer programmers, racial justice activists, and elected officials to discuss the role that data can and should play in Black communities. Join us January 2019 at MIT for our second annual conference

The Team

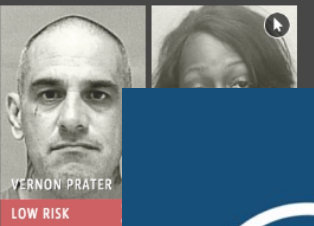




Journalists can be
data science
superheroes

Rating a defendant's risk of future crime is often done in conjunction with an evaluation of a defendant's rehabilitation needs. The Justice Department's National Institute of Corrections now encourages the use of such combined assessments at every stage of the criminal justice process. And a landmark sentencing reform bill currently pending in Congress would mandate the use of such assessments in federal prisons.

Two Petty Theft Arrests



In 2014, then U.S. Attorney General Eric Holder warned that the risk scores might be injecting bias into the courts. He called for the U.S. Sentencing Commission to study their use. "Although these measures were crafted with the best of intentions, I

Borden was rated high risk (took a kid's bike and scooter reoffend.

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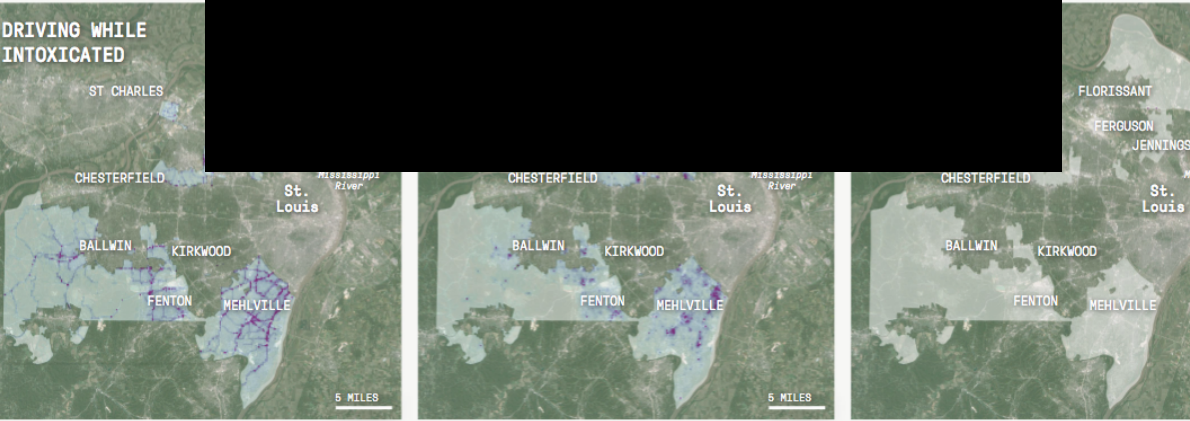
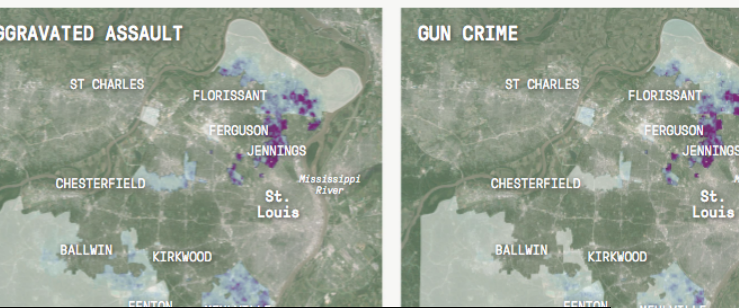
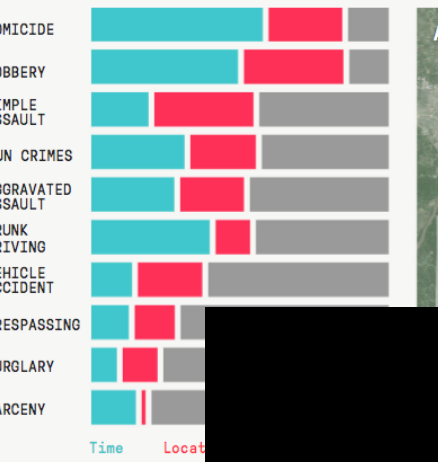
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the people predicted to commit violent crimes actually went on to do so.

When a full range of crimes were taken into account — including misdemeanors such as driving with an expired license — the algorithm was somewhat more accurate than a coin flip. Of those deemed likely to re-offend, 61 percent were arrested for any subsequent crimes within two years.

We also turned up significant racial disparities, just as Holder feared. In forecasting who would re-offend, the algorithm made mistakes with black and white defendants at roughly the same rate but in very different ways.



The New York Times



Driving while intoxicated makes up 10 percent of the total risk score. The darkest regions represent a 1 in 1,300 chance of at least one DWI taking place.

Trespassing makes up about 10 percent of the total risk score. The darkest regions represent cells a 1.7 percent chance of at least one act of trespassing taking place.

Homicides make up 0.66 percent of the total risk score assigned to a cell. The two darkest cells on this map present a 3 percent chance of at least one homicide taking place.

SOURCE: HUNCHLAB



How Trump Consultants Exploited the Facebook Data of Millions

Leer en español

By MATTHEW ROSENBERG, NICHOLAS CONFESSORE and CAROLE CADWALLADR MARCH 17, 2018



Racial bias alleged in Google's ad results

Names associated with black prompts prompt link to arrest search




The New York Times

The Boston Globe



Build diverse teams



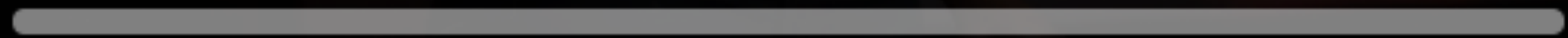
Jer Thorp. Turning Data Around.
<http://bit.ly/TurningDataAround>

1. Design data systems for the well-being of the people from whom the data is taken
2. Whenever possible, provide mechanisms for feedback
3. Honor the complexity of individual and community realities
4. Create real, functioning data publics



Joy Buolamwini *at* TEDxBeaconStreet

How I'm fighting bias in algorithms



8:44

Joy Buolamwini. How I'm fighting bias in algorithms.
<http://bit.ly/FightingBiasInAlgorithms>

Matt Mitchell. Cyber JimCrow: Virtual Public Housing and Poor Doors in Digital Security & Surveillance.
<https://vimeo.com/232659054>



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00:20



danah boyd & Kate Crawford

CRITICAL QUESTIONS FOR BIG DATA

Provocations for a cultural,
technological, and scholarly
phenomenon

The era of Big Data has begun. Computer scientists, physicists, economists, mathematicians, political scientists, bio-informaticists, sociologists, and other scholars are clamoring for access to the massive quantities of information produced by and about people, things, and their interactions. Diverse groups argue about the potential benefits and costs of analyzing genetic sequences, social media interactions, health records, phone logs, government records, and other digital traces left by people. Significant questions emerge. Will large-scale search data help us create better tools, services, and public goods? Or will it usher in a new wave of privacy incursions and invasive marketing? Will data analytics help us understand online communities and political movements? Or will it be used to track protesters and suppress speech? Will it transform how we study human communication and culture, or narrow the palette of research options and alter what 'research' means? Given the rise of Big Data as a socio-technical phenomenon, we argue that it is necessary to critically interrogate its assumptions and biases. In this article, we offer six provocations to spark conversations about the issues of Big Data: a cultural, technological, and scholarly phenomenon that rests on the interplay of technology, analysis, and mythology that provokes extensive utopian and dystopian rhetoric.

Keywords Big Data; analytics; social media; communication studies; social network sites; philosophy of science; epistemology; ethics; Twitter

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Technology is neither good nor bad; nor is it neutral . . . technology's interaction with the social ecology is such that technical developments frequently have environmental, social, and human consequences that go far beyond the immediate purposes of the technical devices and practices themselves. (Kranzberg 1986, p. 545)



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WEAPONS OF MATH DESTRUCTION



HOW BIG DATA INCREASES INEQUALITY
AND THREATENS DEMOCRACY

CATHY O'NEIL



Thank you

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Department of Computer & Information Sciences