Calling Bullshit

The Art of Skepticism in a Data-Driven World

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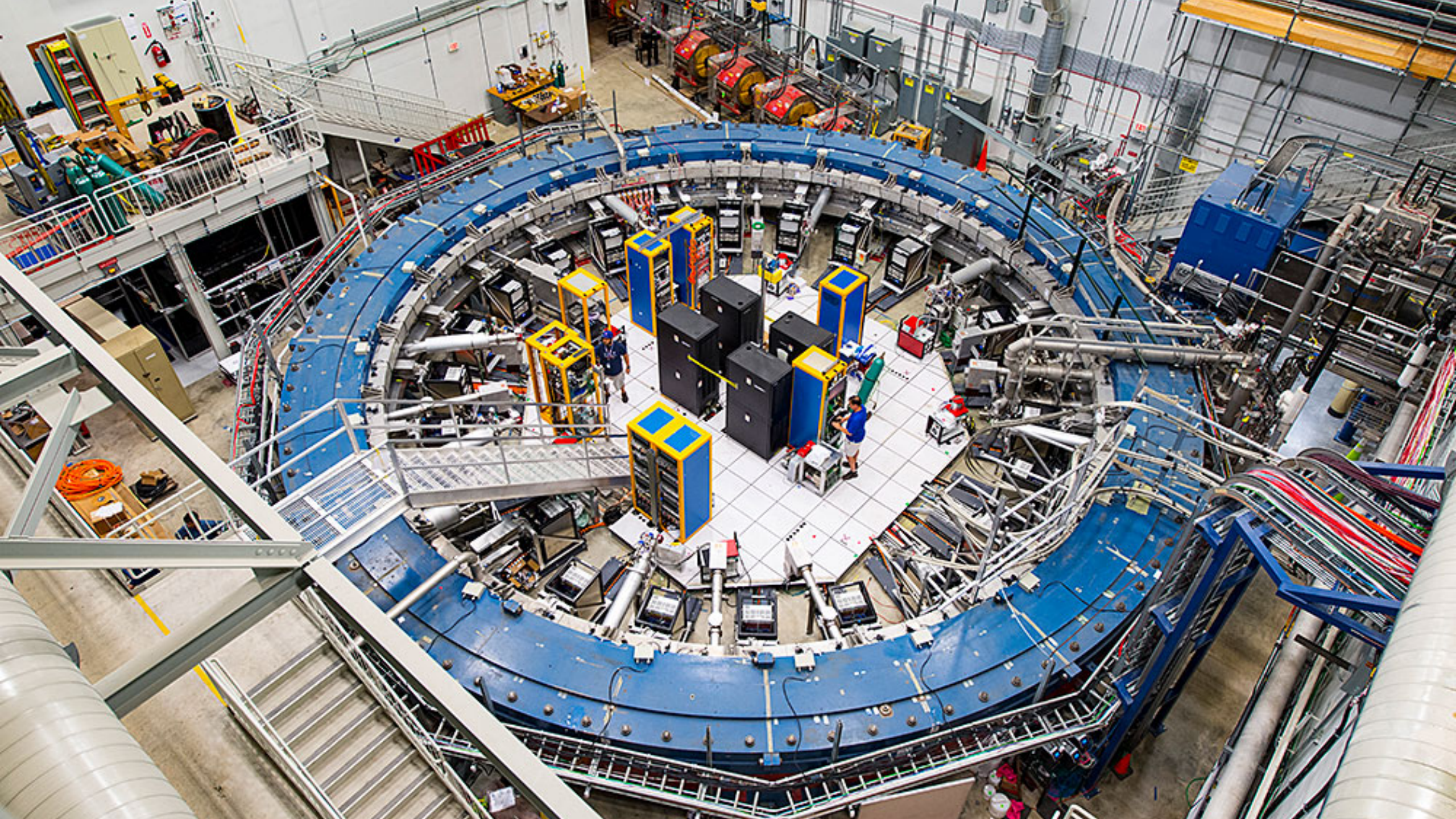
Fermilab

Fermilab Arts and Lecture Series, April 9, 2021



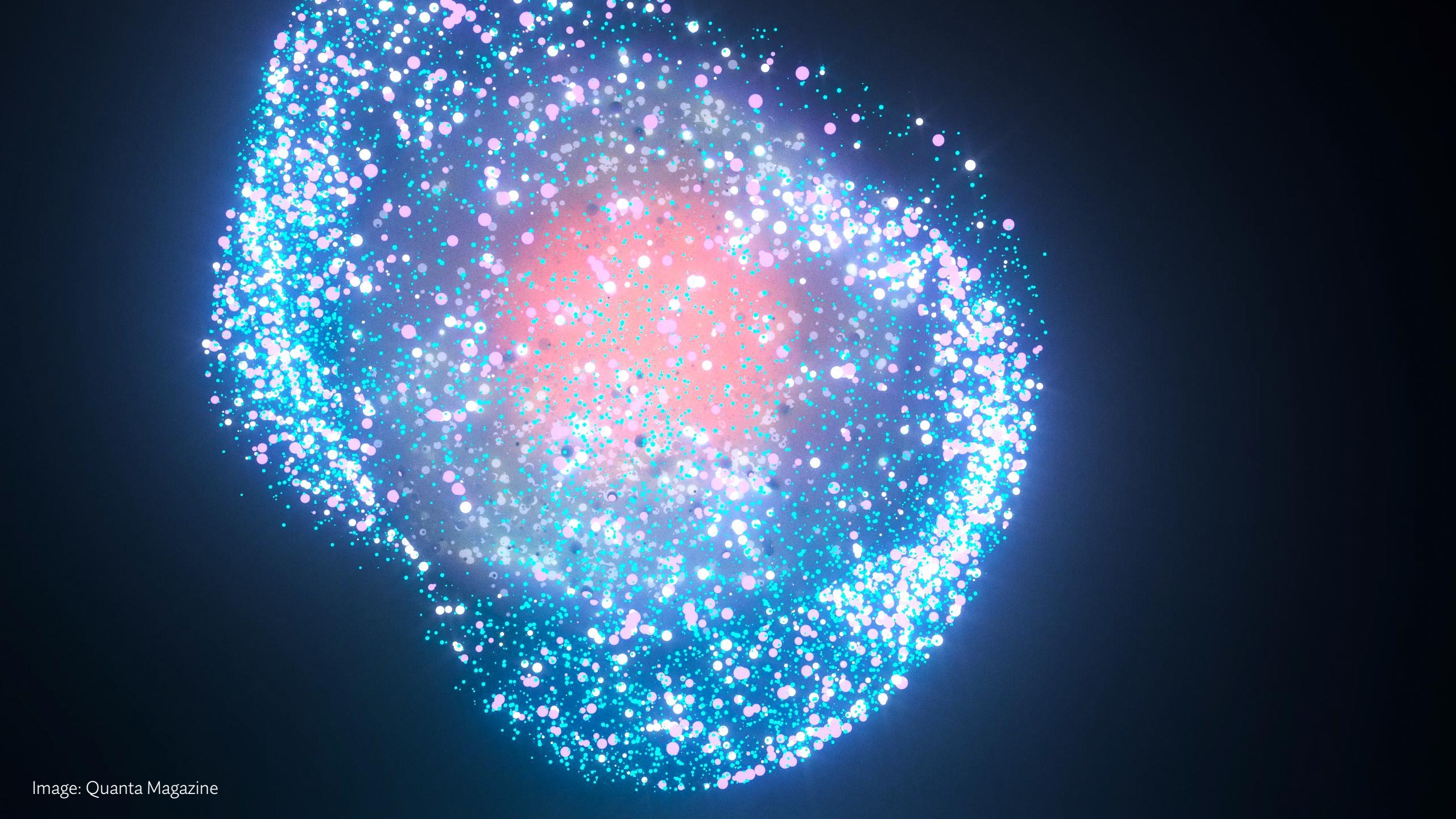


Image: Quanta Magazine

Research

Mapping Disinformation Spread across Online Communities

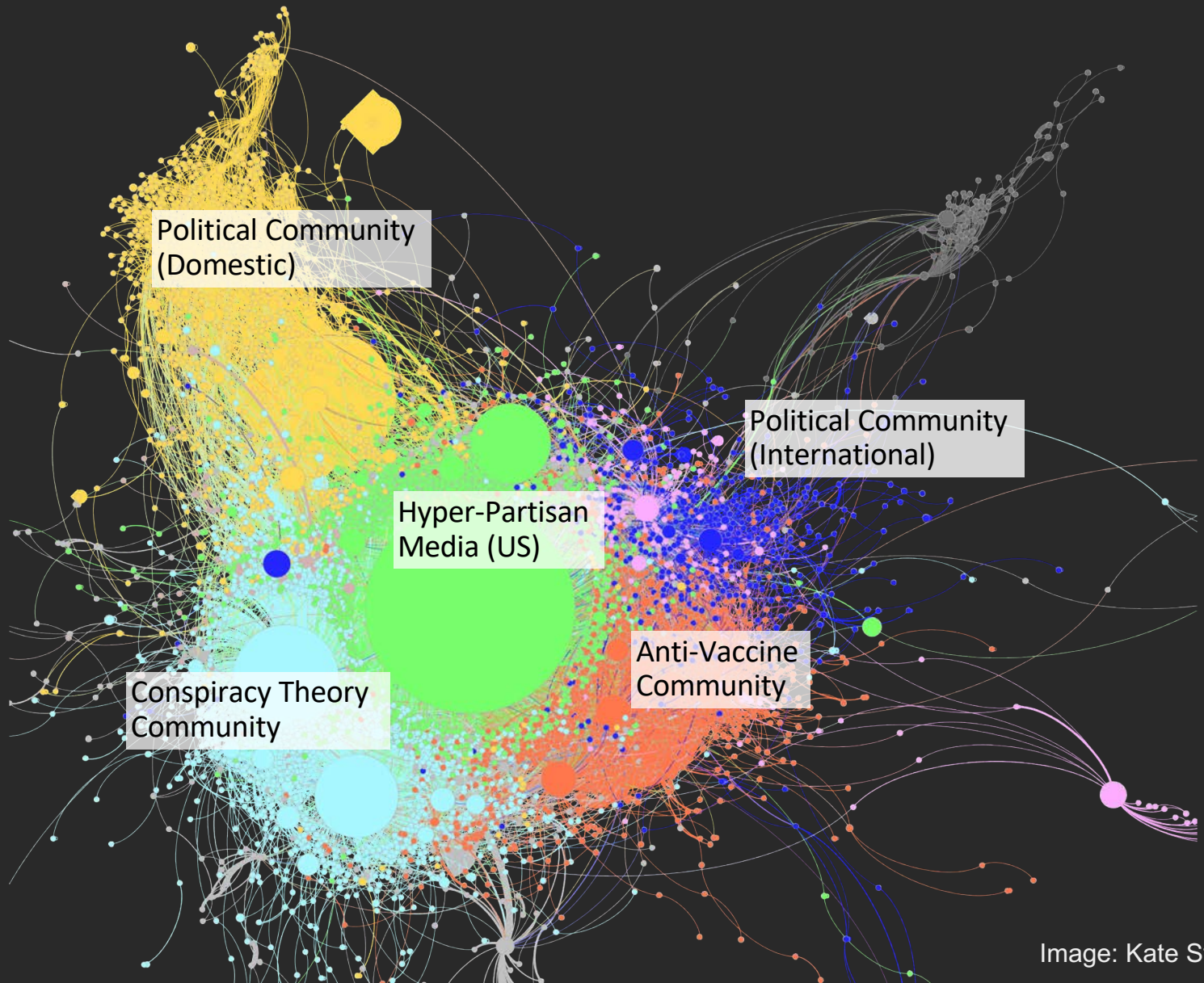


Image: Kate Starbird

We are inundated with information…

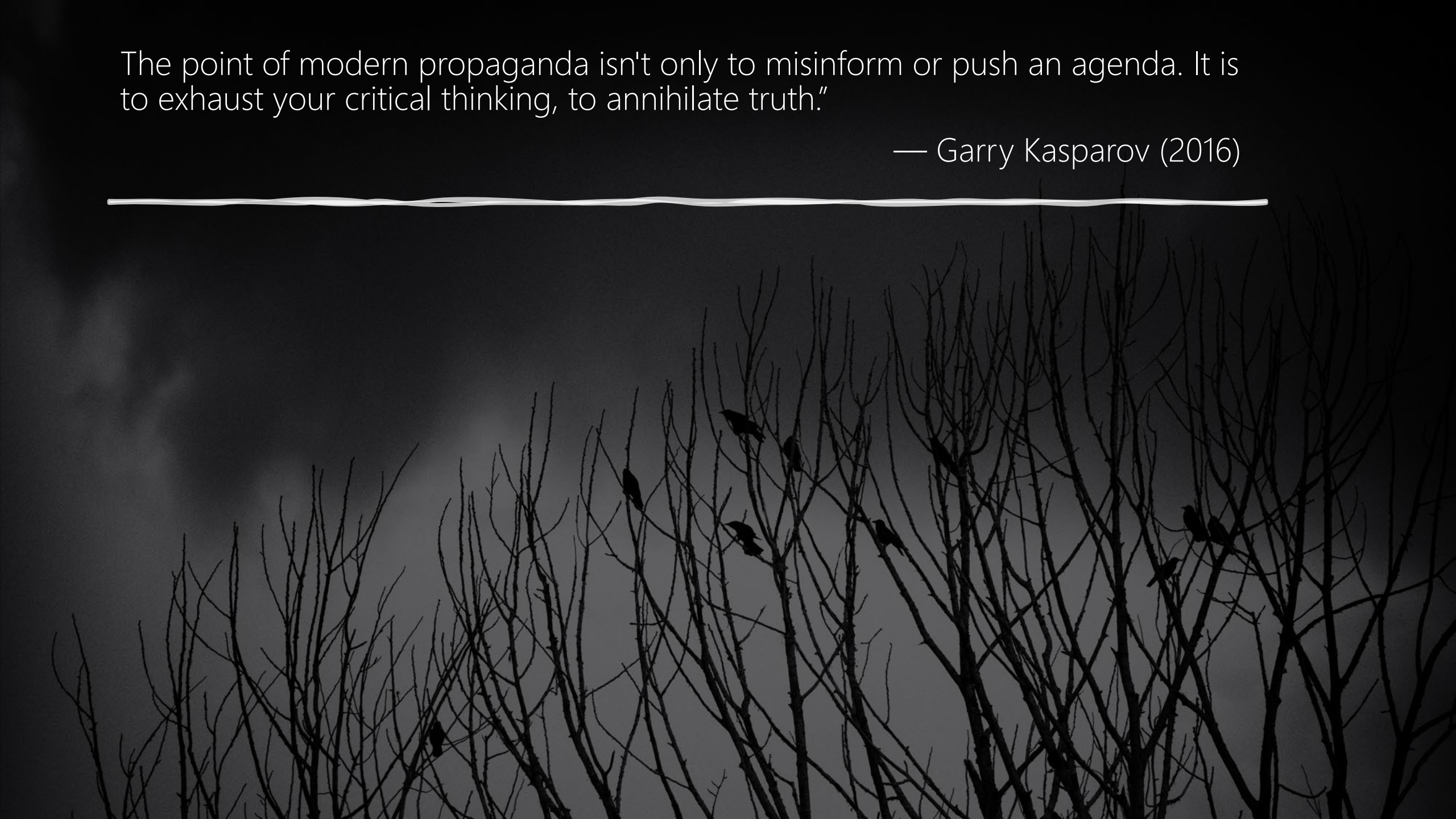
…and so much of it is bullshit.

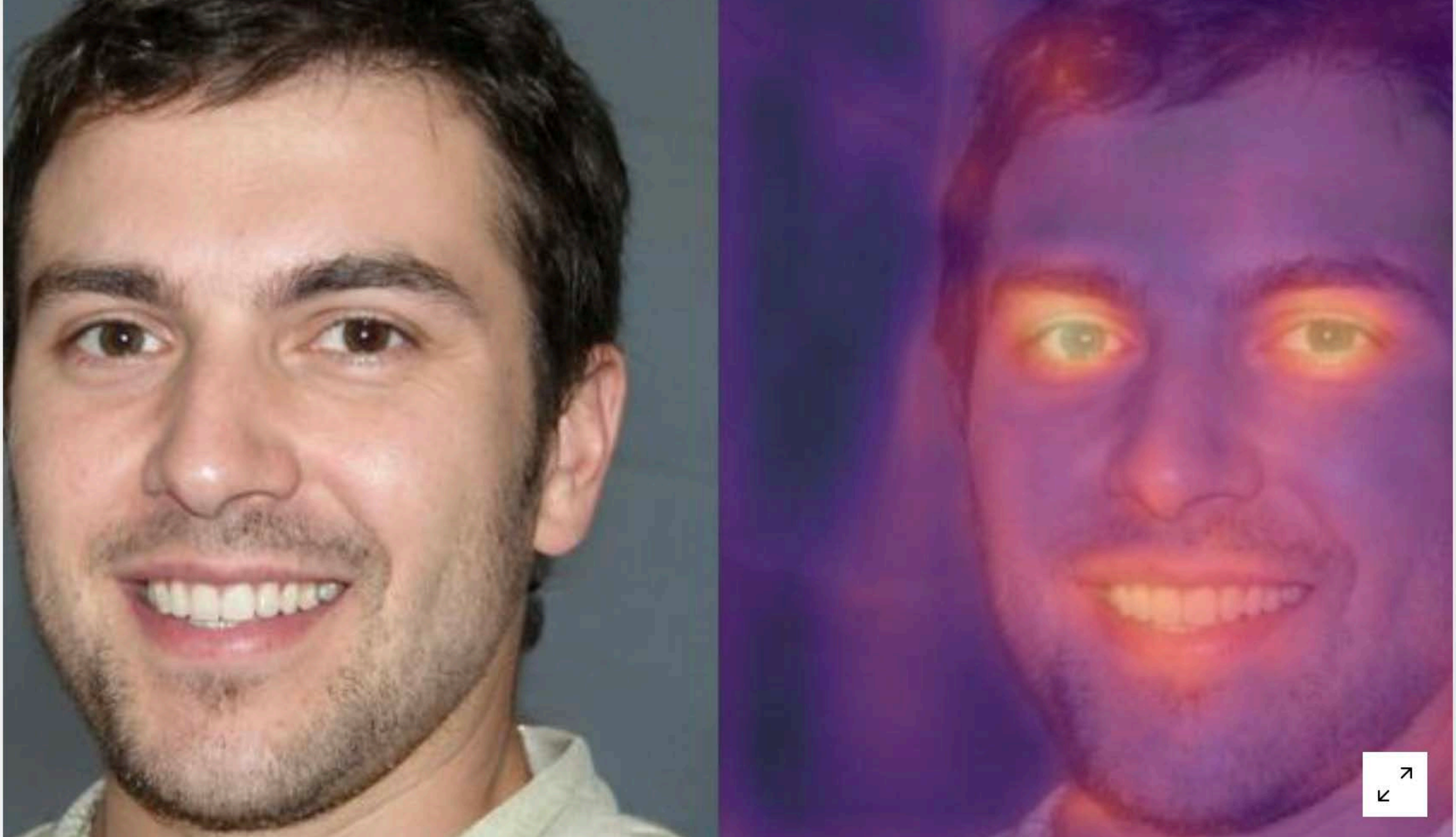
The consequences are profound.

Photo: Carl Bergstrom
And people don’t know who to trust.

The point of modern propaganda isn't only to misinform or push an agenda. It is to exhaust your critical thinking, to annihilate truth."

— Garry Kasparov (2016)





Erik Hinton
@erikhinton

This totally real Amazon employee has a totally real profile image and is not at all a GAN composite.

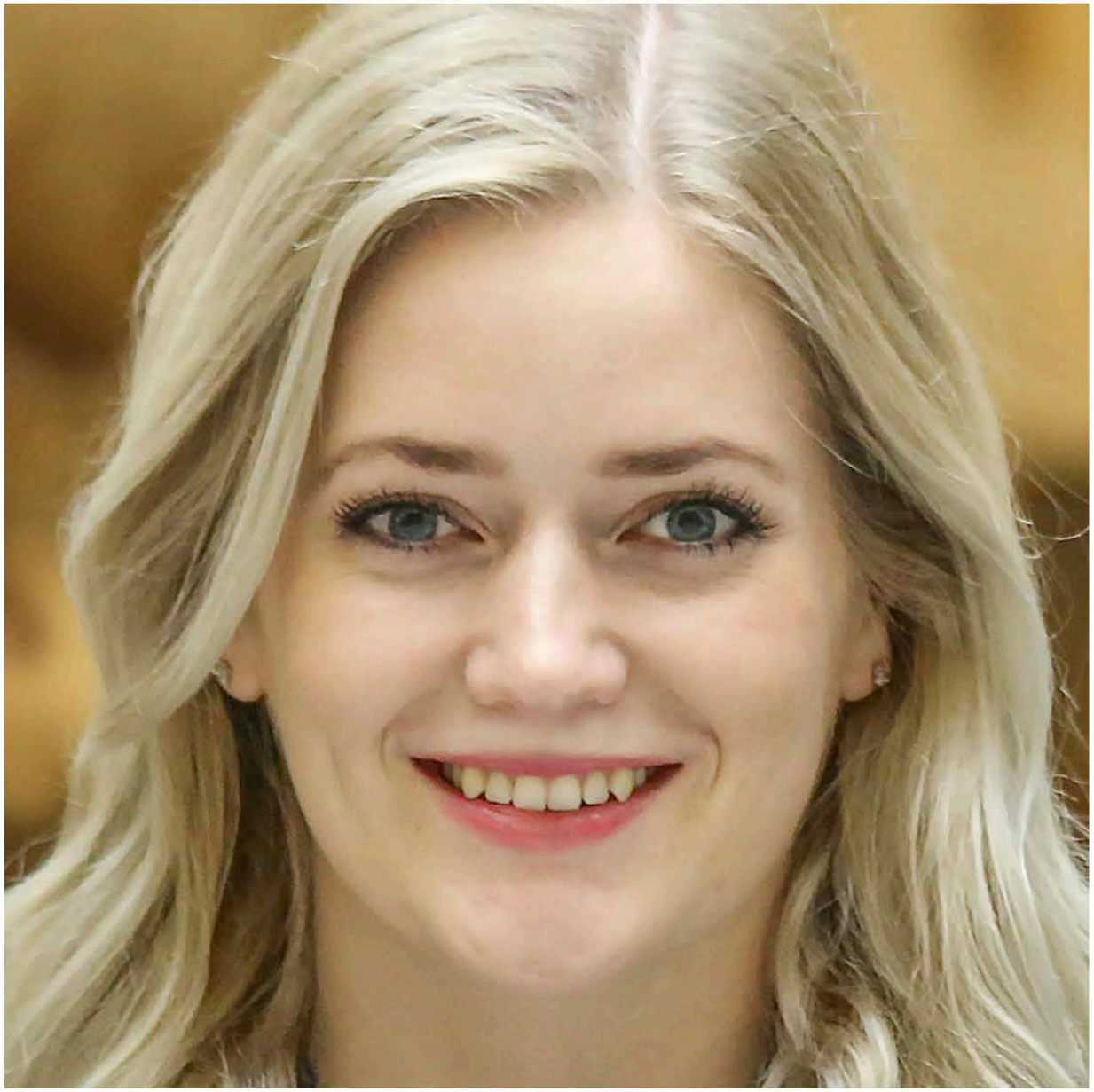
Lulu at CMH1 📦
@AmazonFCLulu

I'm beginning to worry that there's a problem with UTIs across the country, given how frequently many of you need a bathroom break?

You really should see doctors about that.

Which you can do if you work full time at an Amazon FC, since we get comprehensive health benefits!

3:24 PM · Mar 29, 2021 · Twitter Web App



whichfaceisreal.com

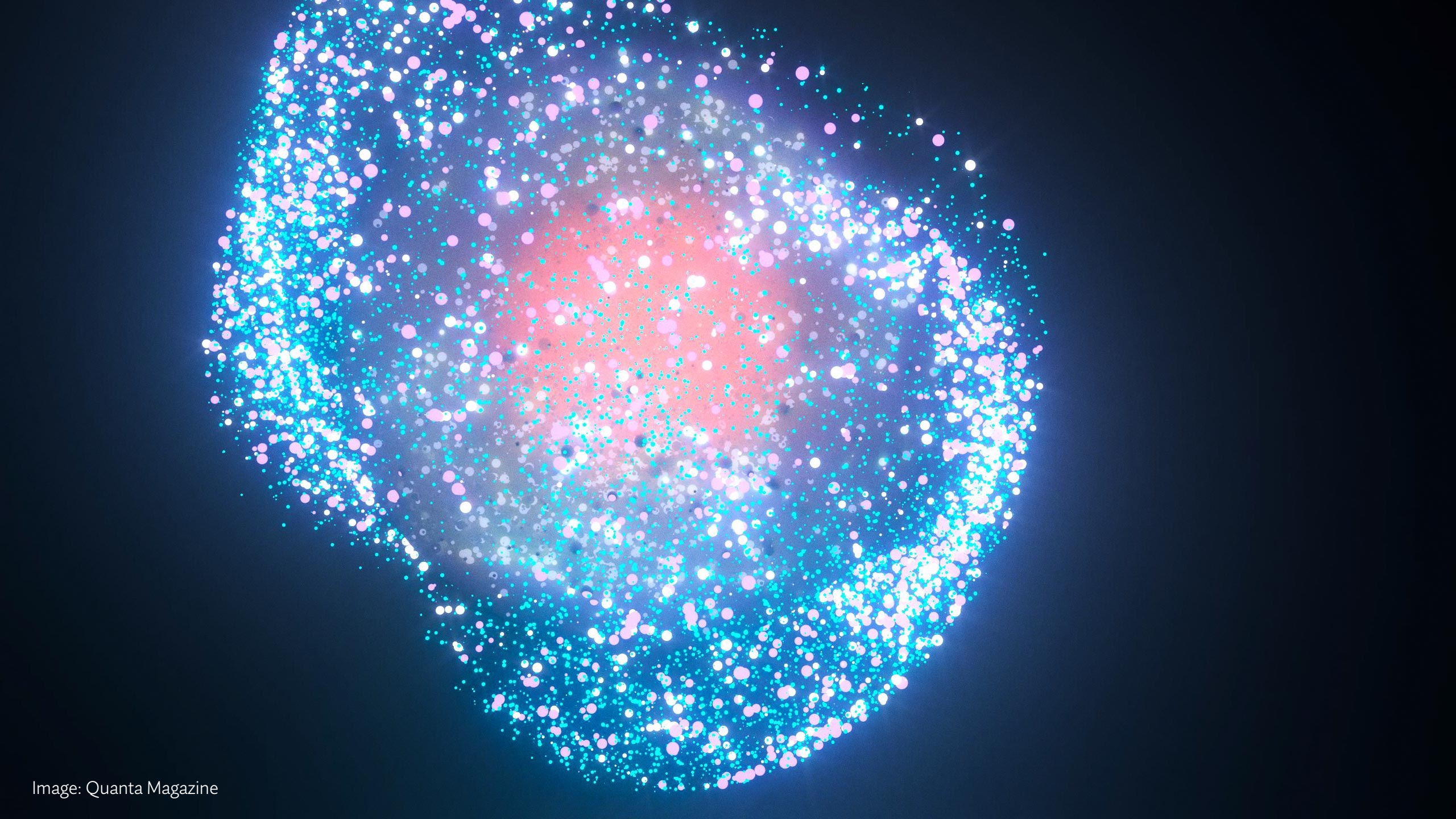


Image: Quanta Magazine

The COVID pandemic upended all of our lives.

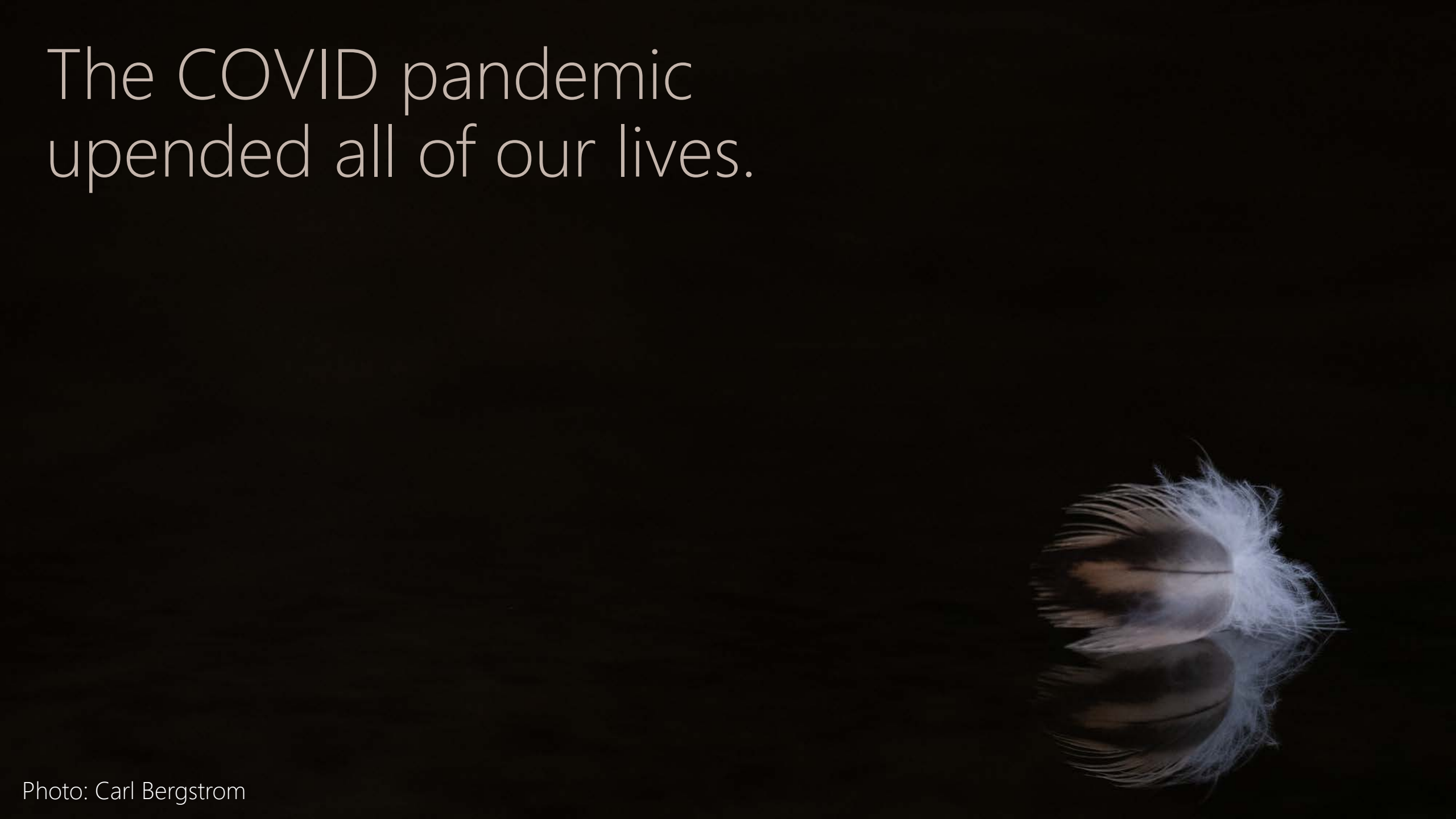


Photo: Carl Bergstrom

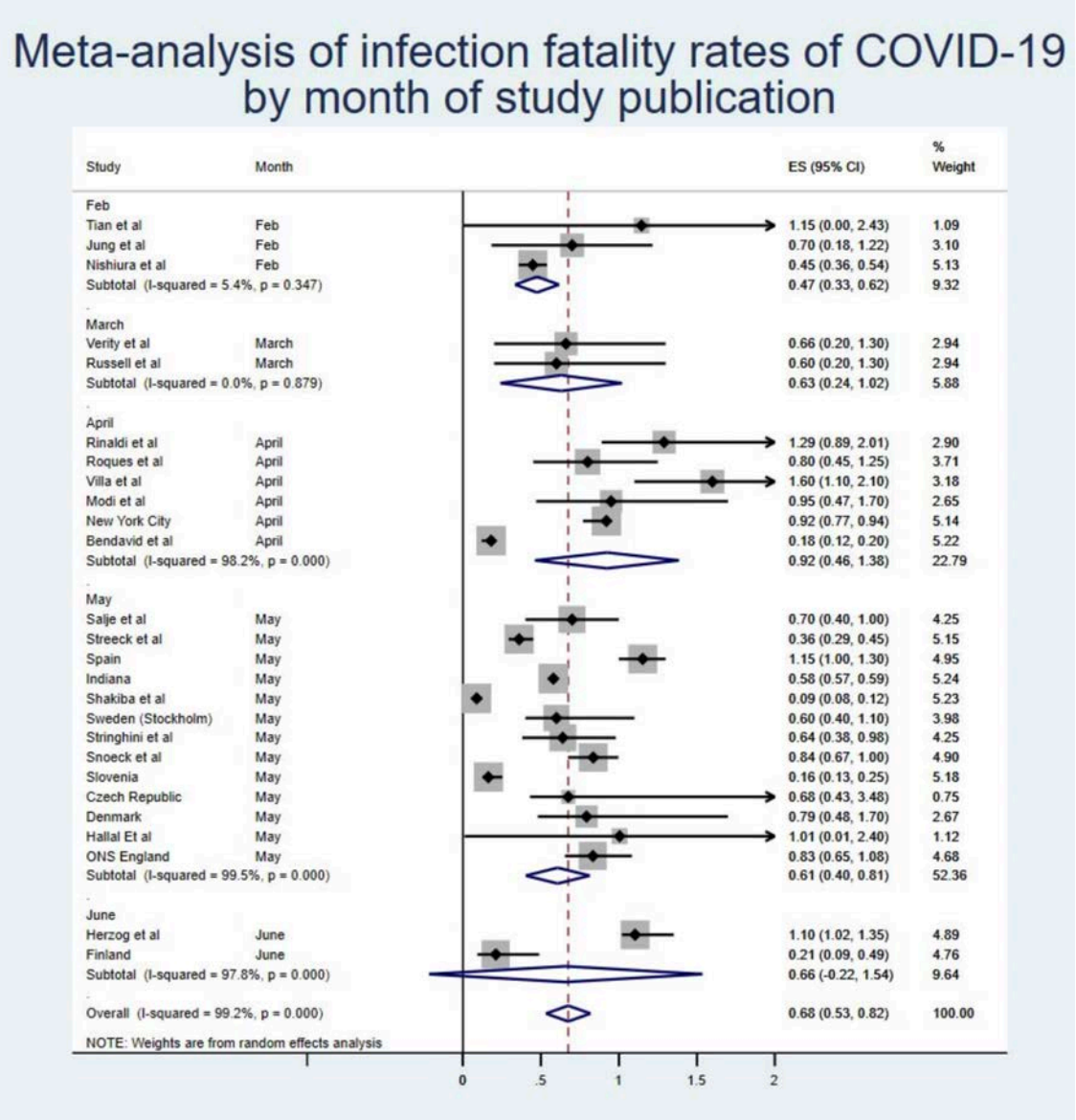
Photo: Carl Bergstrom

We began with scientific uncertainty

about a virus that was never *in* humans before December 2019.

Photo: Carl Bergstrom

Into this uncertainty vacuum flow…



Organized disinformation campaigns

s cellphone while securing the entrance of a nearly empty shop
SFOURI/AFP via Getty Images)

on Fewer Cellphone Us
ay Suggest a High CC
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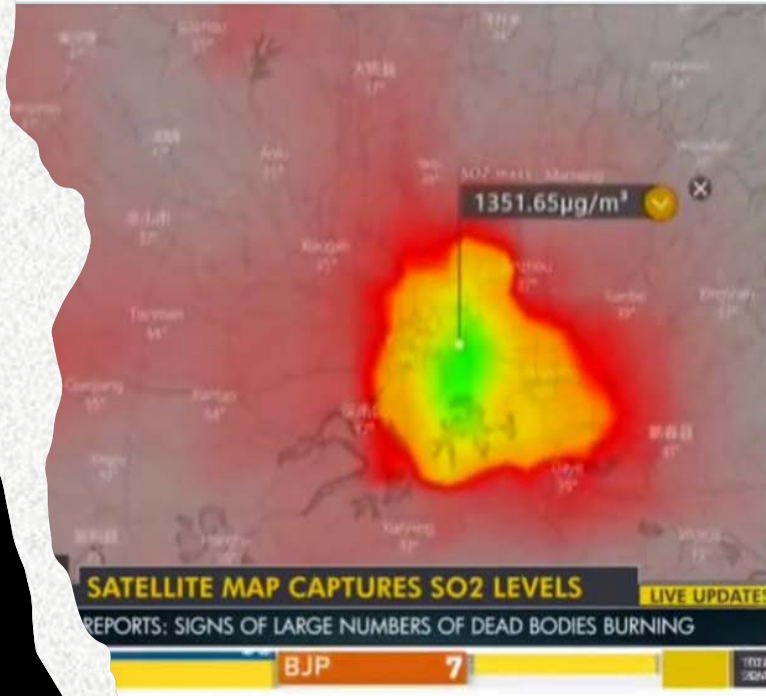
22, 2020 Updated: April 2, 2020

ne that reports are emerging
reporting actual numbers of a
#CoronavirusOutbreak. Increas
ouring areas of Wuhan indica
being cremated silently.
de



er for Android

vperumal@bioschool.iitd.ac.in

WITHDRAWN
See manuscript DOI for details

Abstract:

We are currently witnessing a major epidemic caused by the 2019 novel coronavirus (2019-nCoV). The evolution of 2019-nCoV remains elusive. We found 4 insertions in the spike glycoprotein (S) which are unique to the 2019-nCoV and are not present in other coronaviruses. Importantly, amino acid residues in all the 4 inserts have identity or similarity to those in the HIV-1 gp120 or HIV-1 Gag. Interestingly, despite the inserts being discontinuous on the primary amino acid sequence, 3D-modelling of the 2019-nCoV suggests that they converge to constitute the receptor binding site. The finding of 4 unique inserts in the 2019-nCoV, all of which have identity /similarity to amino acid residues in key structural proteins of HIV-1 is unlikely to be fortuitous in nature. This work provides yet unknown insights on 2019-nCoV and sheds light on the evolution and pathogenicity of this virus with important implications for diagnosis of this virus.

Introduction

Coronaviruses (CoV) are single-stranded positive-sense RNA viruses that infect animals and humans. These are classified into 4 genera based on their host specificity: *Alphacoronavirus, Betacoronavirus, Deltacoronavirus and Gammacoronavirus* (Snijder et al., 2006). There are seven known types of CoVs that includes 229E and NL63 (Genus Alphacoronavirus), OC43, HKU1, MERS and SARS (Genus Betacoronavirus). While 229E, NL63, OC43, and HKU1 commonly infect humans, the SARS and MERS outbreak in 2002 and 2012 respectively occurred when the virus crossed-over from animals to humans causing significant mortality (J. Chan et al., n.d.; J. F.

cember 2019, another outb

Altmetric ? What is this page? Embed badg

ncanny similarity of unique inserts in the 2019-nCoV rotein to HIV-1 gp120 and Gag

erview of attention for article published in bioRxiv

99 news outlets
23 blogs
1 policy source
17034 tweeters
22 Facebook pages
11 video uploaders
32 Dimensions

Dreadful preprints

EOSTATIC AGENTS

y and induction of coronavirus in skin ce

pehri[1], M.G. Roccia[1], M. Jafferany[2], O. Yu.
K.M. Lomonosov[3] and T. Lotti[1,3]

lear and Radiation Physics, G. Marconi U
nigan , USA; [3]Department of Dermatolog
oscow State Medical University, Moscow, R

May 13, 2020 – Accepted June 9, 2020

G millimeter waves could be absorbed by der
ells and play the main role in producing Coron
ctrons and atoms and has an inductor-like str
nd round inductors. Inductors interact with ext
ra waves within the cells. The shapes of these v
al bases of their DNA source. These waves pro
se holes, some extra hexagonal and pentagonal
r and form virus-like structures such as Coron
ssary that the wavelength of external waves be s
es could be good candidates for applying in co
OVID-19) within cells.

Equally dreadful peer-reviewed work

chloroquine or chloroquine with or without a
le for treatment of COVID-19: a multinational
alysis

n S Desai, Frank Ruschitzka, Amit N Patel

chloroquine or chloroquine, often in combination with a second-generation macrolic
nent of COVID-19, despite no conclusive evidence of their benefit. Although general
ndications such as autoimmune disease or malaria, the safety and benefit of thes
evaluated in COVID-19.

ultinational registry analysis of the use of hydroxychloroquine or chloroquine with
nent of COVID-19. The registry comprised data from 671 hospitals in six continents.
d between Dec 20, 2019, and April 14, 2020, with a positive laboratory finding for S
one of the treatments of interest within 48 h of diagnosis were included in one of fo
one, chloroquine with a macrolide, hydroxychloroquine alone, or hydroxychloroc
who received none of these treatments formed the control group. Patients for w
as initiated more than 48 h after diagnosis or while they were on mechanical
ved remdesivir, were excluded. The main outcomes of interest were in-hospi
novo ventricular arrhythmias (non-sustained or sustained ventricular tac

(mean age 53·8 years, 46·3% women) with COVID-19 were hospitalised durin
lusion criteria. Of these, 14 888 patients were in the treatment groups (18
ed chloroquine with a macrolide, 3016 received hydroxychloroquine, and 62
a macrolide) and 81 144 patients were in the control group. 10 698 (11·1%) pati
g for multiple confounding factors (age, sex, race or ethnicity, body-mass index
nd its risk factors, diabetes, underlying lung disease, smoking, immunosuppresse
everity), when compared with mortality in the control group (9·3%), hydroxy
35, 95% CI 1·223–1·457), hydroxychloroquine with a macrolide (23·8%; 1·447, 1·
65, 1·218–1·531), and chloroquine with a macrolide (22·2%; 1·368, 1·273–1·46
with an increased risk of in-hospital mortality. Compared with the control gr
; 2·369, 1·935–2·900), hydroxychloroquine with a macrolide (8·1%; 5·106, 4·
2·760–4·596), and chloroquine with a macrolide (6·5%; 4·011, 3·344–
an increased risk of de-novo ventricular arrhythmia during hospitalisati

confirm a benefit of hydroxychloroquine or chloroquine, when used a
mes for COVID-19. Each of these drug regimens was associated wit
d frequency of ventricular arrhythmias when used for treatment of C

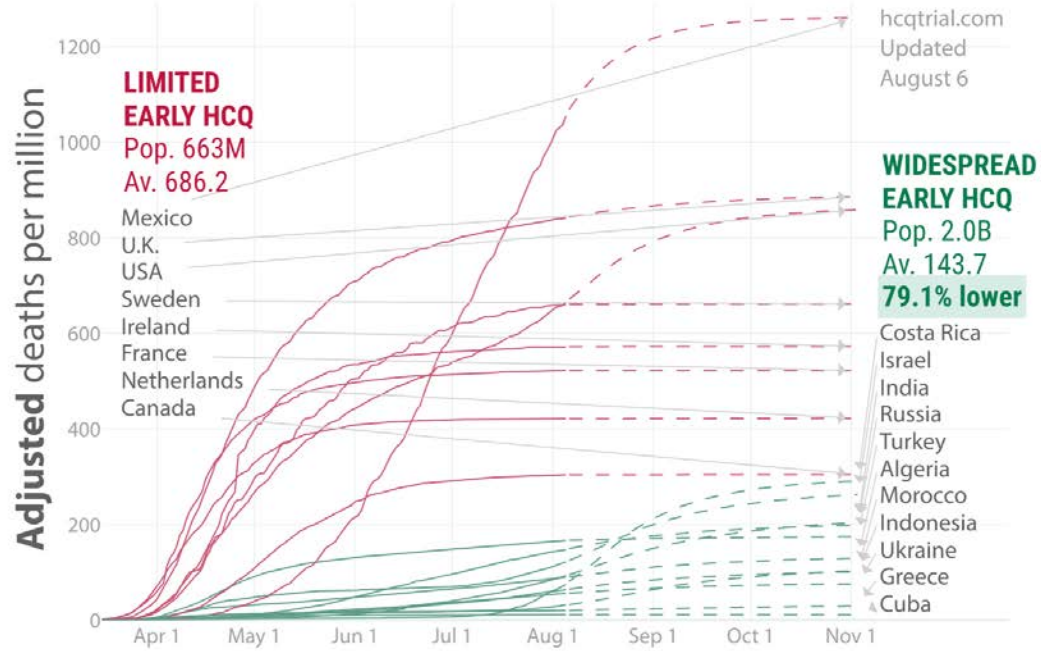
Chair in Advanced Cardiovascular Medicine at Brigham and Wome

Fake studies & astroturfing

Early treatment with hydroxychloroquine: a country-randomized controlled trial

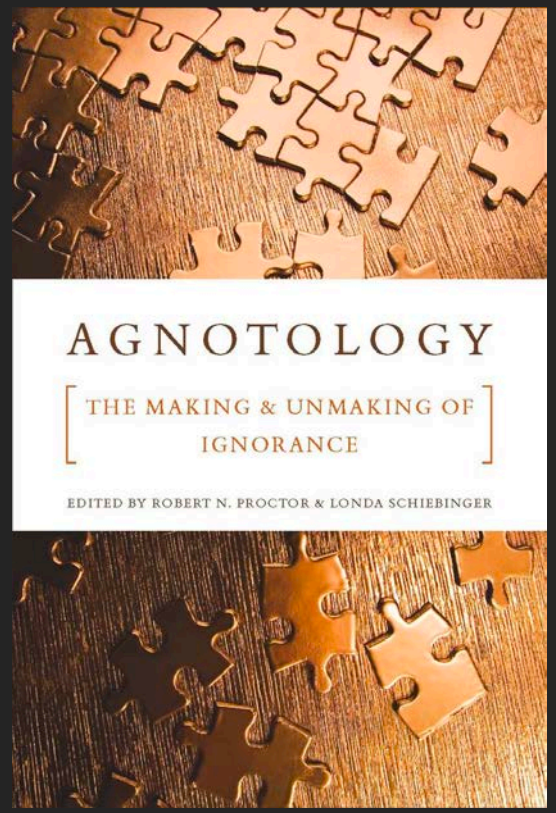
Covid Analysis, August 5, 2020 (updated August 6, 2020)

@CovidAnalysis Share Tweet



any countries either adopted or declined early treatment with HCQ, forming a large untry-randomized controlled trial. 2.0 billion people were assigned to the treatment group, nd 663 million to the control group. As of August 6, 2020, an average of 38.5/million in the eatment group have died, and 440.2/million in the control group, relative risk 0.087. After djustments, treatment and control deaths become 79.6/million and 630.0/million, relative sk 0.13. Confounding factors affect this estimate, including varying degrees of spread etween countries. Accounting for predicted changes in spread, we estimate a relative risk f 0.21. **The treatment group has 79.1% lower chance of death**. We examined diabetes, besity, hypertension, life expectancy, population density, urbanization, testing level, and ntervention level, which do not account for the effect observed.

Organized agnotogenesis



ABC News
@ABC

NEW: People who have been infected with COVID-19 and recovered are protected for up to three months and can safely interact with others, according to new CDC guidance.

Coronavirus updates: CDC forecast predicts death toll could re
The United States has at least 167,242 deaths.
abcnews.go.com

Sloppy reporting

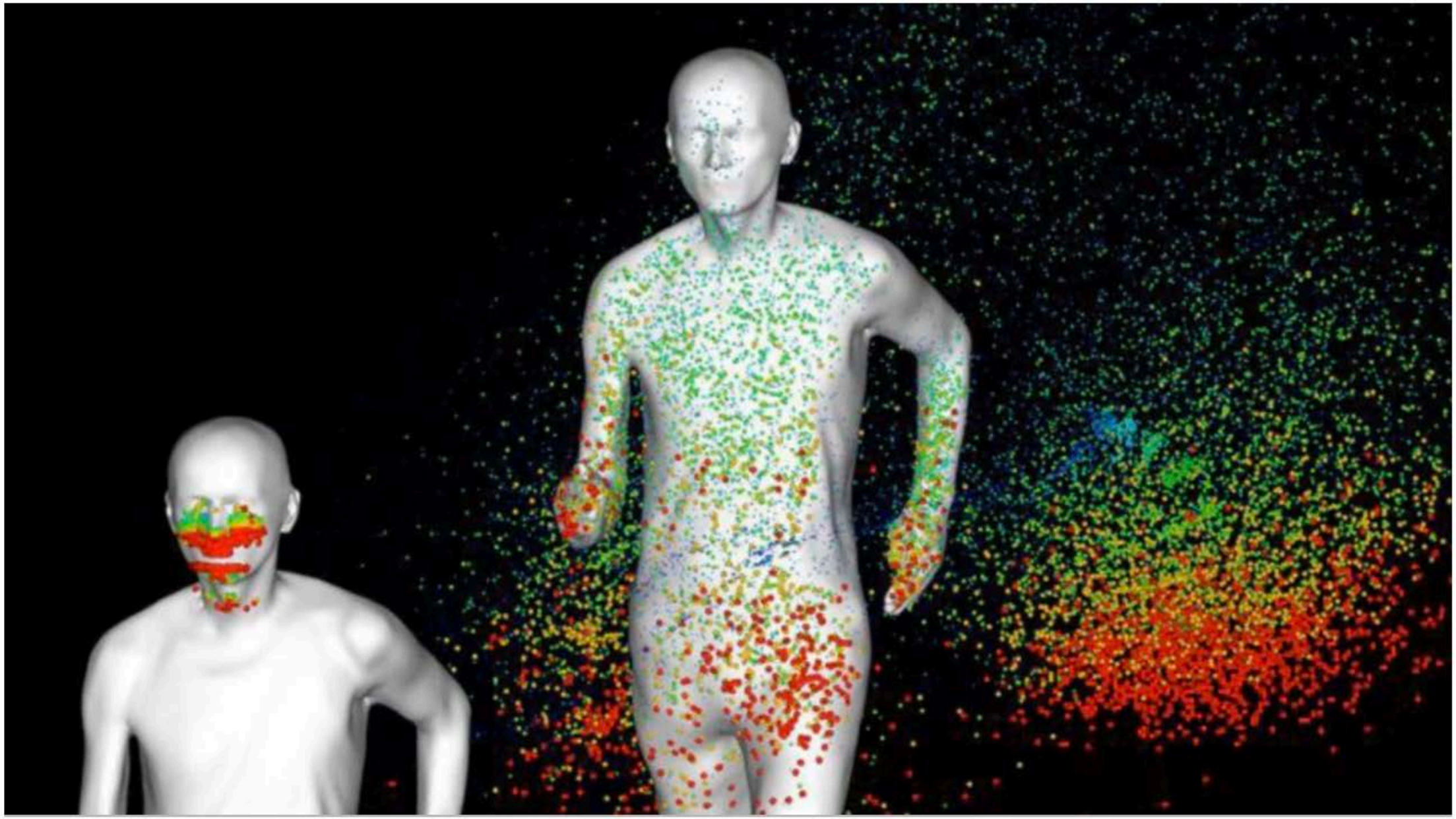


IMAGE: ANSYS

The Viral 'Study' About Runners Spreading Coronavirus Is Not Actually a Study. *Vice News*

People who see
a crisis as a
career opportunity.

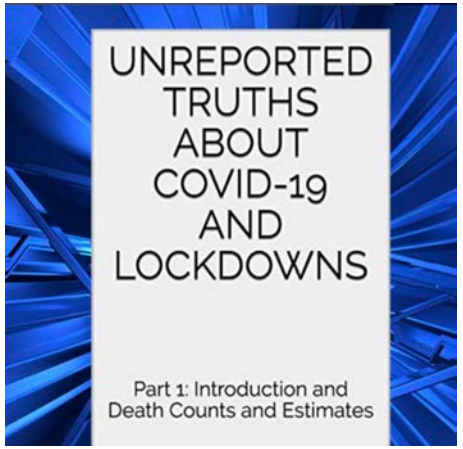
TECHNOLOGY

How to Misinform Yourself About the Coronavirus

Even if you avoid the conspiracy theories, tweeting through a global emergency is messy, context-free, and disorienting.

ALEXIS C. MADRIGAL JANUARY 28, 2020

CARLOS GARCIA RAWLINS / REUTERS



Cherry-picked anecdotes and studies

Photo: Carl Bergstrom

Numbers appear to carry authority.

They almost seem to carry

divine authority.

Photo: Carl Bergstrom

Photo: Carl Bergstrom
What can *we* do about it?

Media Literacy

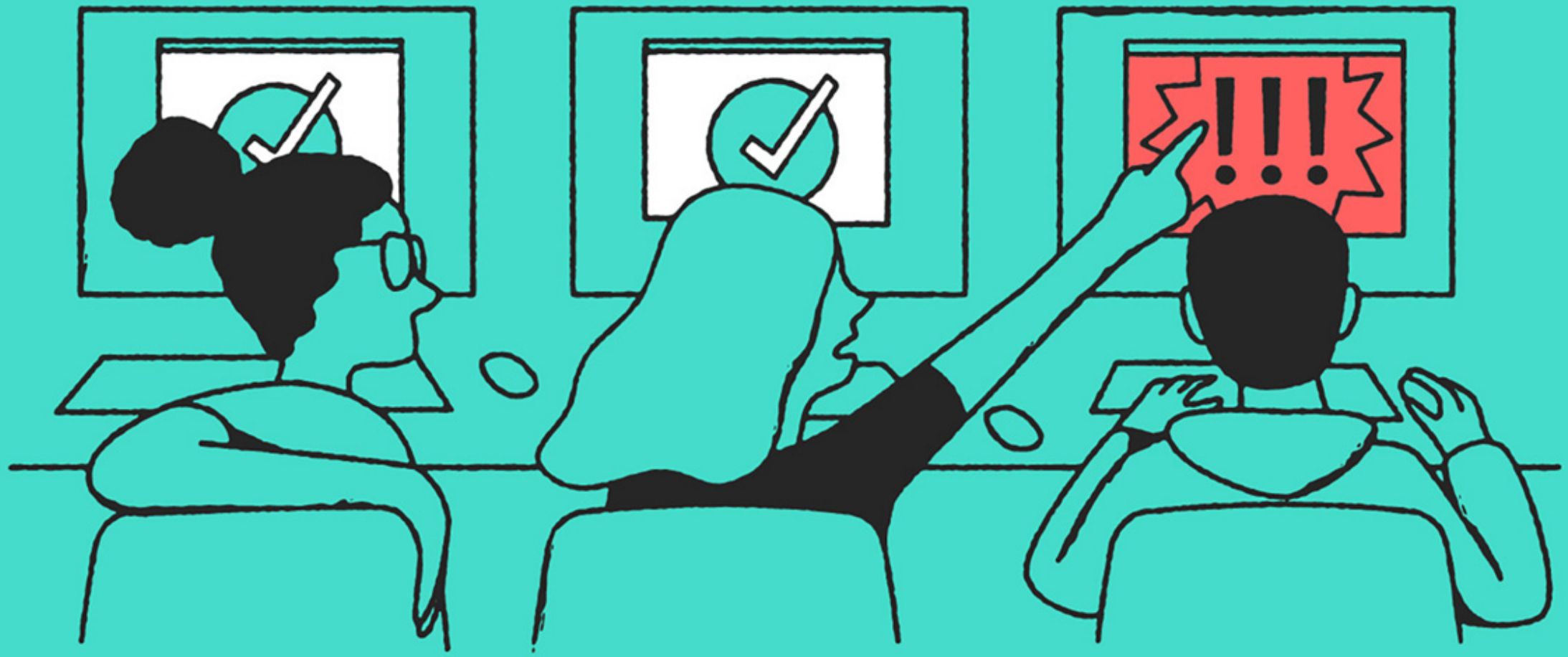


Image: Apple

LEGAL SIZE

THE INFORMATION SCHOOL
University of Washington
MisinfoDay
MARCH 19, 2019
THE INFORMATION SCHOOL
University of Washington

Opinion

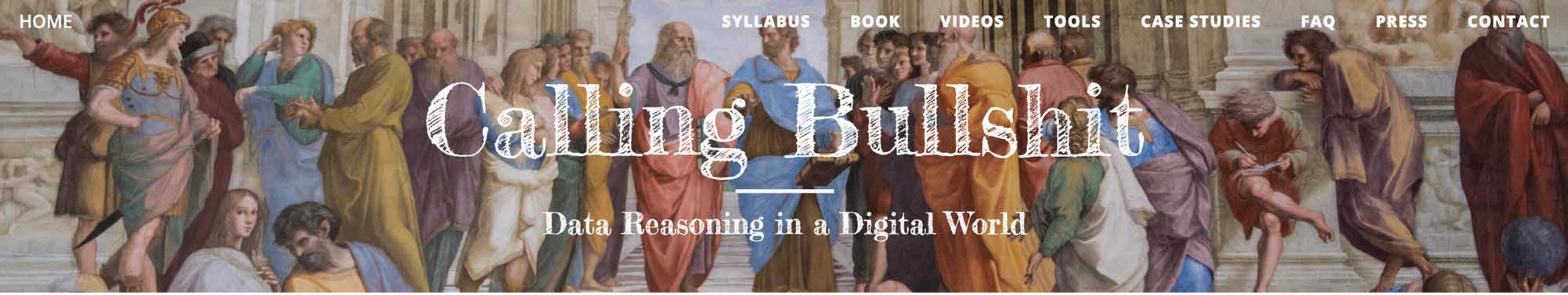
I Used to Think the Remedy for Bad Speech Was More Speech. Not Anymore.

How kids, lawsuits and legislation can save democracy.

CENTER FOR AN INFORMED PUBLIC

UNIVERSITY *of* WASHINGTON

Mission: resist strategic misinformation, promote an informed society, and strengthen democratic discourse.



The world is awash in bullshit. Politicians are unconstrained by facts. Science is conducted by press release. Higher education rewards bullshit over analytic thought. Startup culture elevates bullshit to high art. Advertisers wink conspiratorially and invite us to join them in seeing through all the bullshit — and take advantage of our lowered guard to bombard us with bullshit of the second order. The majority of administrative activity, whether in private business or the public sphere, seems to be little more than a sophisticated exercise in the combinatorial reassembly of bullshit.

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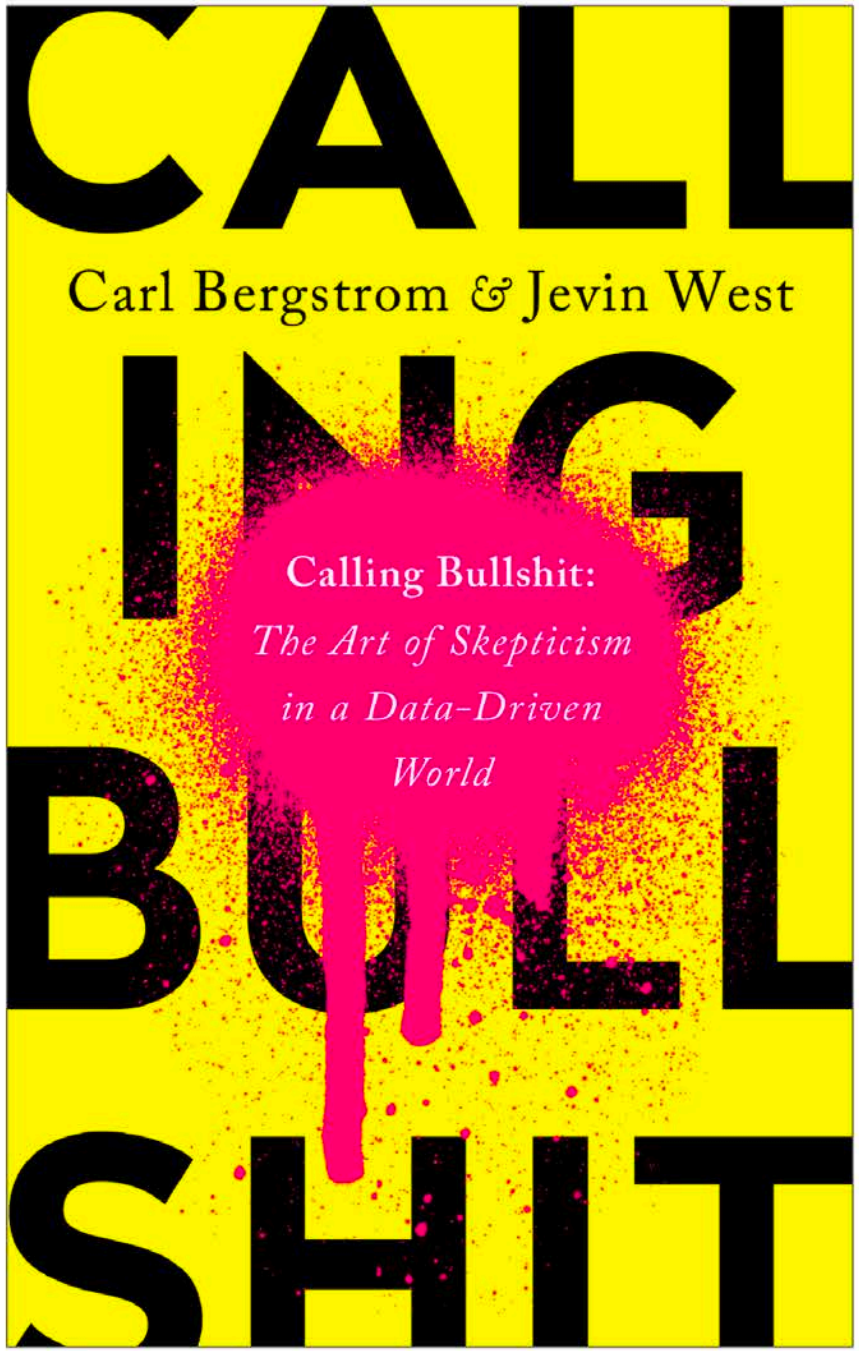
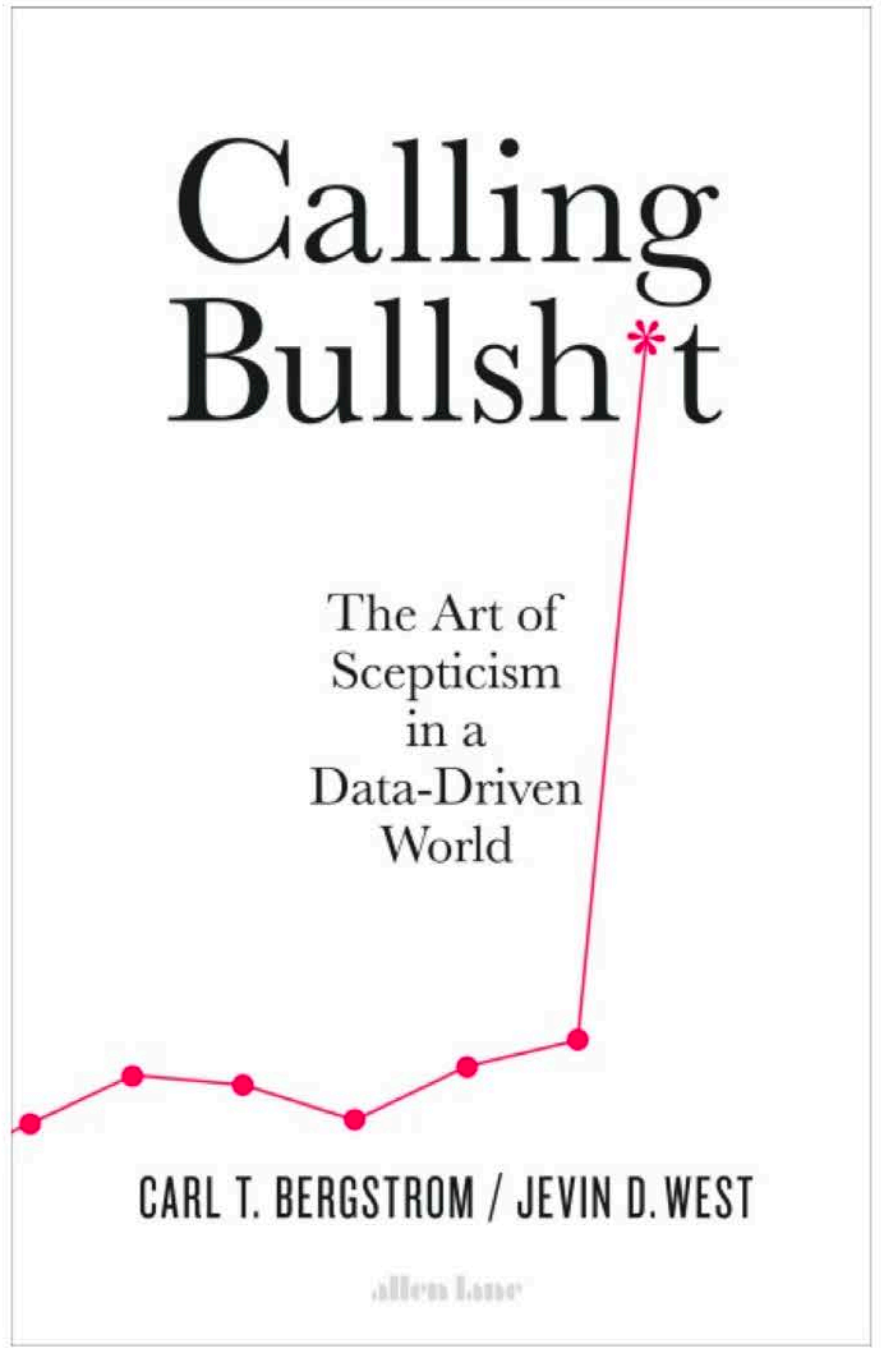
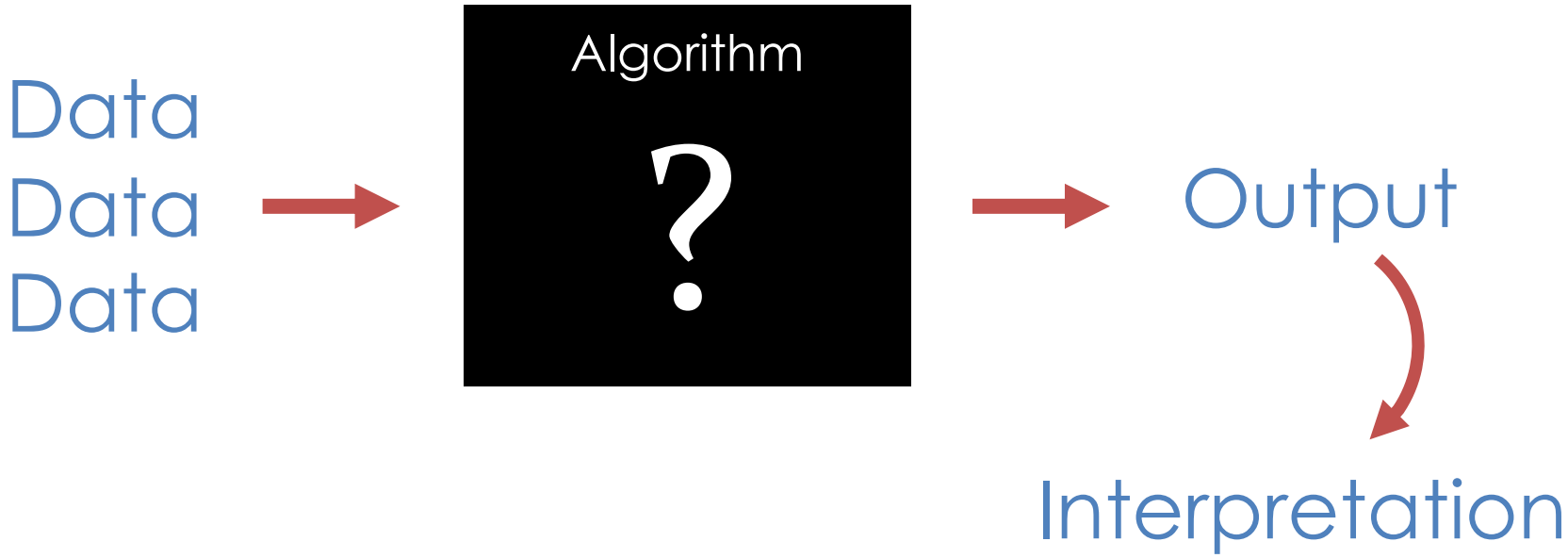
http://callingbullshit.org



Penguin
Random
House





Even when you don't know how an algorithm or statistical test works, you can spot bullshit by looking carefully at what goes in and what comes out.

Mis/Disinformation

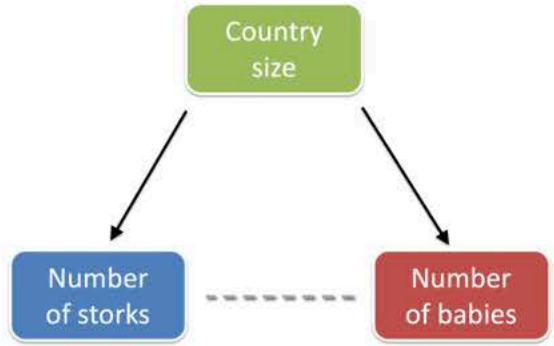
Pope Francis Shocks World, Endorses Donald Trump for President, Releases Statement

11/01/2016 Fabrica Tedzori Global, Politics 0

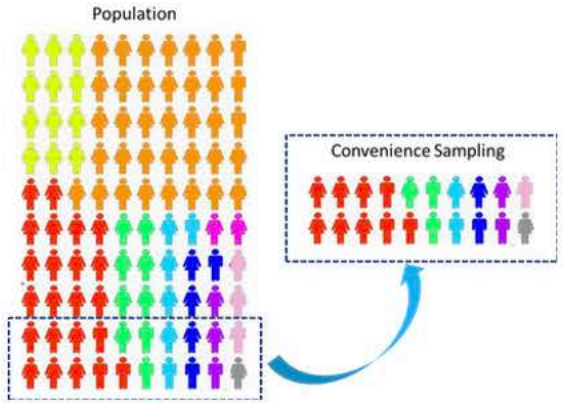
VATICAN CITY – News outlets around the world are reporting on the **News** that Pope Francis has made the unprecedented decision to endorse a **US** presidential candidate. His statement in support of **Donald Trump** was released from the Vatican this evening:

"I have been hesitant to offer any kind of support for either candidate in the **US** presidential election but I now feel that to not voice my concern would be a dereliction of my duty as the Holy See. A strong and free America is vitally important in maintaining a strong and free world and in that sense what happens in American elections affects us all. The Rule of **Law** is the backbone of the American government as it is in any nation that strives for freedom and I now fear that the Rule of **Law** in America has been dealt a dangerous blow. The FBI, in refusing to recommend prosecution after admitting that the law had been broken on multiple occasions by Secretary Clinton, has exposed itself as corrupted by political forces that have become far too powerful.

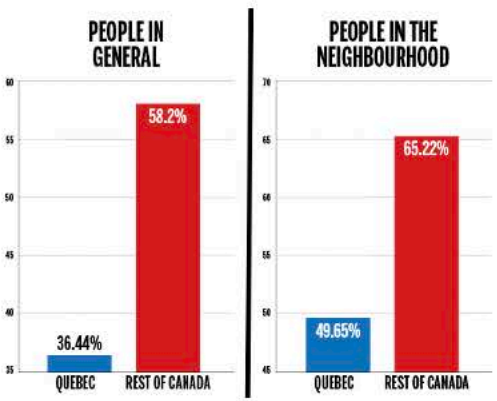
Correlation & causation



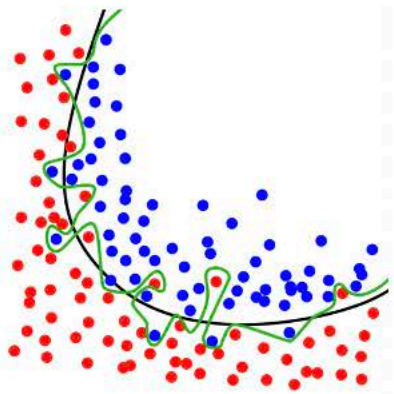
Selection bias



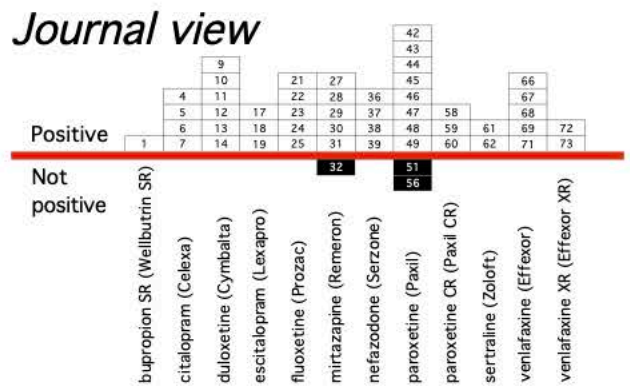
Data visualization



Big data / ML



Nature of science



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Section

Abstract

1. Introduction

2. Material and methods

3. Results

4. Discussion

5. Conclusion

Research articles

Susceptibility to misinformation about COVID-19 around the world

Jon Roozenbeek, Claudia R. Schneider, Sarah Dryhurst, John Kerr, Alexandra L. J. Freeman, Gabriel Recchia, Anne Marthe van der Bles and Sander van der Linden

Published: 14 October 2020 https://doi.org/10.1098/rsos.201199

Review history

Abstract

Misinformation about COVID-19 is a major threat to public health. Using five national samples from the UK (n = 1050 and n = 1150), Ireland (n = 700), the USA (n = 700), Spain (n = 700) and Mexico (n = 700), we examine predictors of belief in the most common statements about the virus that contain misinformation. We also investigate the prevalence of belief in COVID-19 misinformation across different countries and the role of belief in such misinformation in predicting relevant health behaviours. We find that while public belief in misinformation about COVID-19 is not particularly common, a substantial proportion views this type of misinformation as highly reliable in each country

Details References Related Figures

This Issue

October 2020
Volume 7, Issue 10

Article Information

Published by: Royal Society
Online ISSN: 2054-5703

History:

Old School BS

New School BS

“Our collective mission is to refunctionalize customer-driven solutions for leveraging underutilized portfolio opportunities.”

New School BS

“Our collective mission is to refunctionalize customer-driven solutions for leveraging underutilized portfolio opportunities.”

“While short of statistical significance after Bonferroni correction (p=0.13), our results underscore a clinically important effect size (relative odds of survival at 5 years=1.2) that challenges the current therapeutic paradigm.”

The VMMC Quality Equation

$$Q = A \times \frac{(O + S)}{W}$$

Q: Quality
A: Appropriateness
O: Outcomes
S: Service
W: Waste

The VMMC Quality Equation

$$Q = A \times \frac{(O + S)}{W}$$

Q: Quality
A: Appropriateness
O: Outcomes
S: Service
W: Waste

$$Q = S \times \frac{O + A}{W}$$

$$Q = (A + O) \times S - W$$

$$Q = \sqrt[W]{A^O + S^O}$$

Parameter	Effect on Quality
Appropriateness	Increase
Outcomes	Increase
Service	Increase
Waste	Decrease

The VMMC Quality Equation

$$Q = A \times \frac{(O + S)}{W}$$

Q: Quality
A: Appropriateness
O: Outcomes
S: Service
W: Waste

What are the units?

Units of Outcomes and Service have to be the same to add them.

Quality has to be in units of

$$\frac{\text{Appropriateness}}{\text{Waste}} \times \text{whatev.}$$

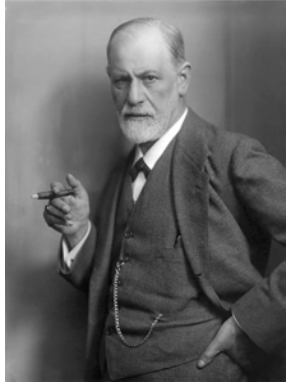
Mathiness is bullshit

- Disregards logic and factual accuracy.
- Trades on the air of rigor conferred by mathematical equations.
- Aims to impress or persuade an audience, using algebraic shock-and-awe.

What is bullshit?

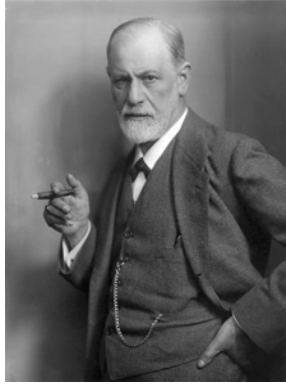
Bullshit involves language, statistical figures, data graphics, and other forms of presentation intended to impress, overwhelm, or persuade — presented with a blatant disregard for truth, logical coherence, or what information is actually being conveyed.

Example: Sigmund Freud



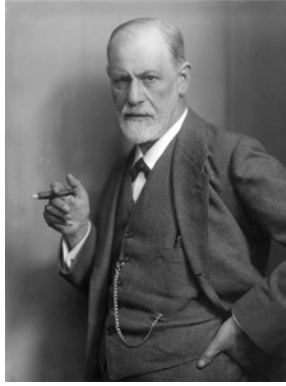
> "So I gave my lecture yesterday. Despite a lack of preparation, I spoke quite well and without hesitation,

Example: Sigmund Freud



> "So I gave my lecture yesterday. Despite a lack of preparation, I spoke quite well and without hesitation, which I ascribe to the cocaine I had taken beforehand.

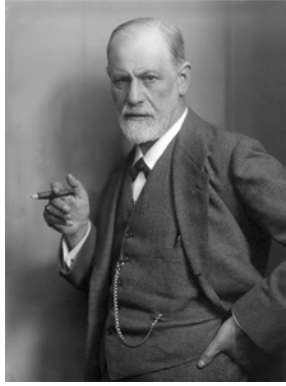
Example: Sigmund Freud



> "So I gave my lecture yesterday. Despite a lack of preparation, I spoke quite well and without hesitation, which I ascribe to the cocaine I had taken beforehand.

I told about my discoveries in brain anatomy, all very difficult things that the audience certainly didn't understand

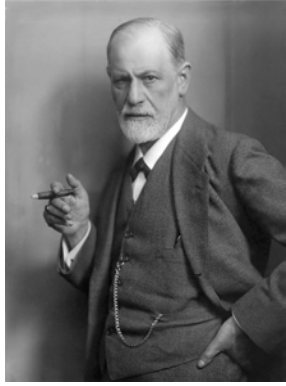
Example: Sigmund Freud



"So I gave my lecture yesterday. Despite a lack of preparation, I spoke quite well and without hesitation, which I ascribe to the cocaine I had taken beforehand.

I told about my discoveries in brain anatomy, all very difficult things that the audience certainly didn't understand, but all that matters is that they get the impression that I understand it."

Example: Sigmund Freud



"So I gave my lecture yesterday. Despite a lack of preparation, I spoke quite well and without hesitation, which I ascribe to the cocaine I had taken beforehand.

I told about my discoveries in brain anatomy, all very difficult things that the audience certainly didn't understand, but all that matters is that they get the impression that I understand it."

Intended to impress, overwhelm, or persuade…presented with a blatant disregard for…what information is actually being conveyed.

Thinking about numbers

Units

% % % %

Percentages

Unfair Comparisons

$$Q = A \times \frac{(O + S)}{W}$$

Mathiness

1…10…100…

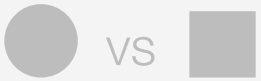
Orders of magnitude

Thinking about numbers

Units

% % % %

Percentages



Unfair Comparisons

$$Q = A \times \frac{(O + S)}{W}$$

Mathiness

1...10...100...

Orders of magnitude

CNN
@CNN

38% of Americans wouldn't buy Corona beer "under any circumstances" because of the coronavirus, according to a recent survey.

5W Public Relations

Phone survey of 737 US beer drinkers
February 25-26th, 2020

- 38% of beer-drinking Americans would not buy Corona under any circumstances now.
- Among those who said they usually drink Corona, only 4% said they would stop drinking Corona, but 14% said they wouldn't order Corona in a public venue
- 16% of beer drinking Americans were confused about whether Corona beer is related to the coronavirus

Thinking about numbers

Units

% % % %

Percentages

● vs ■

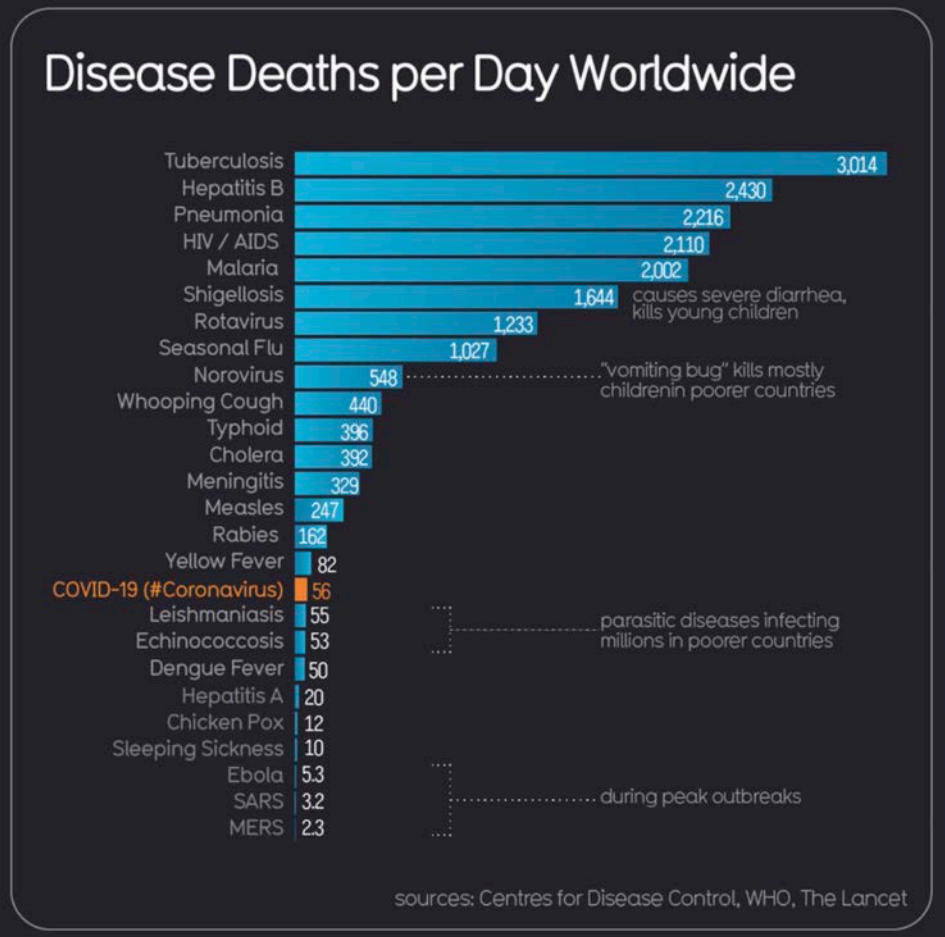
Unfair Comparisons

$Q = A \times \frac{(O + S)}{W}$

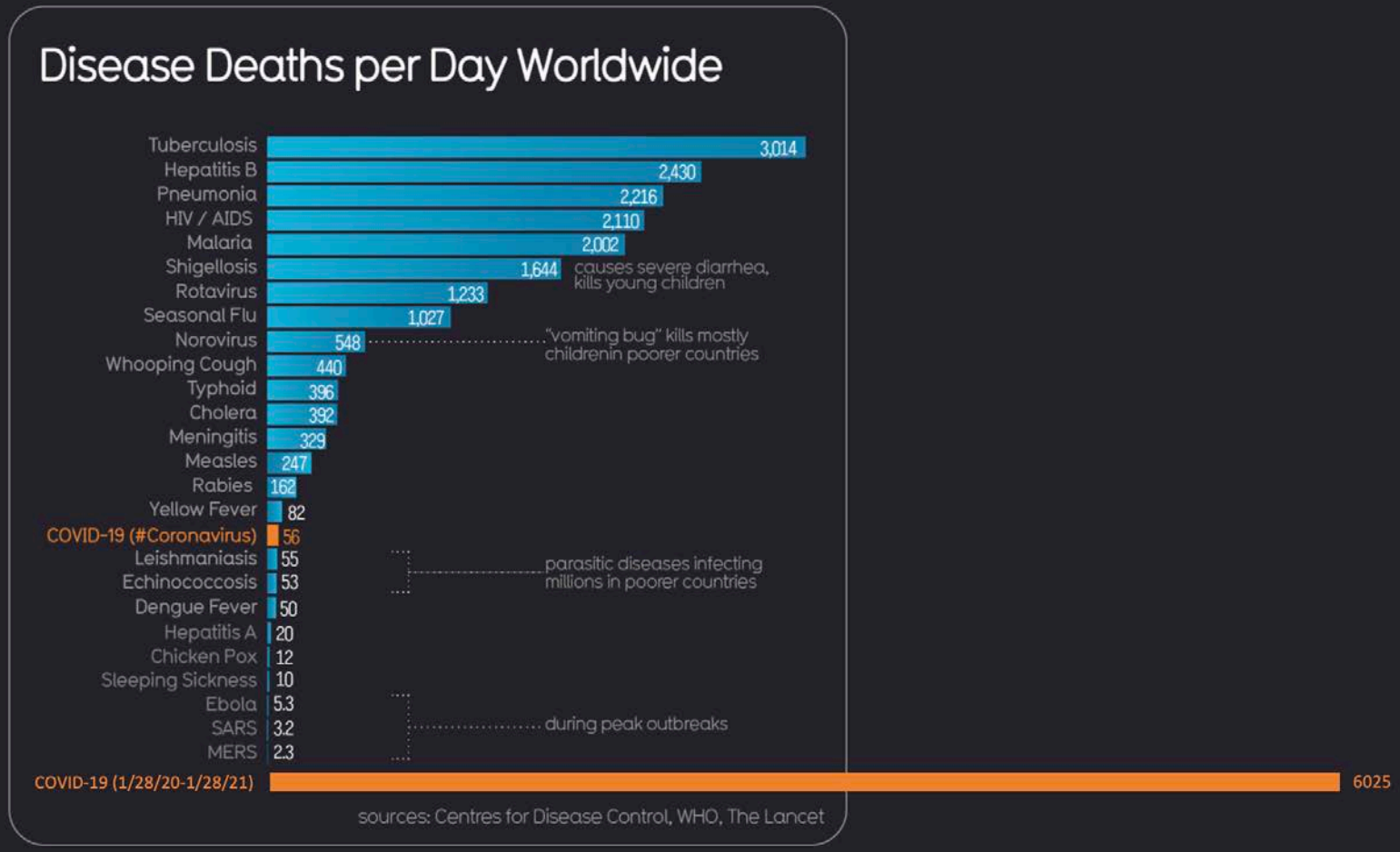
Mathiness

1...10...100...

Orders of magnitude



informationisbeautiful



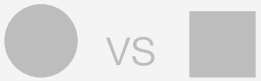
informationisbeautiful

Thinking about numbers

Units

% % % %

Percentages



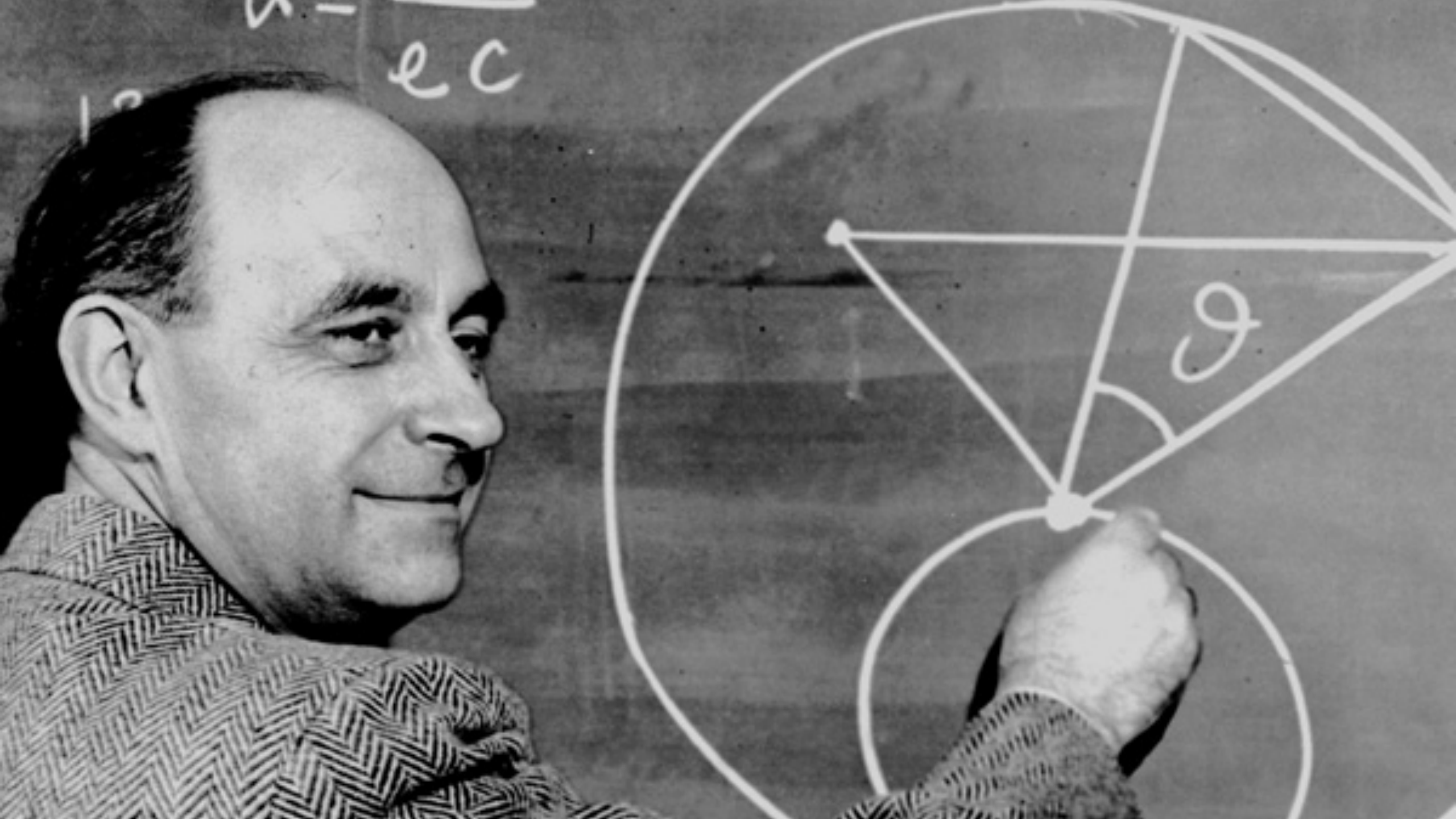
Unfair Comparisons

$$Q = A \times \left(\frac{O + S}{W}\right)$$

Mathiness

1…10…100…

Orders of magnitude



Think about orders of magnitude
(Fermi Estimation)

Food Stamp Fraud at All-Time High: Is It Time to End the Program?

share this | email

Dec 27, 2016 // 3:08pm As seen on Fox & Friends

REACTION: Actress Carrie Fisher Dies at Age 60 After Heart Attack

Should Japanese PM Shinzo Abe Apologize for Pearl Harbor Attack?

Cop Whose House Burned Down Gets Christmas Surprise From Randy Travis <— hasn't

Food stamp fraud is at an all-time high, with cases this year including a state lawmaker and even a millionaire.

According to the USDA, $70 million of taxpayer money was wasted in 2016 due to food stamp fraud.

$70 million sounds like a lot of cash.

But how much is it in the context of the entire food stamp program?

What fraction of Americans receive food stamps?

1%

10%

100%

What fraction of Americans receive food stamps?

1%

10%

100%

How much does the average food stamp recipient receive annually?

$100 $1,000 $10,000

How much does the average food stamp recipient receive annually?

$100 $1,000 $10,000

How many people are there in the United States?

How many people are there in the United States?

About 300,000,000

Thus total expenditures on the food stamp program (not counting administration costs) are about

$$300{,}000{,}000 \times 0.1 \times \$1000 =$$

$$\$30{,}000{,}000{,}000$$

The fraction lost to fraud is thus

$70,000,000 / $ 30,000,000,000 =

0.2% of expenditures

Typical losses in retail would be
on the order of 1.5% to 3%.

Erik Wemple

Agriculture Department seeks correction from Fox News on food-stamp fraud report

By Erik Wemple December 29, 2016

(screenshot)

Mis/Disinformation

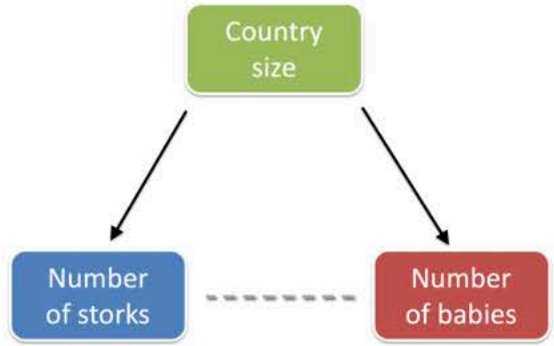
Pope Francis Shocks World, Endorses Donald Trump for President, Releases Statement

11/01/2016 Fabrica Tedzori Global, Politics 0

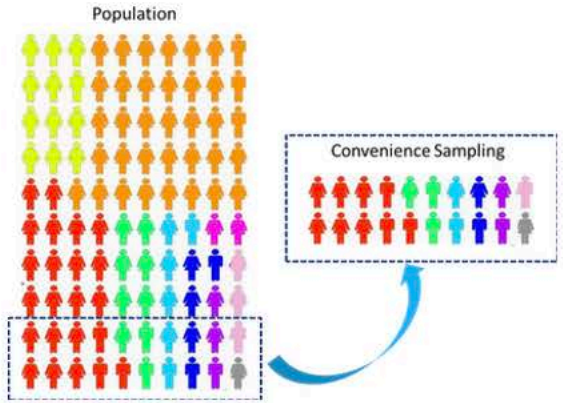
VATICAN CITY – News outlets around the world are reporting on the **News** that Pope Francis has made the unprecedented decision to endorse a **US** presidential candidate. His statement in support of **Donald Trump** was released from the Vatican this evening:

"I have been hesitant to offer any kind of support for either candidate in the **US** presidential election but I now feel that to not voice my concern would be a dereliction of my duty as the Holy See. A strong and free America is vitally important in maintaining a strong and free world and in that sense what happens in American elections affects us all. The Rule of **Law** is the backbone of the American government as it is in any nation that strives for freedom and I now fear that the Rule of **Law** in America has been dealt a dangerous blow. The FBI, in refusing to recommend prosecution after admitting that the law had been broken on multiple occasions by Secretary Clinton, has exposed itself as corrupted by political forces that have become far too powerful.

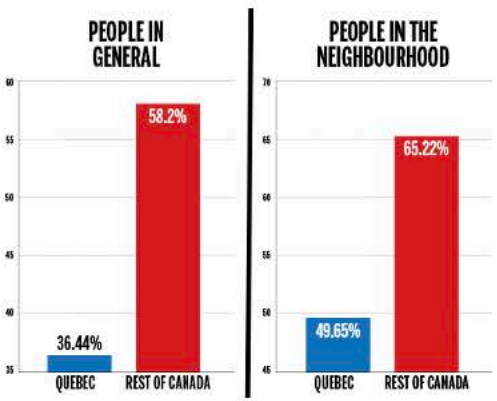
Correlation & causation



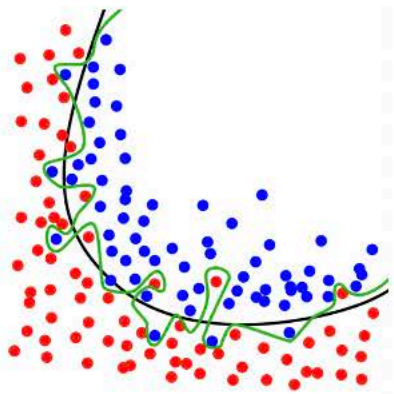
Selection bias



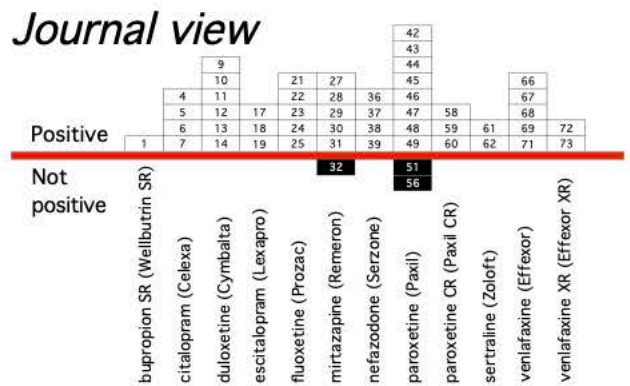
Data visualization



Big data / ML



Nature of science



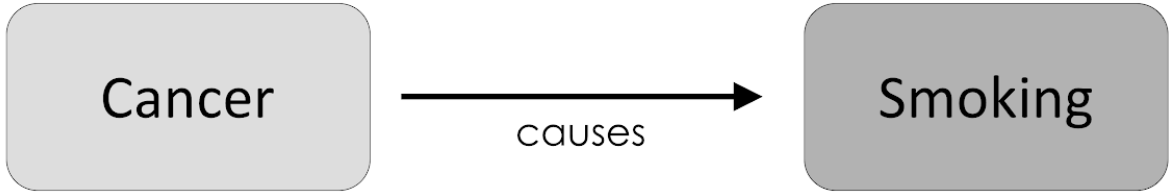
Of the 50 most shared research studies about health outcomes:

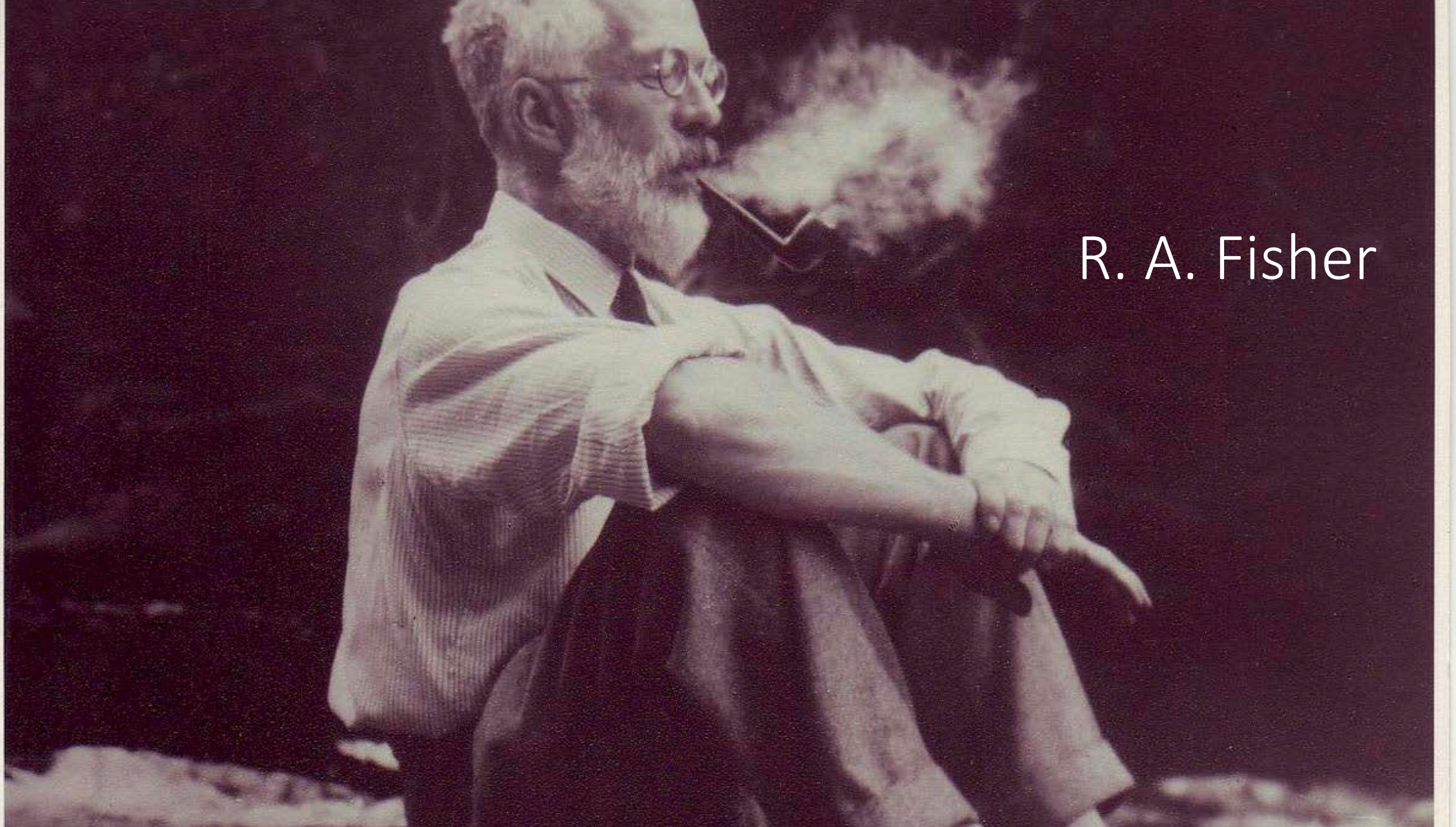
1/3 of journal articles misattribute causality based on correlative evidence

1/2 of news articles do so.

Causality and Block Diagrams

Maybe smoking doesn't cause cancer,
maybe cancer causes smoking!




R. A. Fisher

CORONAVIRUS | 130,196 views | Jun 6, 2020, 11:26am EDT

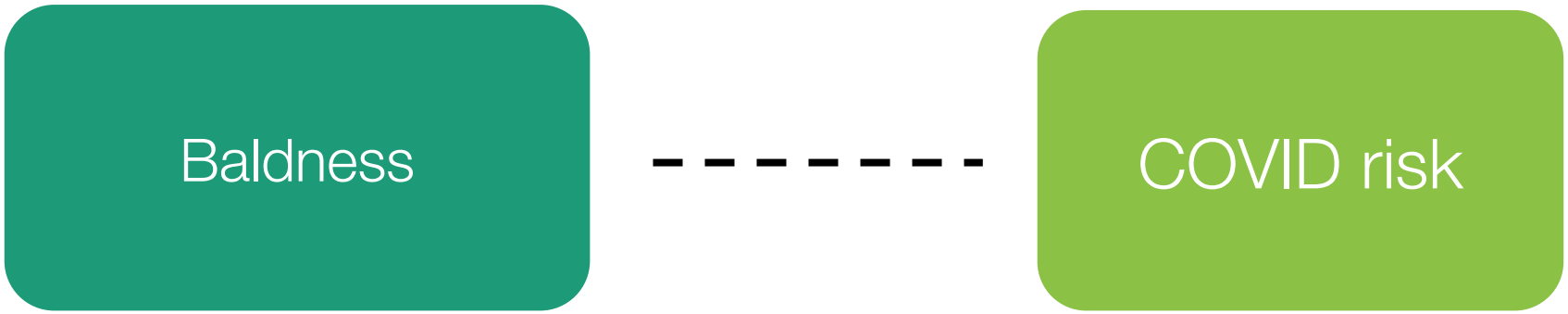
Bald Men At Higher Risk Of Severe Coronavirus Symptoms

Marla Milling Contributor

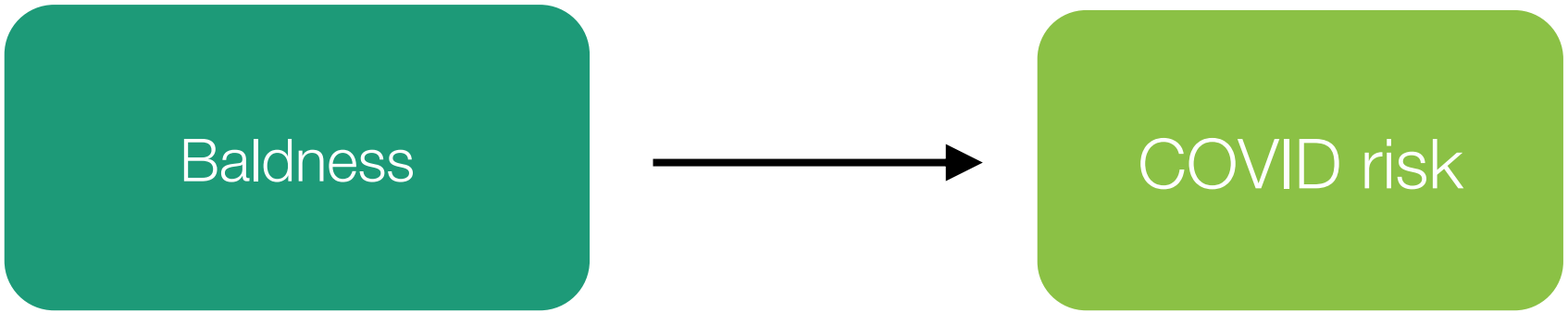
Healthcare

I am a Forbes.com Contributor specializing in geriatric health and women's health articles.

Correlation and causation


Baldness
COVID risk

Hypothesis: endocrine involvement in COVID pathogenesis



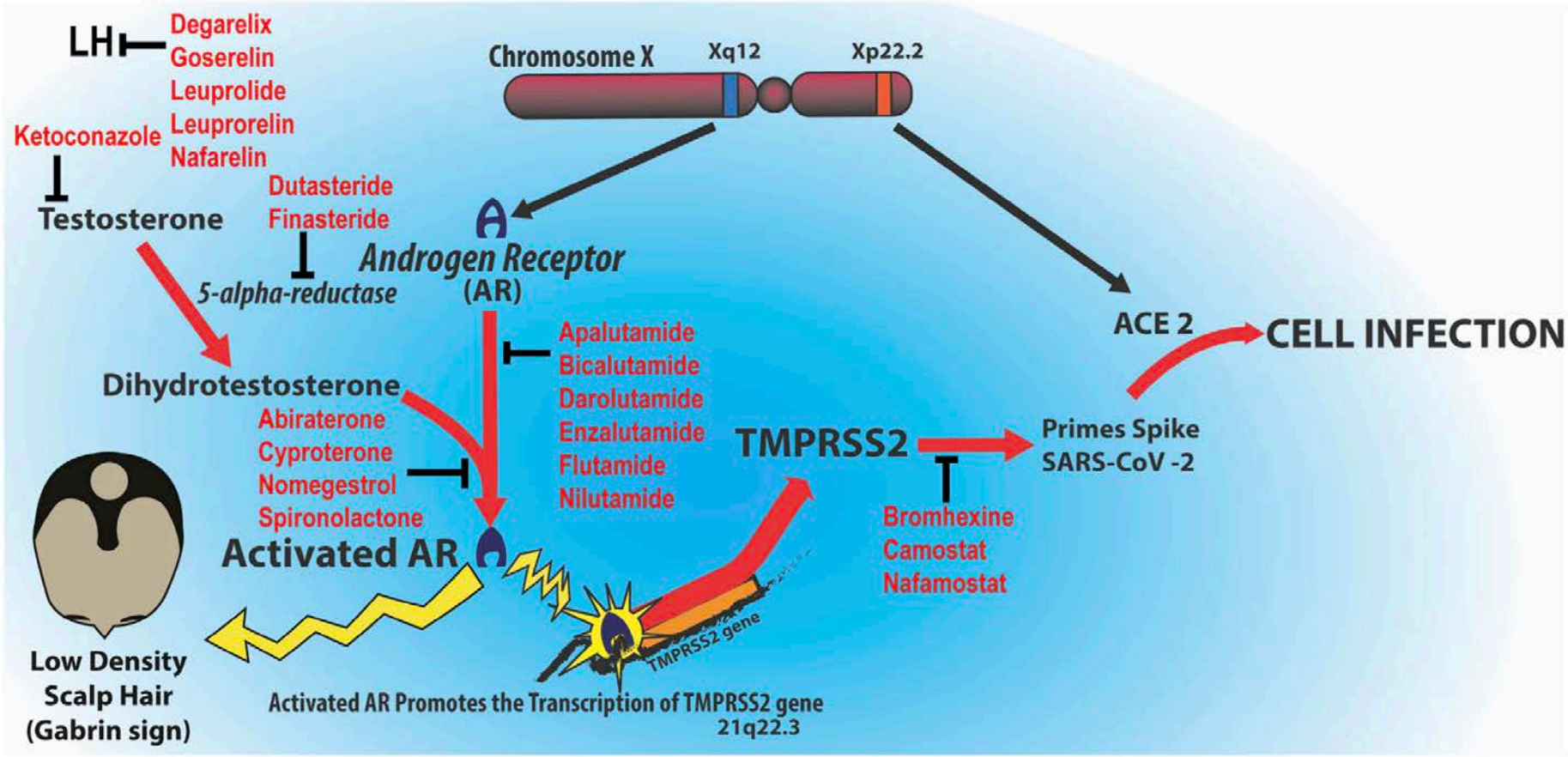
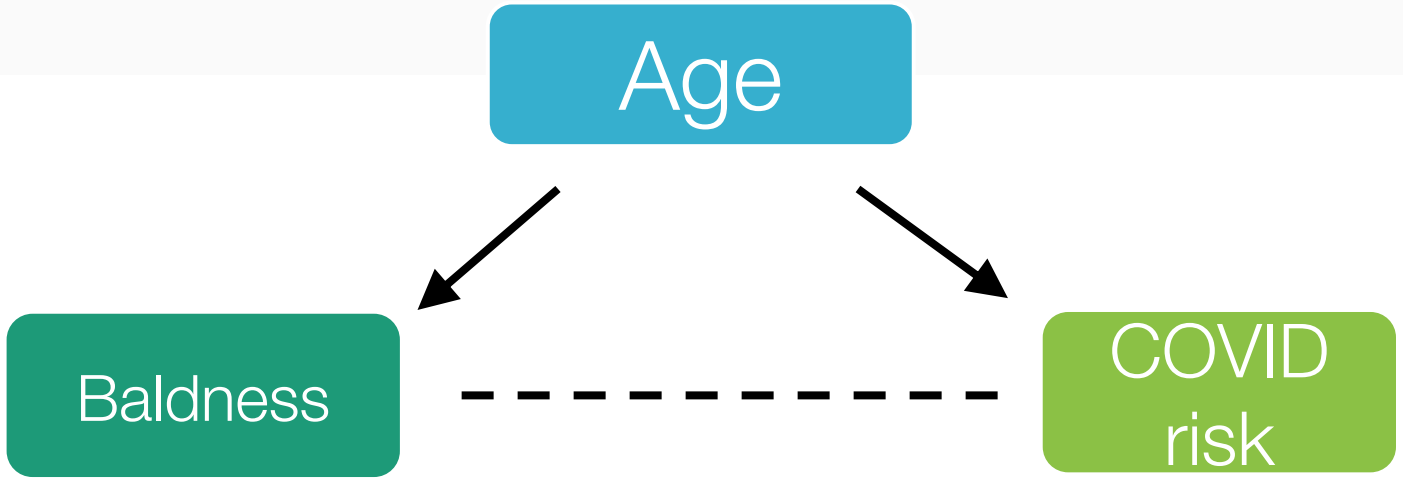


Fig 2. Possible targets of the androgen pathway for severe acute respiratory syndrome coronavirus 2 (*SARS-CoV*-2) prophylaxis and adjuvant therapy. Antiandrogen therapies include gonadotropin-releasing hormone (*GnRH*) analogs (degarelix, goserelin, leuprolide, leuprorelin, nafarelin), which stop luteinizing hormone (*LH*) secretion and induce chemical castration. Testosterone is regarded as the main androgen hormone, and its production is inhibited by ketoconazole, an inhibitor of steroidogenesis. Dutasteride and finasteride, 5-α-reductase inhibitors, target synthesis of dihydrotestosterone, the most potent intrinsic androgen hormone. Androgen receptor inhibitors may be steroidal (abiraterone, cyproterone, nomegestrol, or spironolactone), or nonsteroidal (apalutamide, bicalutamide, darolutamide, enzalutamide, flutamide, or nilutamide). Transmembrane protease, serine 2 (*TMPRSS2*) blockers include bromhexine, camostat, and nafamostat. *ACE*, Angiotensin converting enzyme.

Wambier et al 2020
J. Am. Acad. Dermat.

Updated (6/8/20) This piece has been clarified to note that the study did not control for age, which is a risk factor for hair loss and severe Covid-19.



Forbes

Selection bias occurs when the people who you sample differ systematically from the population at large, with respect to the question you are asking

Ignoring selection bias can produce misleading estimates about a population.

Photo: Carl Bergstrom

Photo: Carl Bergstrom

A puzzle from the insurance industry

PROGRESSIVE

Insurance | Claims | Your Policy

Search / Keywords

#1 Auto Insurance Site

Make a Payment | Log In

1-800-PROGRESSIVE

Switching saves you over **$500** on average*

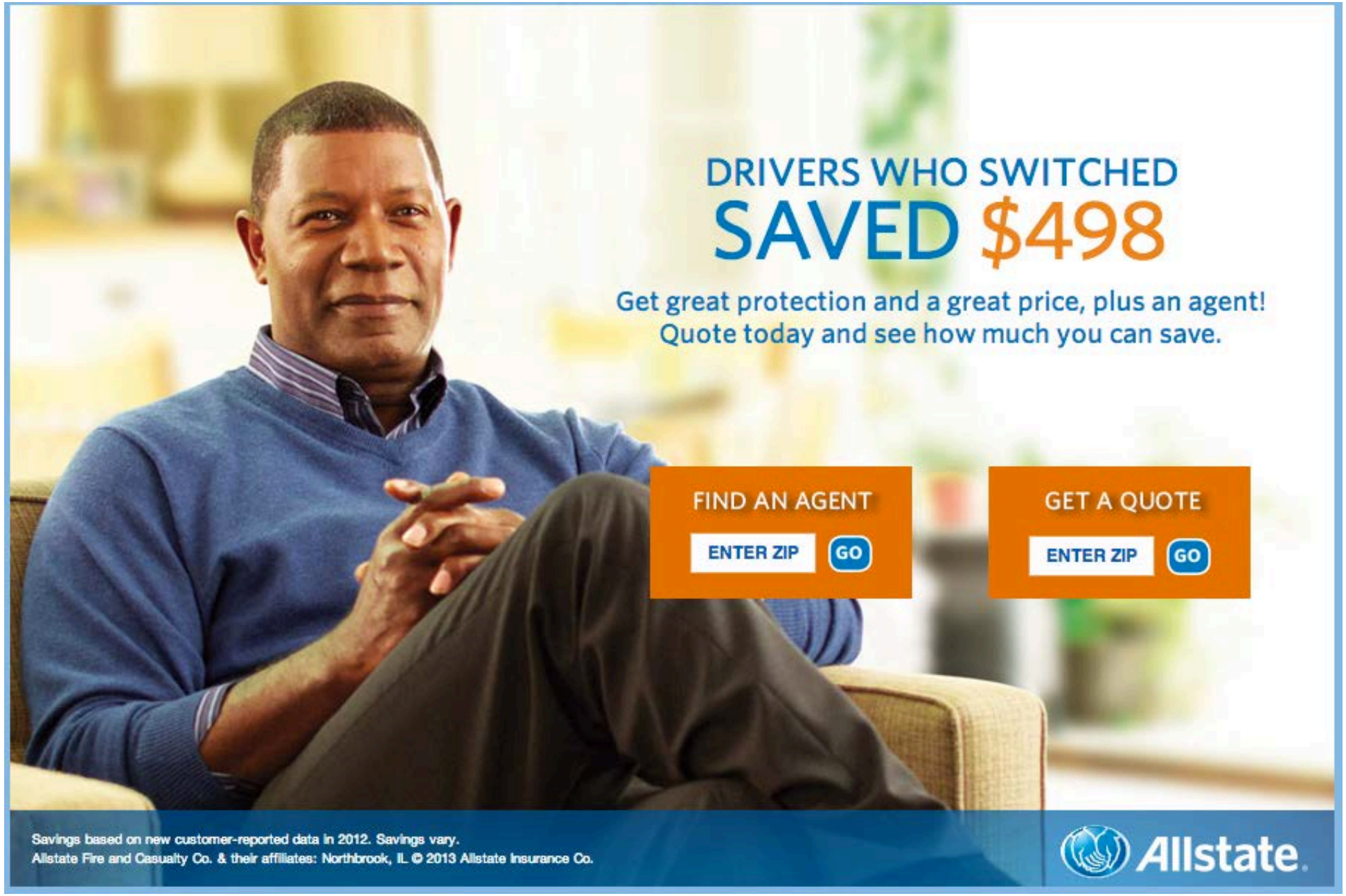
Zip Code

Auto

Get a Quote

› Quote with a Local Agent

› Retrieve a Quote


DRIVERS WHO SWITCHED
SAVED $498
Get great protection and a great price, plus an agent!
Quote today and see how much you can save.
FIND AN AGENT
ENTER ZIP
GO
GET A QUOTE
ENTER ZIP
GO
Savings based on new customer-reported data in 2012. Savings vary.
Allstate Fire and Casualty Co. & their affiliates: Northbrook, IL © 2013 Allstate Insurance Co.
Allstate.

New Farmers customers who purchased multiple policies **saved** an average of

$502 each year

Kirk D. Baldwin

Contact Me

FARMERS INSURANCE GROUP

FARMERS

BIG SAVINGS

New GEICO customers report average annual savings over $500 on car insurance.

Click for a free rate quote. ▶▶

GEICO

☆ **GEICO Insurance** Inbox -...se@gmail.com 5:52 AM GI

Bull, switch to GEICO and you could save $500 or more.

To: bullsht.course@gmail.com

3/6/2021: See Why GEICO Could Be Your Best Choice, Bull Shtcourse

Name	: Bull Shtcourse

Dear Bull,

There's a high possibility you might be overpaying for your car's insurance. With GEICO's affordable rates and additional discounts, you could bring down your high auto insurance premiums.

Bull, Here's Your Free Quote >>

Selection bias.

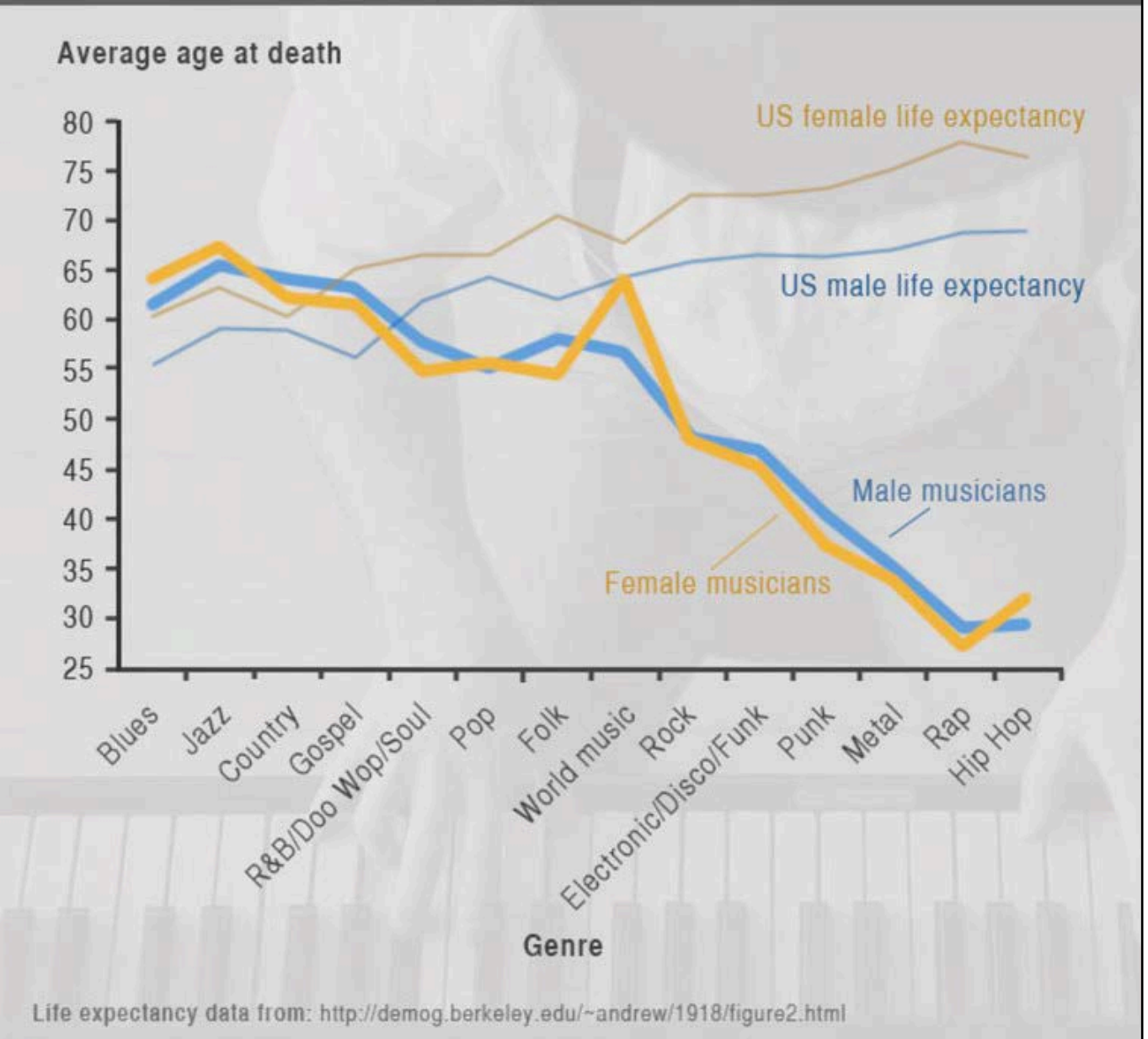
'Mask mouth': Dentists warn prolonged use of masks leading to poor oral hygiene

Dentists are warning about the health issues tied to prolonged use of a mask to stop the spread of the coronavirus.

washingtonexaminer.com

Age of death and musical genre

Average age of death for popular musicians by genre and sex



Life expectancy data from: http://demog.berkeley.edu/~andrew/1918/figure2.html

Source: Author

Photo: Clarence Davis

"Murder accounted for 6.0% of deaths across the sample, but was the cause of 51% of deaths in rap musicians and...hip hop musicians, to date. This could be due to these genres' strong associations with drug-related crime and gang culture."

"It's a cautionary tale to some degree. People who go into rap music or hip hop or punk, they're in a much more occupational hazard profession compared to war. We don't lose half our army in a battle."

— Dianna Kenny in the *Washington Post*

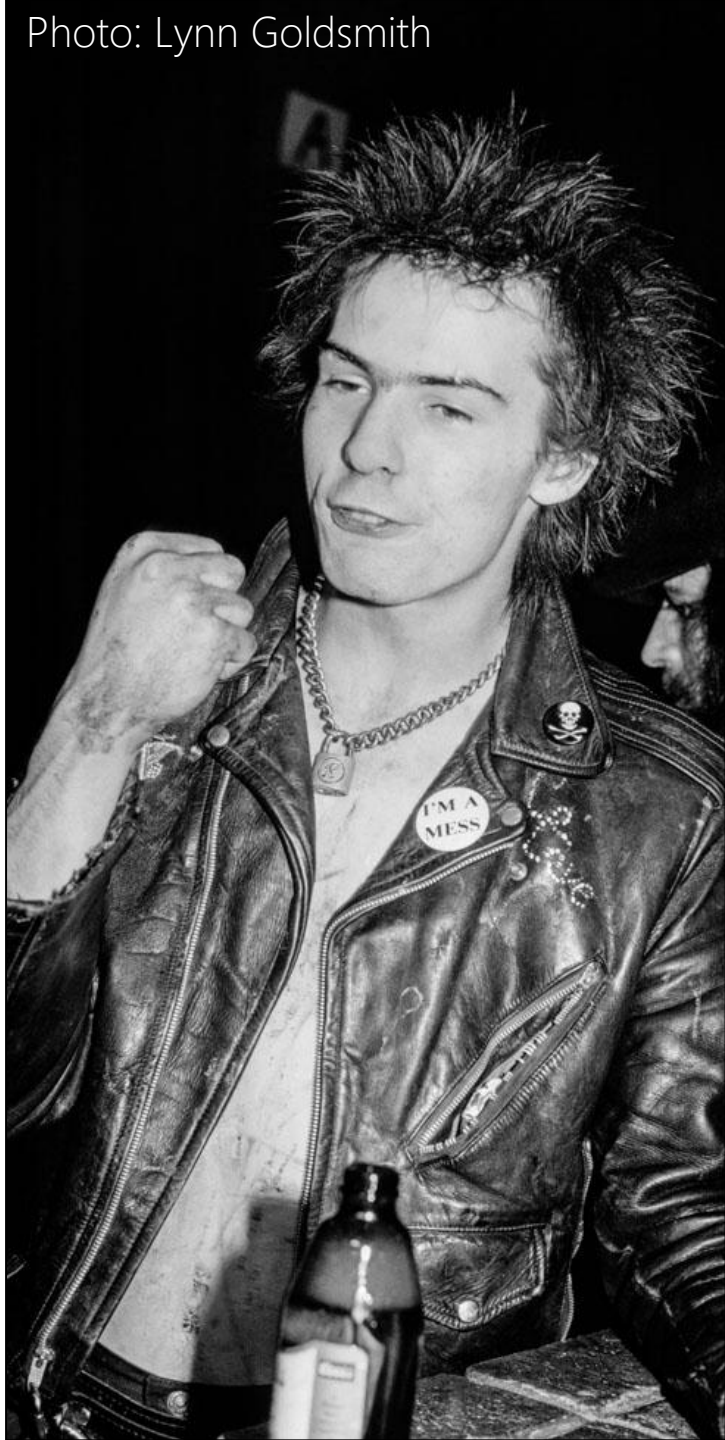
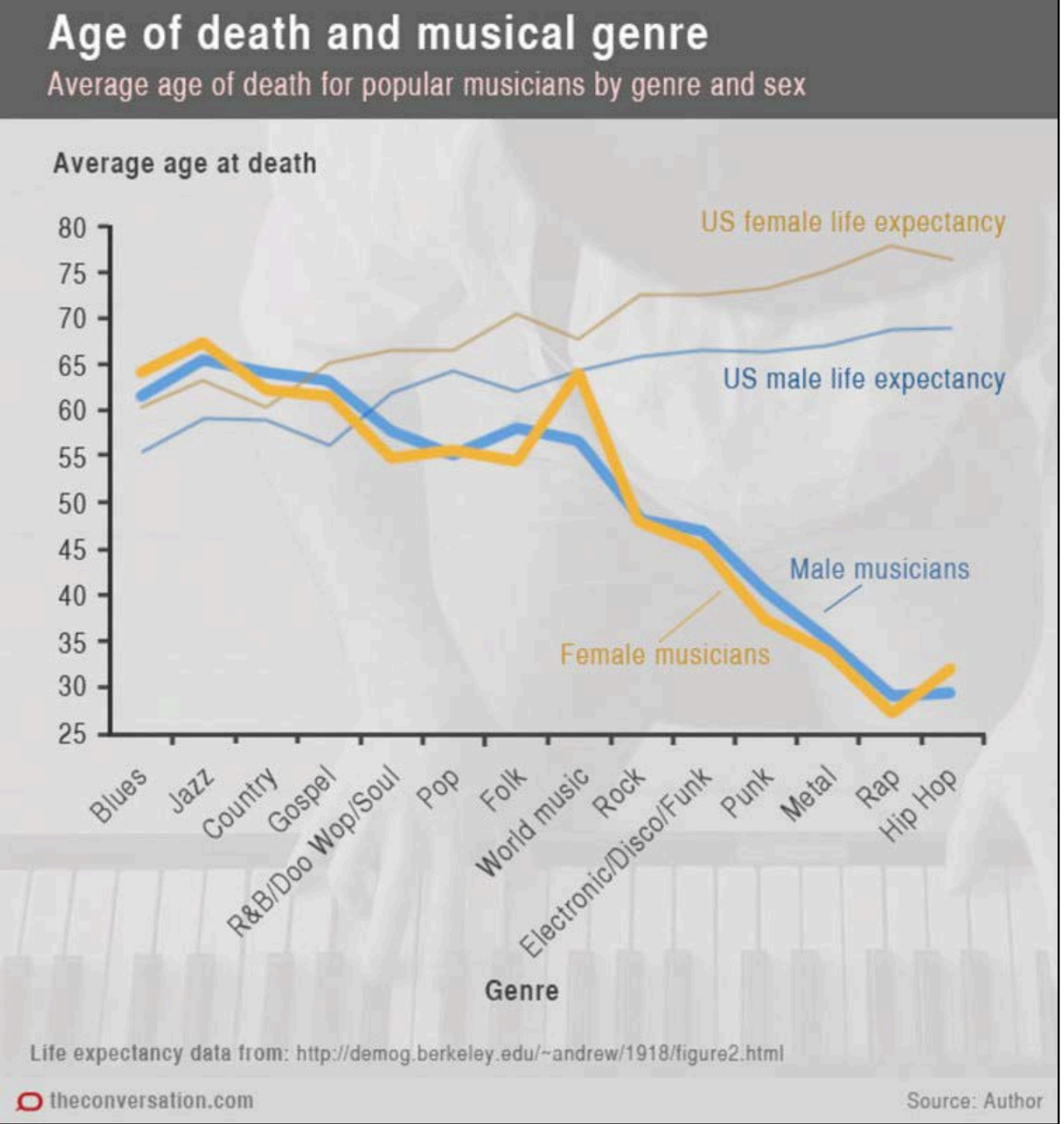


Photo: Lynn Goldsmith



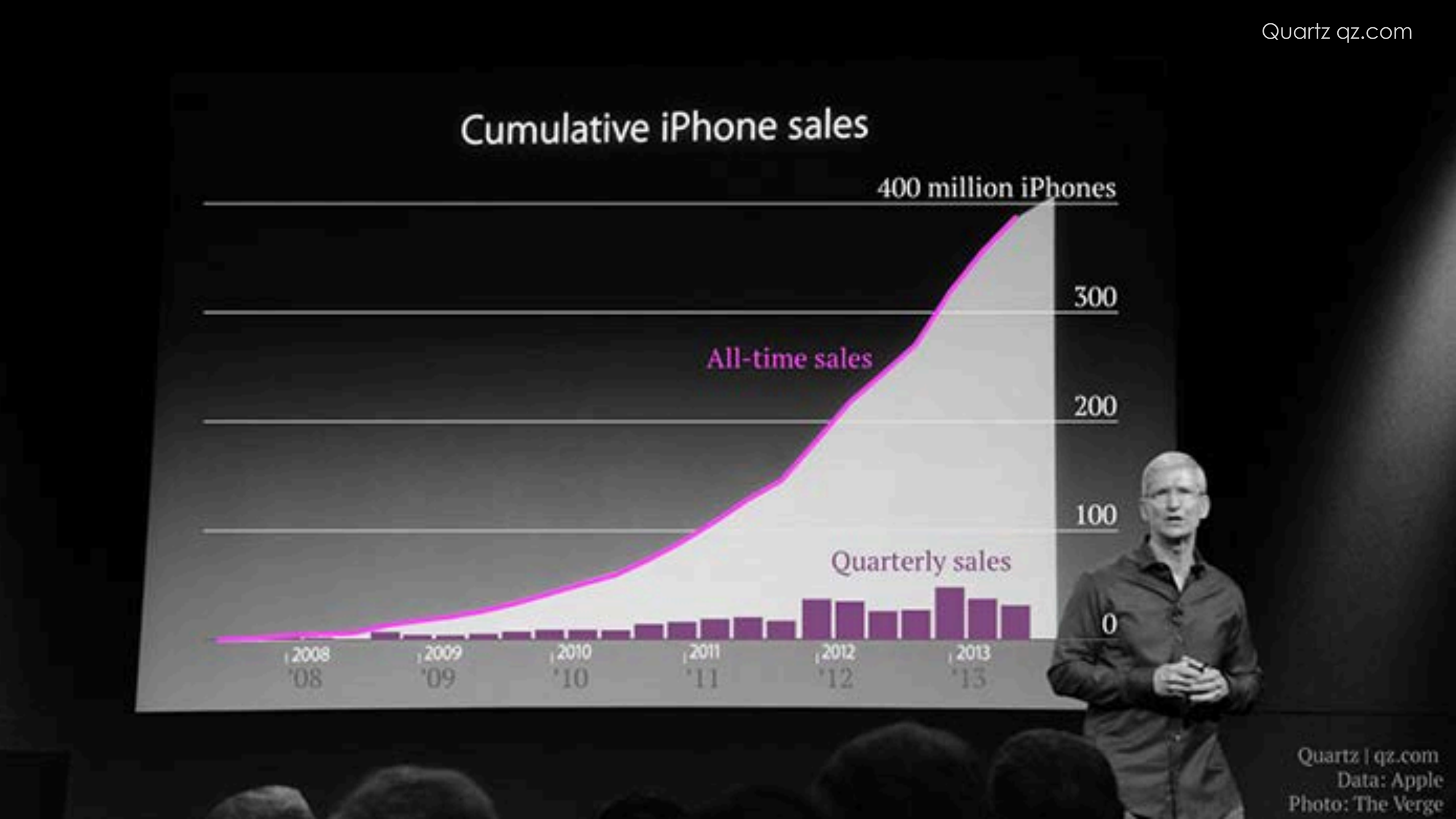
Right Censoring.

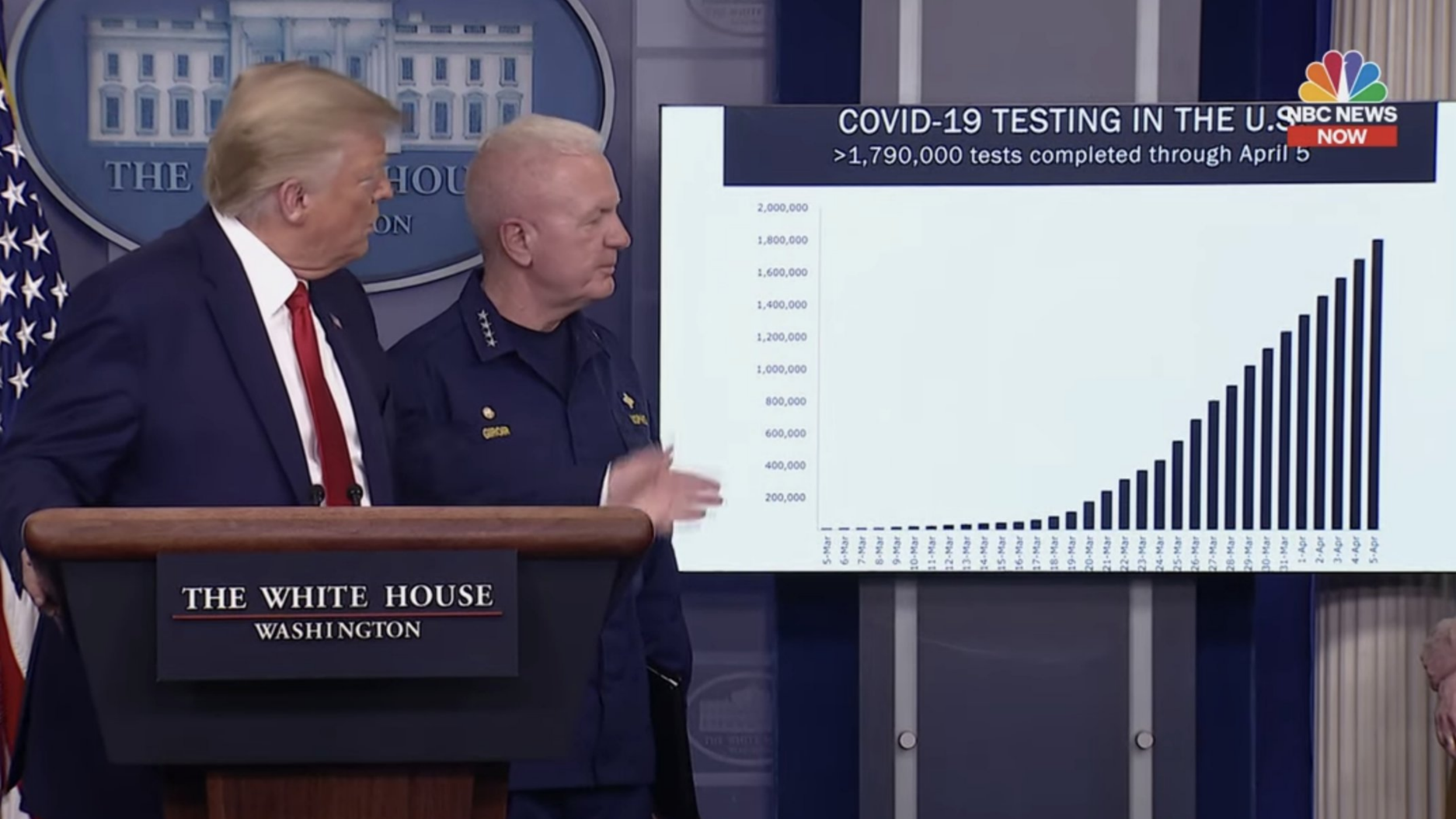
It's not that rap and hip-hop stars are more likely to die young.

It's that they haven't yet had time to die old.

Data visualization

The Verge


Cumulative iPhone sales
400 million iPhones
300
200
100
0
All-time sales
Quarterly sales
2008
'08
2009
'09
2010
'10
2011
'11
2012
'12
2013
'13
Quartz | qz.com
Data: Apple
Photo: The Verge


THE WHITE HOUSE
WASHINGTON
COVID-19 TESTING IN THE U.S
>1,790,000 tests completed through April 5
NBC NEWS NOW
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
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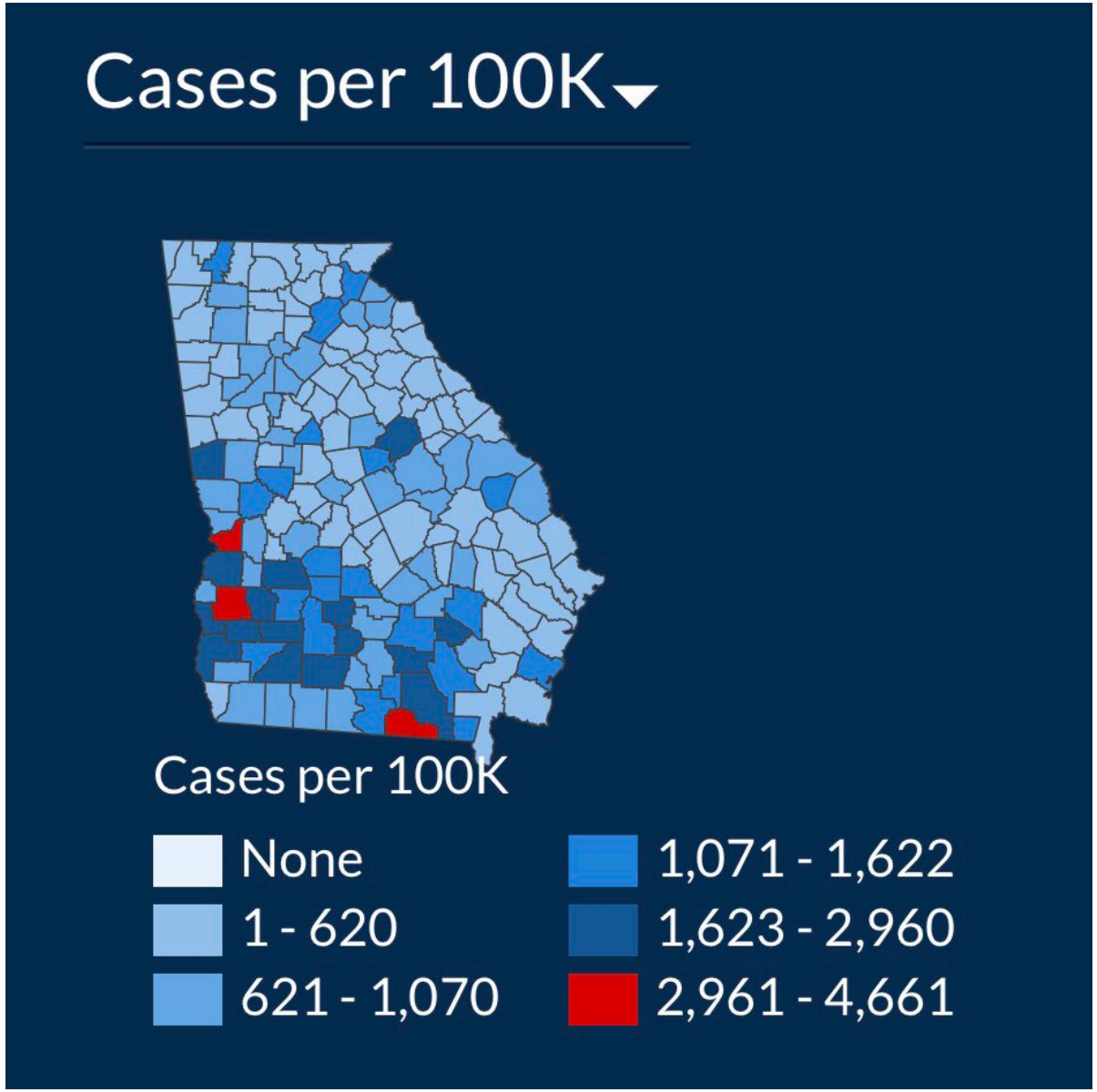
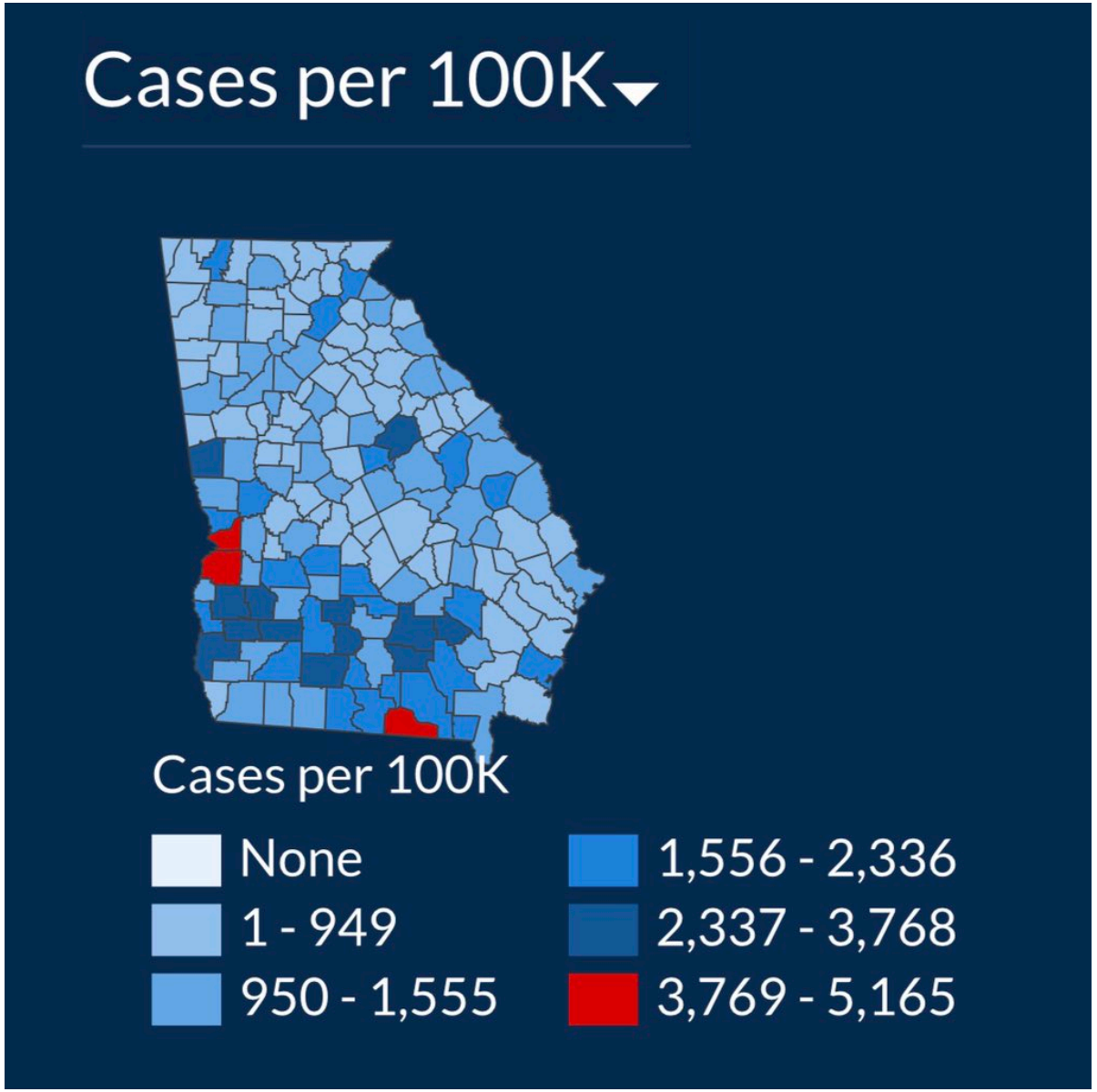
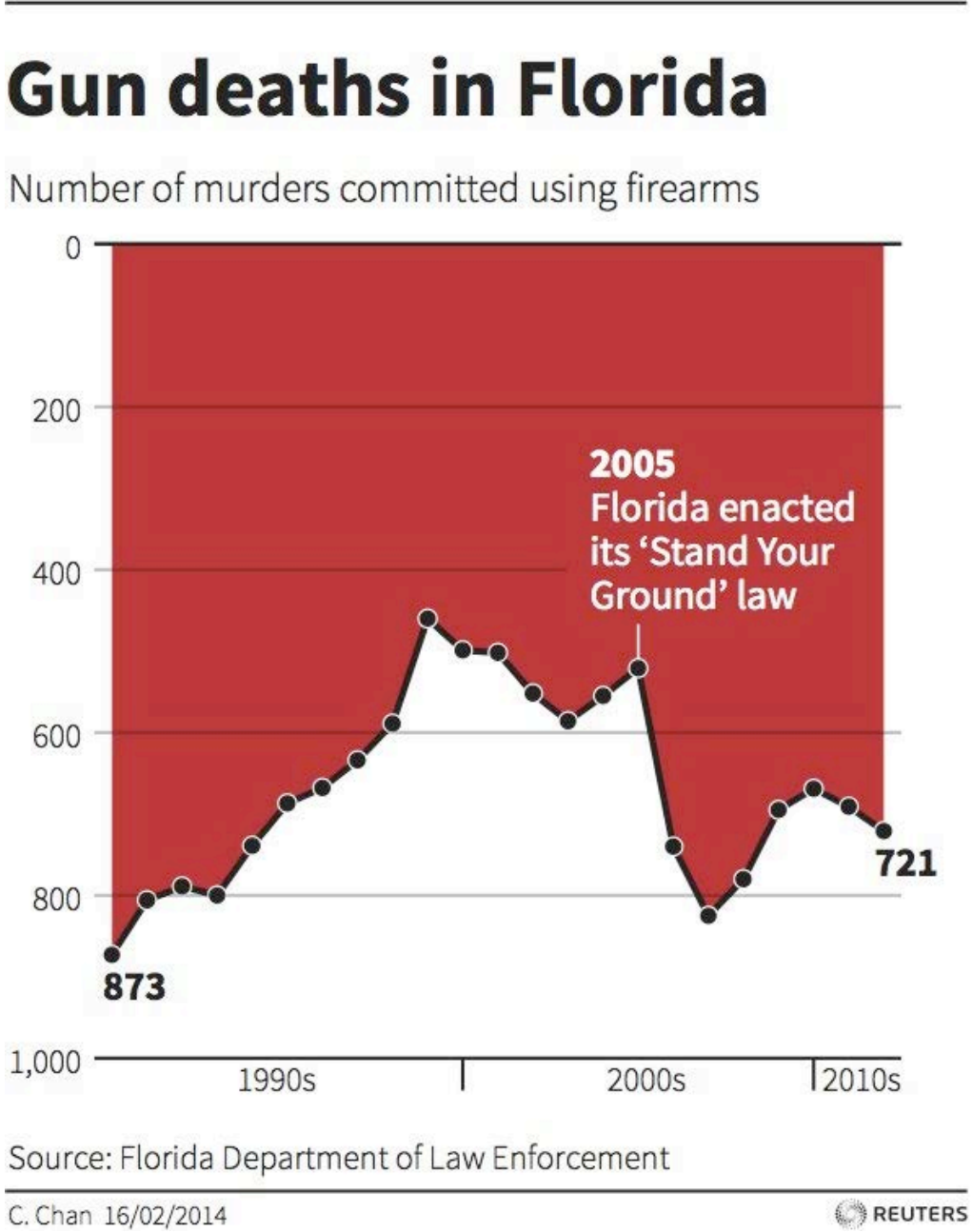


July 2

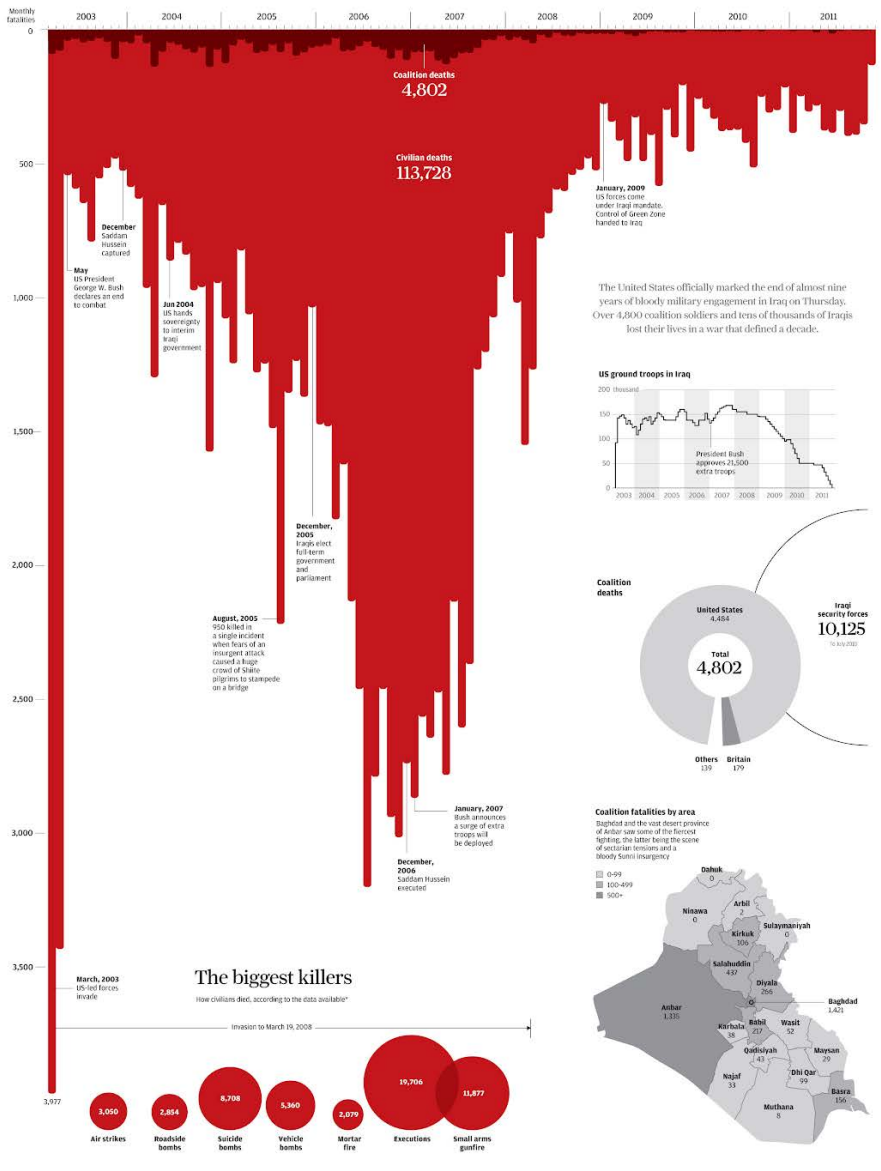


July 17



Via http://blog.heapanalytics.com/how-to-lie-with-data-visualization/

Iraq's bloody toll



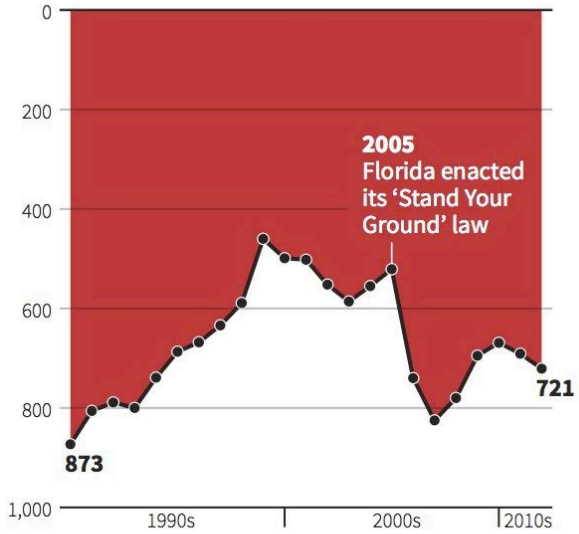
SCMP graphic: Simon Scarr

*Deaths from unknown causes are not included. Causes of death accounting for less than 0.5 per cent of killings also not included.

Sources: Casualties, Iraq Body Count; New England Journal of Medicine; Global Security; Brookings Institution

Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

C. Chan 16/02/2014 REUTERS

Hanlon’s razor

Never ascribe to malice what can be adequately explained by incompetence.

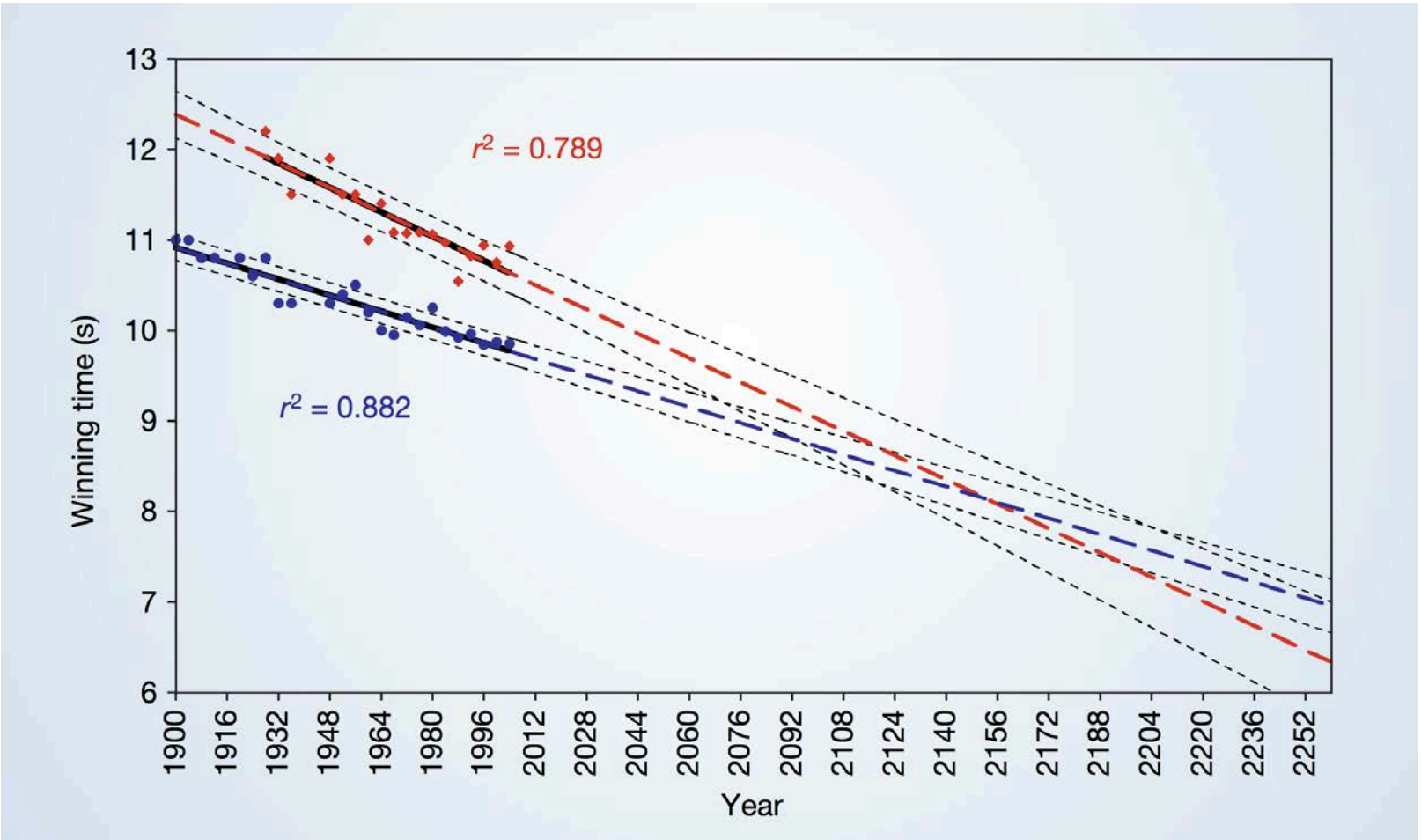
Never ascribe to incompetence what could be an understandable mistake.

Digital Civics and Ethics

Photo: Carl Bergstrom

Momentous sprint at the 2156 Olympics?

Women sprinters are closing the gap on men and may one day overtake them.



Tatem et al. (2004) *Nature*

“Sir — A. J. Tatem and colleagues calculate that women may out-sprint men by the middle of the twenty-second century (*Nature* **431**,525; 2004). They omit to mention, however, that (according to their analysis) a far more interesting race should occur in about 2636, when times of less than zero seconds will be recorded.

In the intervening 600 years, the authors may wish to address the obvious challenges raised for both time-keeping and the teaching of basic statistics.”

— Kenneth Rice

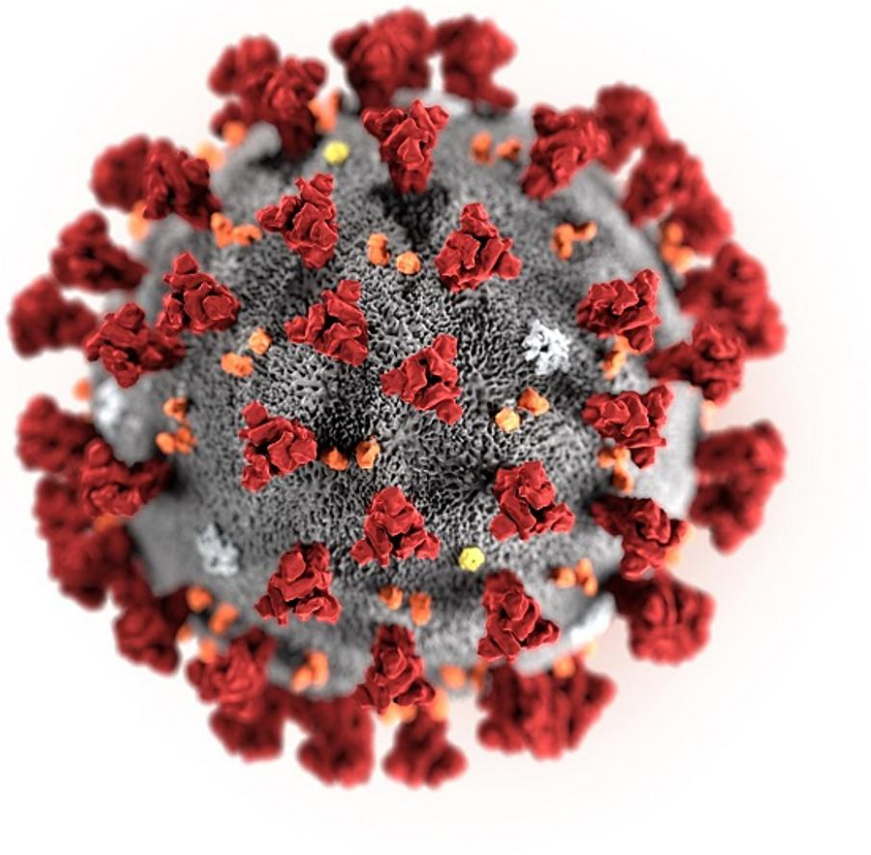
Kenneth Rice (2004) *Nature*

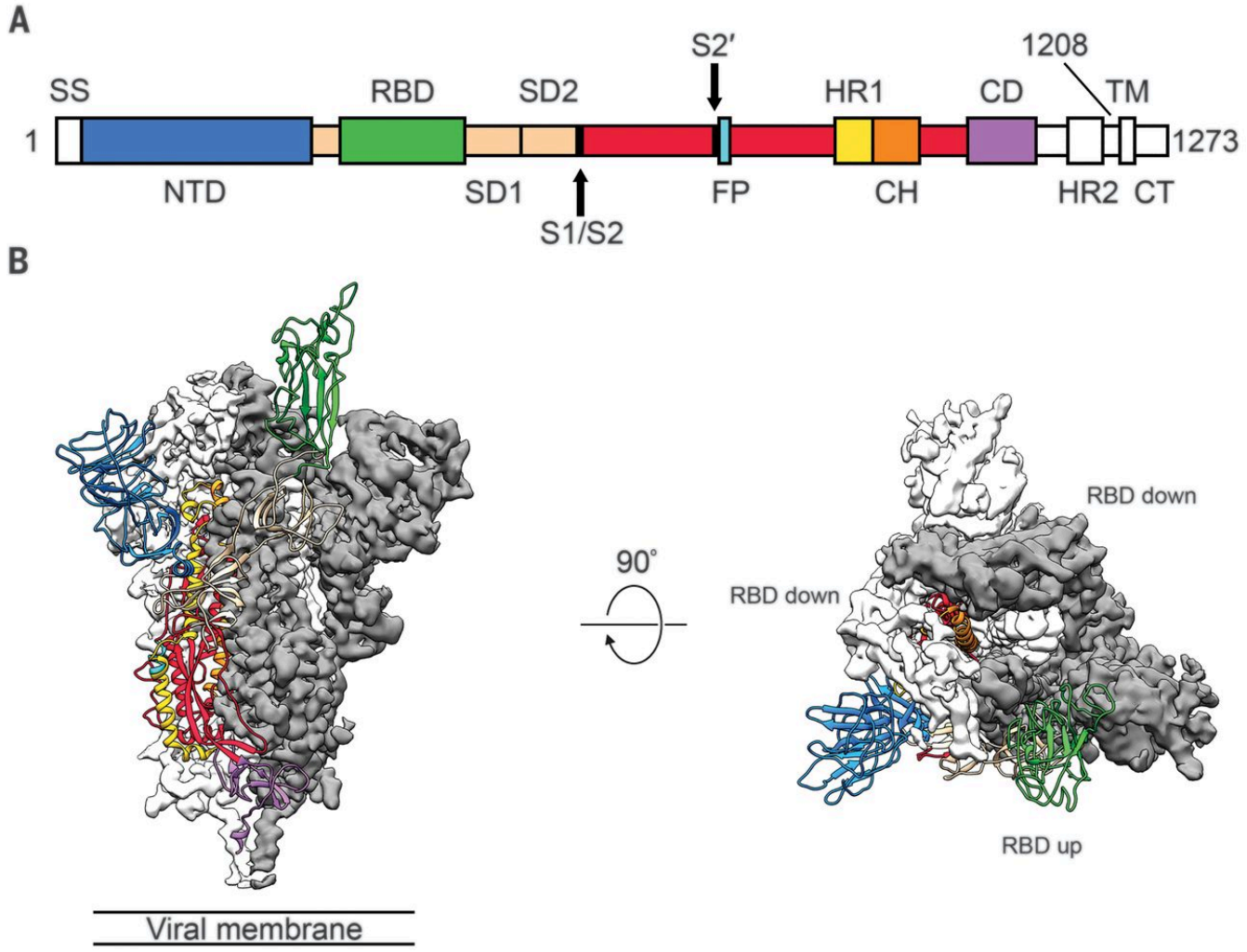
Method: *Reductio ad absurdum*

Show that an argument's methods or assumptions lead to ridiculous conclusions.

Photo: Carl Bergstrom
We started with a novel virus and a massive uncertainty vacuum.

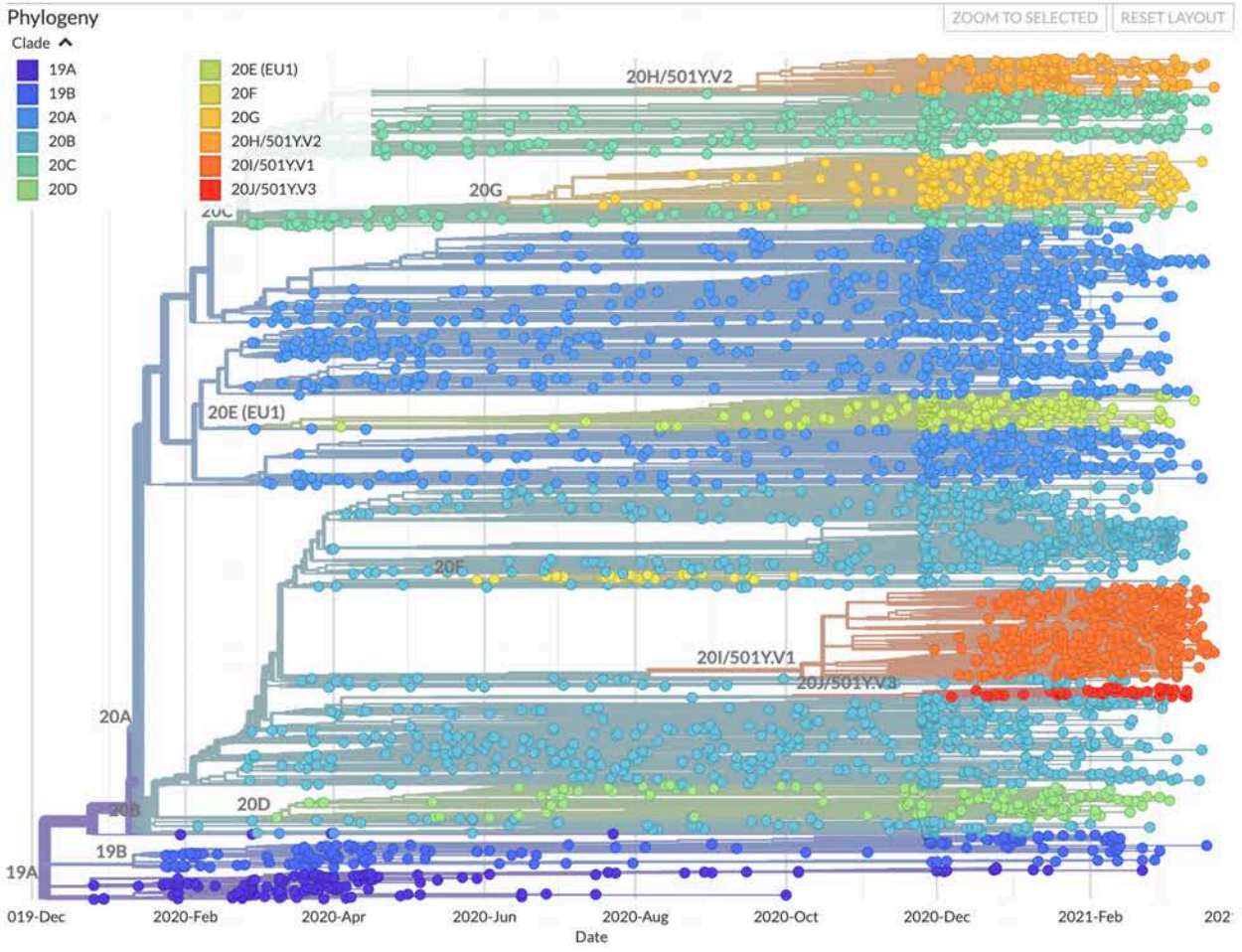
We know the entire genomic and molecular structure of the virus

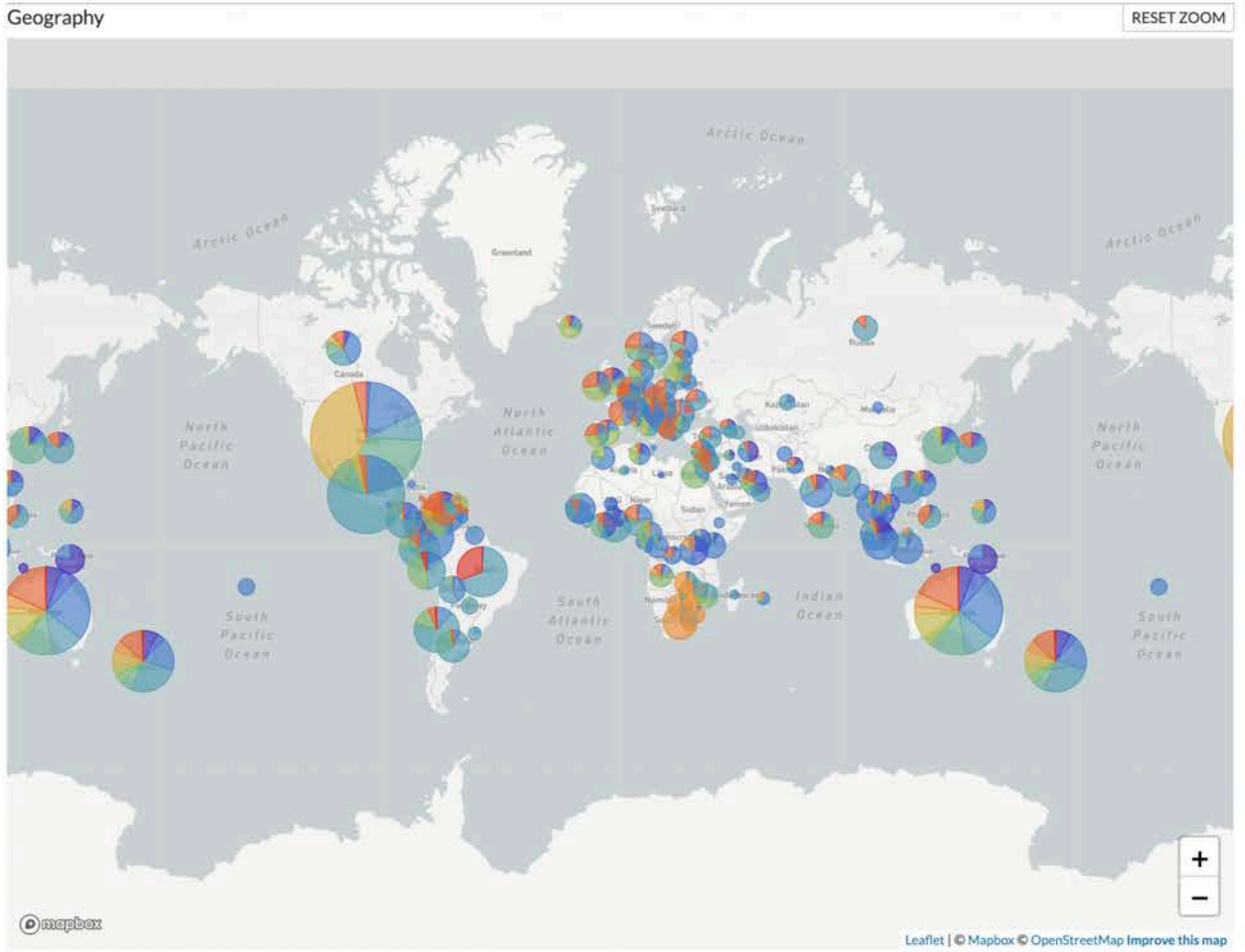




CDC; Wrapp et al. (2020)

We have used genomic epidemiology to trace its evolution and spread around the globe.





Nextstrain.org

We have developed 10 COVID vaccines with more on the way.

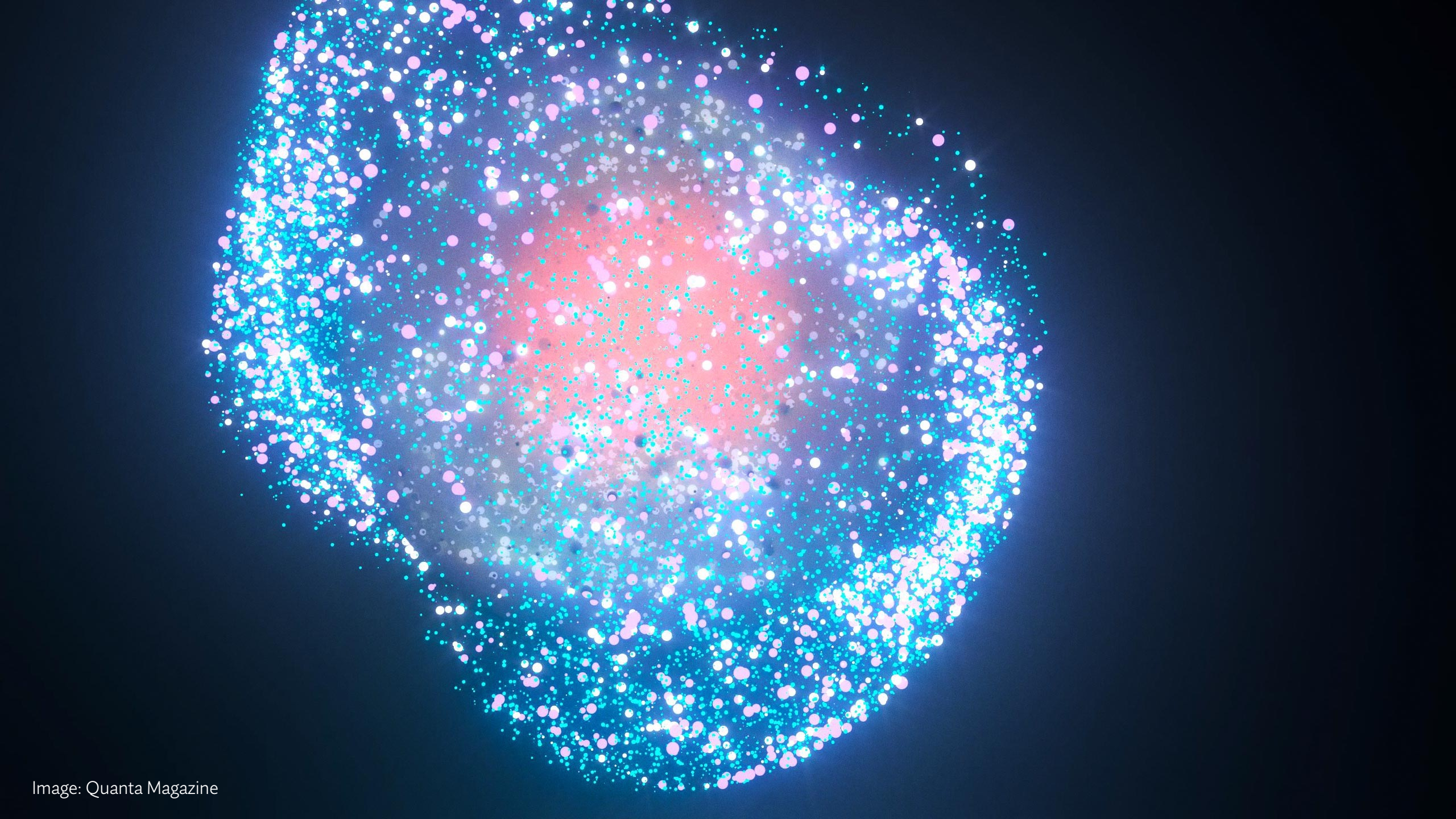


Image: Quanta Magazine

COLLOQUIUM PAPER

Misinformation in and about science

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Humans learn about the world by collectively acquiring information, filtering it, and sharing what we know. Misinformation undermines this process. The repercussions are extensive. Without reliable and accurate sources of information, we cannot hope to halt climate change, make reasoned democratic decisions, or control a global pandemic. Most analyses of misinformation focus on popular and social media, but the scientific enterprise faces a parallel set of problems—from hype and hyperbole to publication bias and citation misdirection, predatory publishing, and filter bubbles. In this perspective, we highlight these parallels and discuss future research directions and interventions.

misinformation | disinformation | fake news | data reasoning | science communication

SOCIAL SCIENCES

Misinformation has reached crisis proportions. It poses a risk to international peace (1), interferes with democratic decision making (2), endangers the well-being of the planet (3), and threatens public health (4, 5). Public support for policies to control the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is being undercut by misinformation, leading to the World Health Organization's "infodemic" declaration (6). Ultimately, misinformation undermines collective sense making and collective action. We cannot solve problems of public health, social inequity, or climate change without also addressing the growing problem of misinformation.

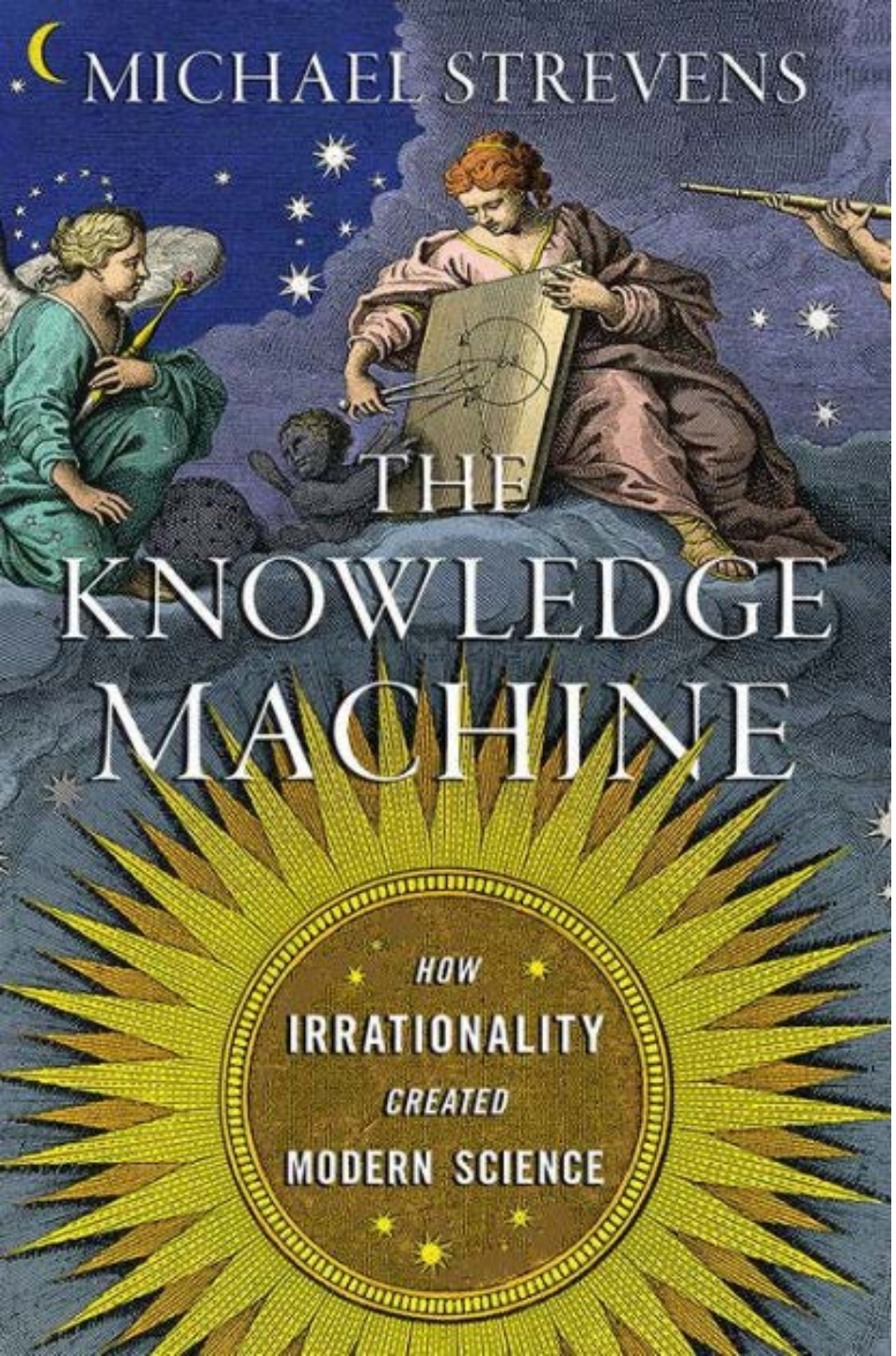
Most of the research efforts and interventions examine broad, public consumption of misinformation—modeling the spreading

broadcast media (14), many of these sources are dangerously hyperpartisan.

Nearly 40% of Americans viewed content from untrustworthy websites during the 2016 US election, but these articles only represented about 6% of all news articles consumed (16), and sharing of "fake news" may be less prevalent than often reported in the media (17). That said, even seemingly trustworthy news sites push misleading headlines. Headlines from rival publishers appear side by side on our phones, competing for the ensuing clicks that drive advertising revenue. The unvarnished truth is not always enough to capture our attention. Thorough, detailed, accurate reporting has to compete with clickbait that manufactures emotional responses, curiosity, and anticipation (18). How can thoughtful analysis of minimum wage rates and unemployment trends possibly compete with yet another celebrity breakup, the one hygiene trick your dentist does not want you to know, or nine cats who look like characters from The Office? Publishers need flair, fluff, and sparkle to draw our attention—and they have responded enthusiastically.

Nuance falls by the wayside. Headlines often replace factual statements with promises of emotional experiences. Highly shared Facebook headlines pledge to "make you cry tears of joy," "give you goosebumps," or "melt your heart" (19). Rather than summarize the contents of the story, headlines deliberately obscure them to incite a click: "How to avoid the leading cause of death"; "Do economists think the Fed will cut rates?" Forward reference headlines (20) exploit our curiosity (21)

Photo: Carl Bergstrom
DATA
Science is relentlessly empirical.



Science requires huge volumes of careful data.

"Humans in their natural state are not much disposed to pay attention to such trifles. But they love to win....

[Science] creates a dramatic contest in which the trifles acquire an unnatural luster, becoming, for their tactical worth, objects of fierce desire. [This] redirects great quantities of energy that might have gone to philosophical or other forms of argument into empirical testing."

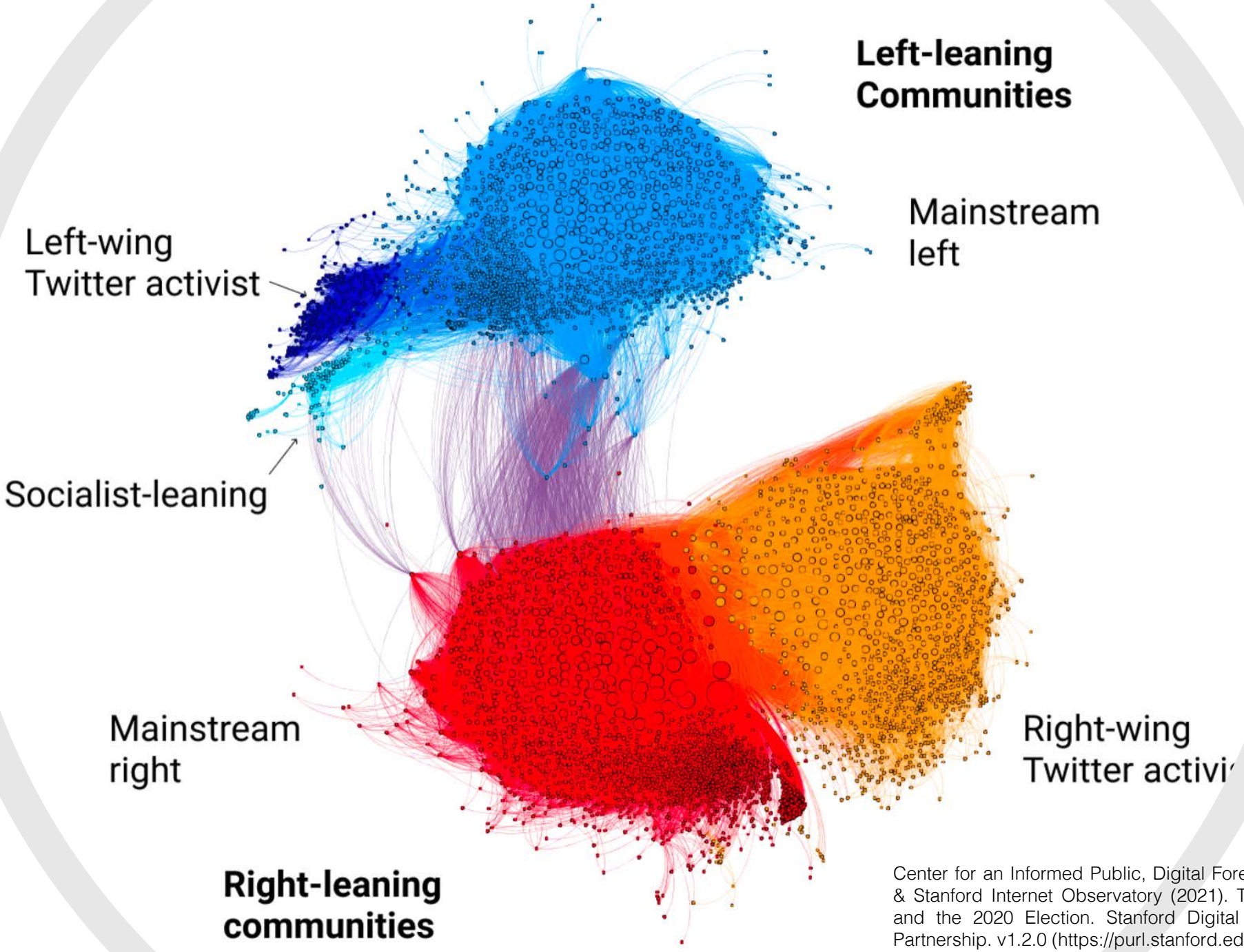
- Michael Strevens (2020)

At its foundation, science has a largely agreed-upon set of data and procedures used to adjudicate disagreements.

Tribal epistemology

> “Information is evaluated based not on conformity to common standards of evidence or correspondence to a common understanding of the world, but on whether it supports the tribe’s values and goals and is vouchsafed by tribal leaders. “Good for our side” and “true” begin to blur into one.”

—David Roberts, *Vox*



Center for an Informed Public, Digital Forensic Research Lab, Graphika, & Stanford Internet Observatory (2021). The Long Fuse: Misinformation and the 2020 Election. Stanford Digital Repository: Election Integrity Partnership. v1.2.0 (https://purl.stanford.edu/tr171zs0069)

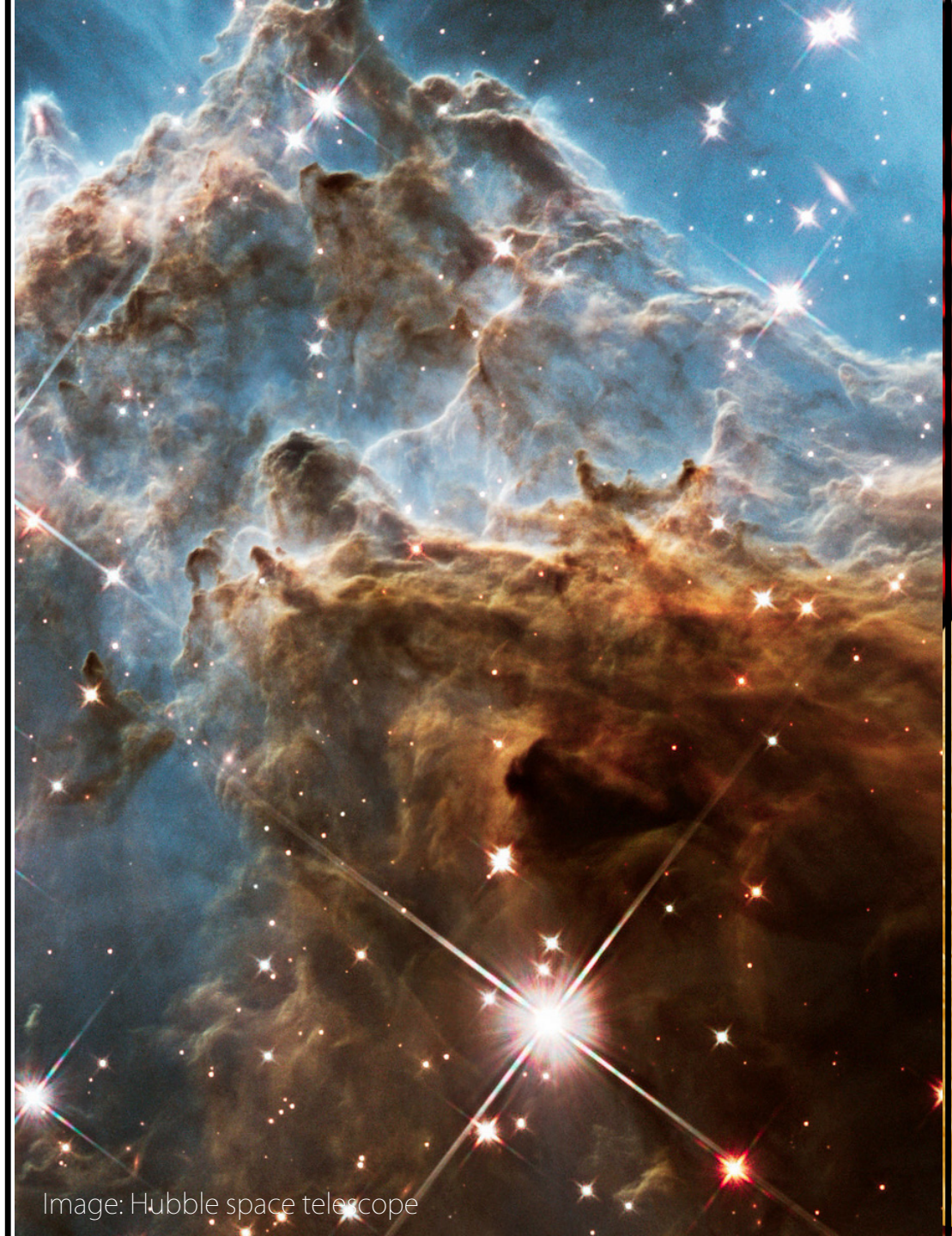
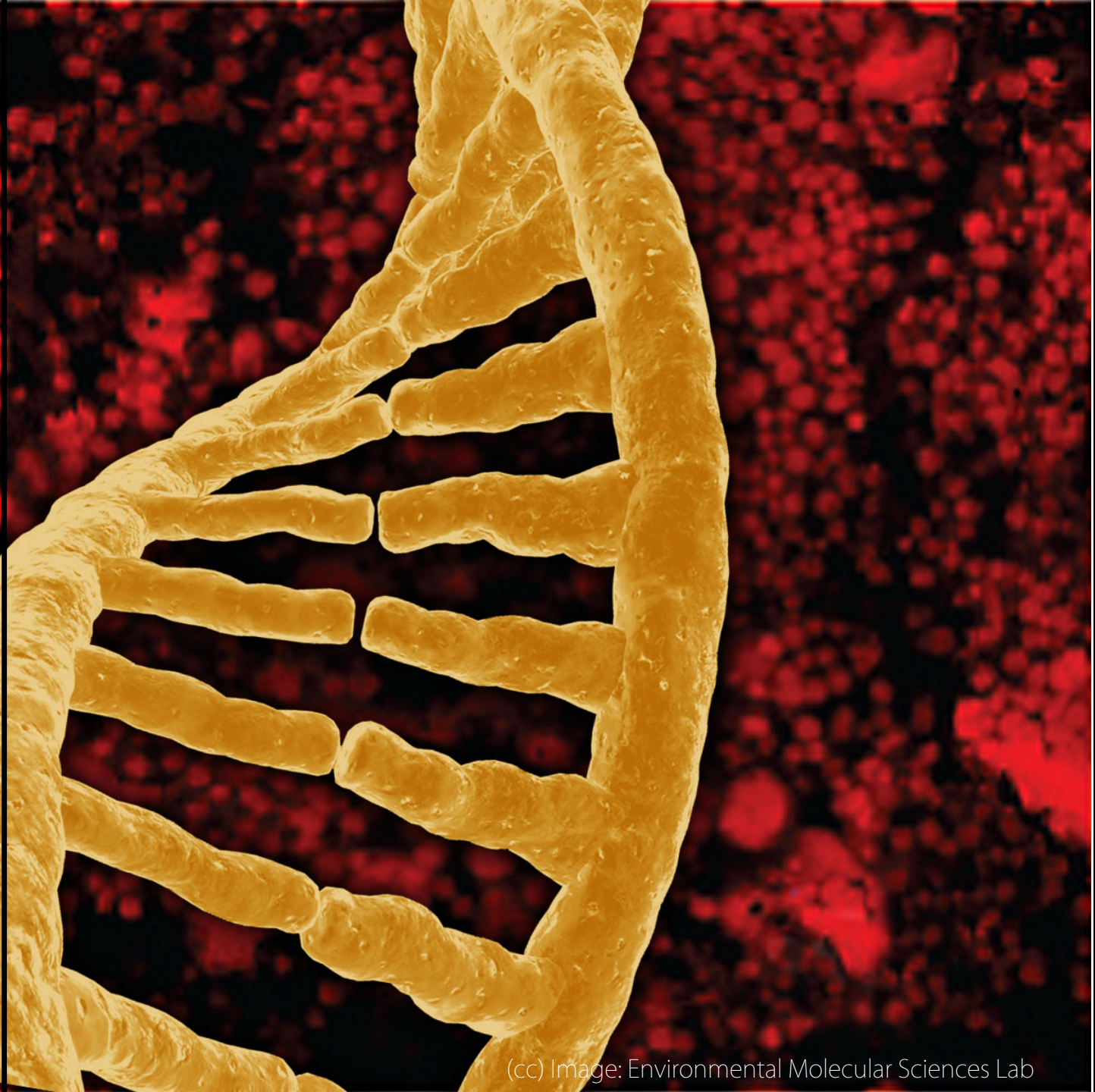


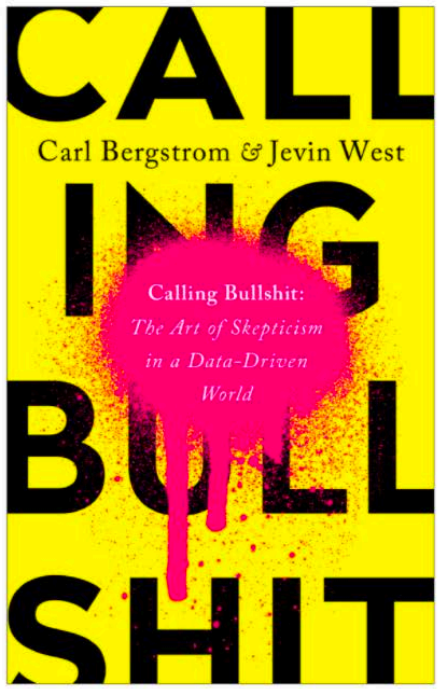
Image: Hubble space telescope



(cc) Image: Environmental Molecular Sciences Lab

Postman's third law: At any given time, the chief source of bullshit with which you have to contend is yourself.

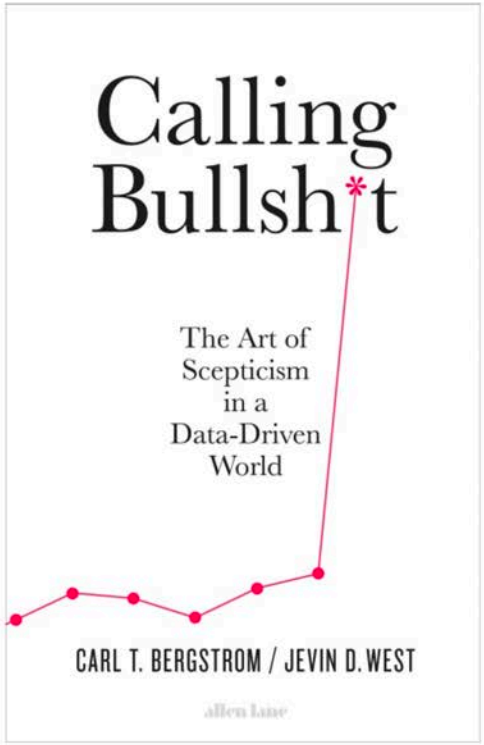
Photo: Carl Bergstrom



@callin_bull

@CT_Bergstrom

@jevinwest



http://callingbullshit.org