

Ethics (+ Accessibility)

Data Visualization

Frank Elavsky

Based on slides from Alex Cabrera, Katherine Ye, Arvind Satyanarayan, and Michael Correll



dig.cmu.edu

What you will learn today

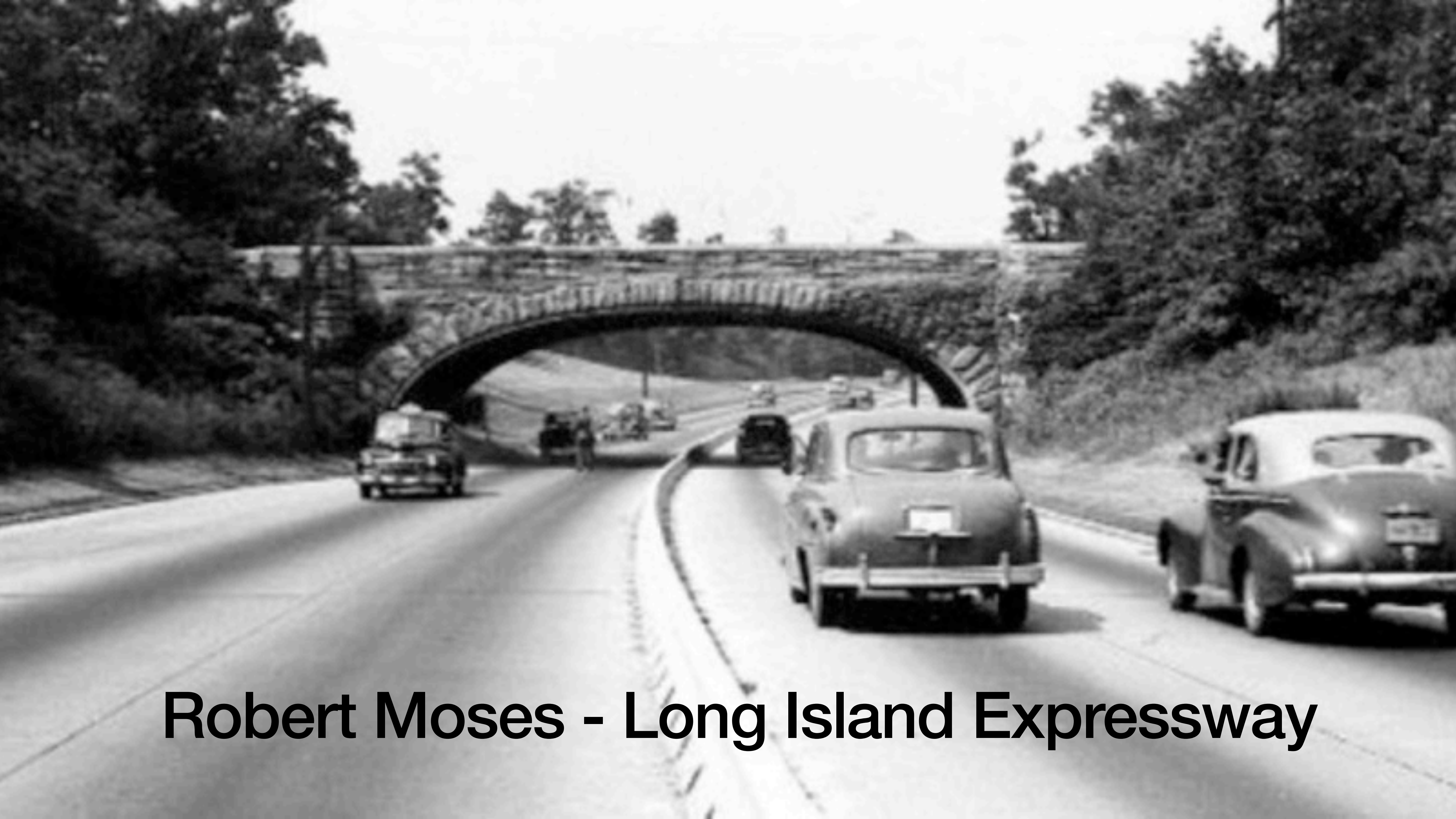
What are the ethical concerns and decisions you might face as a data scientist and visualization practitioner in the real world?

Goals

- Understand what *ethics* are (at a high level)
- Evaluate the quality and ethical implications of visualizations
- Think critically about
 - the politics and persuasion of visualization
 - data and its limitations/biases
 - who has access to and is impacted by visualization



Artifacts/technology can be
used for political aims



Robert Moses - Long Island Expressway

Is technology neutral, but used for
political aims?



UC Tomato Harvester

LANGDON WINNER

Do Artifacts Have Politics?

IN CONTROVERSIES ABOUT TECHNOLOGY AND SOCIETY, there is no idea more provocative than the notion that technical things have political qualities. At issue is the claim that the machines, structures, and systems of modern material culture can be accurately judged not only for their contributions of efficiency and productivity, not merely for their positive and negative environmental side effects, but also for the ways in which they can embody specific forms of power and authority. Since ideas of this kind have a persistent and troubling presence in discussions about the meaning of technology, they deserve explicit attention.¹

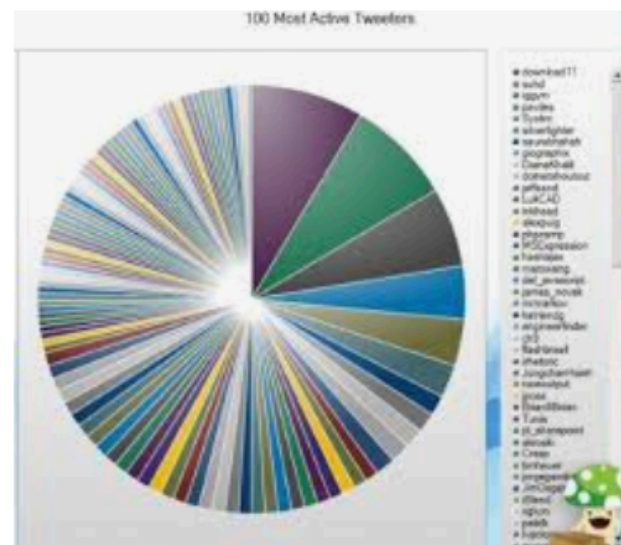
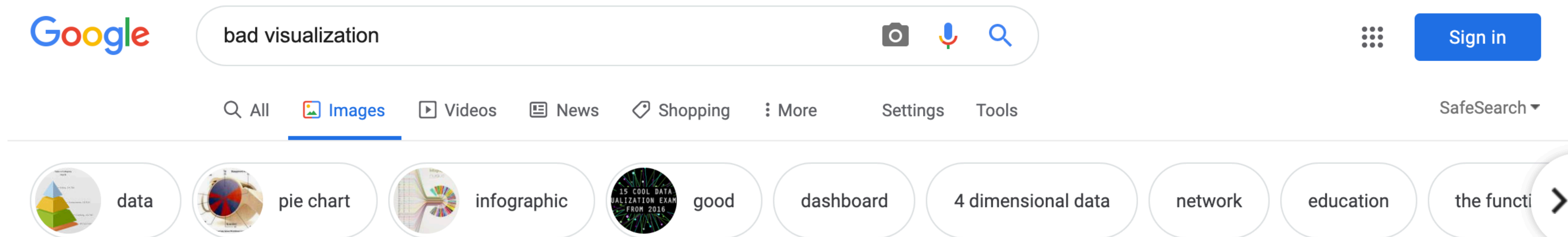


Facial recognition systems
used politically? inherently politically?

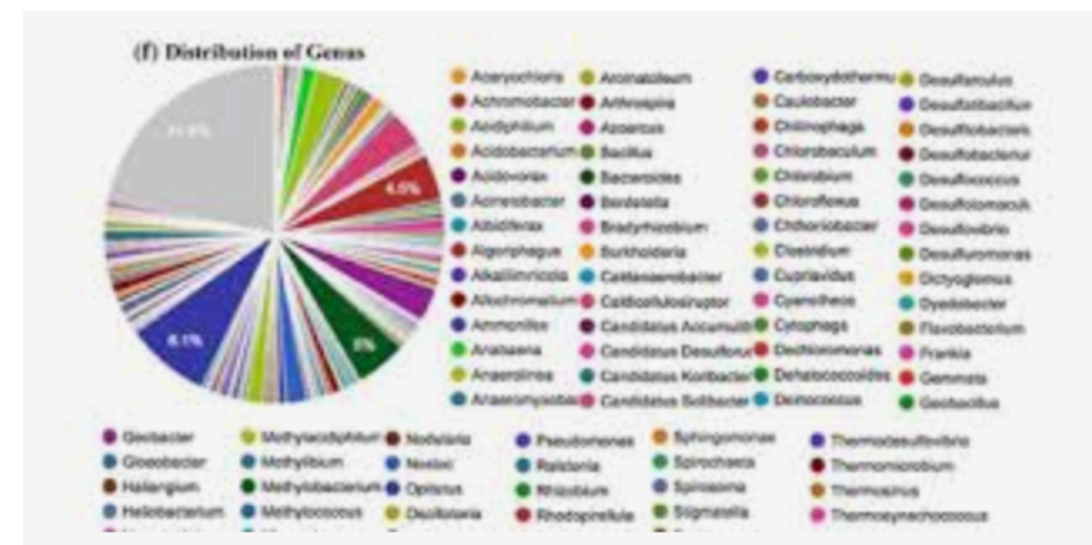
"The process of observing the world and quantifying it is a political act, and deserves ethical consideration"

Michael Correll

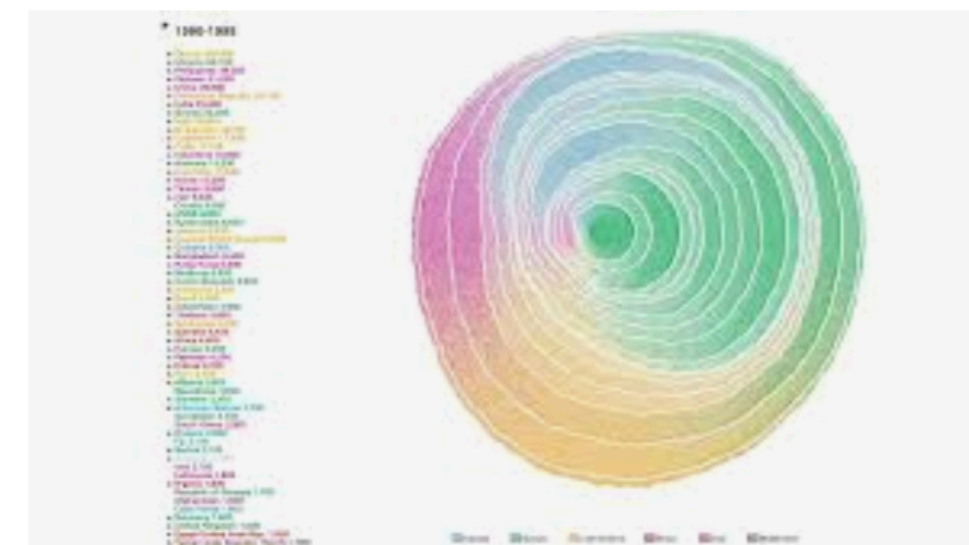
What is a bad visualization?



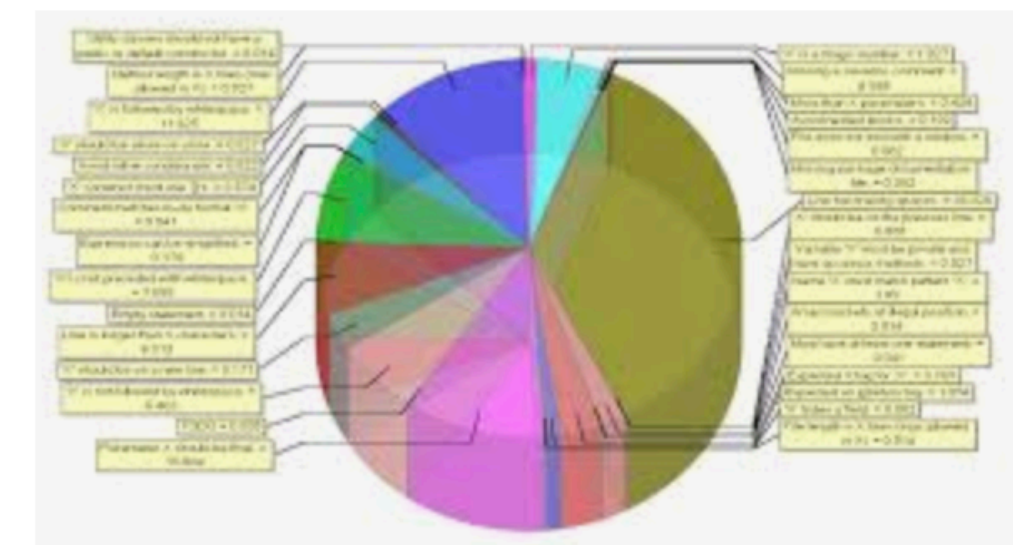
9 Worst Data Visualizations Ev...
livingqlikview.com



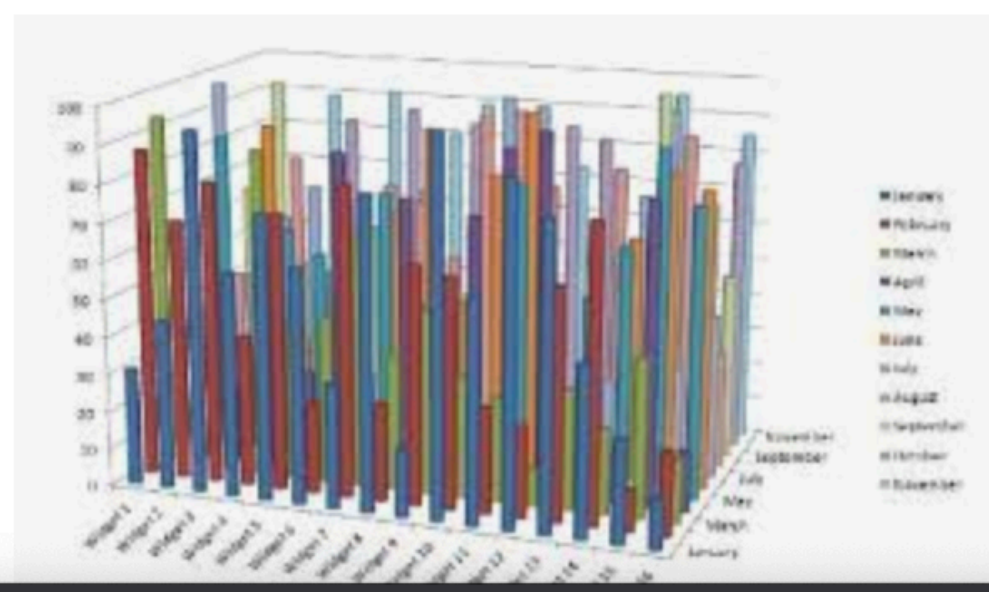
Data Stories: Avoiding Visualization ...
tdwi.org



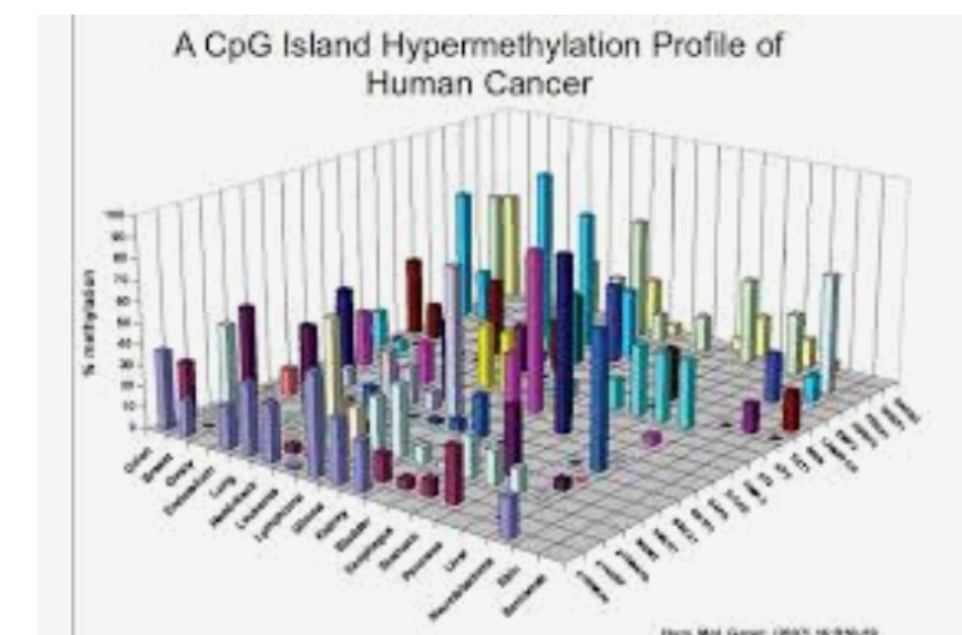
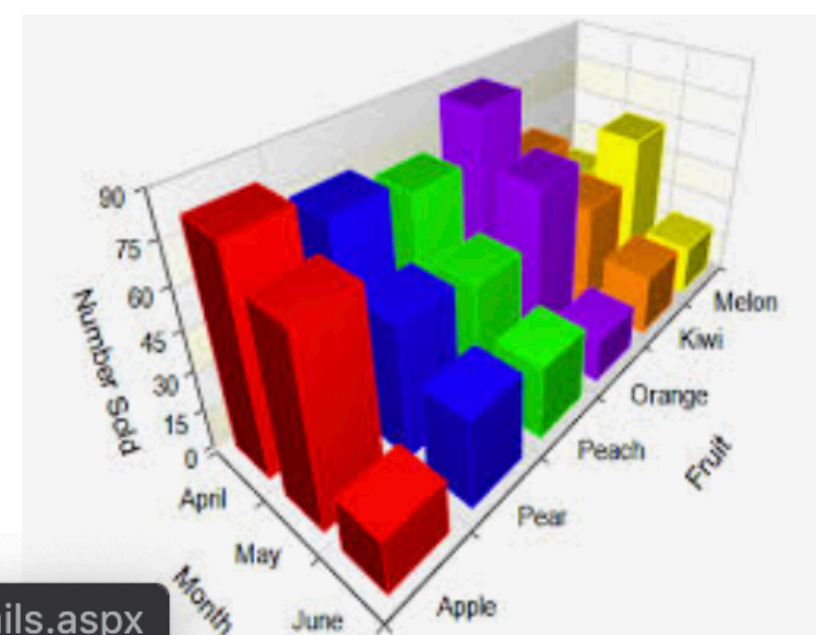
The Best and Worst Data Visualizations ...
kdnuggets.com



Pin on Chartjunk Data Visualization
pinterest.com



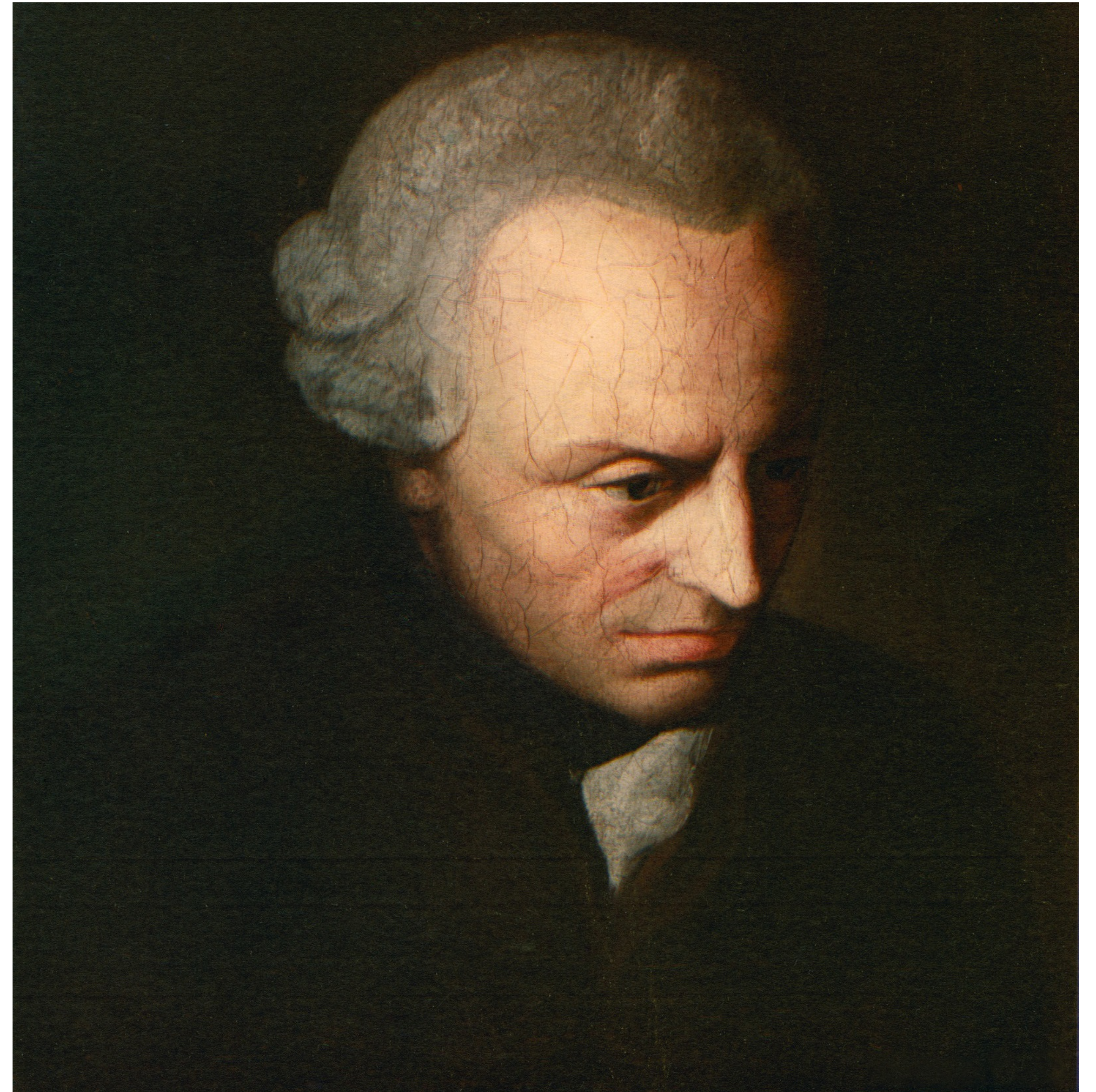
<https://tdwi.org/articles/2018/02/28/bi-all-visualization-fails.aspx>



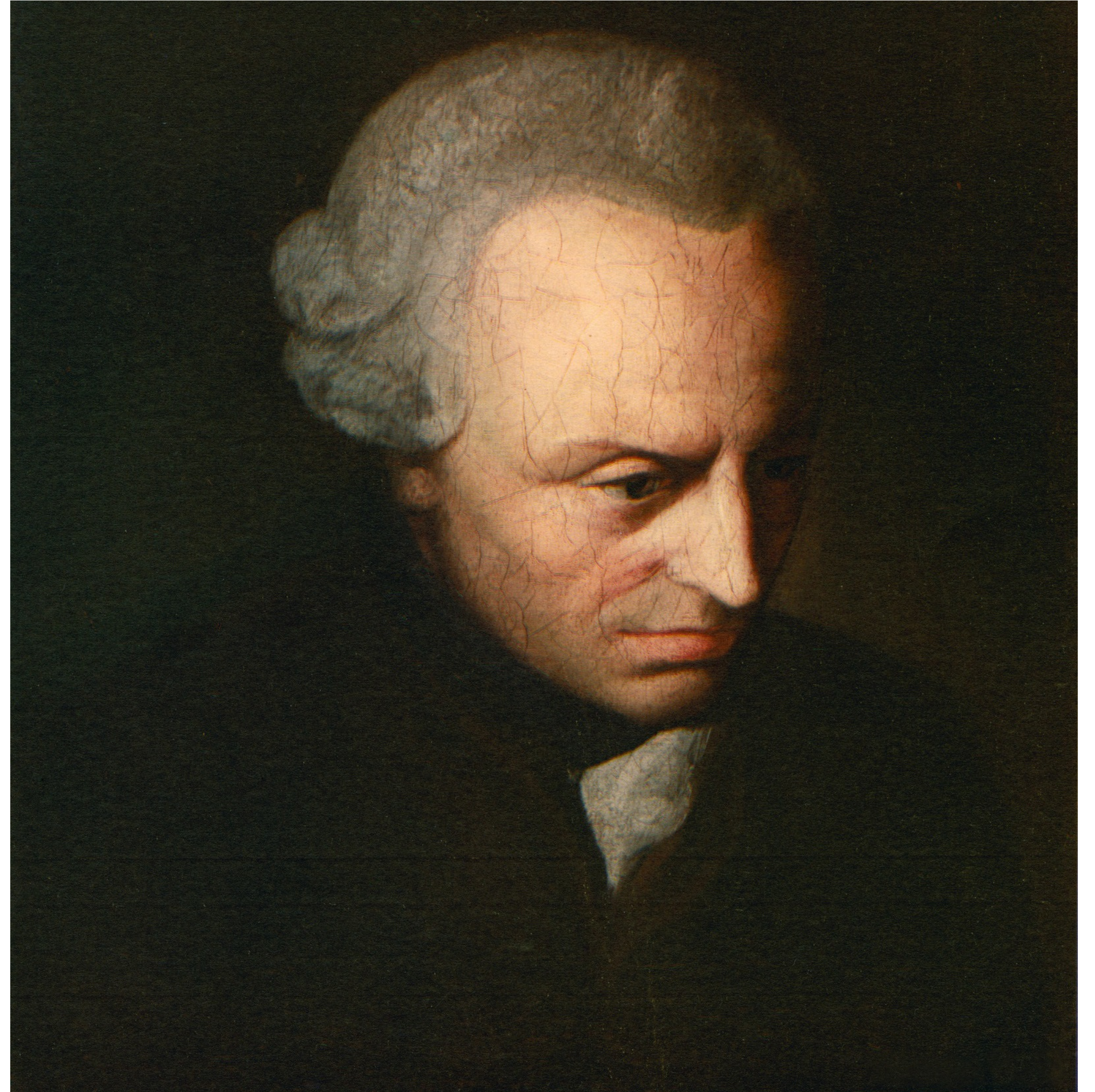
If visualizations are **inherently political** and our
common perception of “bad” visualizations is limited:

**How do we judge the value and
ethics of visualizations?**

What is *bad*? And what is *good*?
How do we “know” or not?

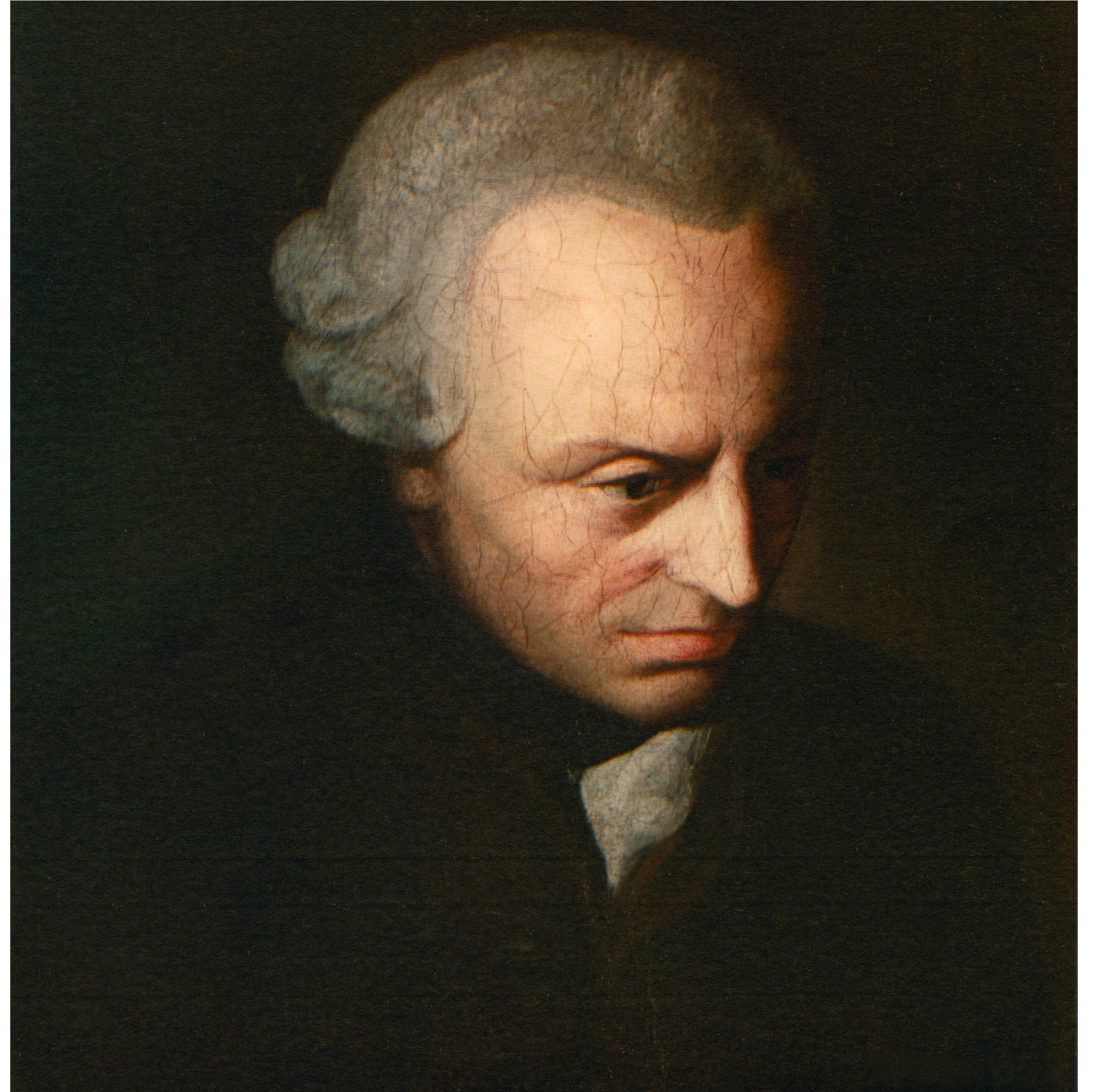


Example: Immanuel Kant



Deontological ethics

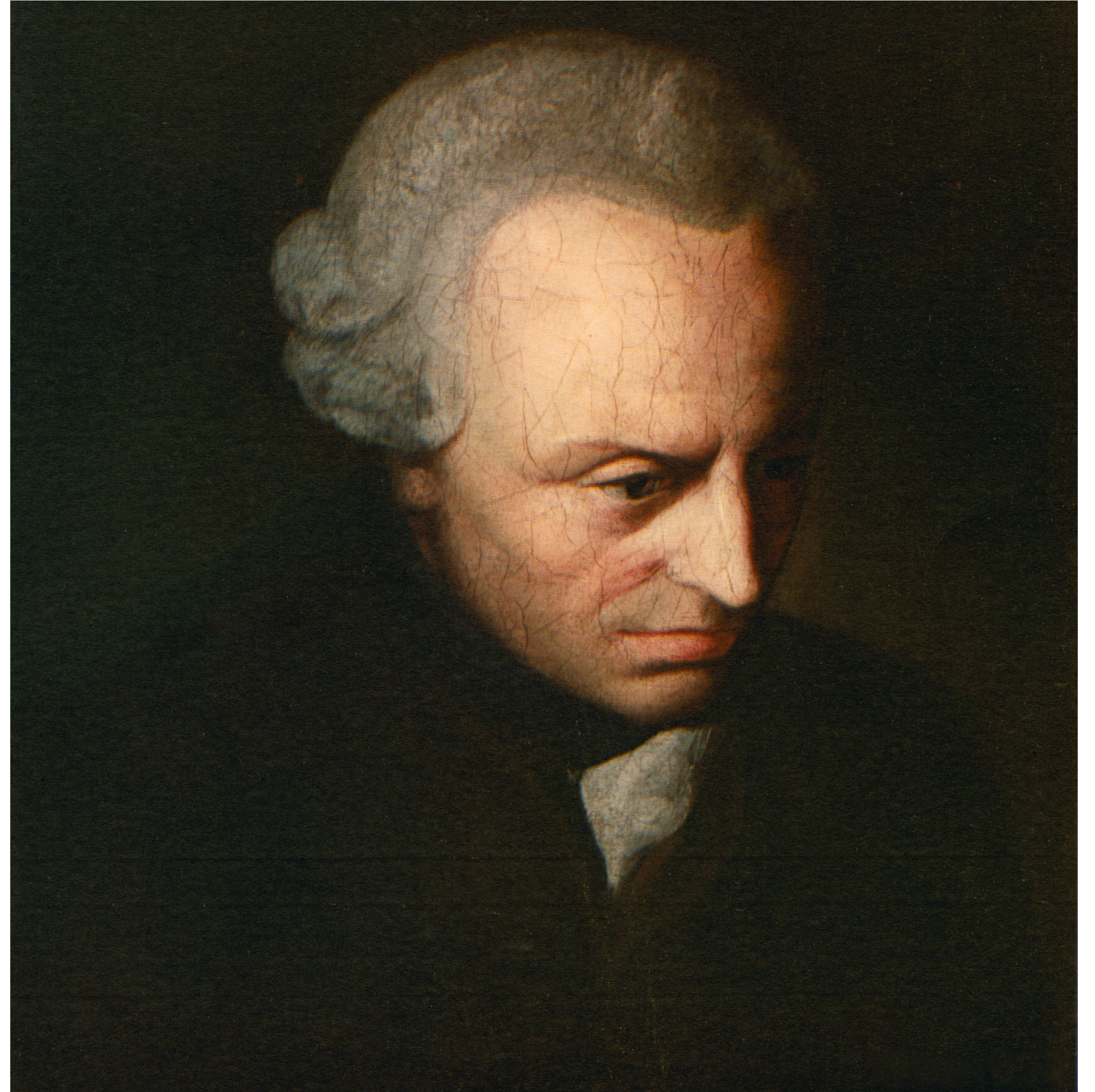
Example: Immanuel Kant



Deontological ethics

Example: Immanuel Kant

An act is ethical based on whether it follows *rules*, ie “do not lie.”

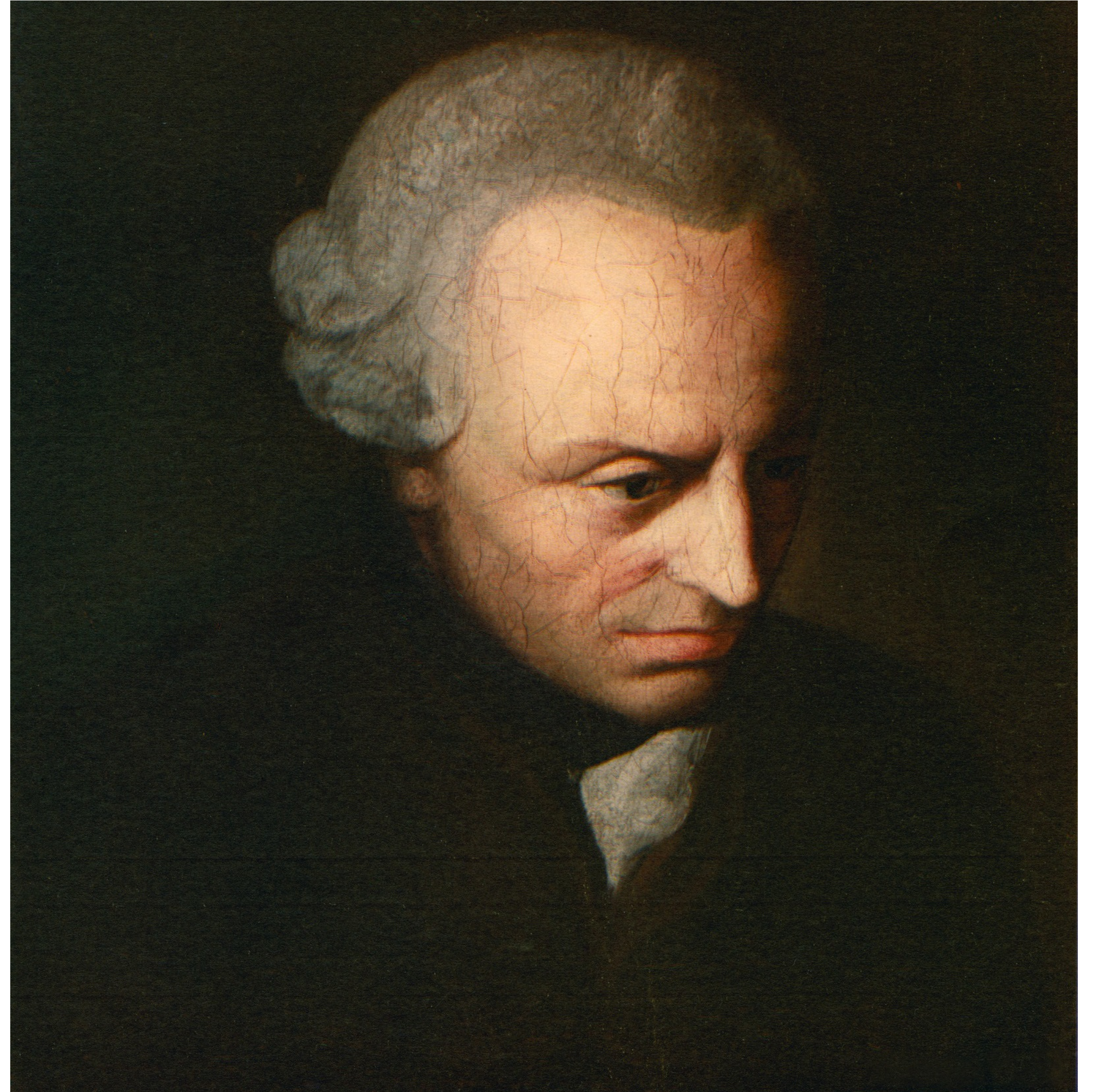


Deontological ethics

Example: Immanuel Kant

An act is ethical based on whether it follows *rules*, ie “do not lie.”

Kant argued for the existence of universal rules (his “categorical imperative”): “Act only on that maxim whereby you can at the same time will that it should become a universal law”



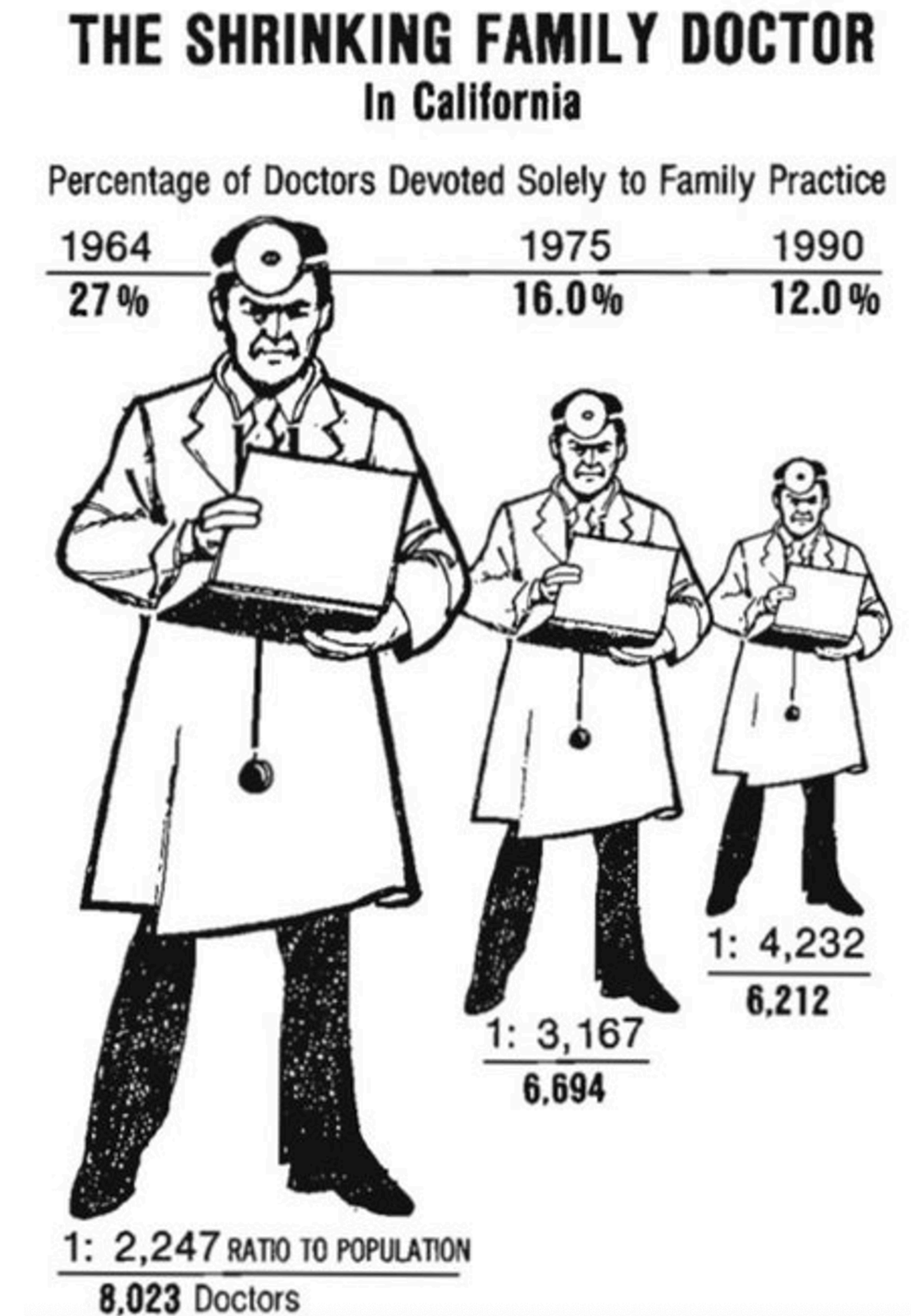
Tufte's “lie factor”

LF = Effect in graphic / effect in data

If $LF \neq 1$, then it is lying!

This image?

LF = 2.8!





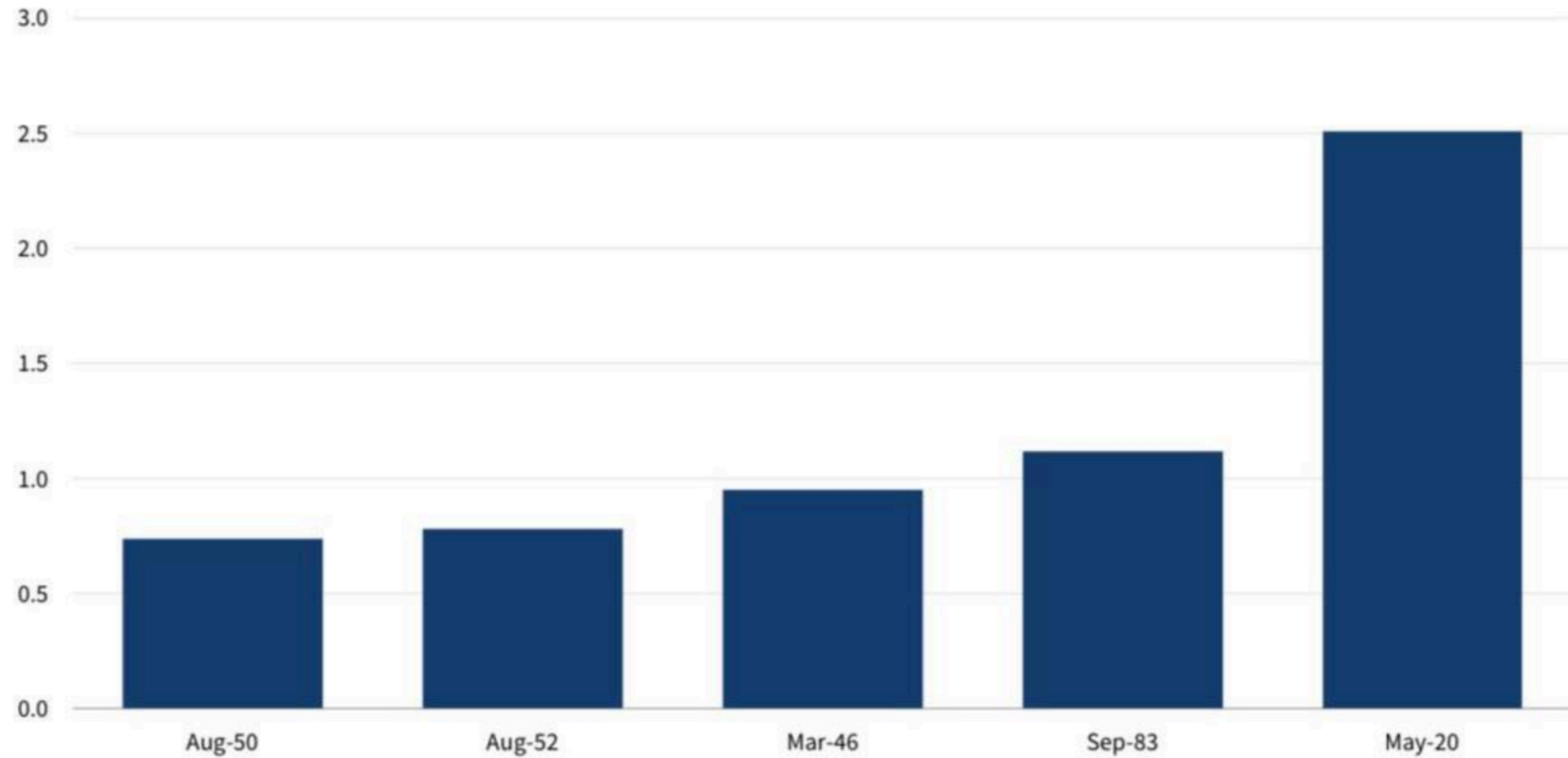
Donald J. Trump ✓
@realDonaldTrump



Greatest Top Five Monthly Jobs Gains in HISTORY. We are #1!

Top Five Monthly Jobs Gains

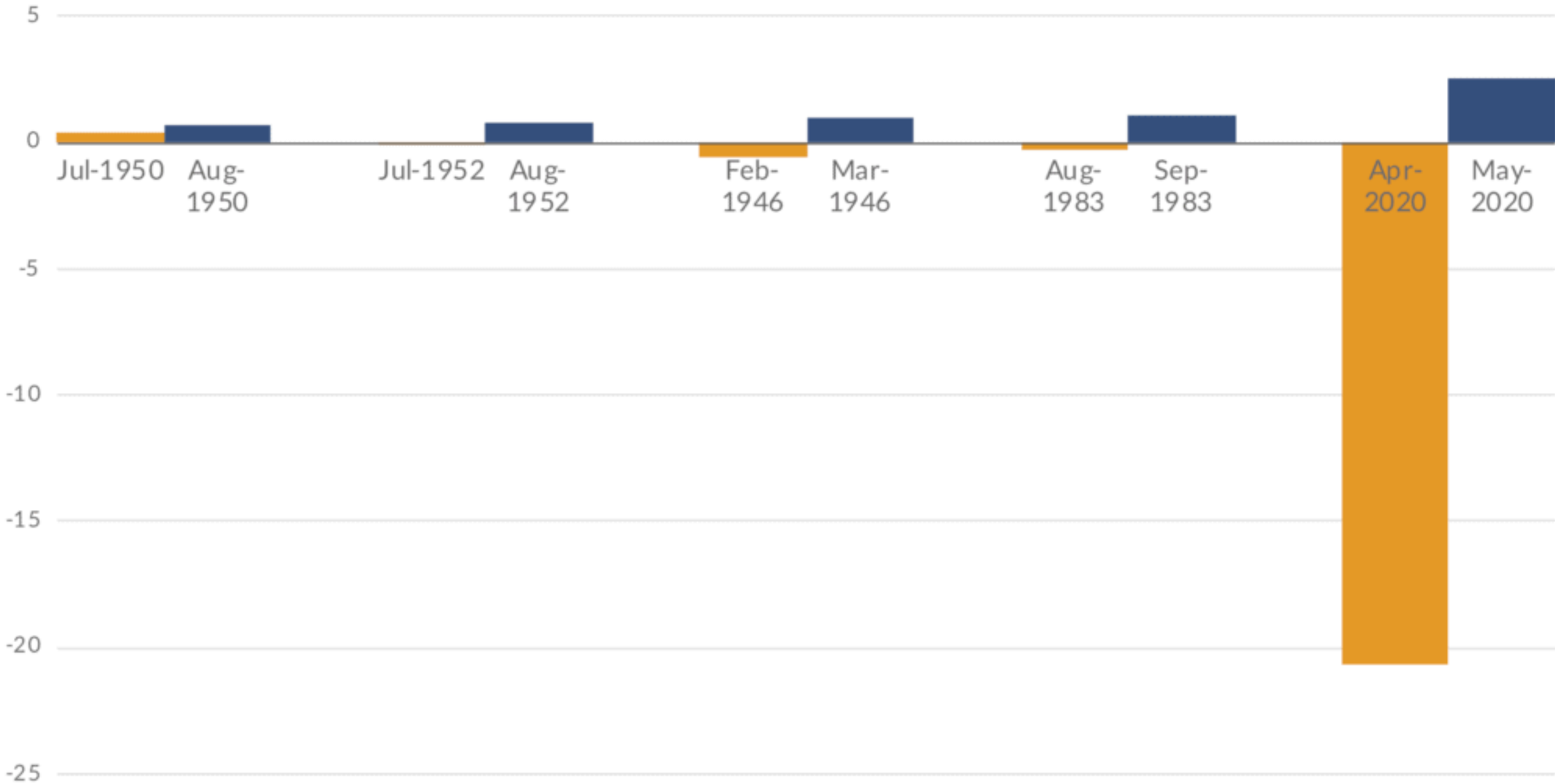
Millions



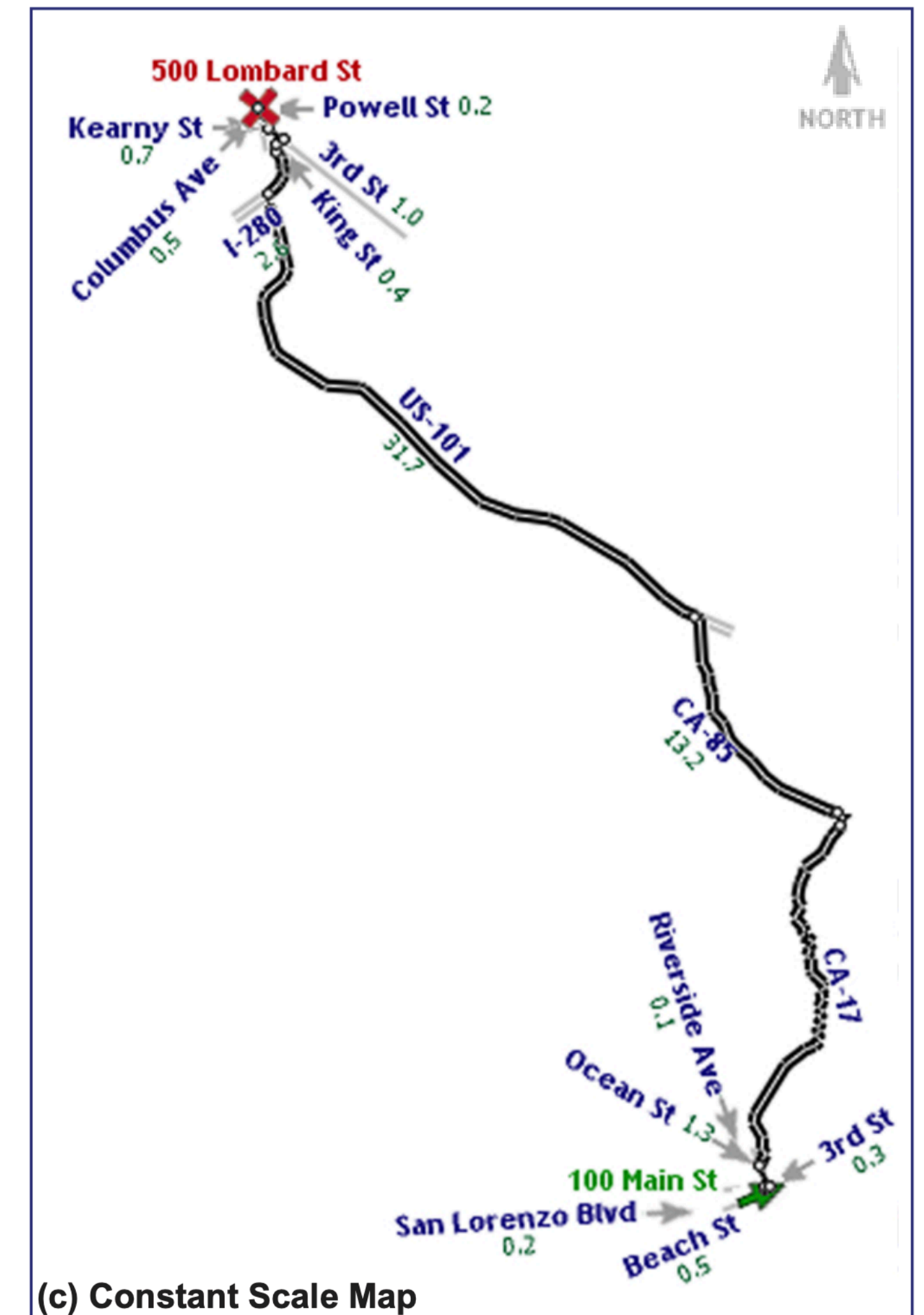
Sources: BLS; CEA

Top Five Monthly Jobs Gains...and the month before

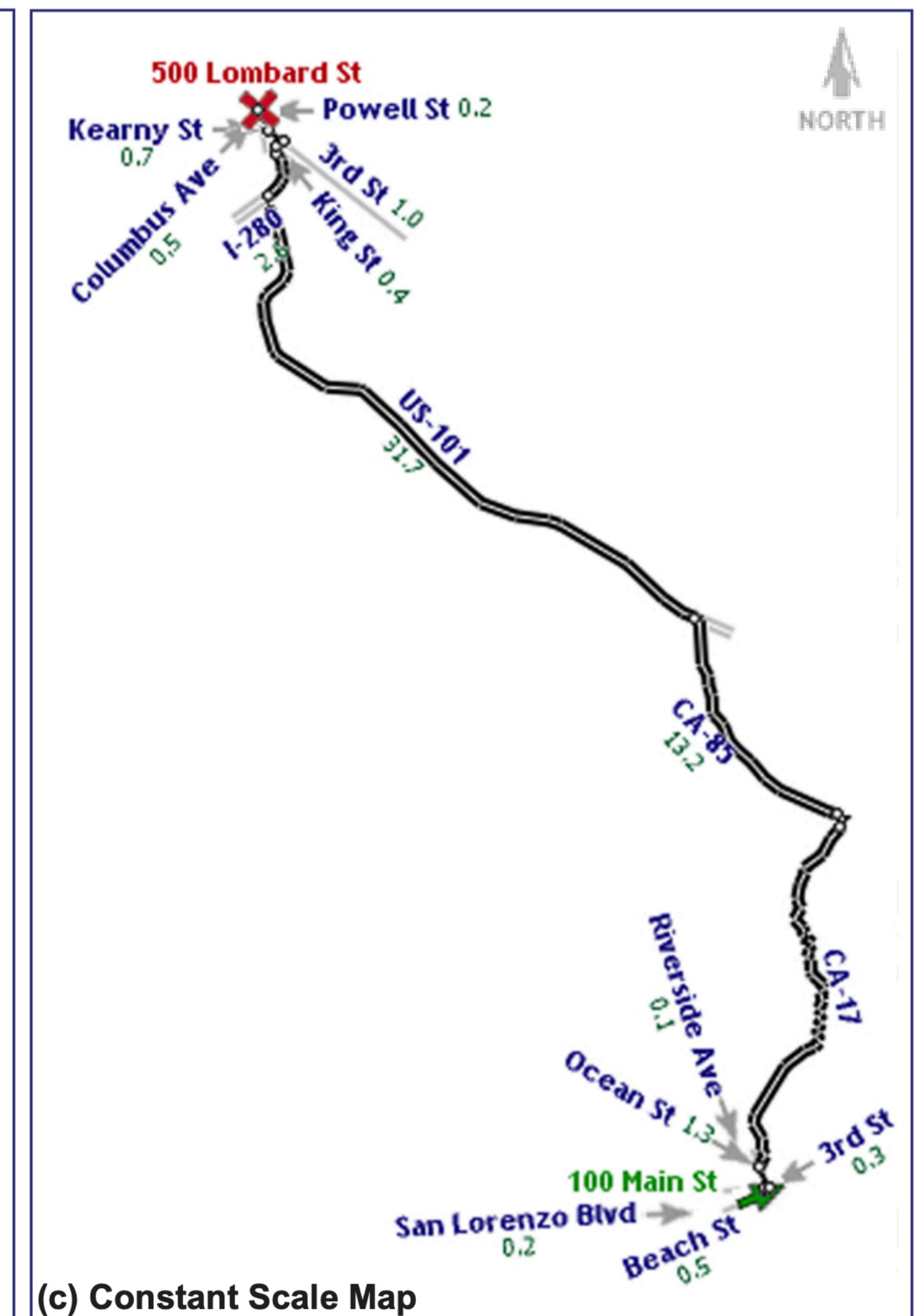
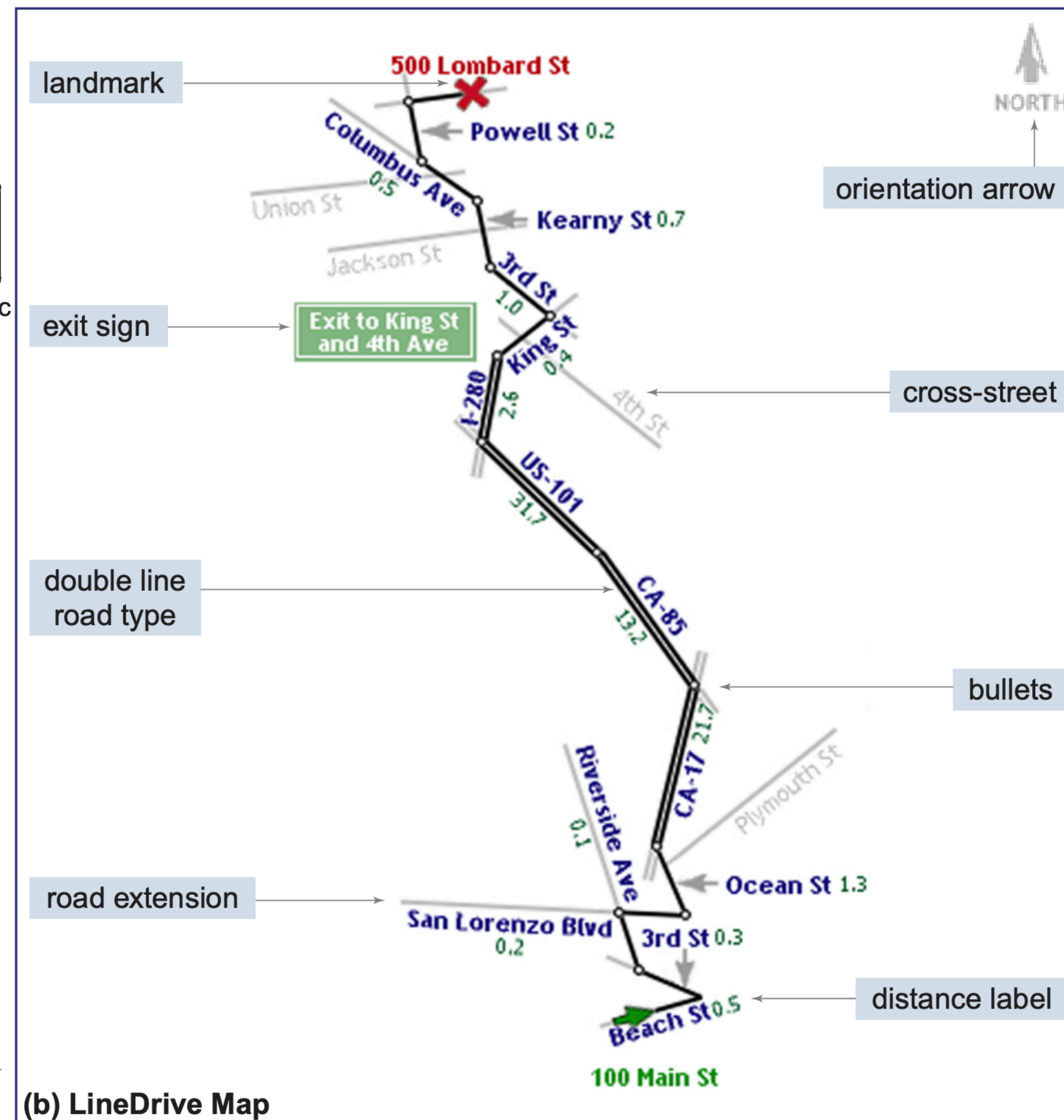
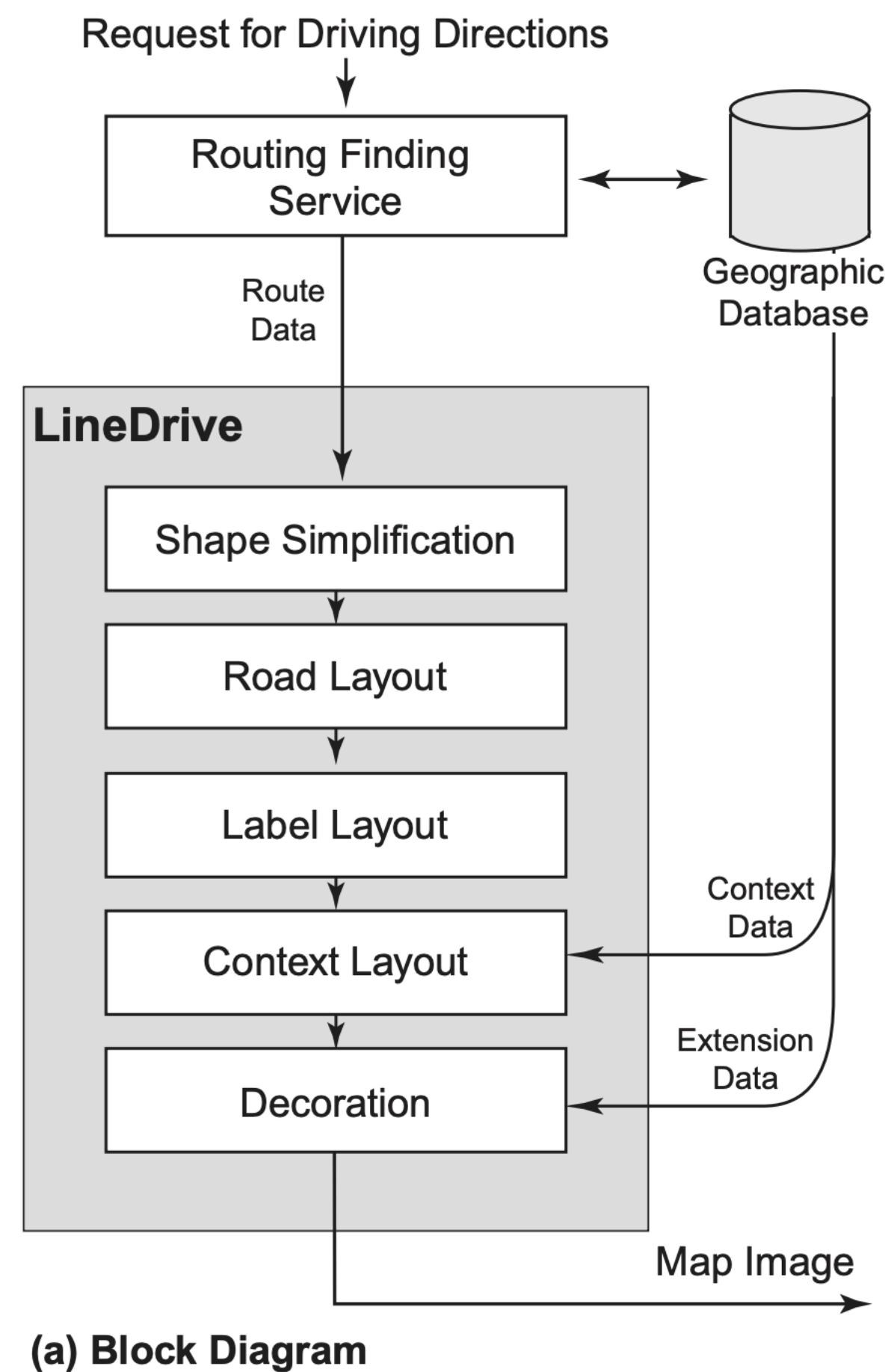
Millions



But is “truth” in pixels objectively good?



What if a “lie” in pixels has a better consequence? (more on this later)



“While it may seem like an extreme statement, I think the ideology of almost all current information visualization is anathema to humanistic thought, antipathetic to its aims and values. The persuasive and seductive rhetorical force of visualization performs such a powerful reification of information that graphics such as Google Maps are taken to be simply a presentation of “what is,” as if all critical thought had been precipitously and completely jettisoned.”

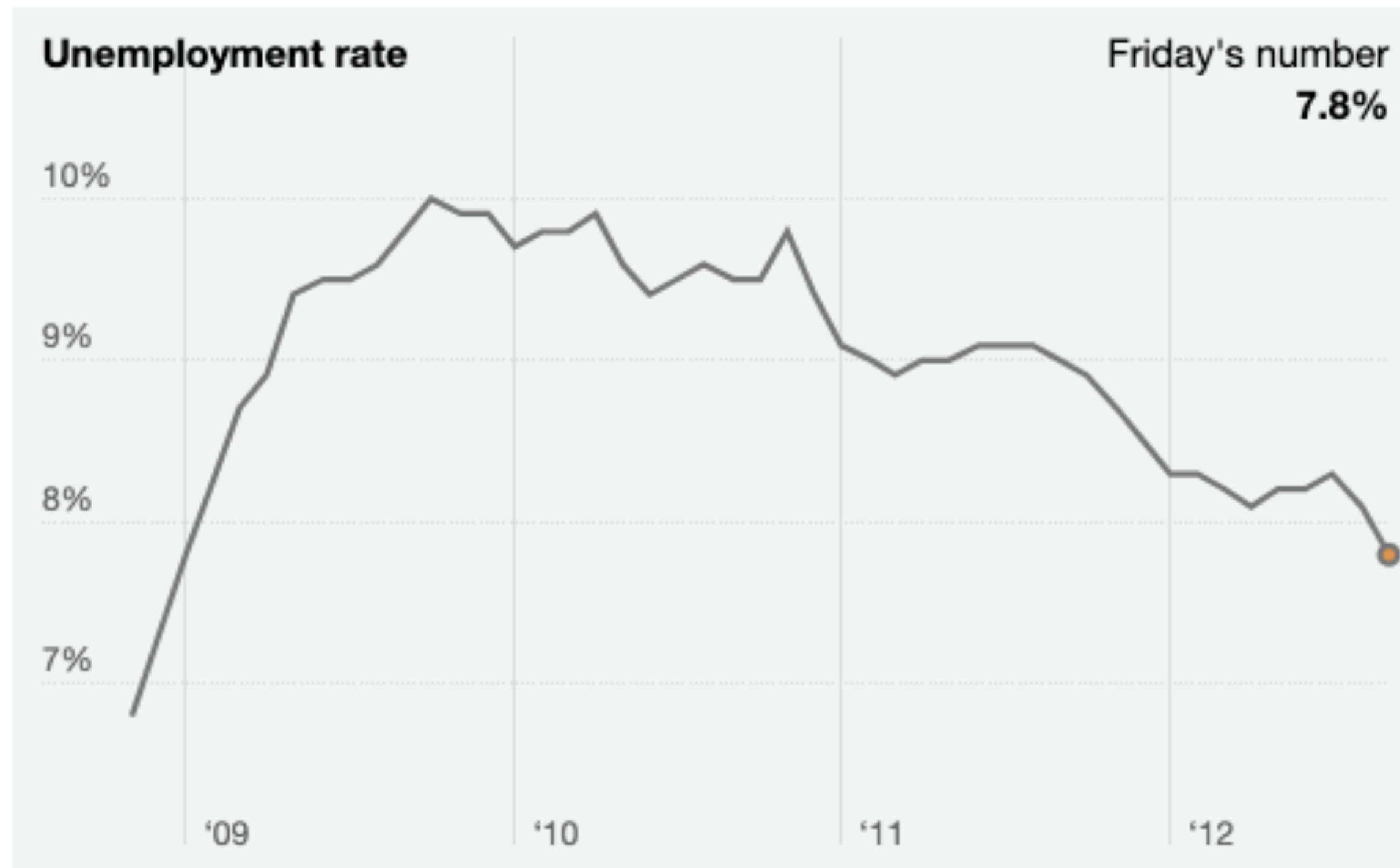
Johanna Drucker

Humanistic theory and digital scholarship

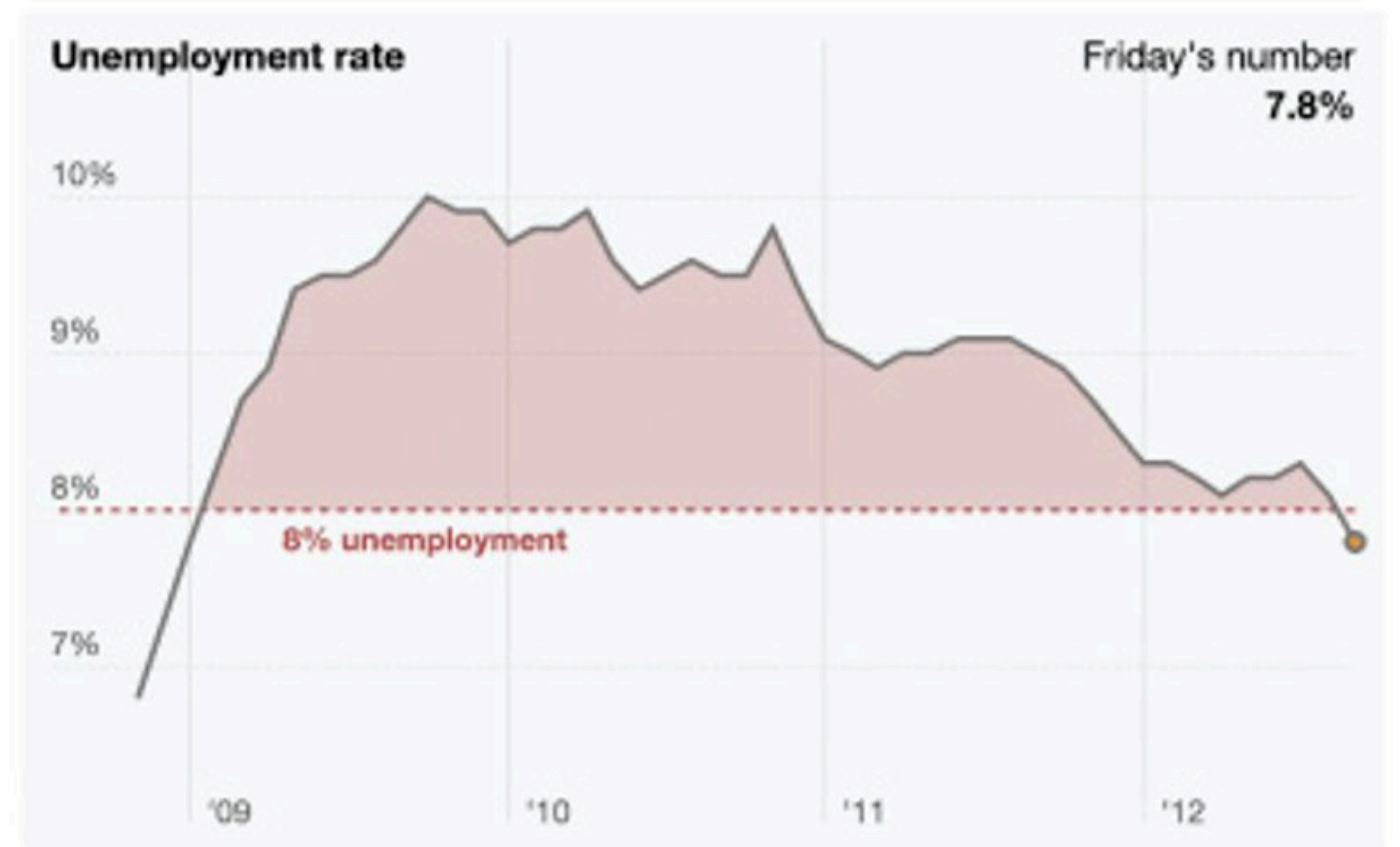
Visualization gives aura of objectivity

Do not have to be explicitly skewed to tell a story

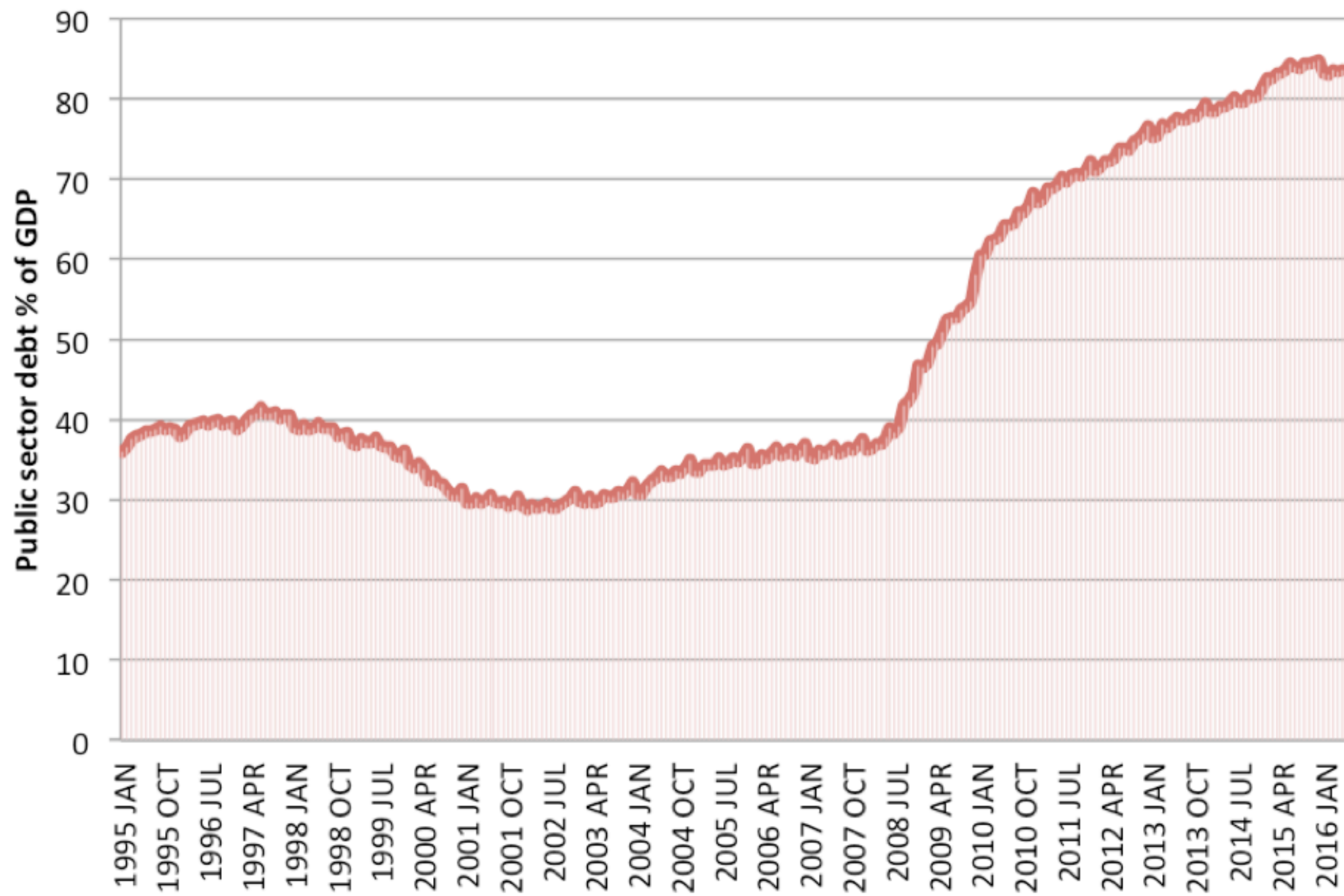
The unemployment rate fell to 7.8%.



The rate was above 8 percent for 43 months.

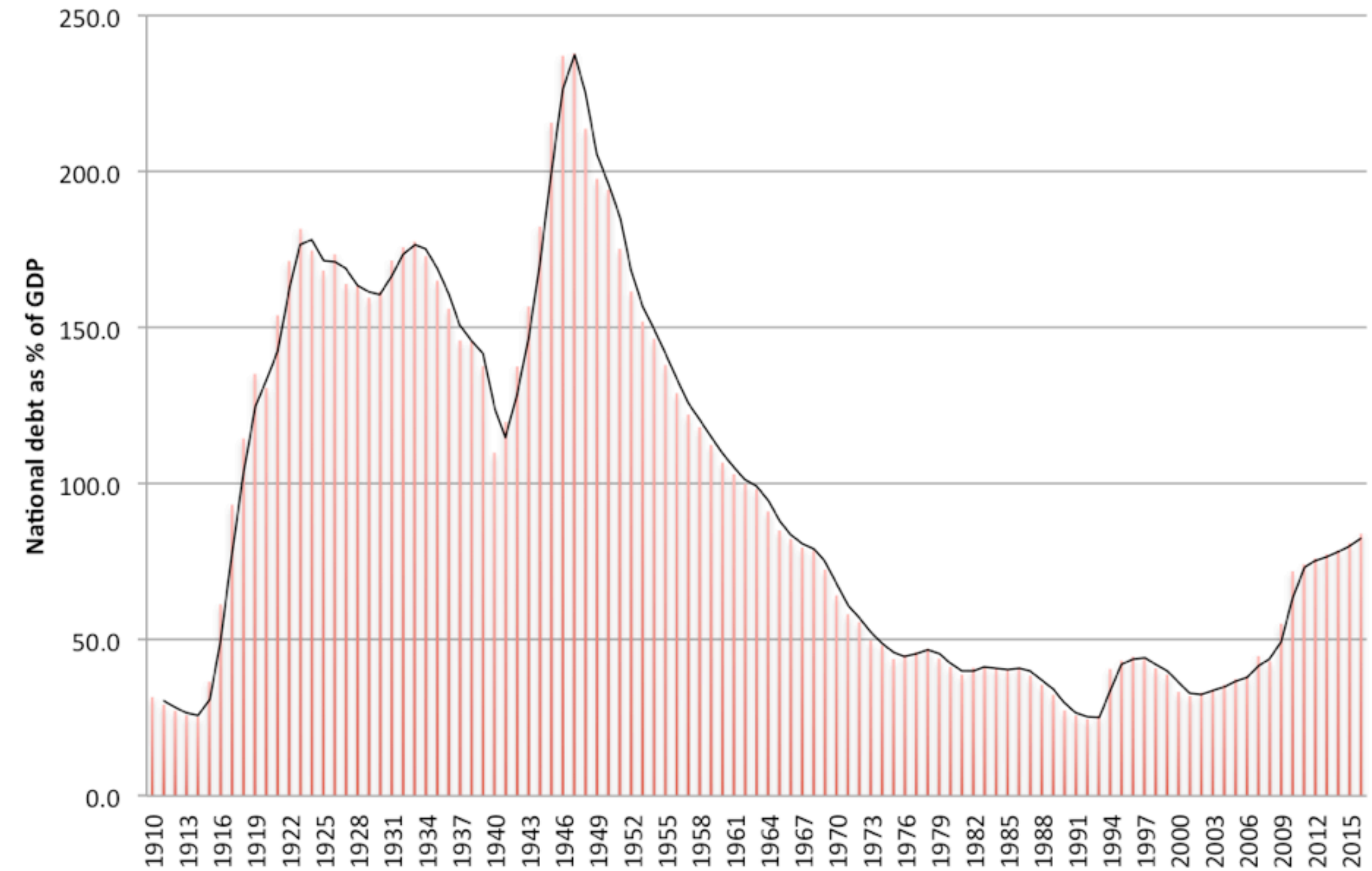


UK national debt % GDP



www.economicshelp.org | Source: ONS HF6X - June 2016

UK National debt



www.economicshelp.org | source - Reinhart, AER and OBR - 2016

Deontological ethics

Limits?

- How do you handle edge cases or rules that have holes?
- Who decides which rules exist and why?
- How do you define and interpret rules? Who arbitrates that?
- Can the rules change?
- What about rules that *aren't* universal?



Role ethics

Example: Confucius



Role ethics

Example: Confucius

You have a role to play, and being “good” means you fulfill the obligations of that role.

Society expects different things from different roles, so obligations can be different for different people.



Hippocratic Oath

Oath of Ethics taken by Doctors

- First ethical principles in medicine, 300-500 BC

Modified version of the text still used to swear in doctors.

It has also been adopted in other fields such as business



An “oath” (or guidelines) for researchers, journalists

ACM CODE OF ETHICS

*Computing professionals' actions **CHANGE THE WORLD**.
They should reflect upon the wider impact of their work,
consistently supporting the public good.*

GENERAL ETHICAL PRINCIPLES.

Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing. Avoid harm. Be honest and trustworthy. Be fair and take action not to discriminate. Respect the work required to produce new ideas, inventions, and creative works, and computing artifacts. Respect privacy. Honor confidentiality.

PROFESSIONAL RESPONSIBILITIES.

Strive to achieve **high quality** in both the processes and products of professional work. Maintain **high standards** of professional competence, conduct, and ethical practice. Know and **respect existing rules** pertaining to professional work. Accept and provide appropriate **professional review**. Give **comprehensive and thorough evaluations** of computer systems and their impacts, including analysis of possible risks. Perform **work only in areas of competence**. Foster **public awareness and understanding** of computing, related technologies, and their consequences. Access computing and communication resources only when authorized or when compelled by the public good. Design and implement systems that are **robustly and usably secure**.

PROFESSIONAL LEADERSHIP PRINCIPLES.

Ensure that the public good is the central concern during all professional computing work. Articulate, encourage acceptance of, and evaluate fulfillment of **social responsibilities** by members of the organization or group. Manage personnel and resources to **enhance the quality of working life**. Articulate, apply, and support policies and processes that **reflect the principles of the Code**. Create opportunities for members of the organization or group to **grow as professionals**. **Use care** when modifying or retiring systems. Recognize and take special care of systems that become integrated in the infrastructure of society.

<https://www.acm.org/code-of-ethics>



Guidelines for ethical data visualization

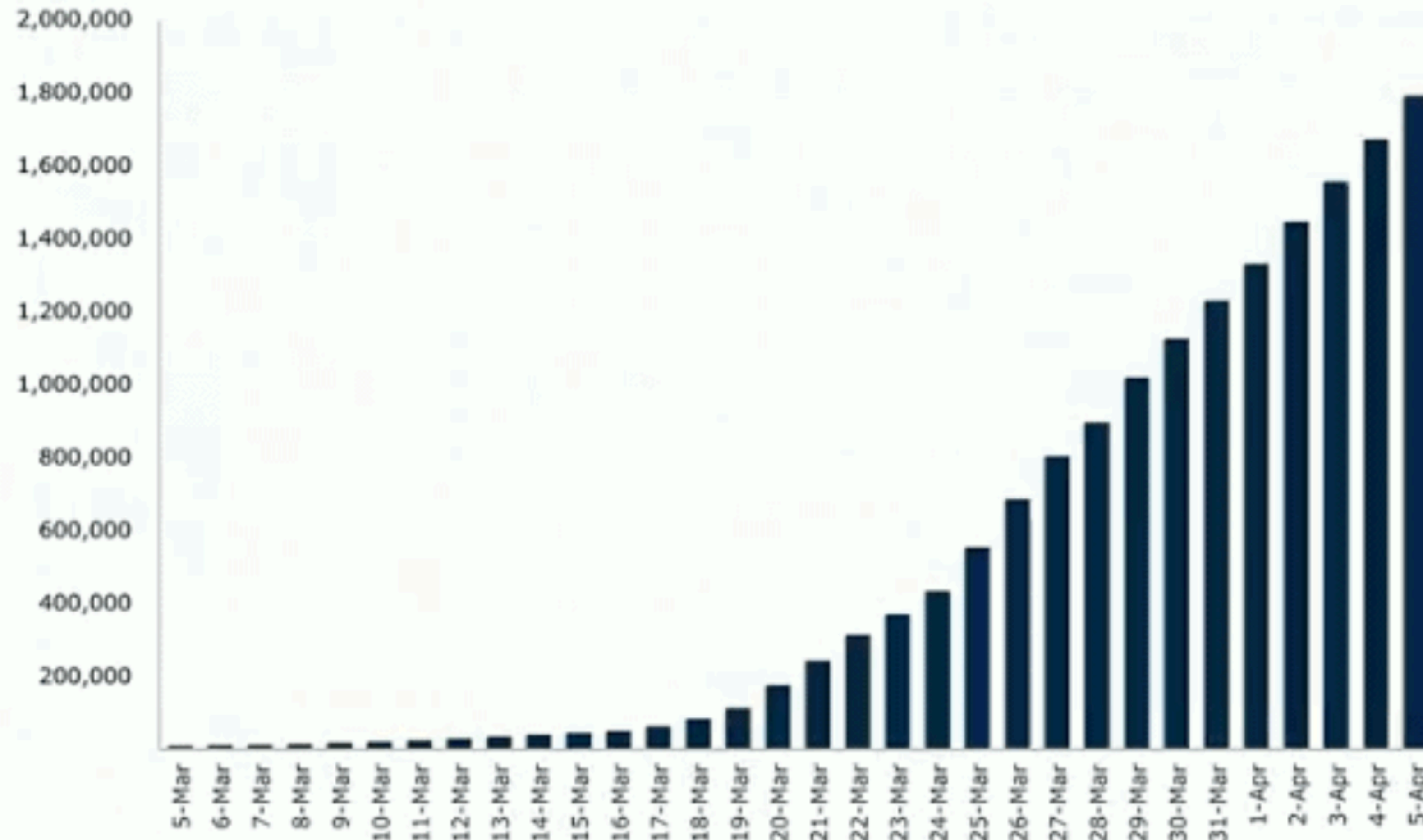
A non-exhaustive list

1 Transparency

Tell your data's story, its uncertainty, and its assumptions,

COVID-19 TESTING IN THE U.S.

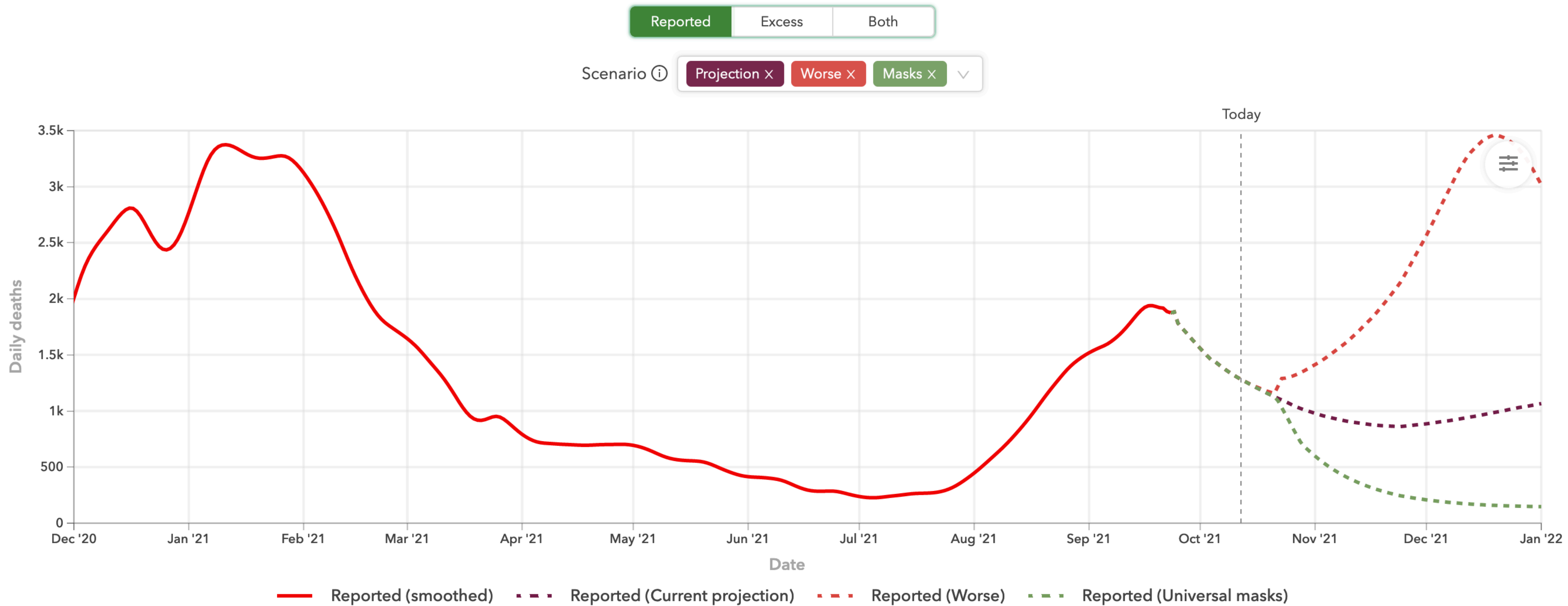
>1,790,000 tests completed through April 5





Daily deaths [↗](#)

Daily deaths is the best indicator of the progression of the pandemic, although there is generally a 17-21 day lag between infection and deaths.



All deaths specific to COVID-19 patients.

Guidelines for ethical data visualization

A non-exhaustive list

1 Transparency

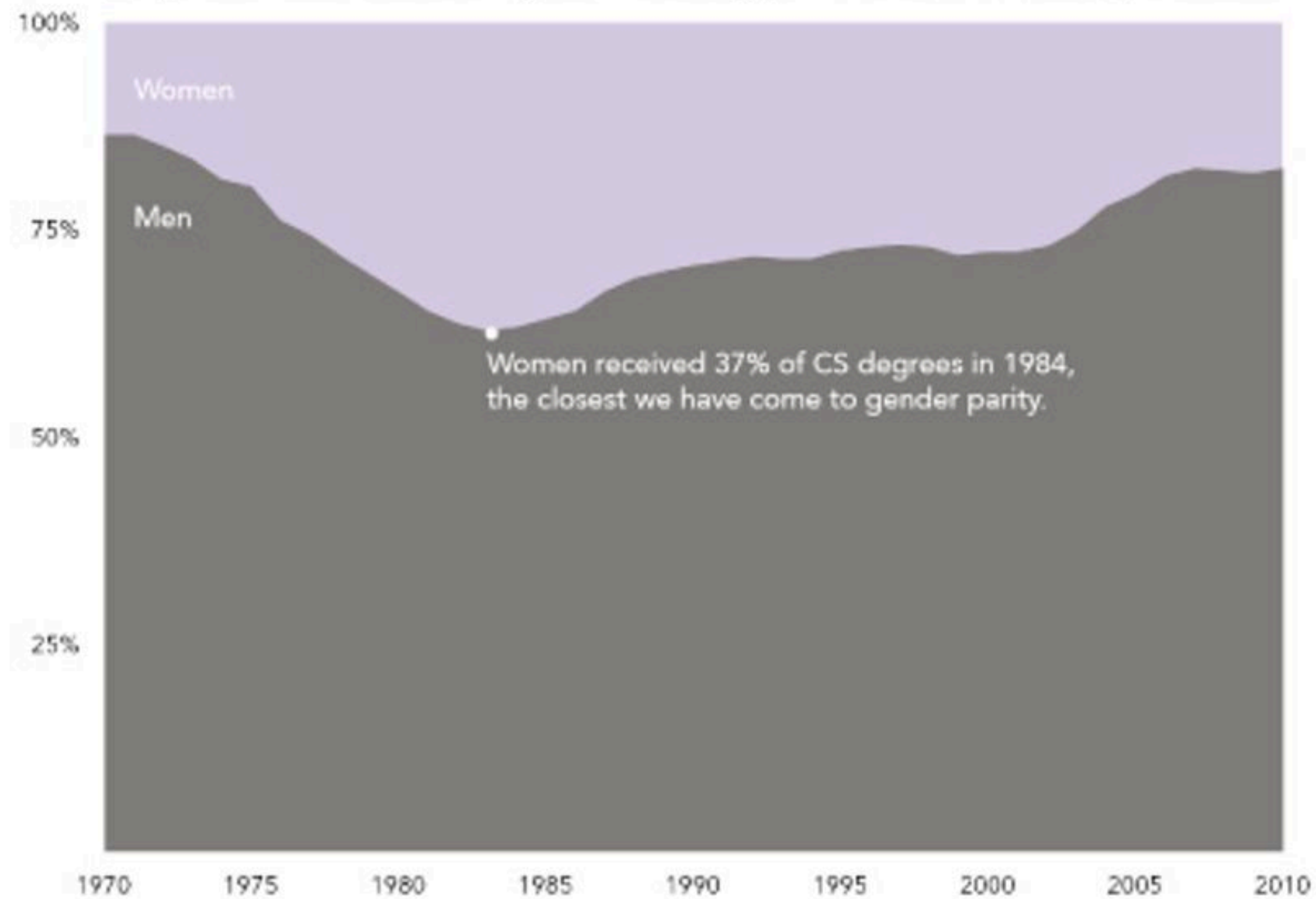
Tell your data's story, its uncertainty, and its assumptions,

2 Empower marginalized voices

Question power, humanize data

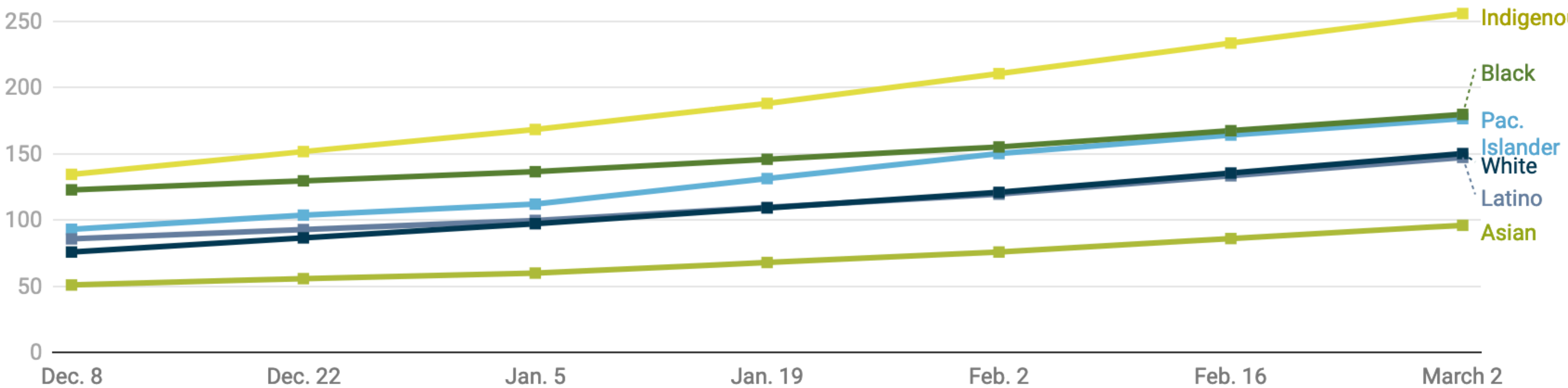
Computer Science, the Man Factory

Computer science bachelor's degrees awarded by gender in the United States, 1970–2010



Indigenous, Black & Pacific Islander Americans have experienced the highest death tolls from COVID-19

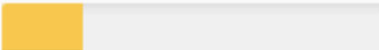
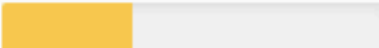
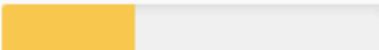
Cumulative actual (crude) COVID-19 mortality rates per 100,000, by race and ethnicity, Dec. 8, 2020-March 2, 2021



Gender Shades - Intersectionality

Gender Classifier	Overall Accuracy on all Subjects in Pilot Parlaiments Benchmark (2017)
 Microsoft	93.7%
 FACE++	90.0%
 IBM	87.9%



Gender Classifier	Darker Male	Darker Female	Lighter Male	Lighter Female	Largest Gap
 Microsoft	94.0% 	79.2% 	100% 	98.3% 	20.8% 
 FACE++	99.3% 	65.5% 	99.2% 	94.0% 	33.8% 
 IBM	88.0% 	65.3% 	99.7% 	92.9% 	34.4% 



Guidelines for ethical data visualization

A non-exhaustive list

1 Transparency

Tell your data's story, its uncertainty, and its assumptions,

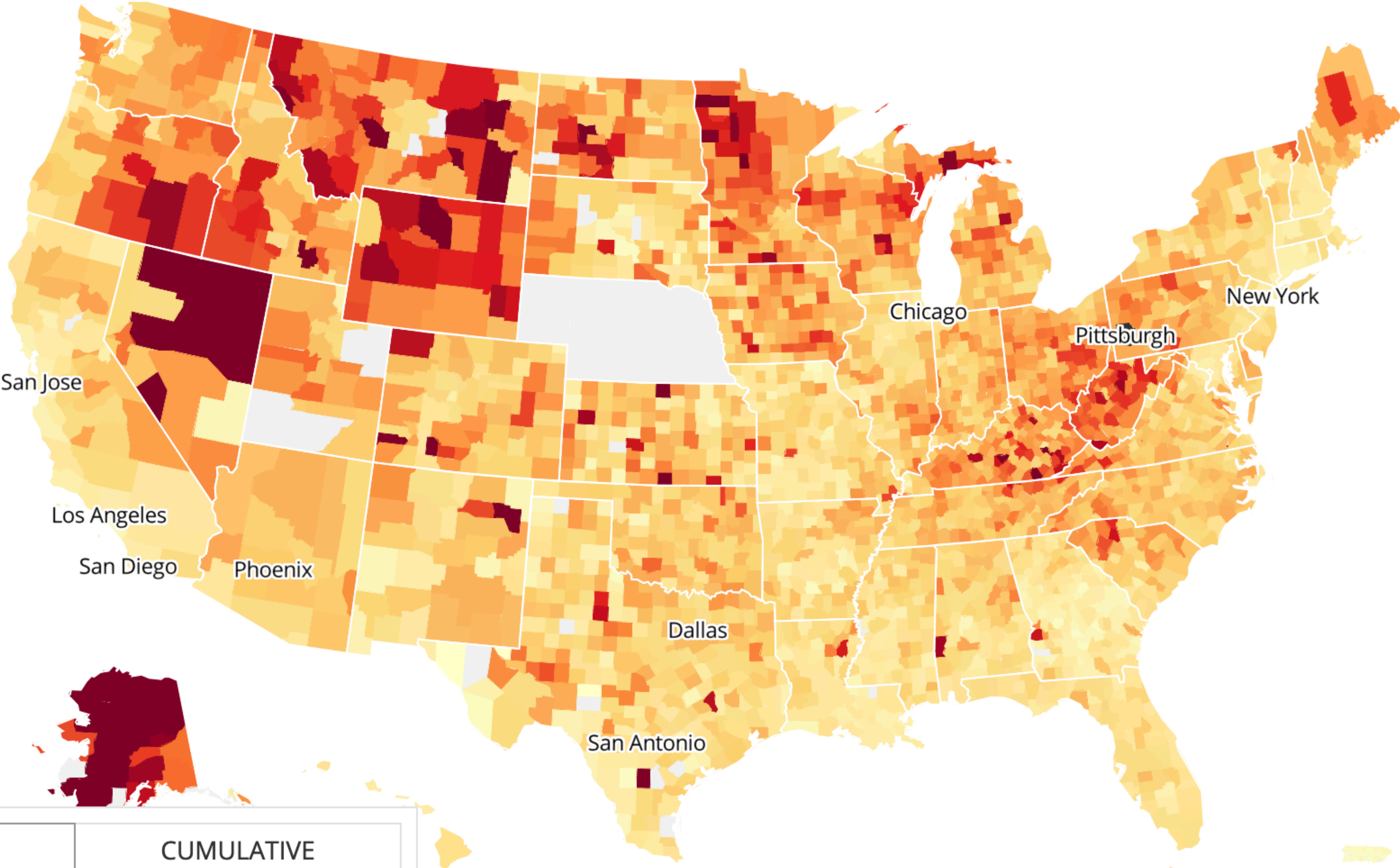
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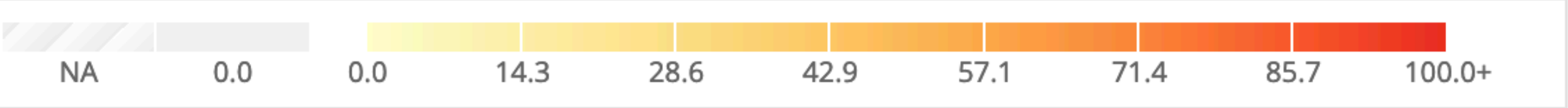
3 Consider your story and its perception

How will your visualization be perceived? How will people use it? And *who* can use it?

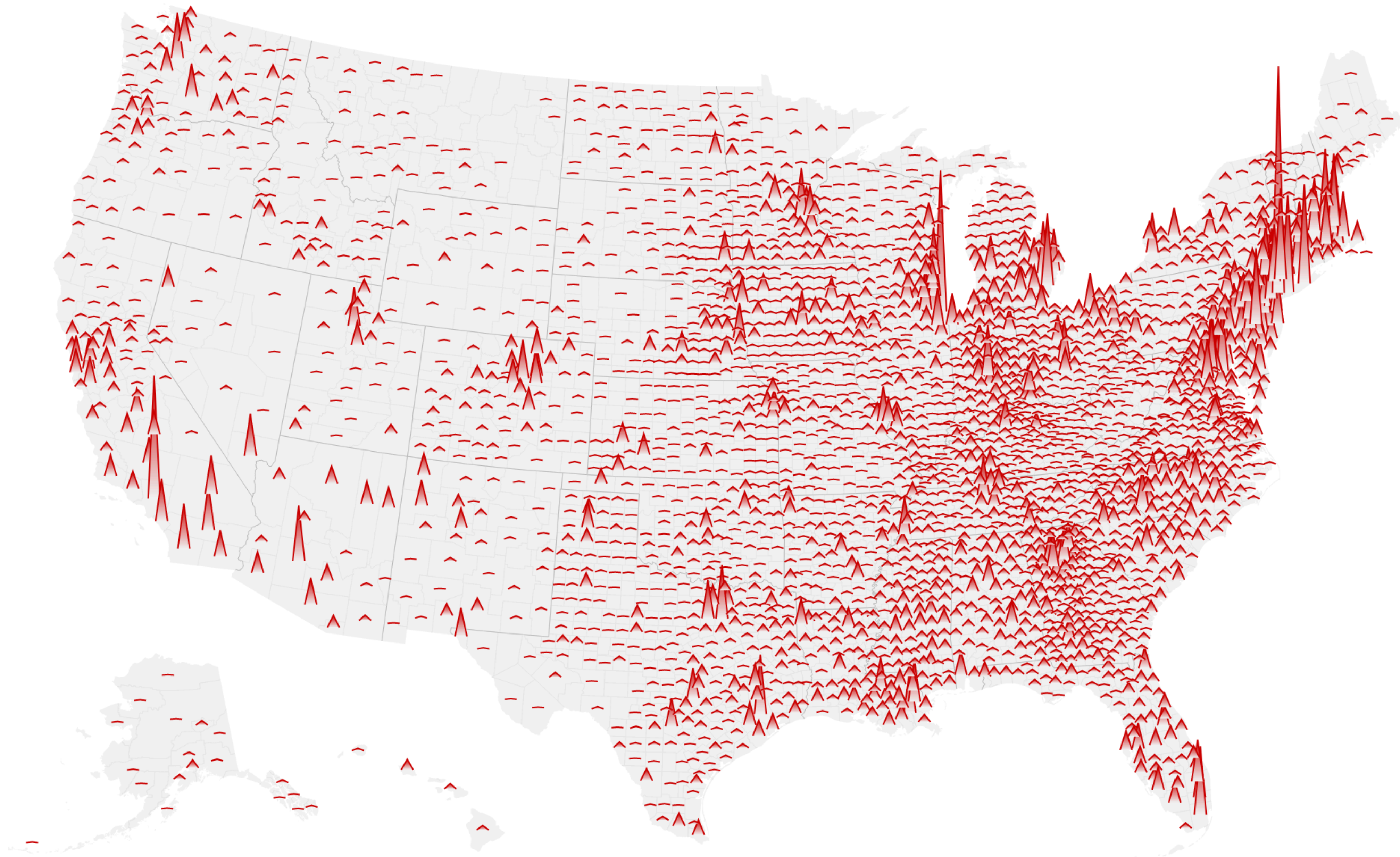
Newly reported COVID-19 cases per 100,000 people (7-day average) ?

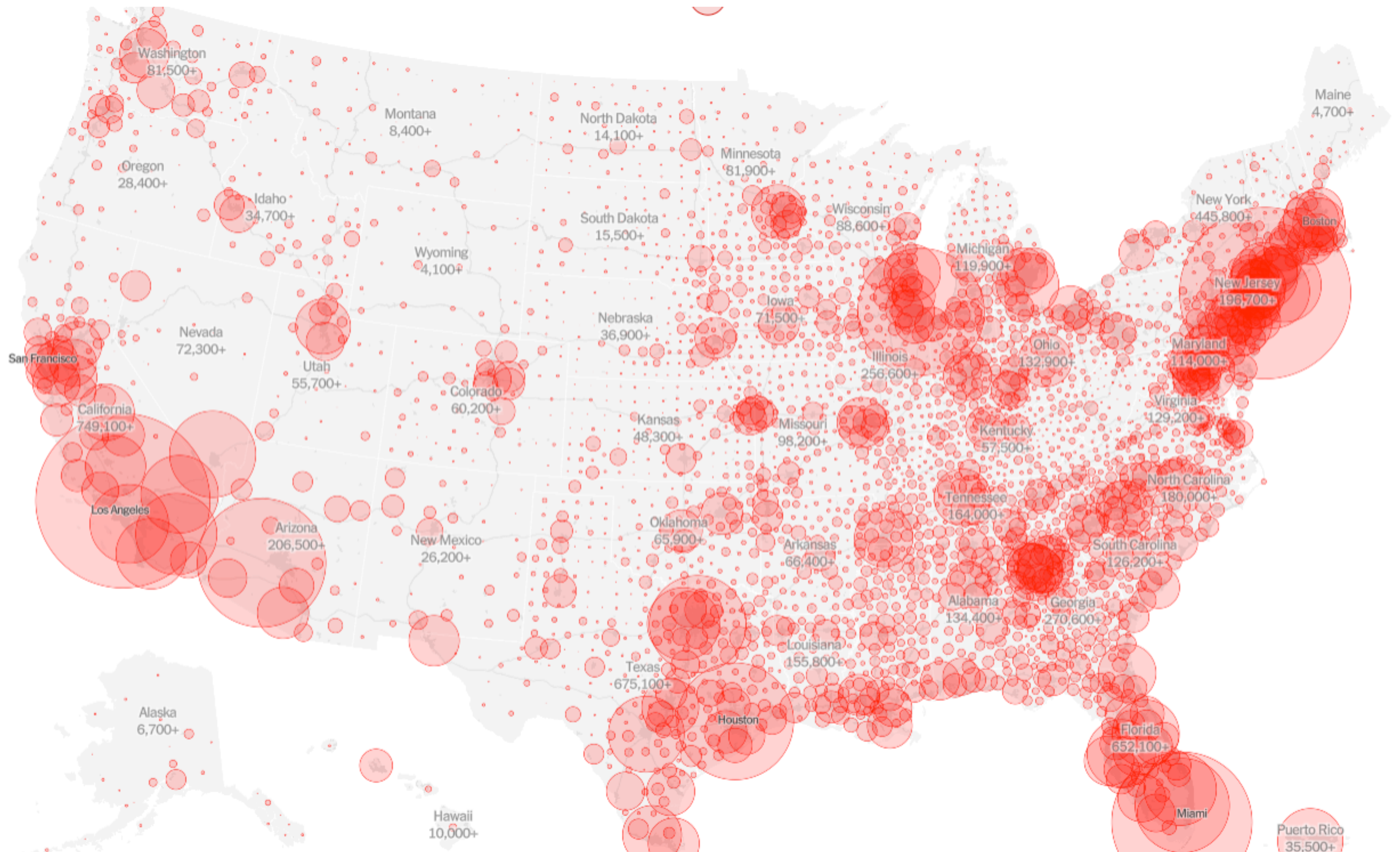


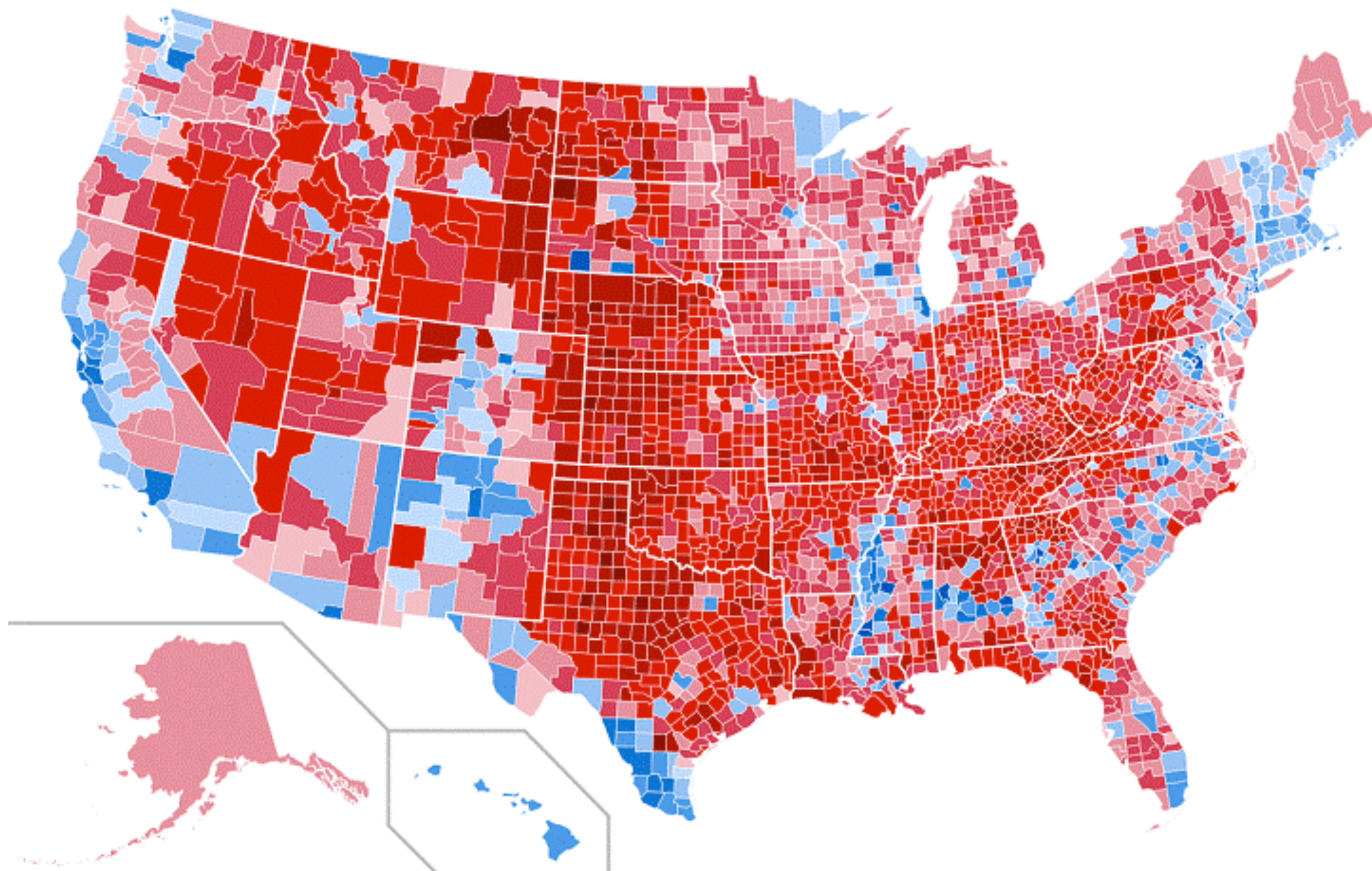
NEW	CUMULATIVE
RATIOS (PER 100,000)	COUNTS

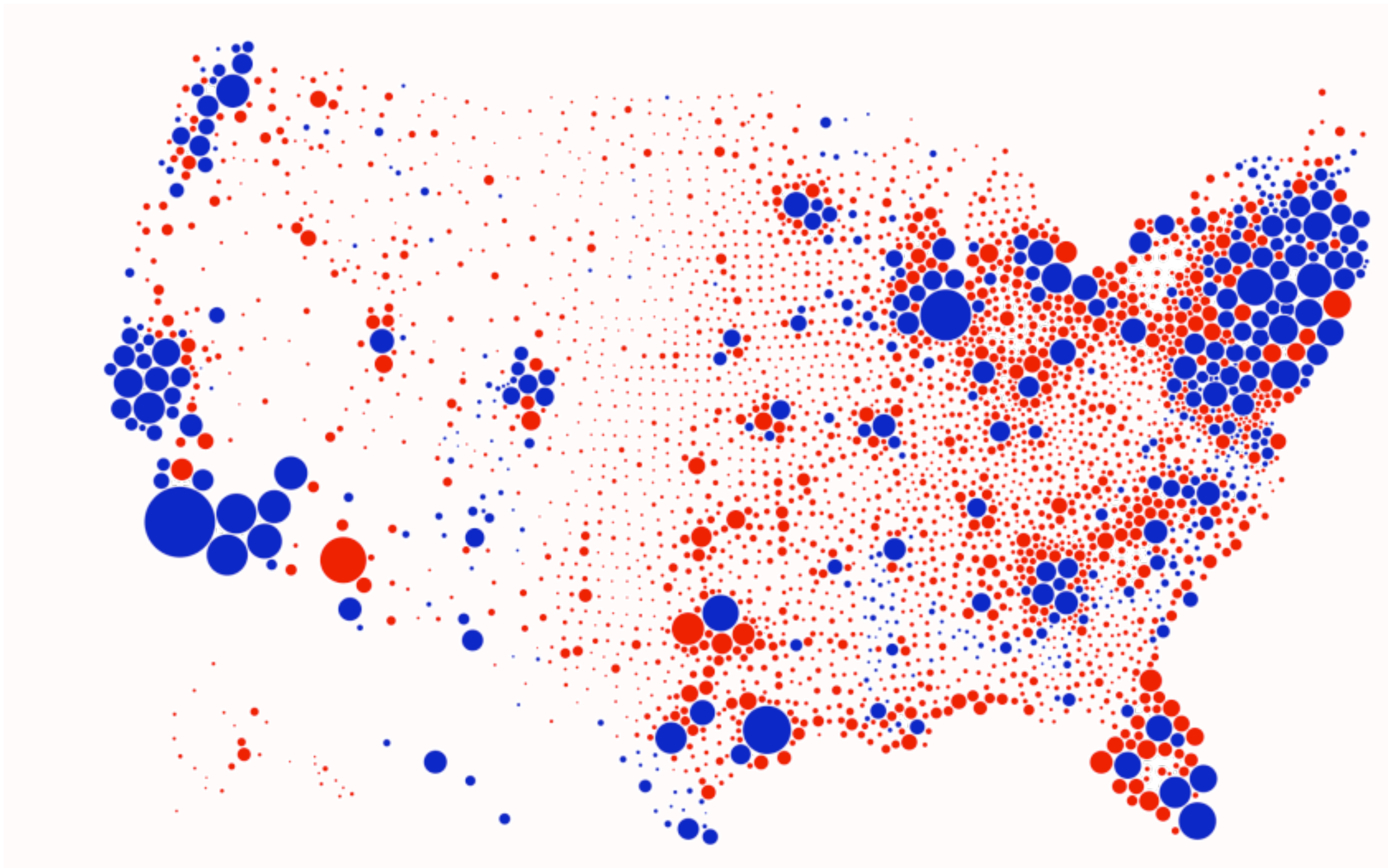


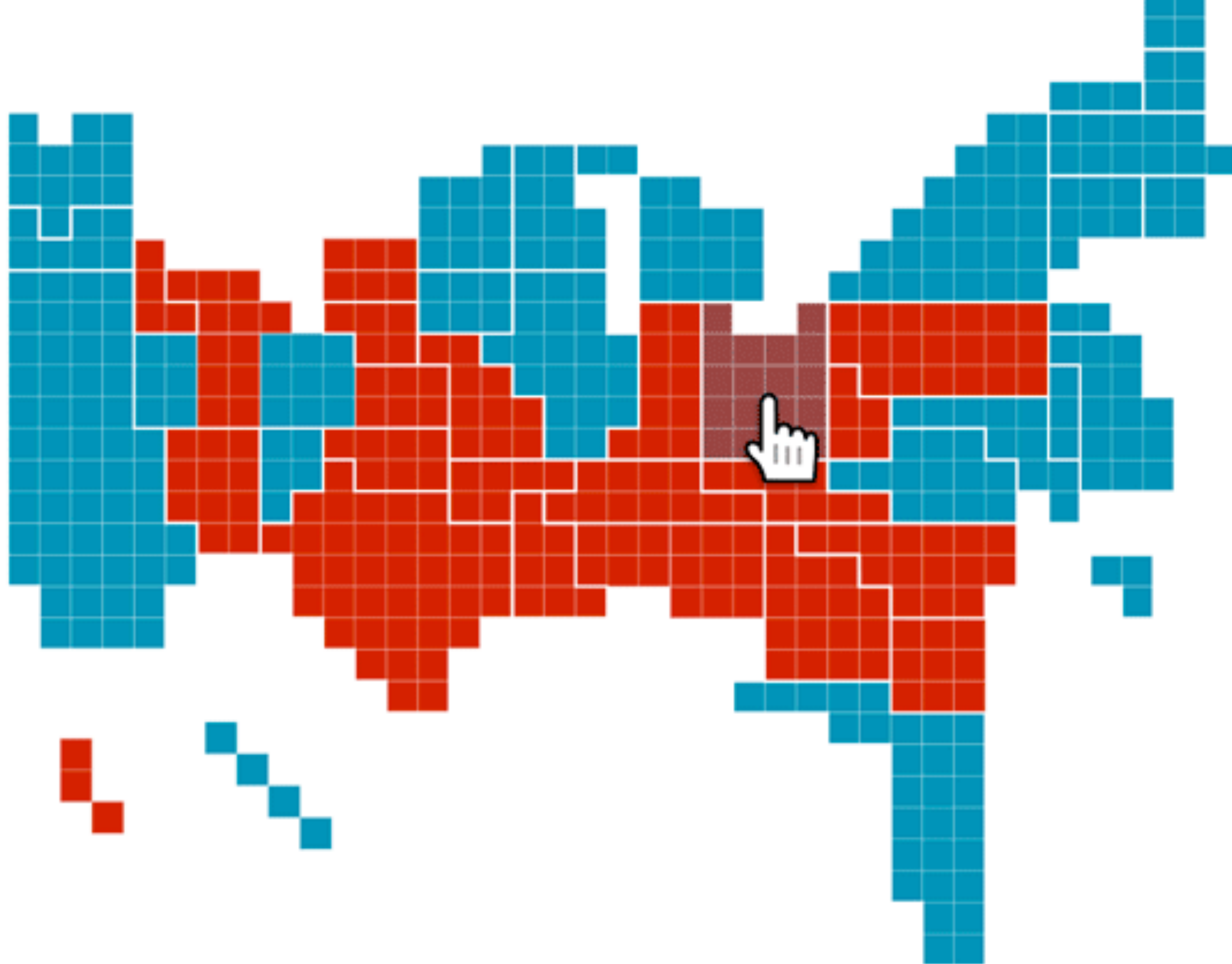
100% Coverage











Role ethics

Limits?



Role ethics

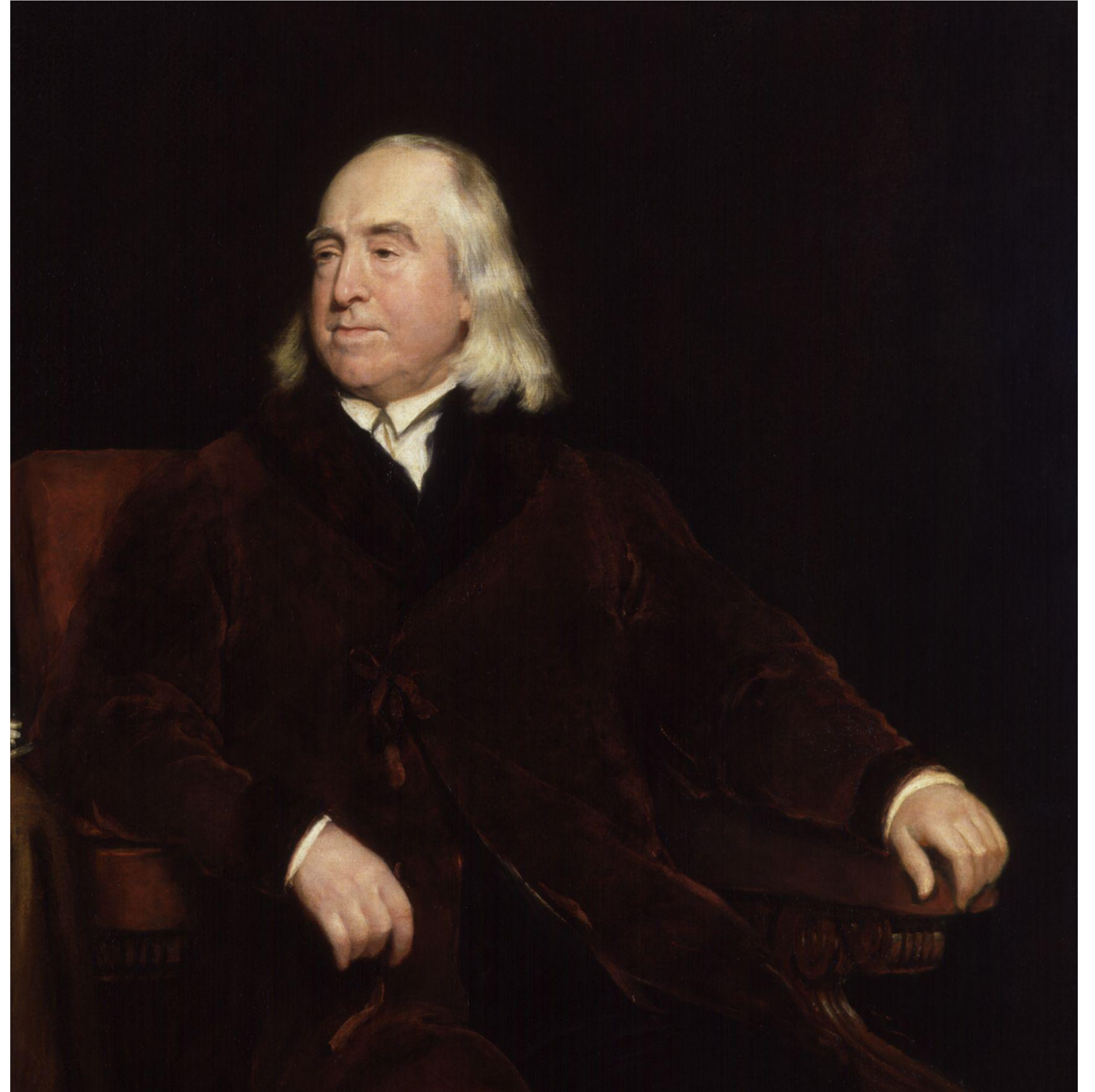
Limits?

- Who gives you your roles?
- What if you have roles with conflicting obligations?
- What if some roles accomplish harm? (I.e. “just following orders”)
- What if nobody has the roles we need or roles that accomplish good are hard or unrewarding?



Consequentialist ethics

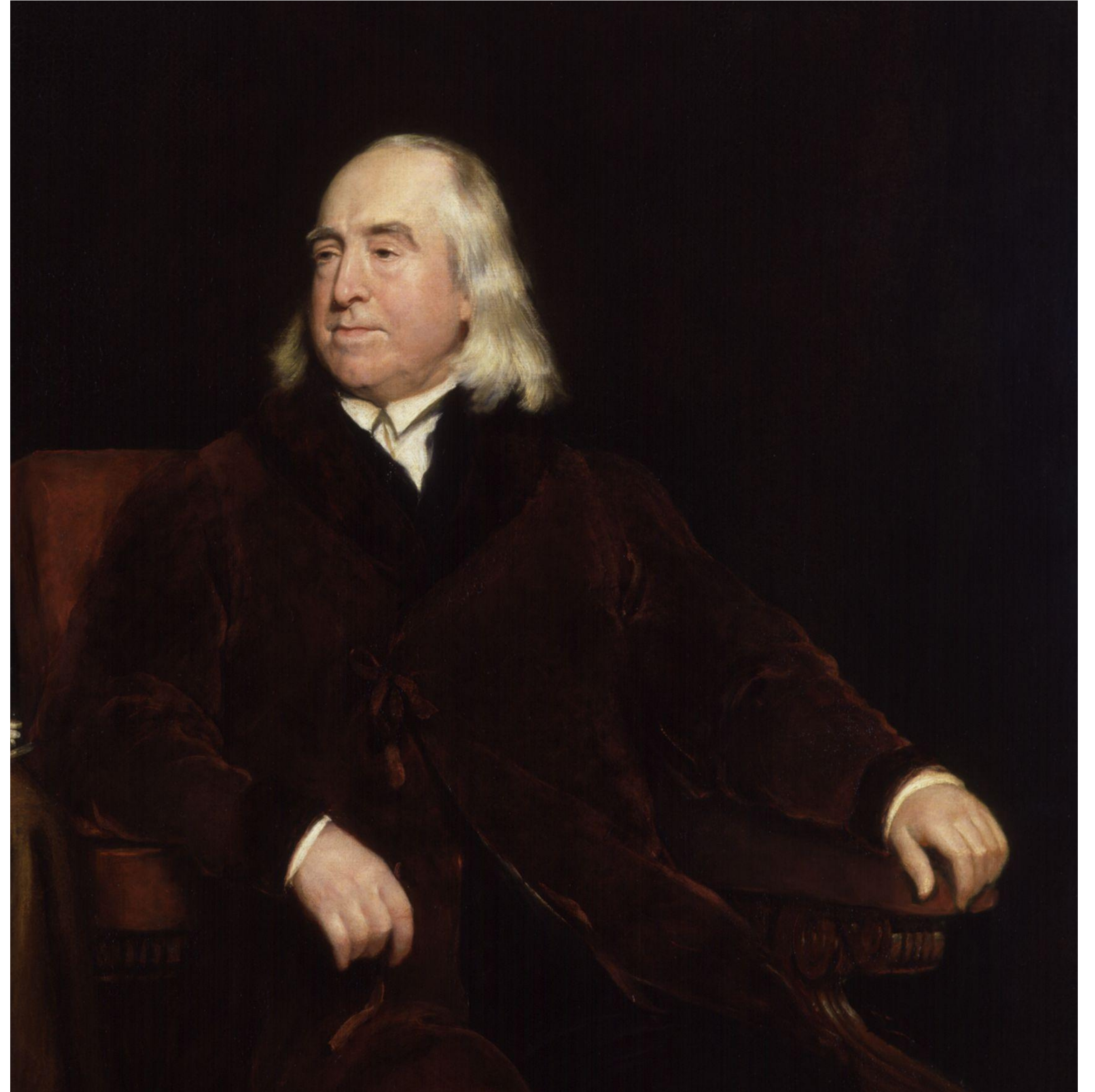
Example: Jeremy Bentham



Consequentialist ethics

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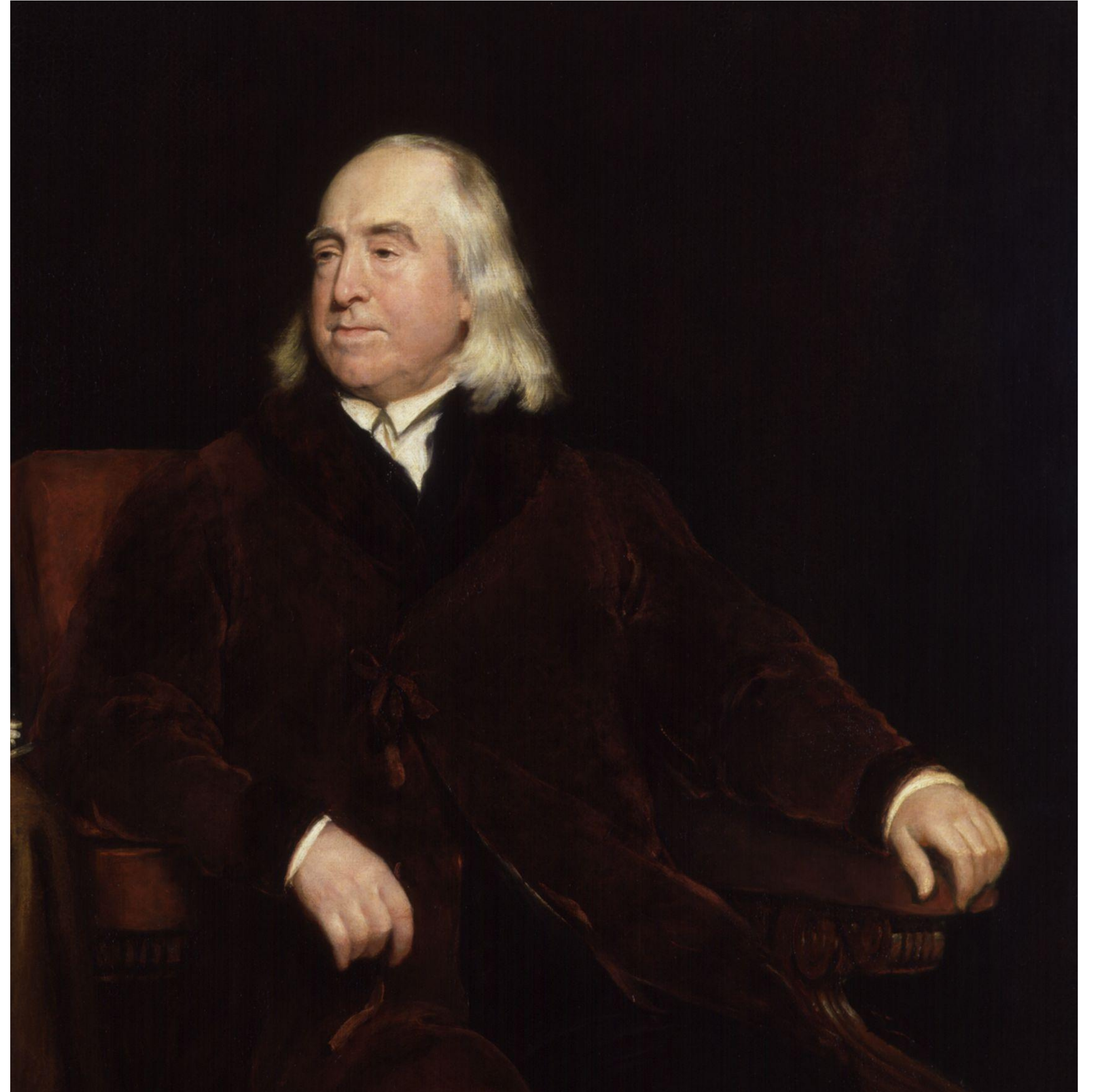


Consequentialist ethics

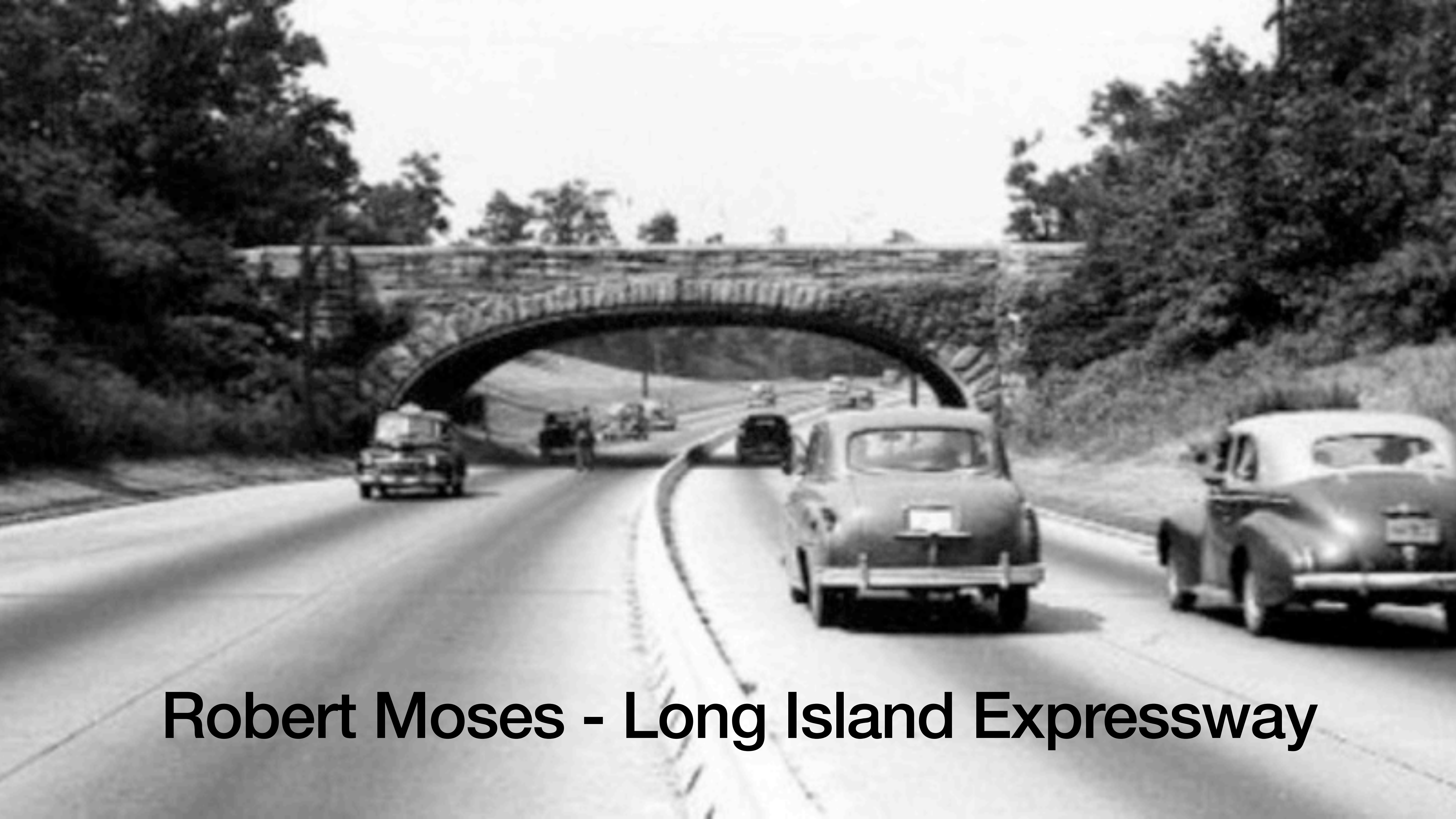
Example: Jeremy Bentham

An action is ethical or unethical based on *outcomes* or *consequences* (referred to as the “telos” or “teleological”).

Bentham is credited for *utilitarianism*, or the idea that if you can measure outcomes, you can *optimize for their utility*, ie good.





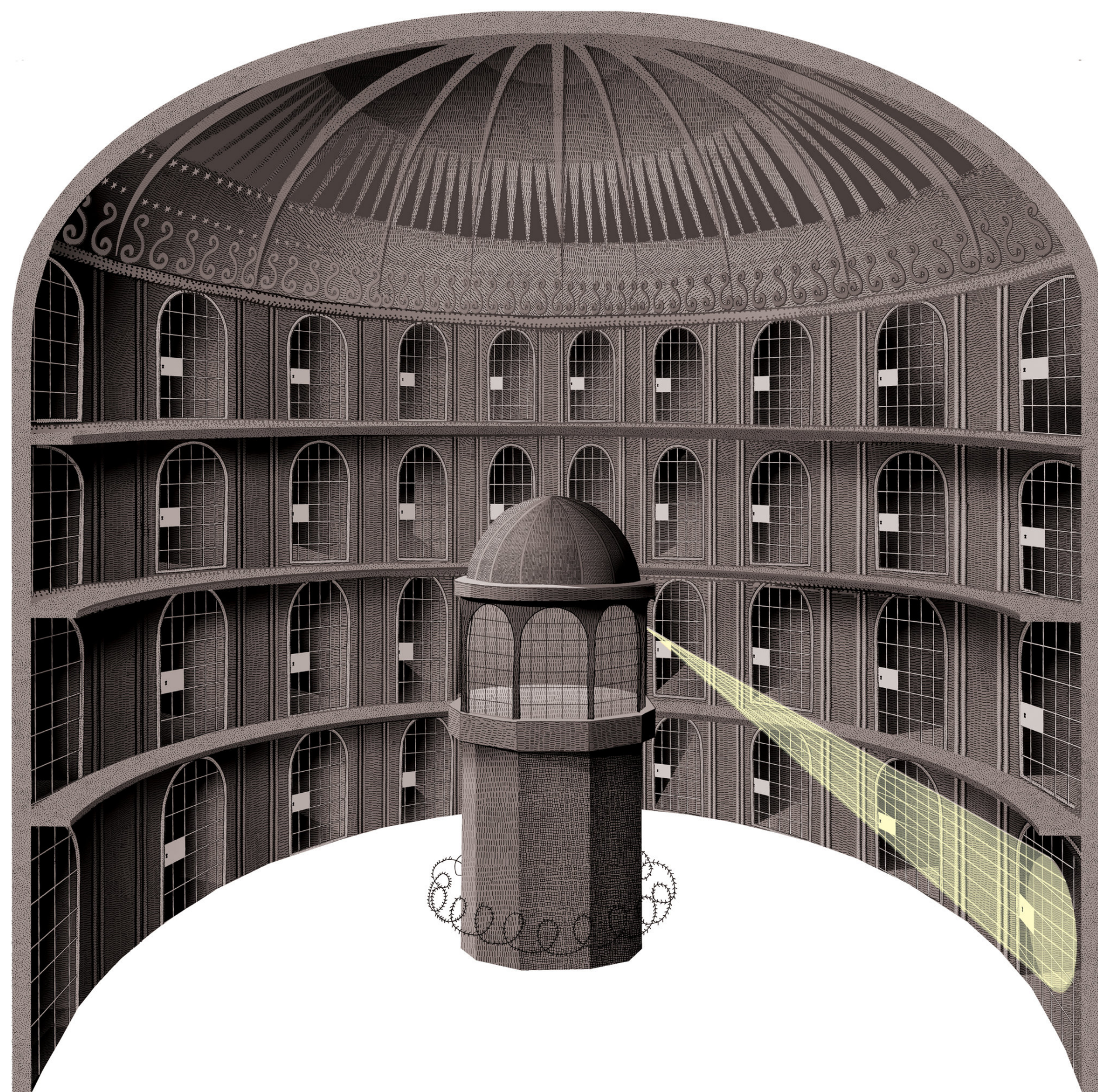


Robert Moses - Long Island Expressway



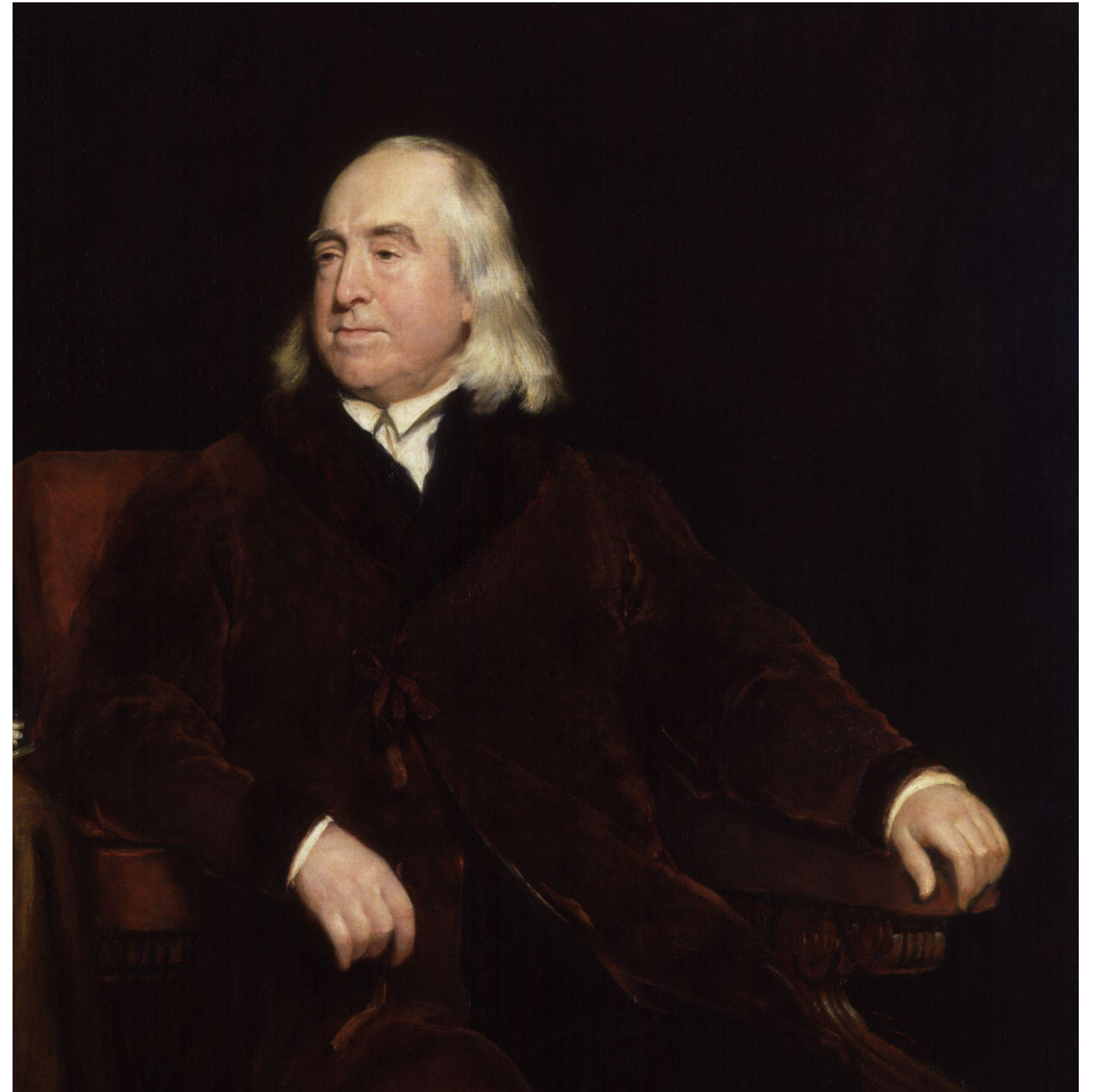
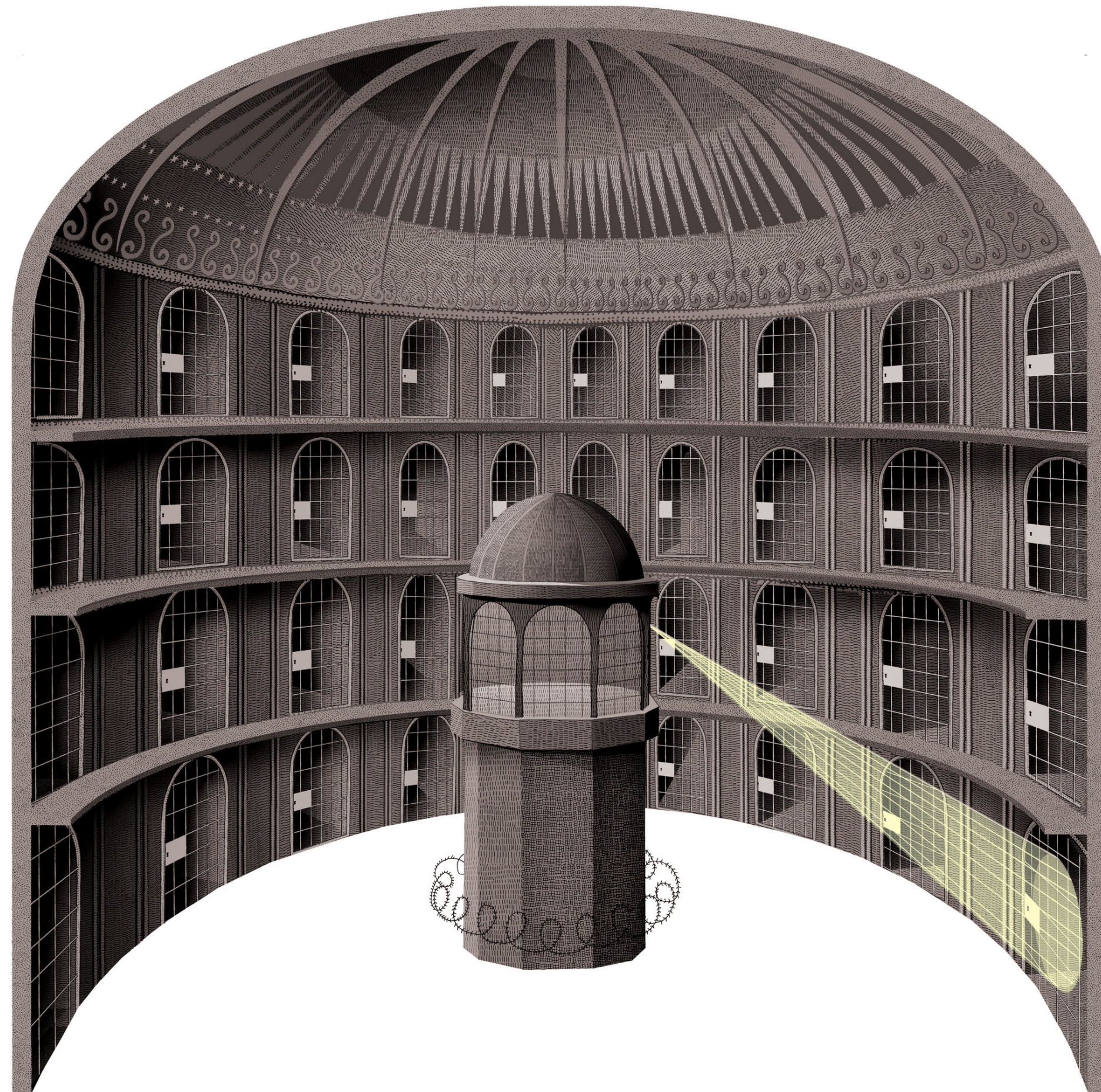
UC Tomato Harvester



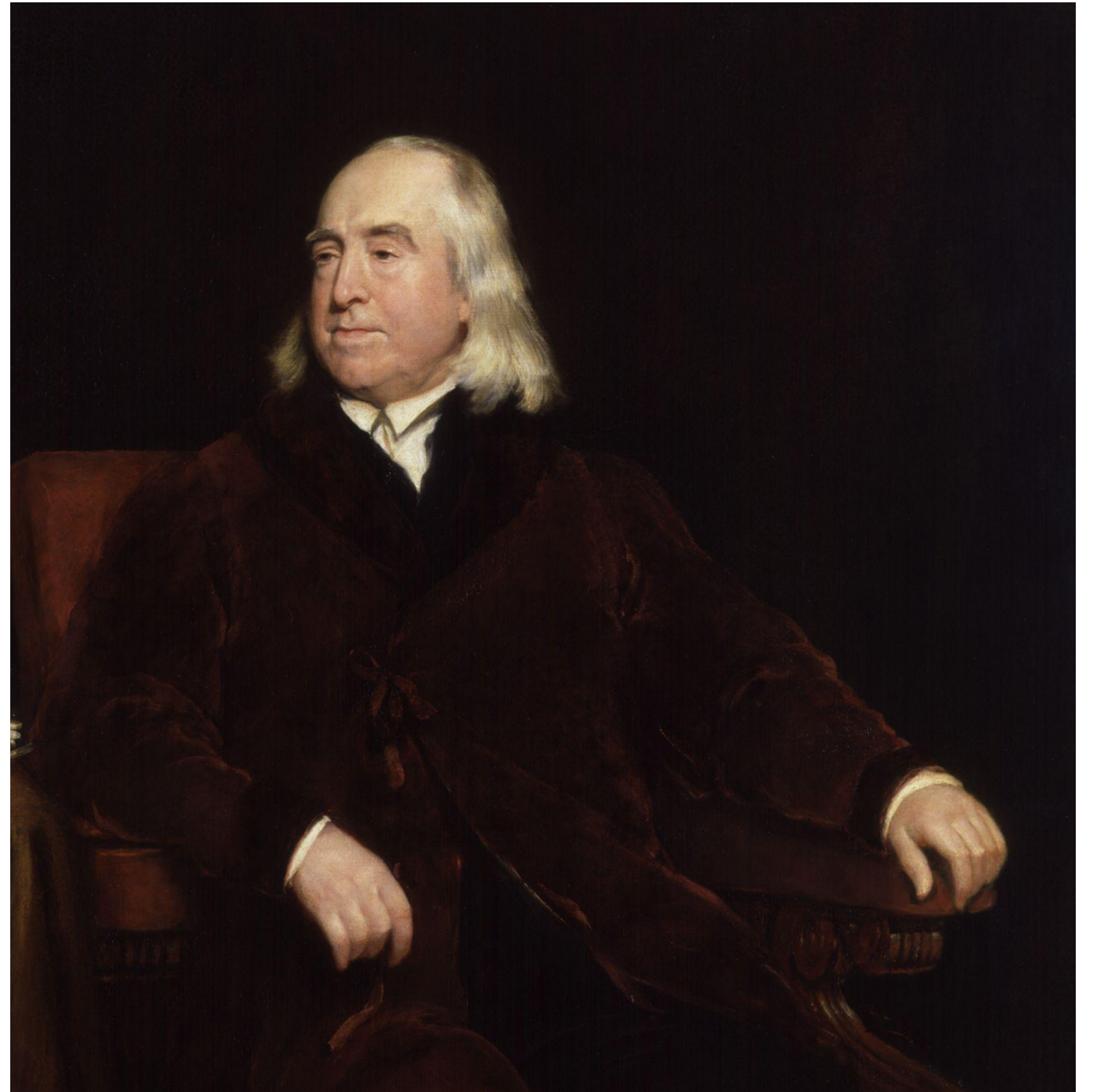
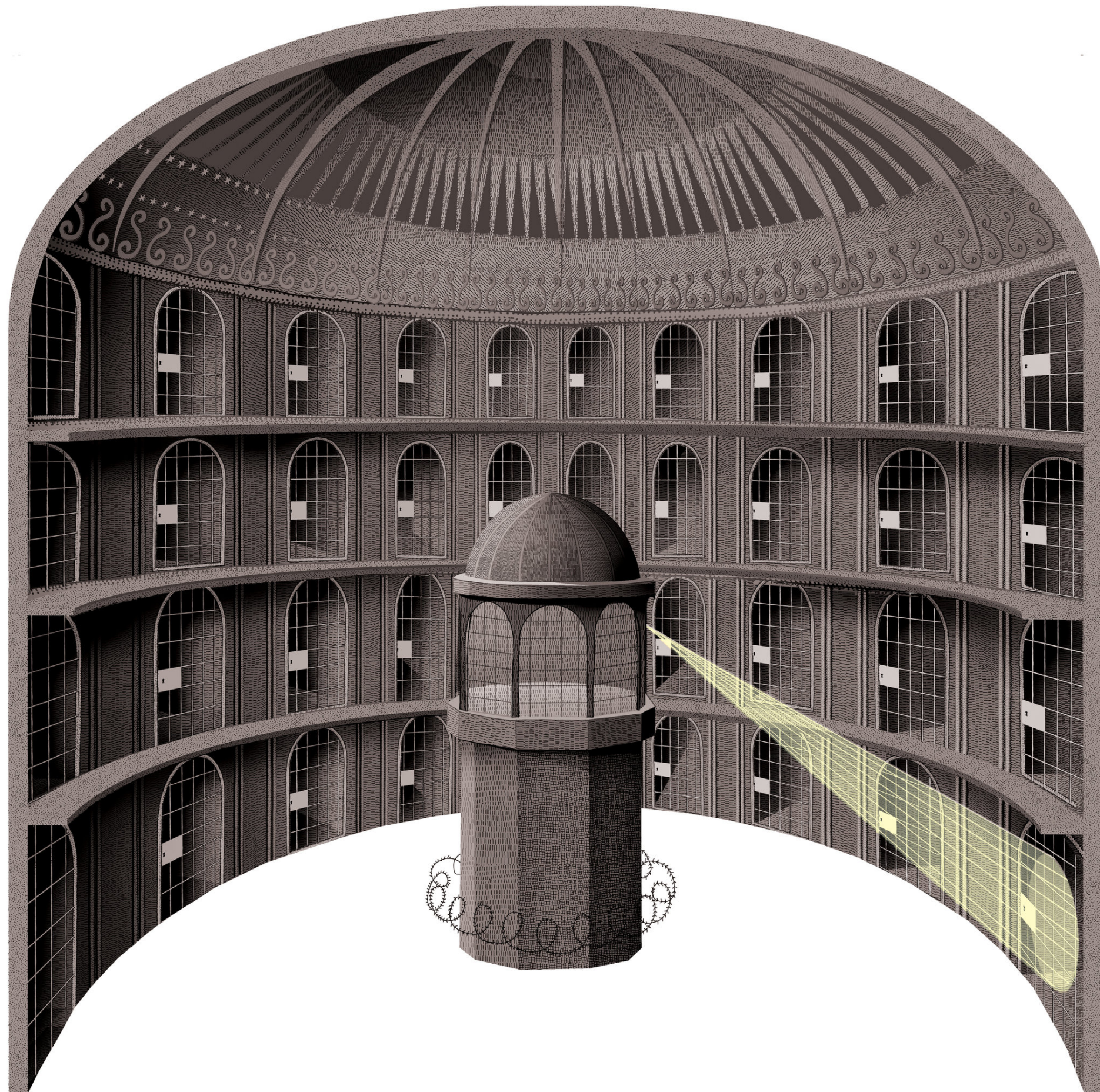


The panopticon

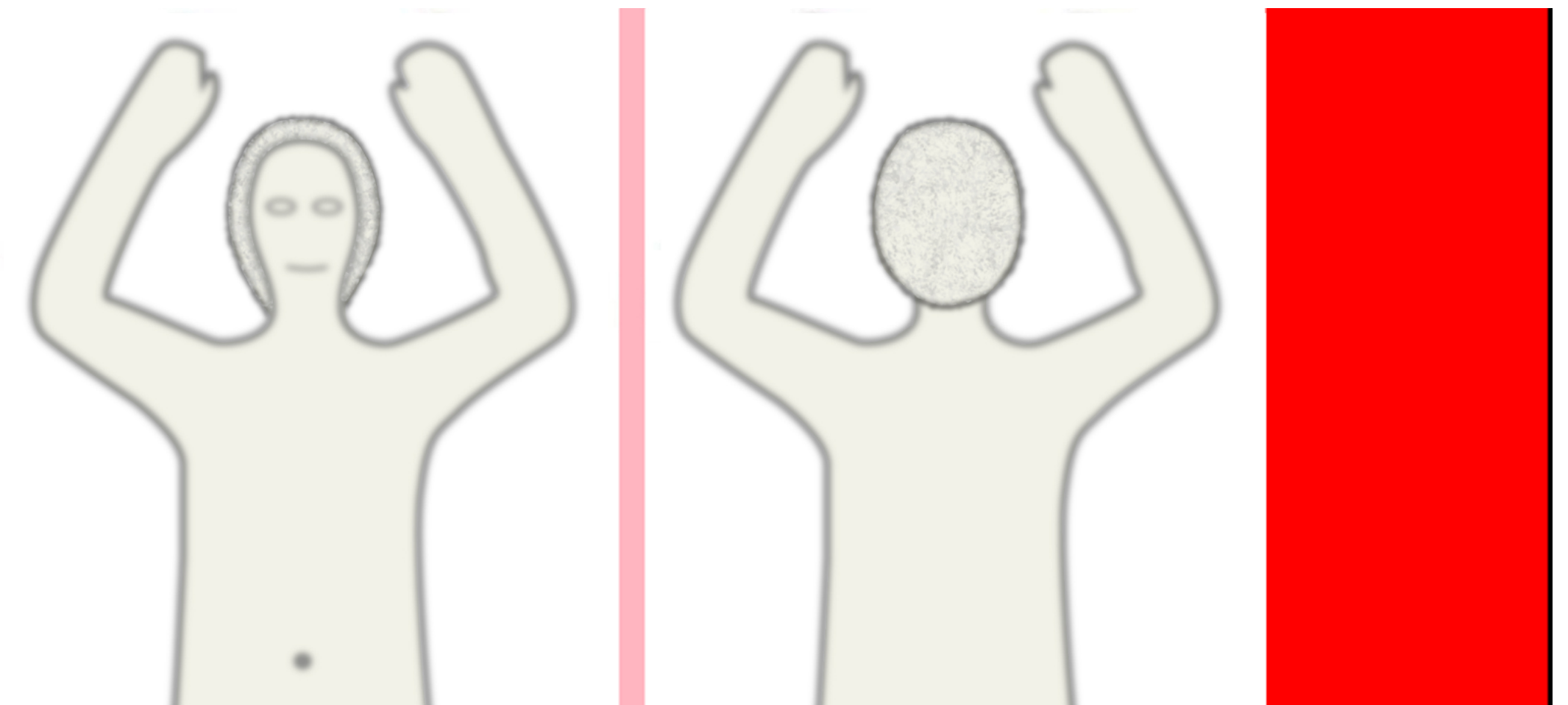
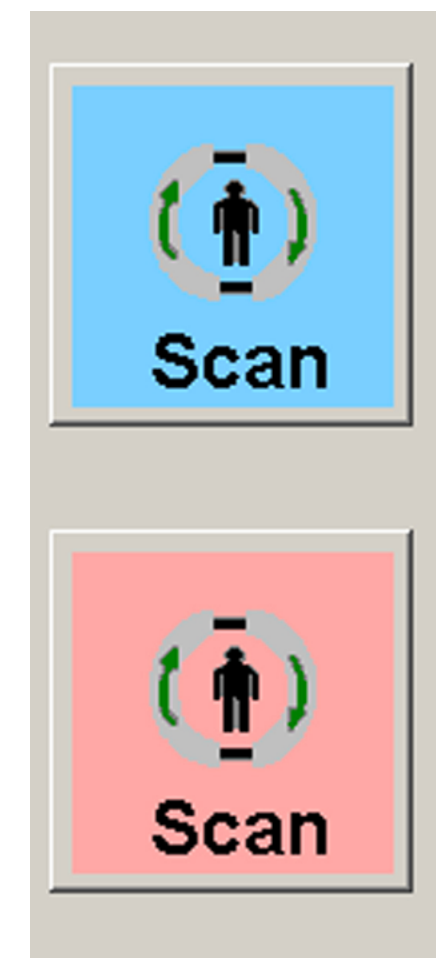
Surveillance, data/capta, and utility



The *seer* has power
over the *seen*.



On consequential ethics, ask: How might my visualization result in *harm*?



Power isn't inherently bad, either!
Remember: we are thinking of *consequences*.

Power isn't inherently bad, either!
Remember: we are thinking of *consequences*.



<http://mimionuoha.com/the-library-of-missing-datasets>, Mimi Onuoha

Can we imagine capturing information which could *liberate* us?



<http://mimionuoha.com/the-library-of-missing-datasets>, Mimi Onuoha

An Incomplete List of Missing Data Sets

This list will always be incomplete, and is designed to be illustrative rather than comprehensive. It also comes primarily from the perspective of the U.S, though the complete list of datasets features far more international examples.

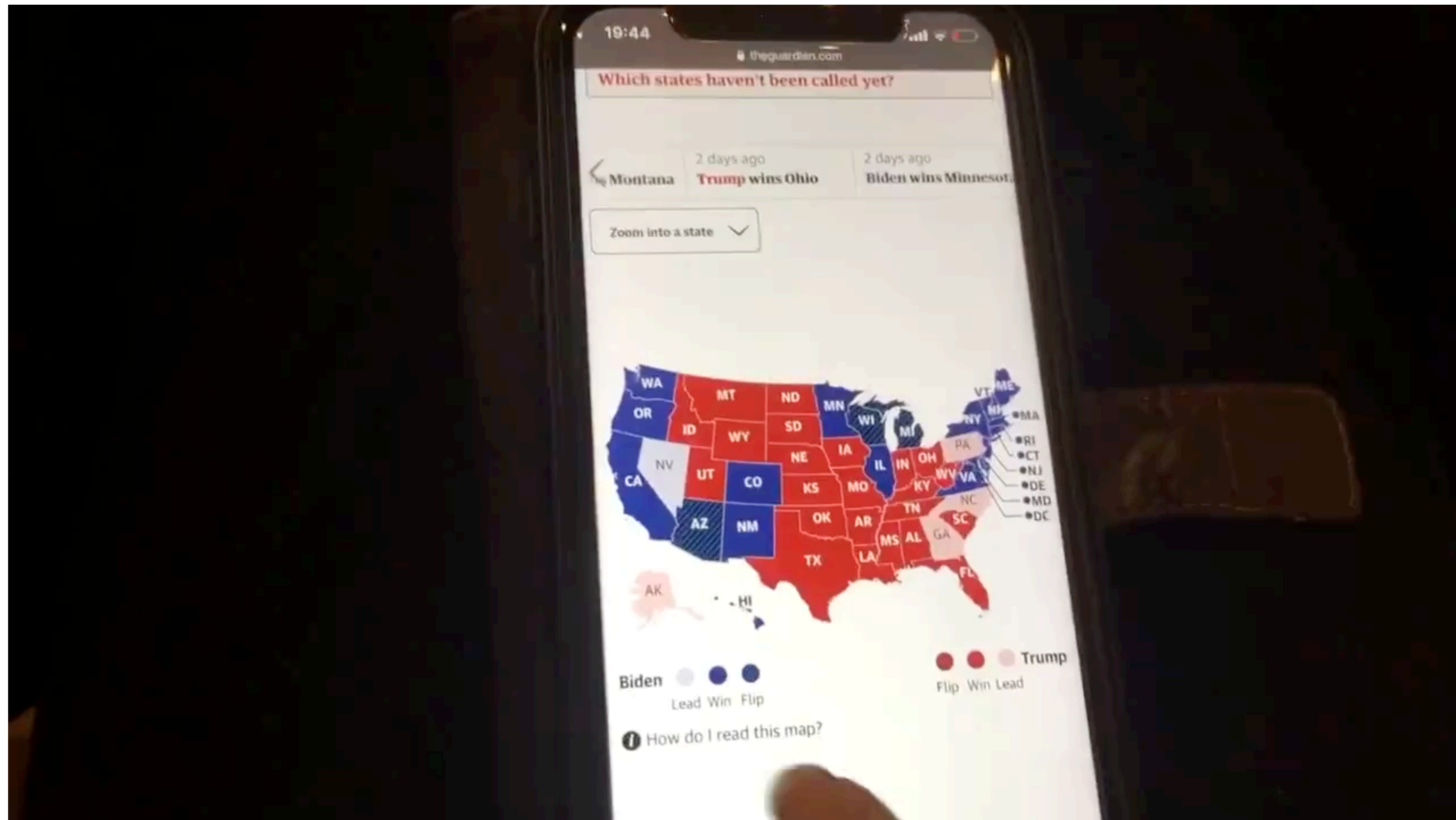
- ~~Civilians killed in encounters with police or law enforcement agencies~~ [update: this is no longer a missing dataset]
- Sales and prices in the art world (and relationships between artists and gallerists)
- People excluded from public housing because of criminal records
- Trans people killed or injured in instances of hate crime (note: existing records are notably unreliable or incomplete)
- Poverty and employment statistics that include people who are behind bars
- Muslim mosques/communities surveilled by the FBI/CIA
- Mobility for older adults with physical disabilities or cognitive impairments
- LGBT older adults discriminated against in housing
- Undocumented immigrants currently incarcerated and/or underpaid
- Undocumented immigrants for whom prosecutorial discretion has been used to justify release or general punishment
- Measurements for global web users that take into account shared devices and VPNs
- Firm statistics on how often police arrest women for making false rape reports
- Master database that details if/which Americans are registered to vote in multiple states
- Total number of local and state police departments using stingray phone trackers (IMSI-catchers)
- How much Spotify pays each of its artists per play of song

Who is excluded from visualization?

**A short introduction to disability and the ethics of accessibility in
visualization**

What is an inaccessible experience like?

Credit: Sarah Fossheim [on twitter](#)



(Consequentialist ethics)
Exclusion is bad, but so are *painful* “inclusive” experiences (which are common!)

So “accessibility:” What is it?

Accessibility:

1. The qualities that make an experience open or usable to all.

Accessibility:

1. The qualities that make an experience open or usable to all.
- 2. The qualities that make an experience open or usable specifically for people with disabilities.**

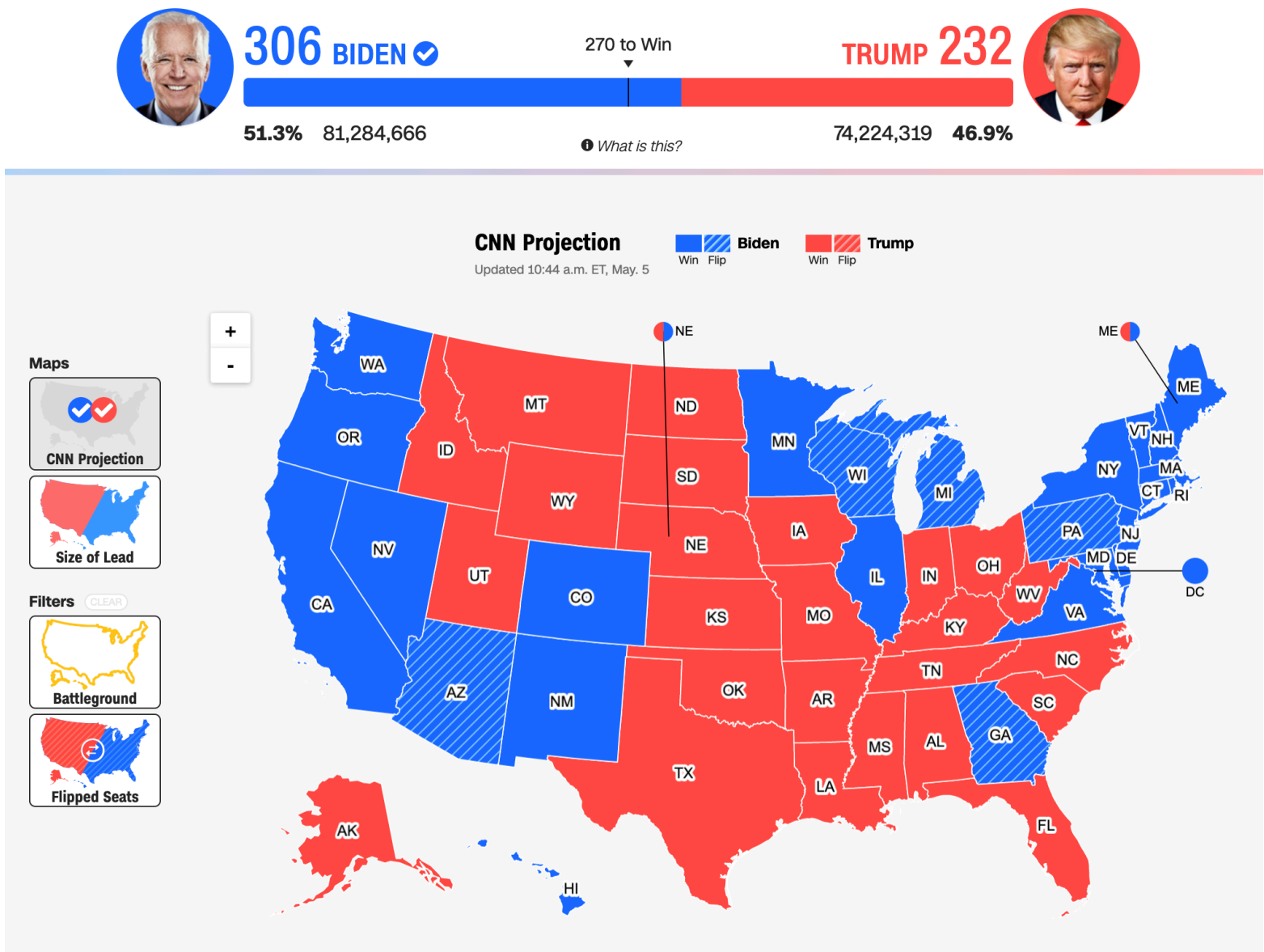
People with disabilities have a right to:

Participate in politics

PRESIDENTIAL RESULTS

Joe Biden wins election to be the 46th US President

Pennsylvania's 20 electoral votes put native son Joe Biden above the 270 needed to become the 46th President of the United States. Born in Scranton, the former vice president and longtime Delaware senator defeated Donald Trump, the first President to lose a reelection bid since George H.W. Bush in 1992.



Credit: [CNN](#)

People with disabilities have a right to:

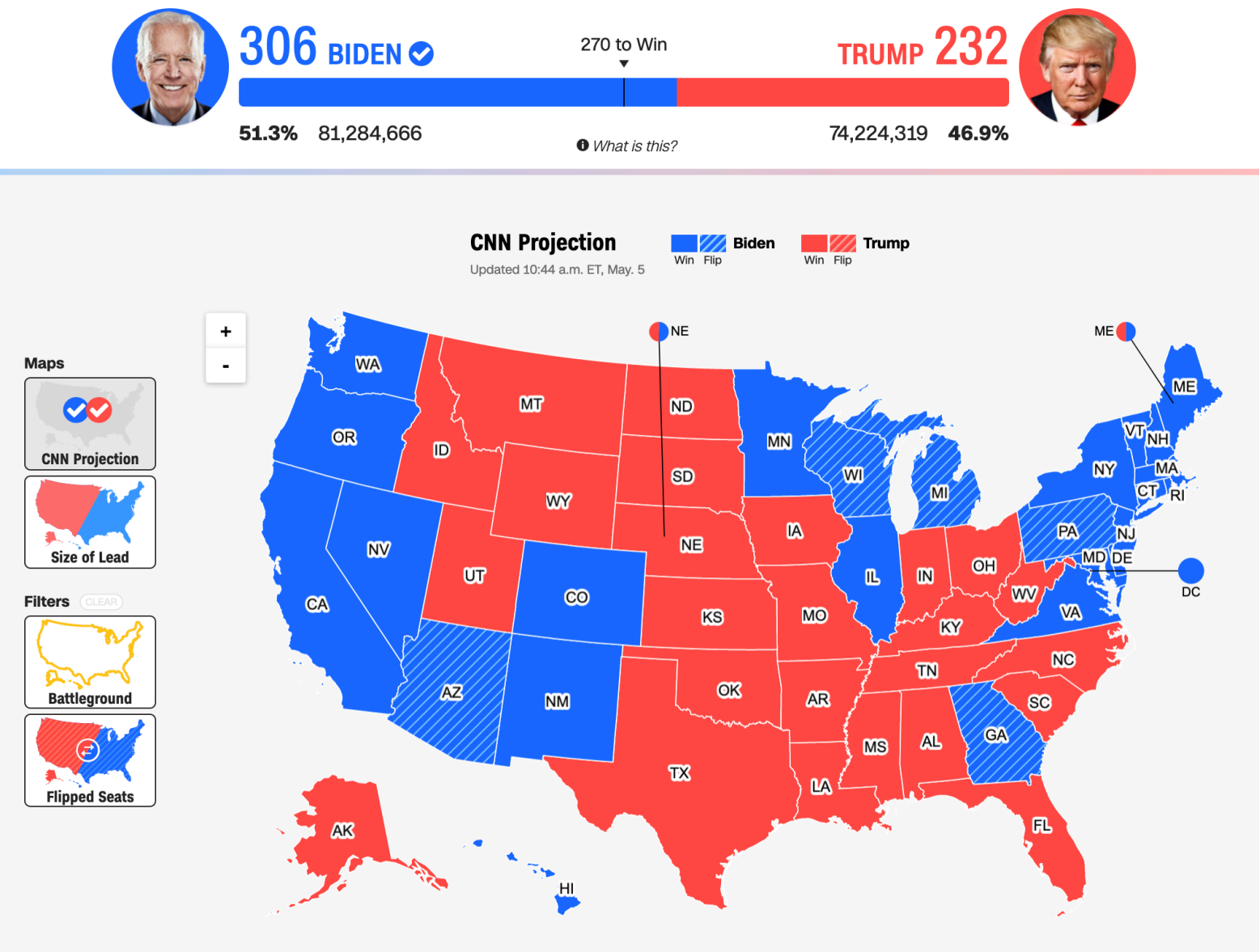
Participate in politics

Make informed decisions

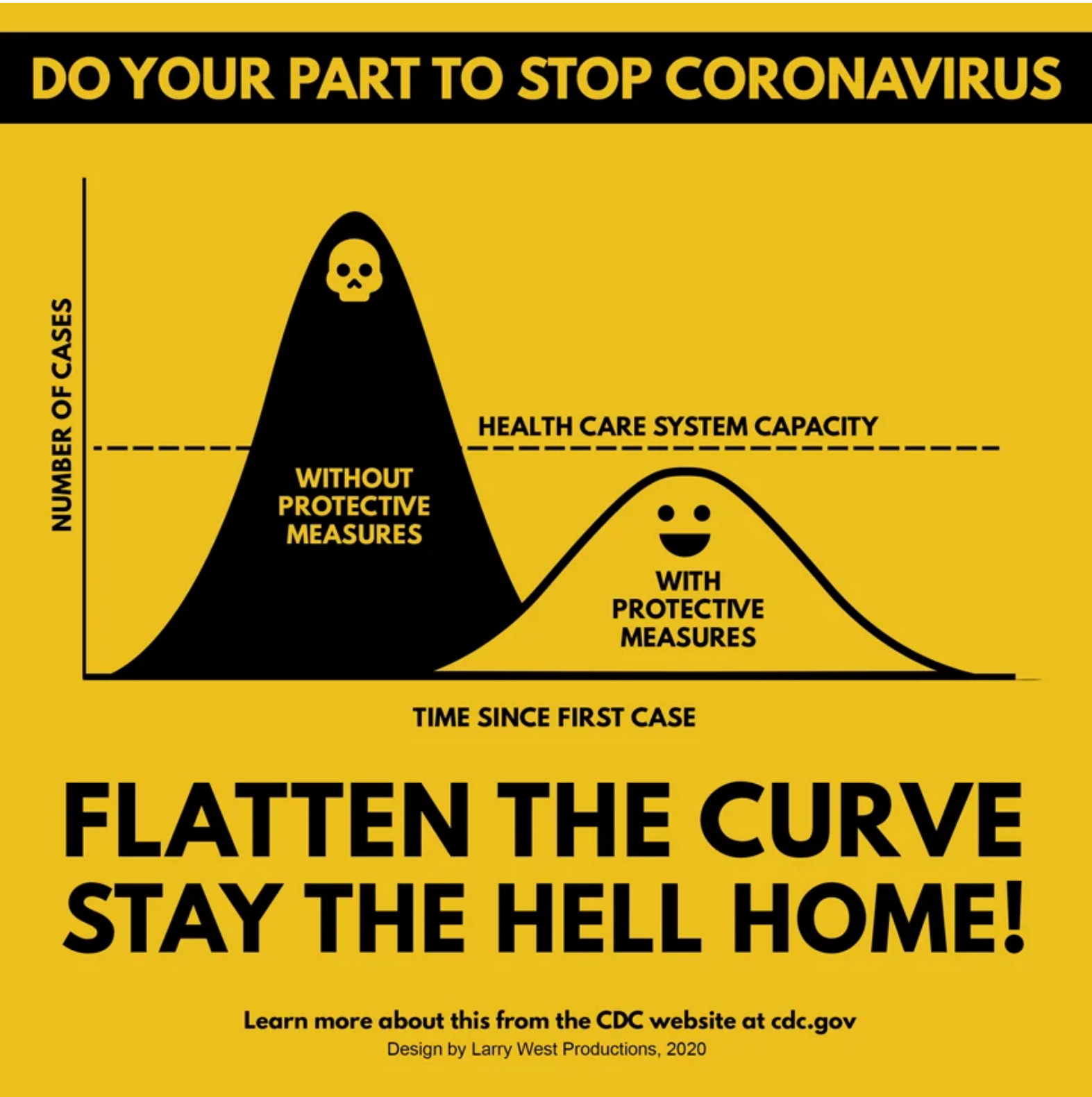
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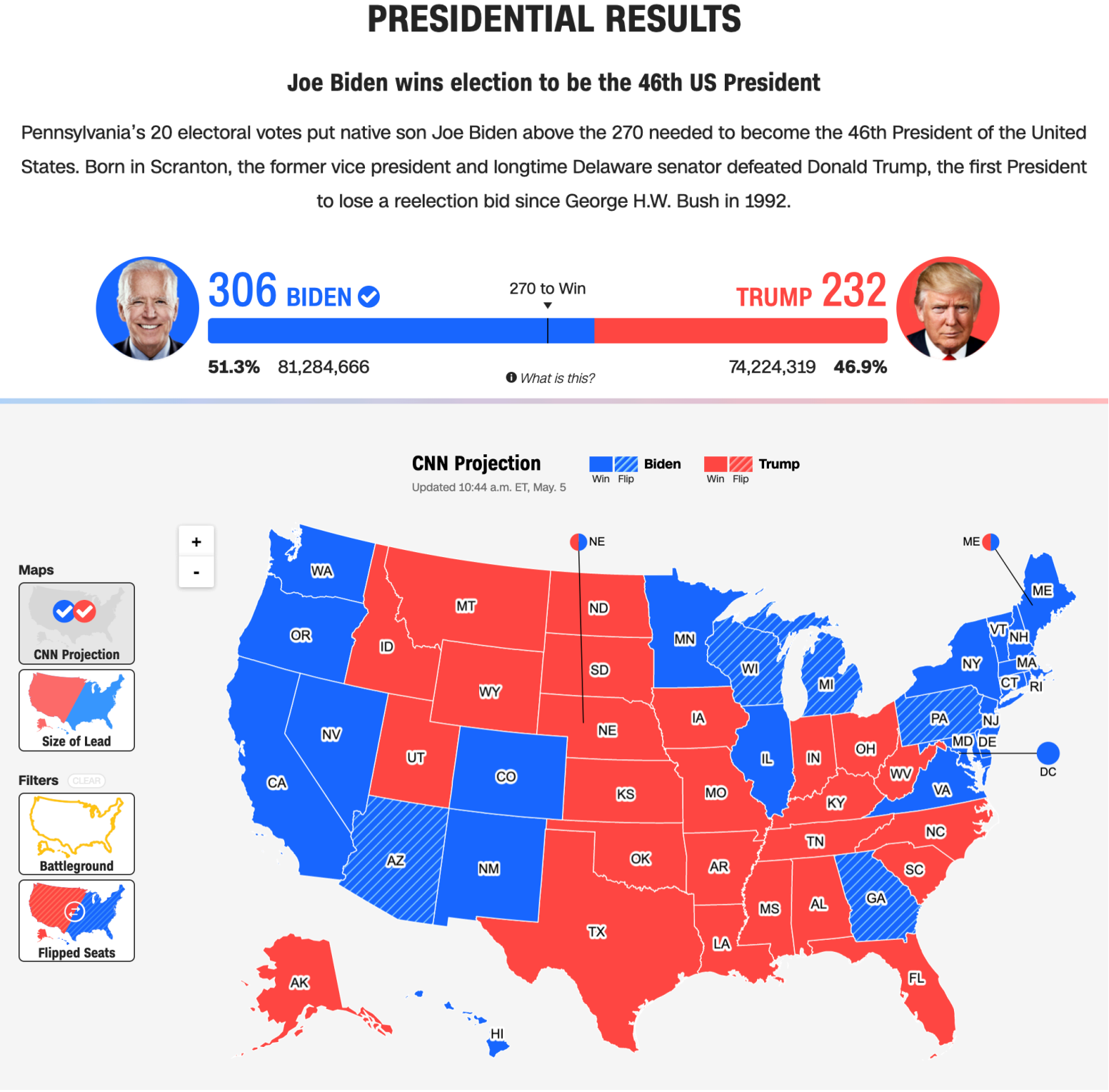
Credit: [CNN](#)



Credit: [Reddit](#)

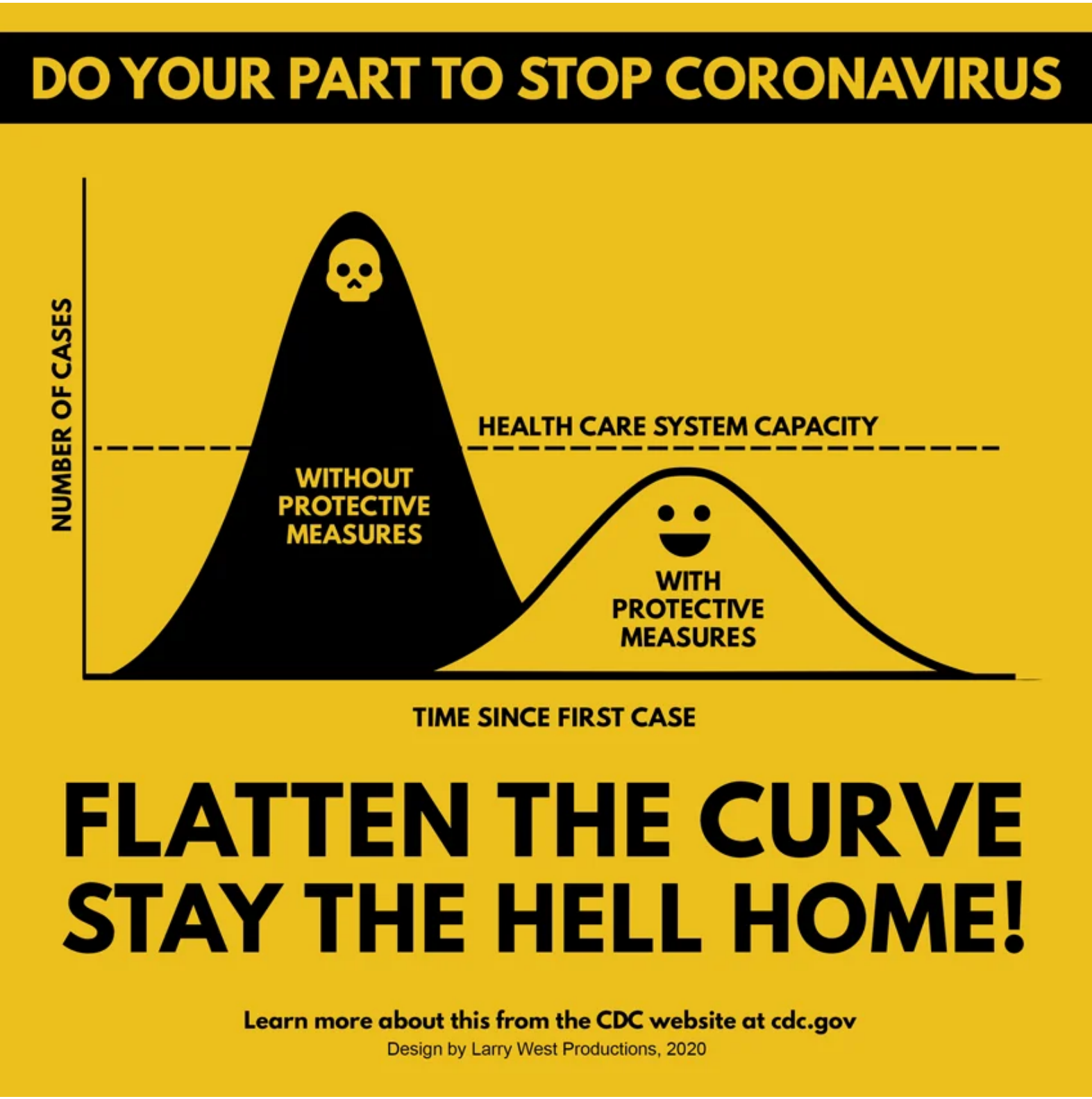
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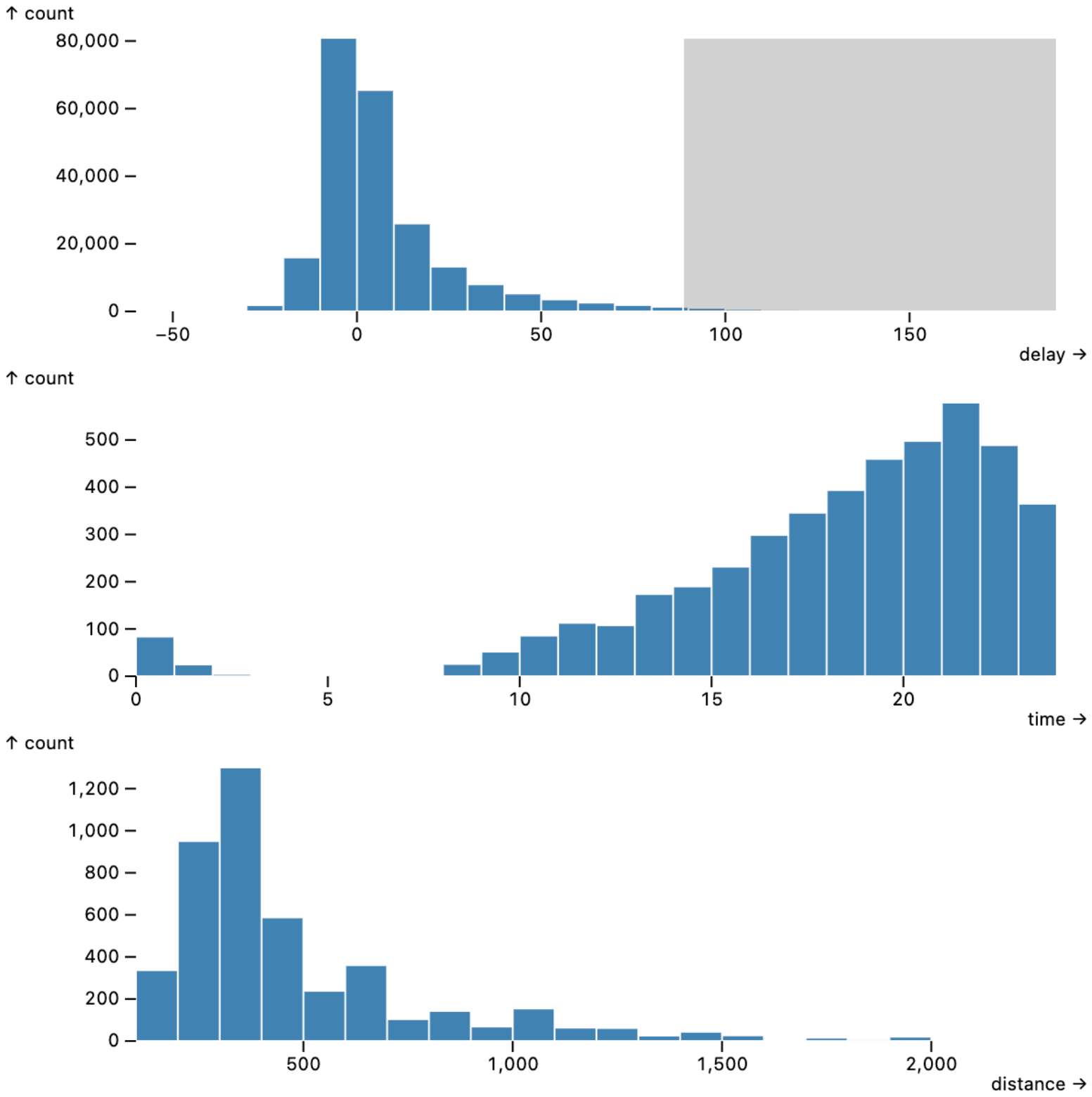
Credit: [CNN](#)

Make informed decisions



Credit: [Reddit](#)

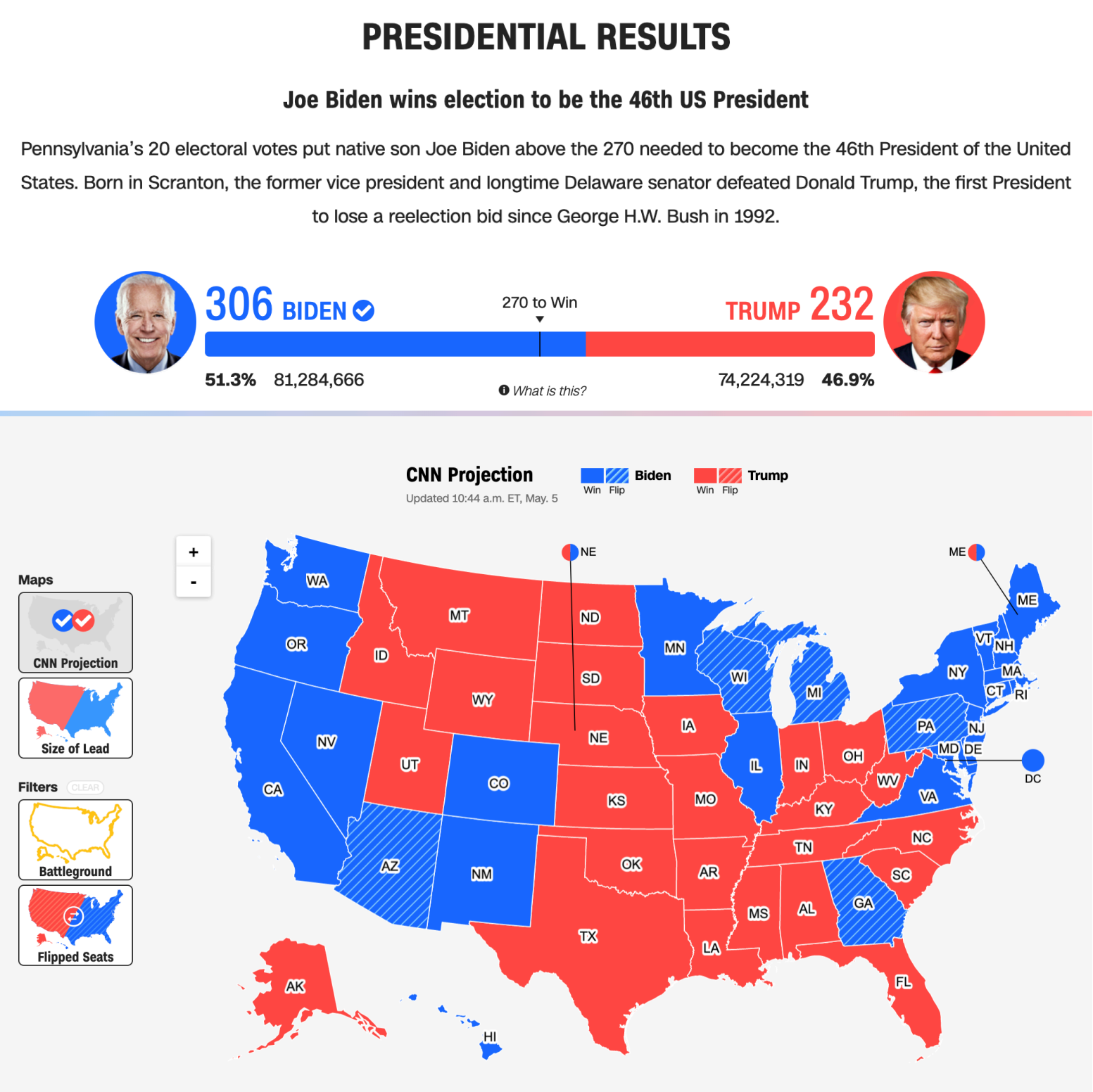
Analyze data quickly and efficiently



Credit: [Our research](#)

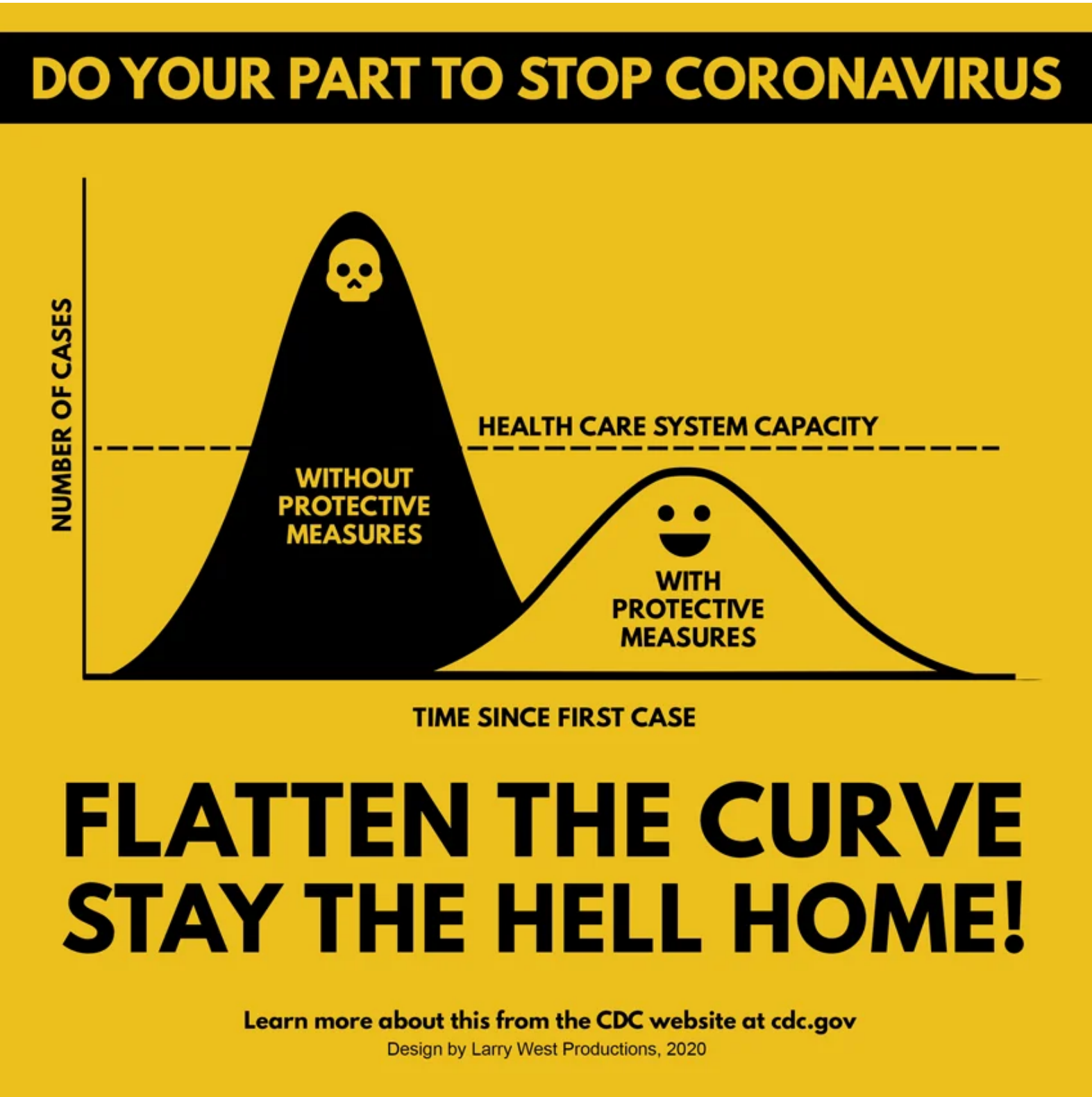
People with disabilities *should be able to:*

Participate in politics



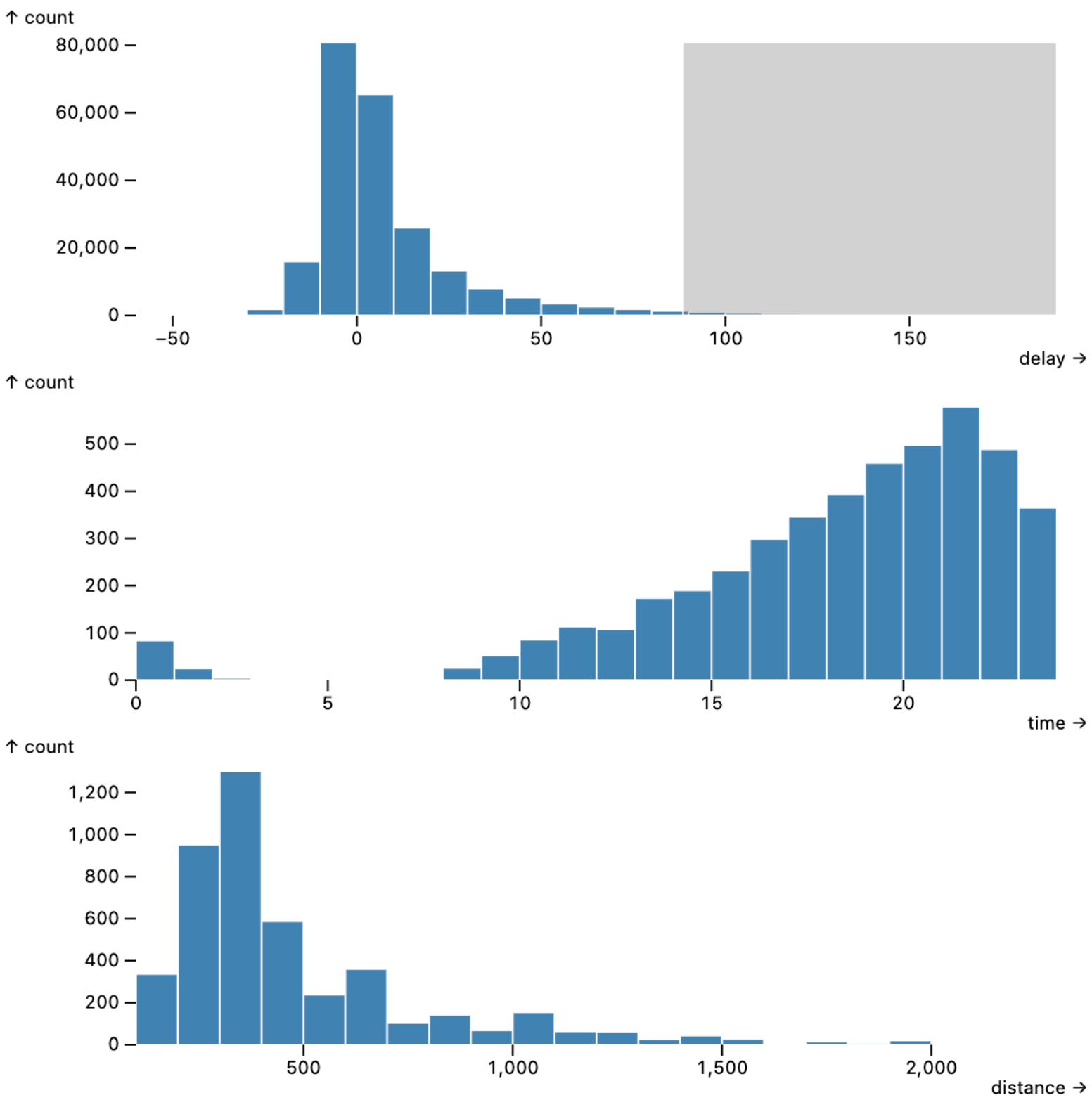
Credit: [CNN](#)

Make informed decisions

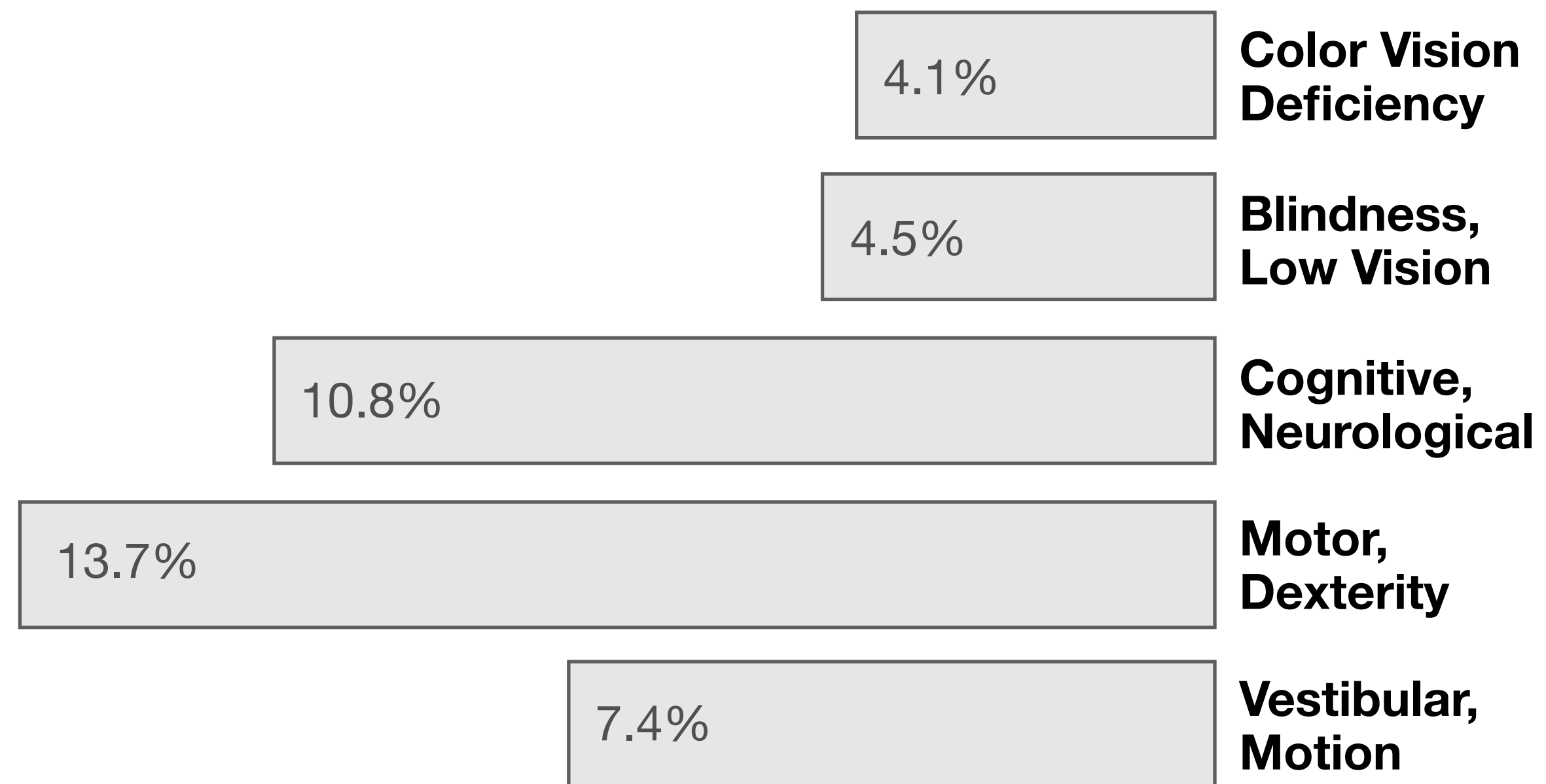


Credit: [Reddit](#)

Analyze data quickly and efficiently



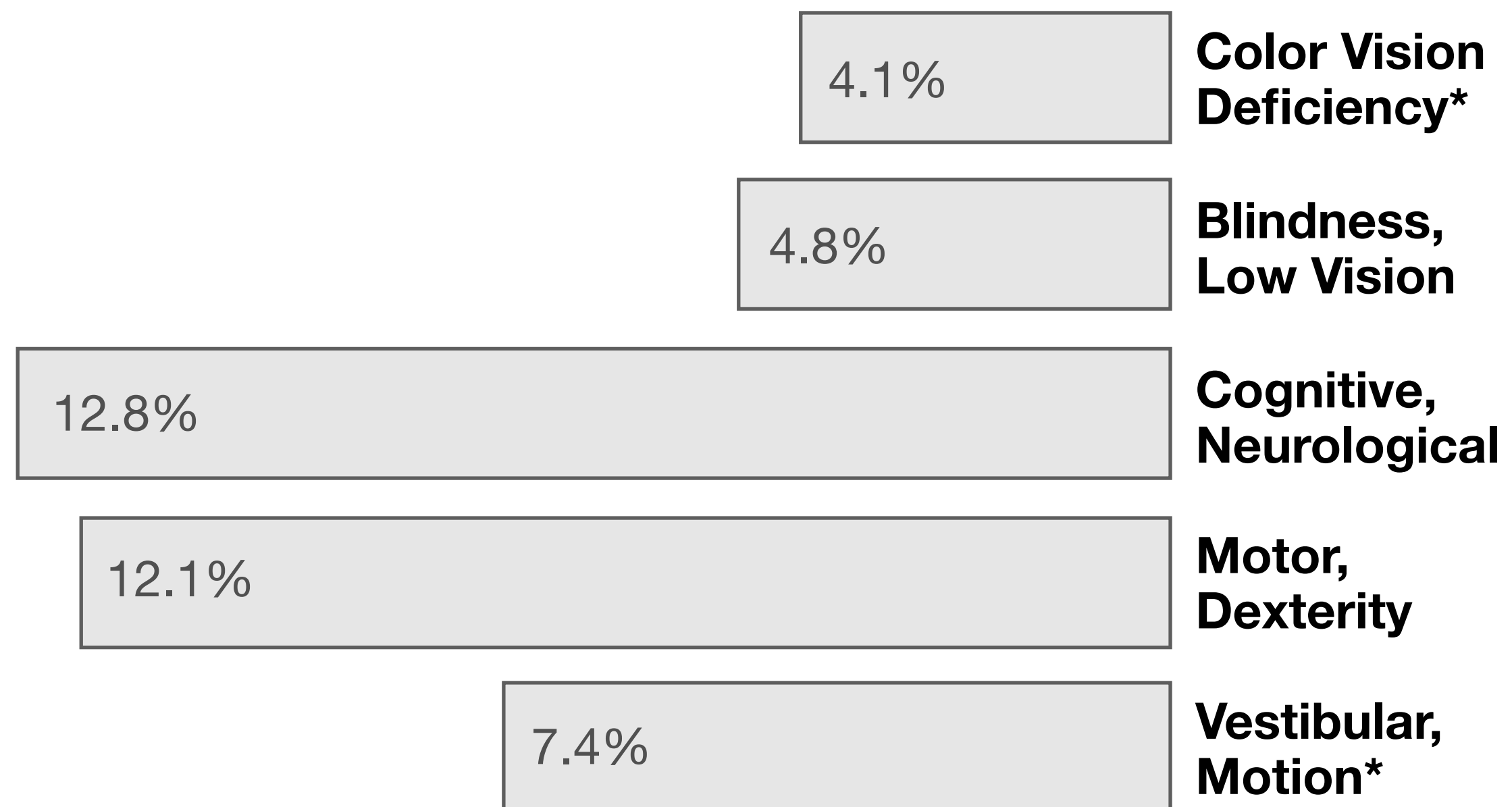
Credit: [Our research](#)



Source: Okoro et al. "Prevalence of Disabilities and Health Care Access by Disability Status and Type Among Adults"

~26% of people living in the United States self-report living with a disability that affects their daily life (2017)

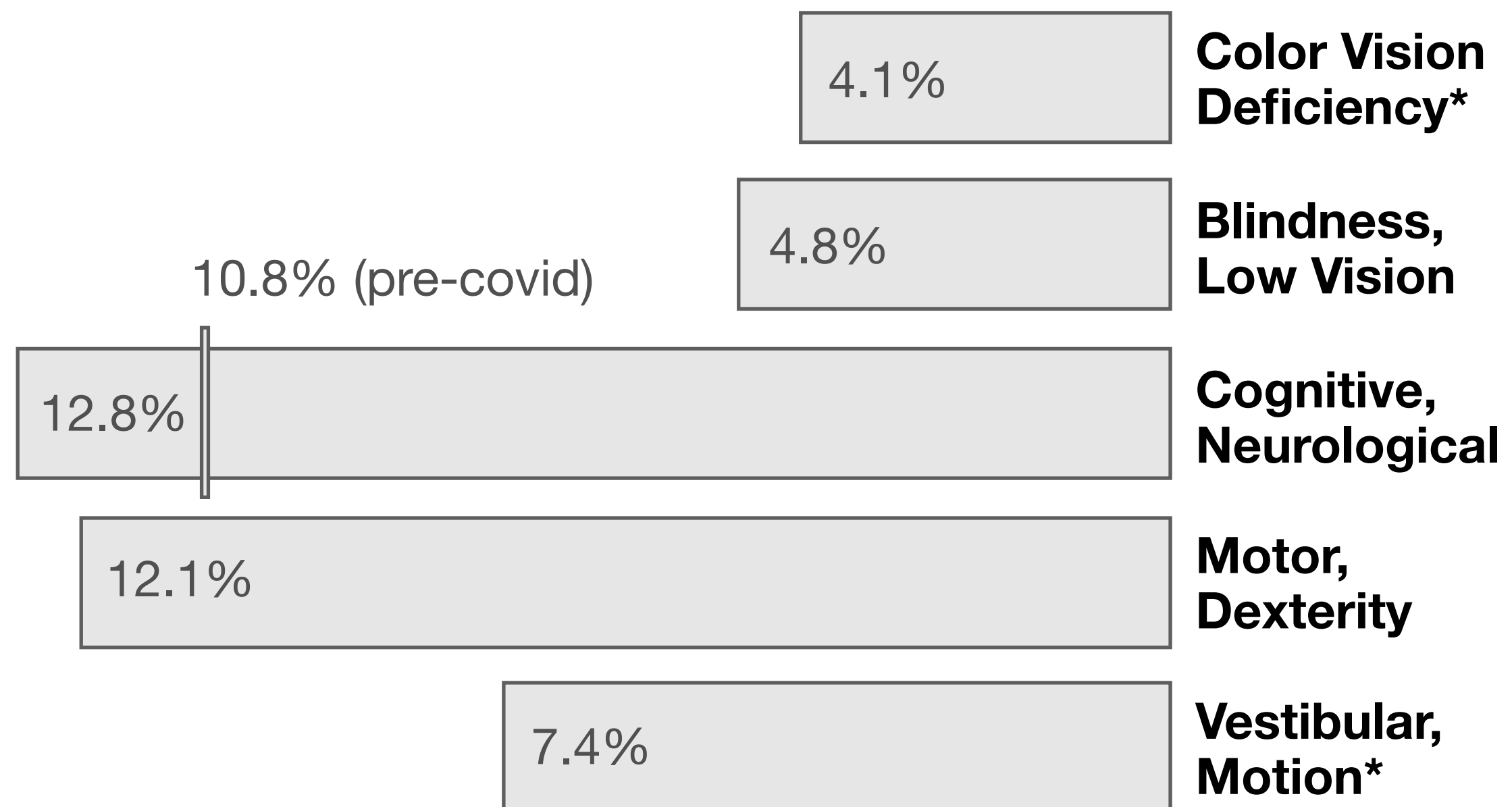
**~27% of people
living in the
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with a disability
that affects their
daily life (2023)**



Centers for Disease Control and Prevention. Disability and Health Data System (DHDS). 2023. Available from: <http://dhds.cdc.gov>

*No new data

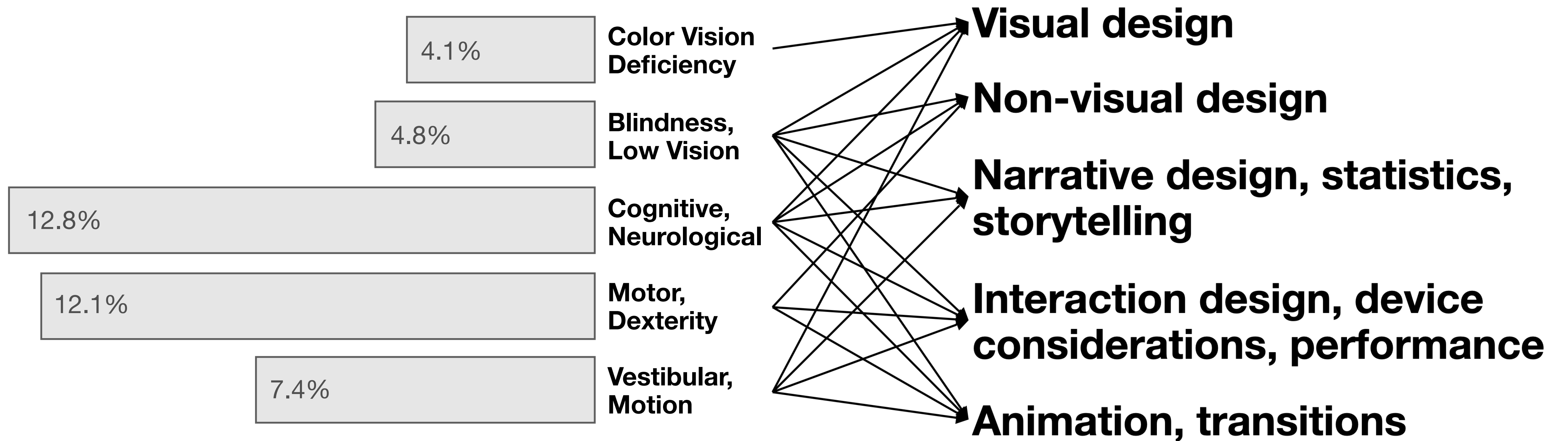
Cognitive disability is on the rise



Centers for Disease Control and Prevention. Disability and Health Data System (DHDS). 2023. Available from: <http://dhds.cdc.gov>

*No new data

Accessibility affects every aspect of visualization work



Even for profit-driven consequentialism: It is *expensive* to exclude accessibility

15% of time to include accessibility during a project

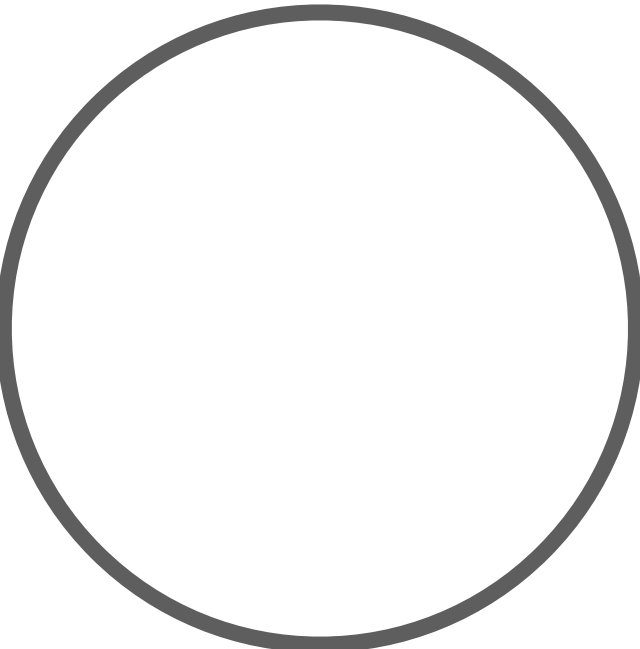


And this helps make sure ~27% of all people aren't excluded

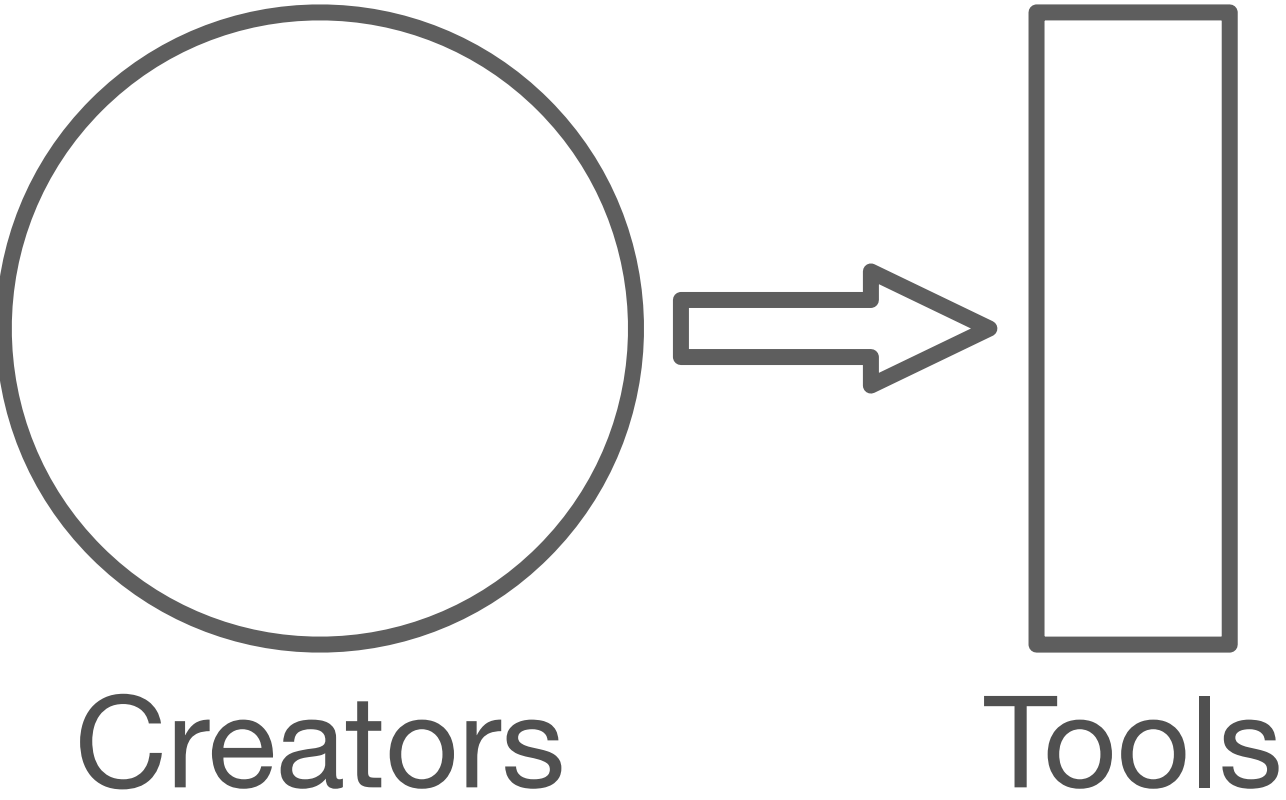


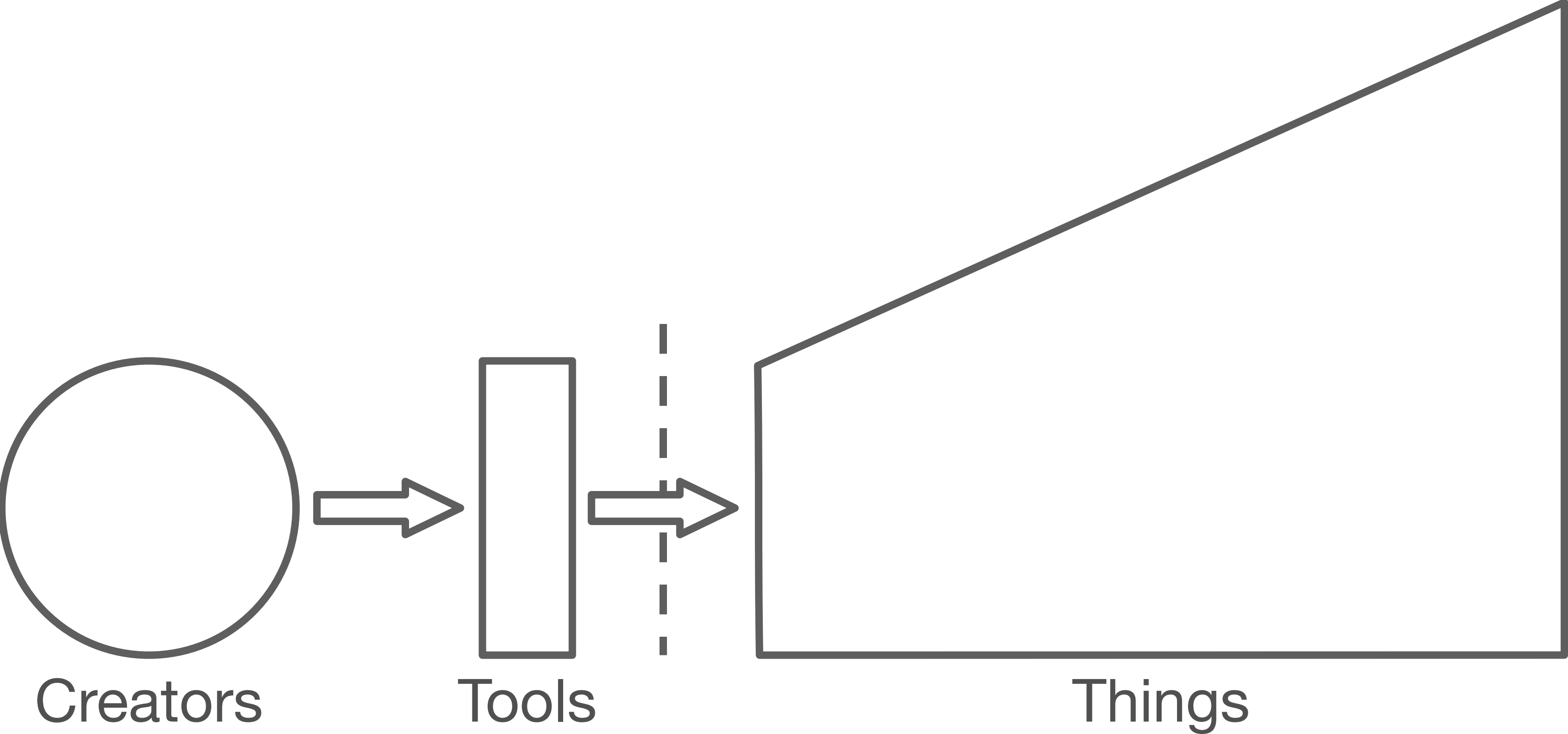
But excluding accessibility costs a project 1.5-10x more time later

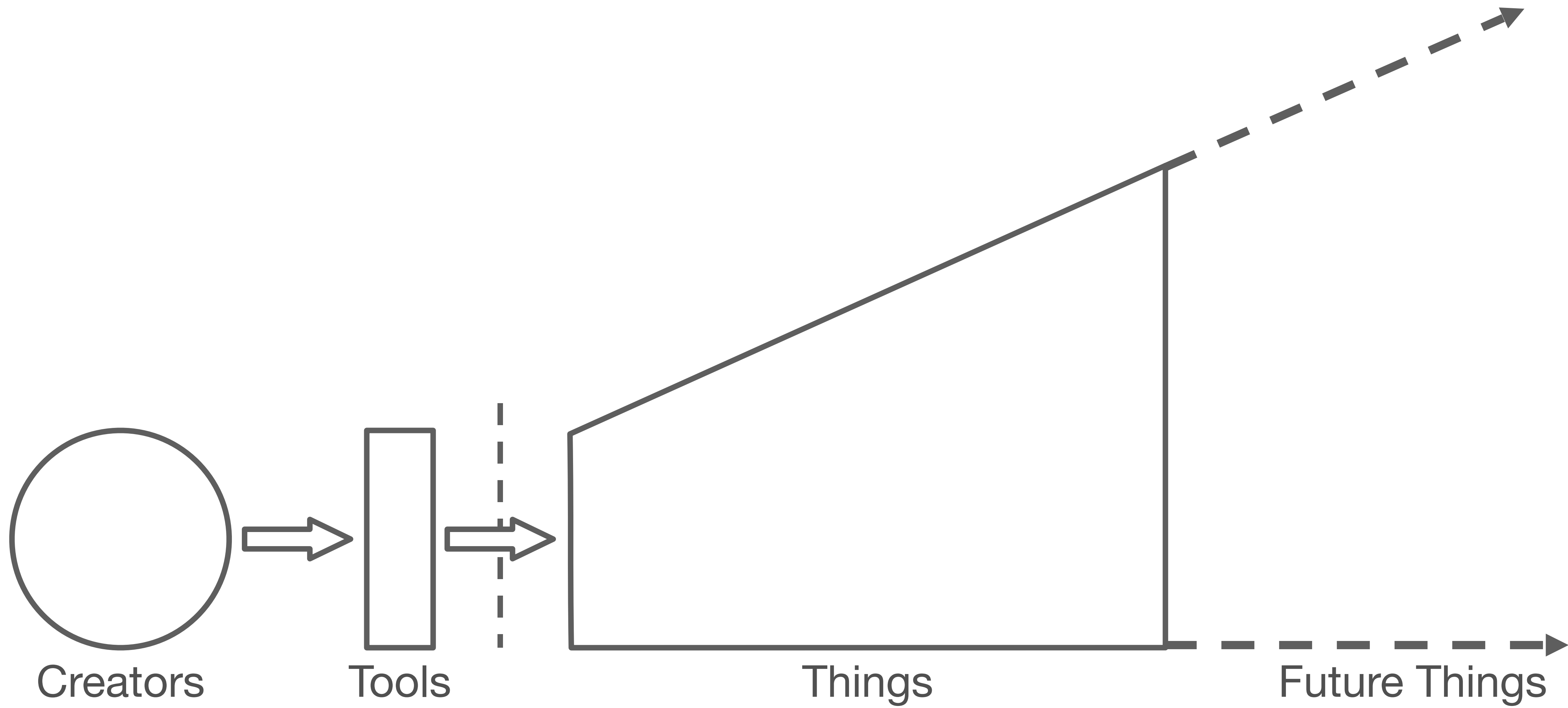




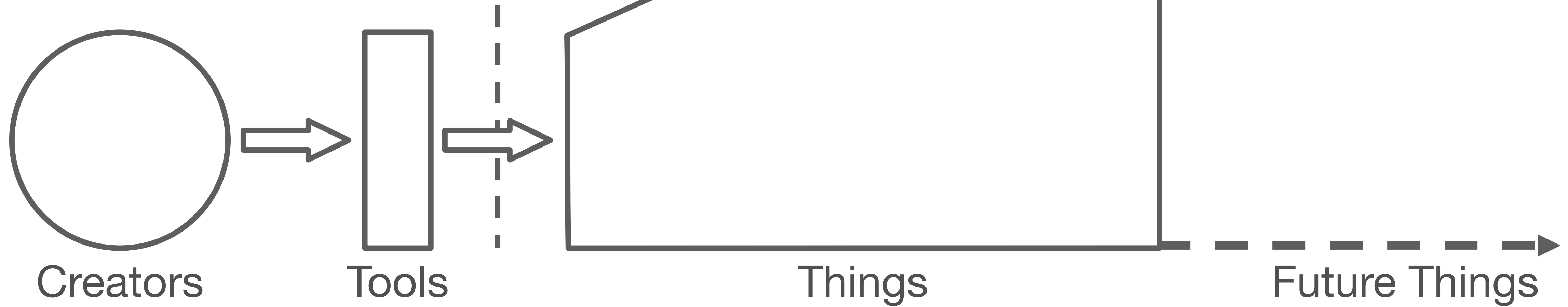
Creators





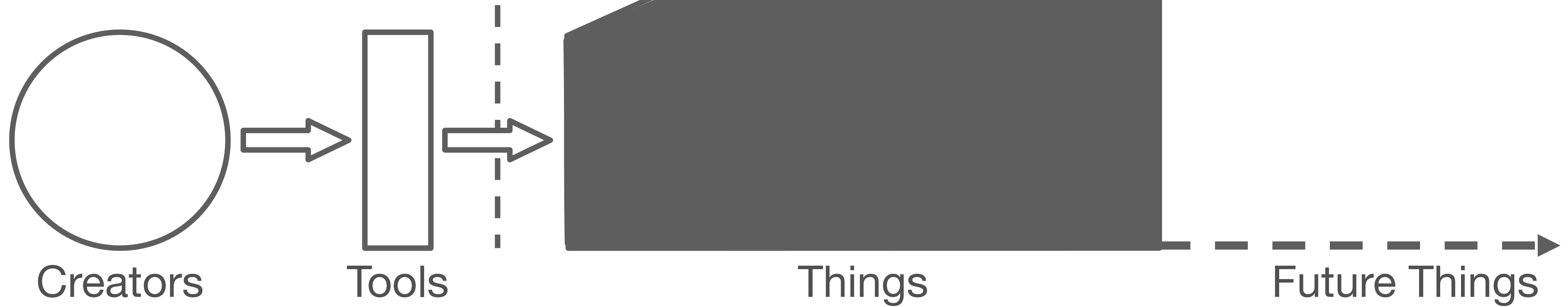


**But how much of this is
inaccessible?**



97-99%

Source: World Wide Web Consortium. "The WebAIM Million Report." 2019-2024



(Role ethics)

***Who* is responsible for making this accessible?**

Concept: The social framing of disability

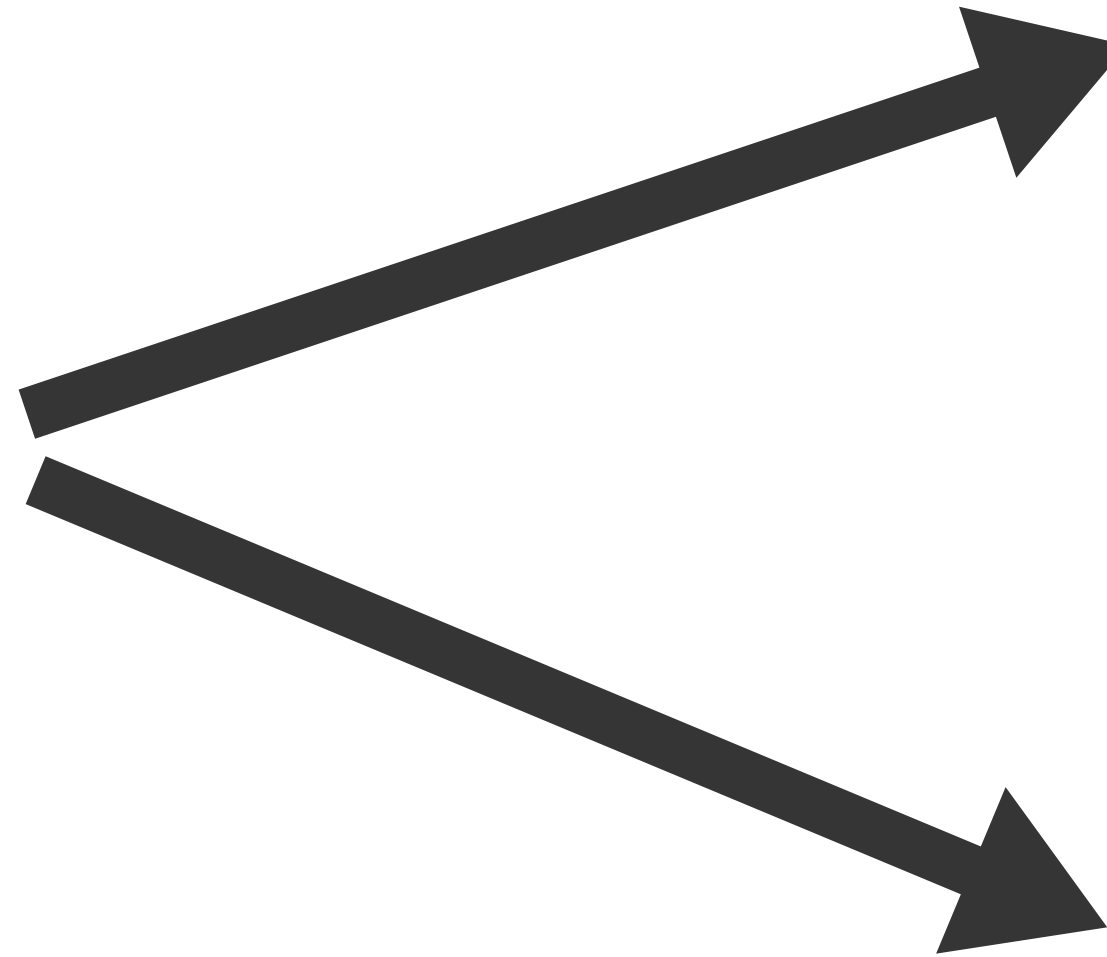
What about curbs in our cities?



Medicalizing framing: the body is the cause/location of disability (according to normative standards).



Augment or “cure” the body, the person typically bears the cost of access.



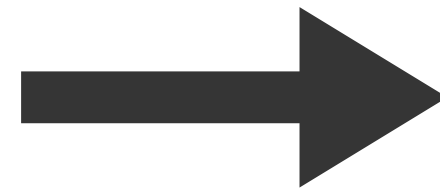
(Consequentialist ethics)

People with disabilities often bear the burden of technology and access, which produces bad outcomes.

Social framing: The *curb* is the source/location where disability is produced (as a “barrier” to access).



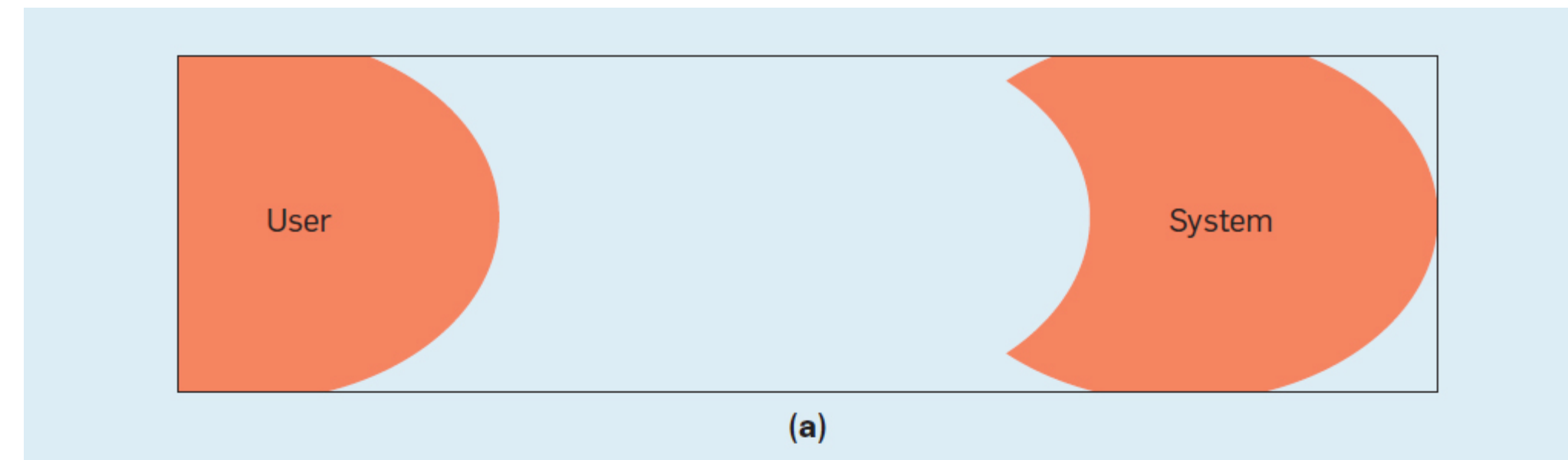
We built barriers, so now we need to fix them.



Concept: **Ability Assumptions**

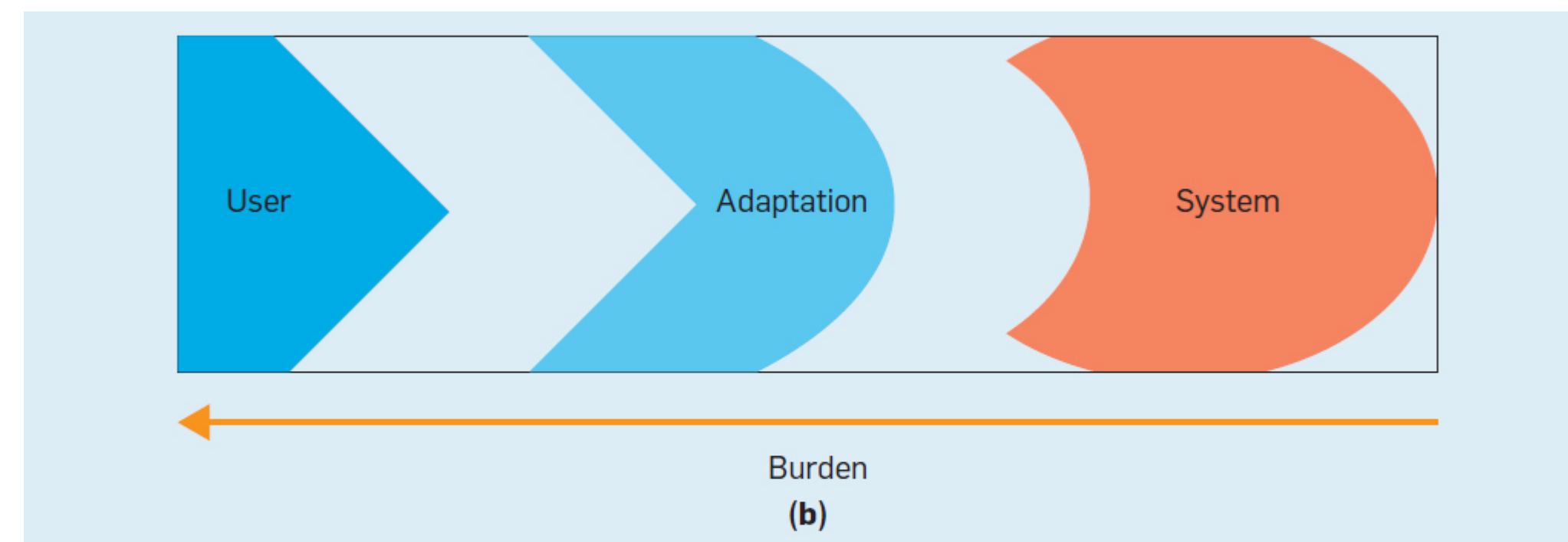
Ability Assumptions

(Wobbrock et al) <https://cacm.acm.org/magazines/2018/6/228034-ability-based-design/fulltext>



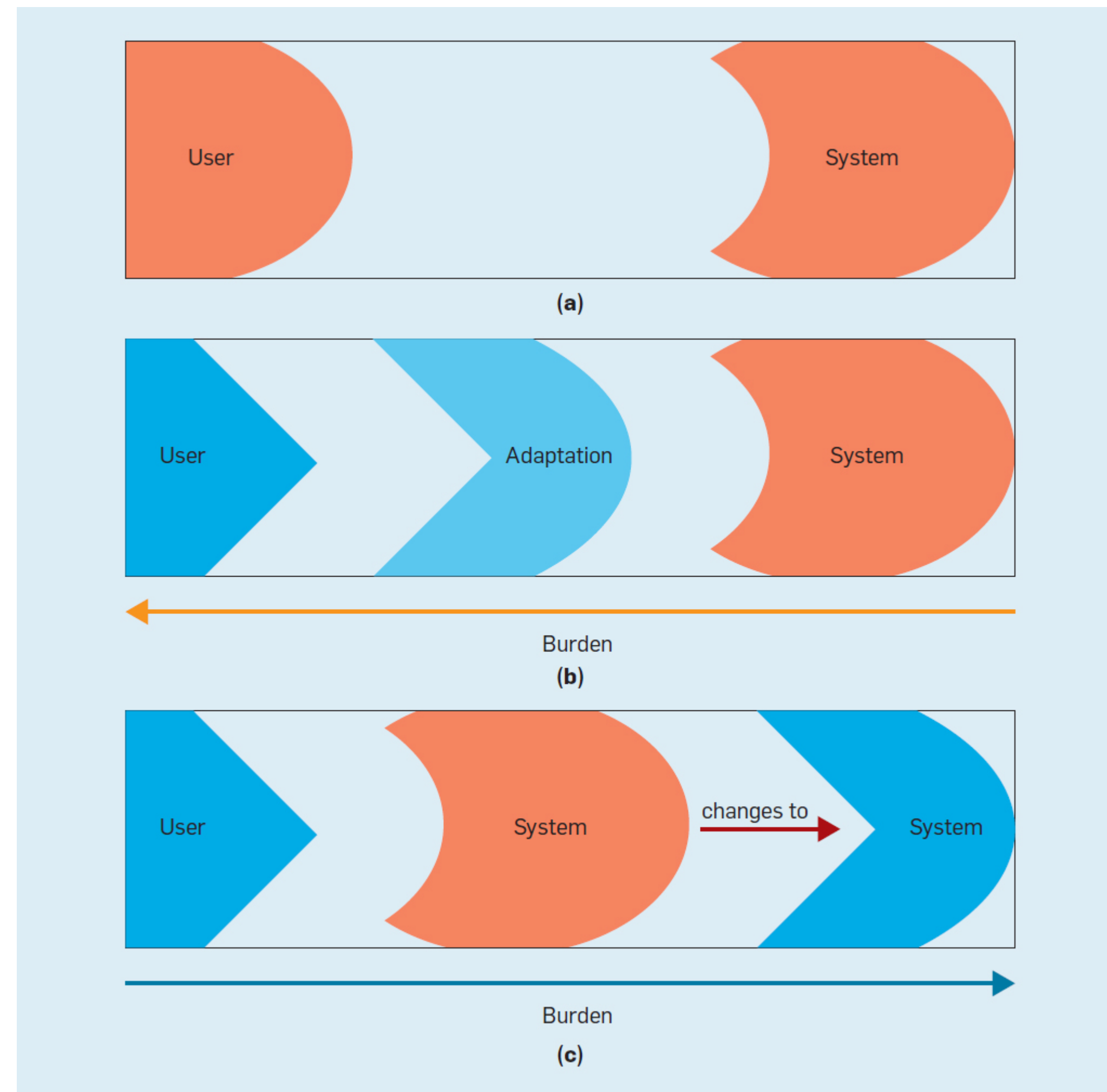
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A curb exclusively assumes the ability to step up



A cut curb has fewer *exclusive* ability assumptions



Concept: **Situational Impairment**

Permanent

Touch



One arm

Permanent

Temporary

Touch



One arm



Arm injury

Permanent

Temporary

Situational

Touch



One arm



Arm injury



New parent

We all experience situational impairment in our daily lives. **Accessibility benefits everyone!**

	Permanent	Temporary	Situational
Touch	 One arm	 Arm injury	 New parent

“Design for One, Extend to All”

Microsoft’s Inclusive Design 101 Toolkit: https://download.microsoft.com/download/b/0/d/b0d4bf87-09ce-4417-8f28-d60703d672ed/inclusive_toolkit_manual_final.pdf

	Permanent	Temporary	Situational
Touch	 One arm	 Arm injury	 New parent
See	 Blind	 Cataract	 Distracted driver
Hear	 Deaf	 Ear infection	 Bartender
Speak	 Non-verbal	 Laryngitis	 Heavy accent

**Does “design for one, extend to all”
have limits? Problems?**

Final Concept: **Disability-Centered Design**

**“Nothing about us
without us”**
And the 1977 504 sit-in.

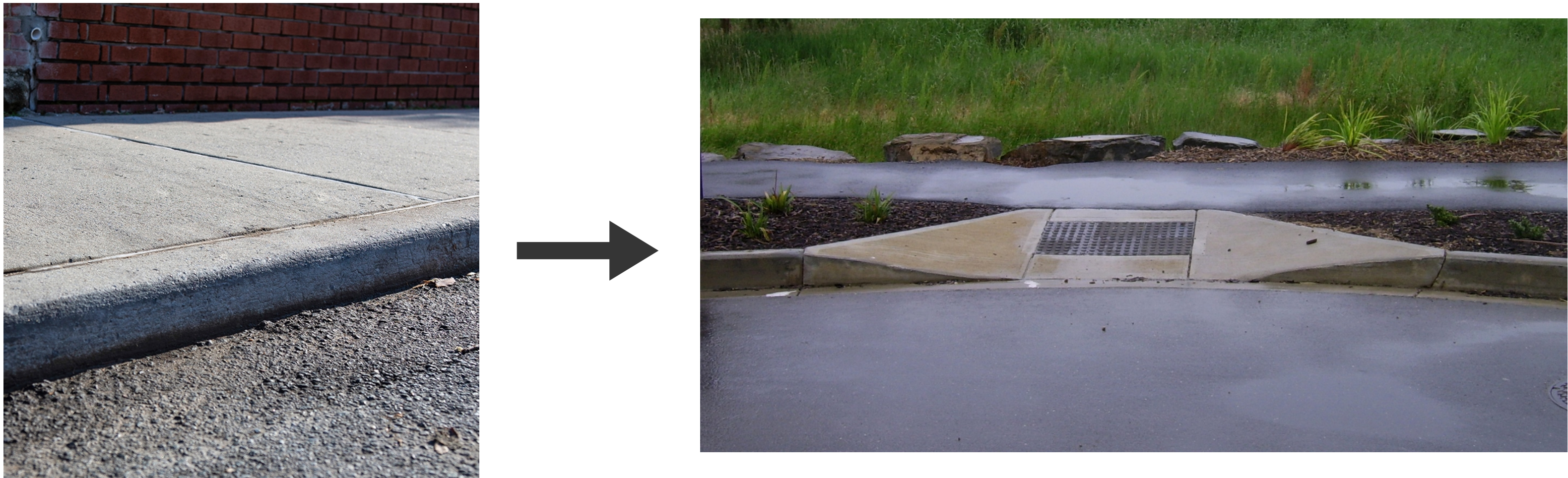


(Deontological + consequentialist ethics)
Having the ADA has actually been awesome for using litigation as a way to pressure change.

(Consequentialist ethics)

Observing the “curb cut effect” has also helped push adoption of accessibility, even in corporate/profit-driven contexts!

However, “curb cut” work has been *prioritized*



	Permanent	Temporary	Situational
Touch			
	One arm	Arm injury	New parent

(Consequentialist ethics)

Unfortunately, work that doesn't have an obvious curb-cut effect is often not funded or de-prioritized.

ASL interpretation vs subtitles



A sign language interpreter at Pittsburgh Steelers Super Bowl Rally in 2011.

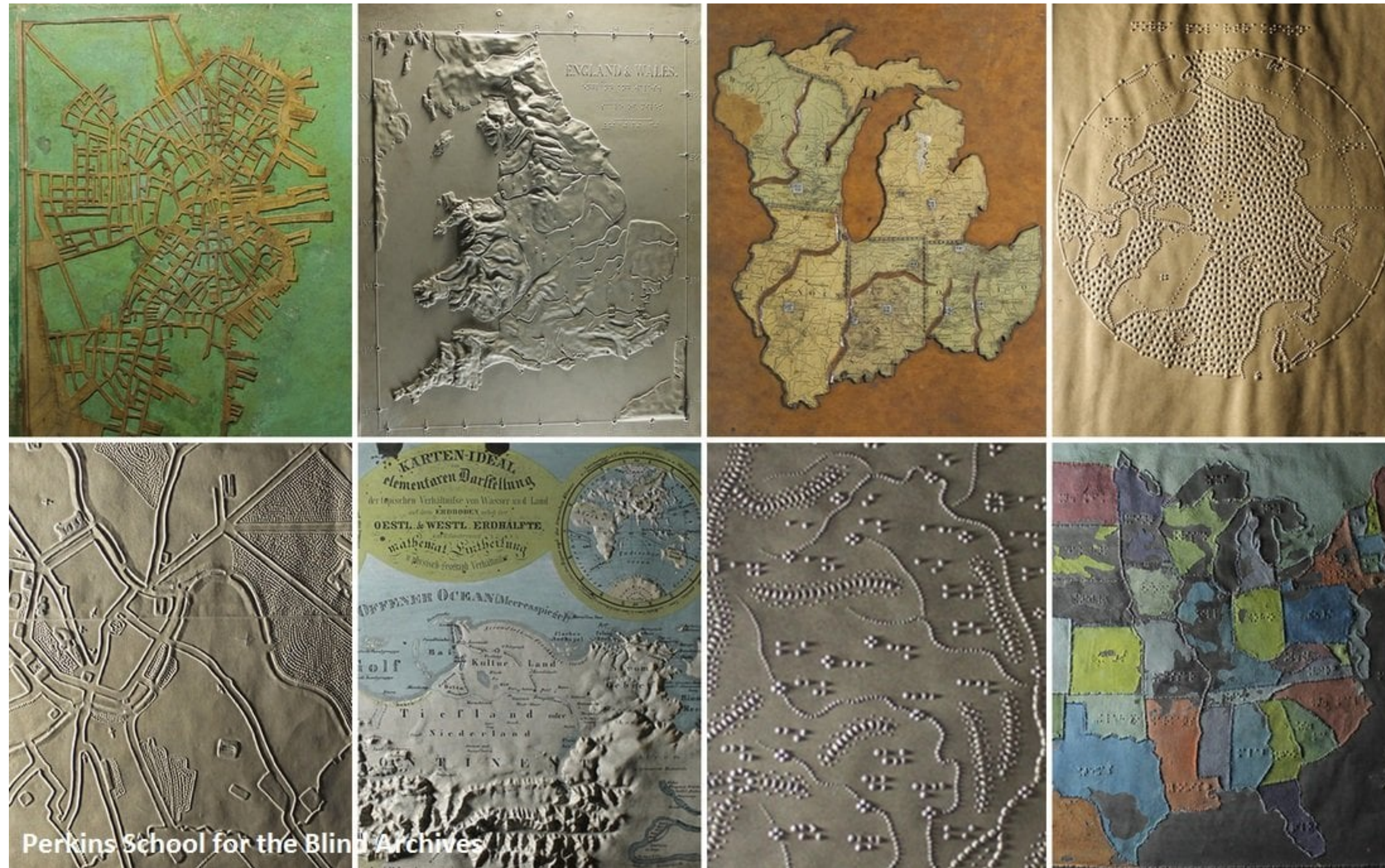
[https://en.m.wikipedia.org/wiki/
File:American Sign Language Interpreter.jpg](https://en.m.wikipedia.org/wiki/File:American_Sign_Language_Interpreter.jpg), wikipedia



Subtitles in Charade, 1963

<https://en.wikipedia.org/wiki/Subtitles>, wikipedia

The best work *centers* on people with disabilities, includes them, and has the best outcomes for their work and lives



[Perkins School for the Blind Archives](#), with tactile maps dating back to the early 1800s