

Narrative Visualization

DSC 106: Data Visualization

Sam Lau
UC San Diego

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slido.com
#2919



Announcements

Lab 7 (Scrollytelling) out, due Friday

Final Project Proposal (and groups) due Friday

FAQs:

1.

About Project Grading

Fulfill all project requirements = 9/10.

Going above and beyond (e.g. polish, creative encoding, storytelling) = extra points.

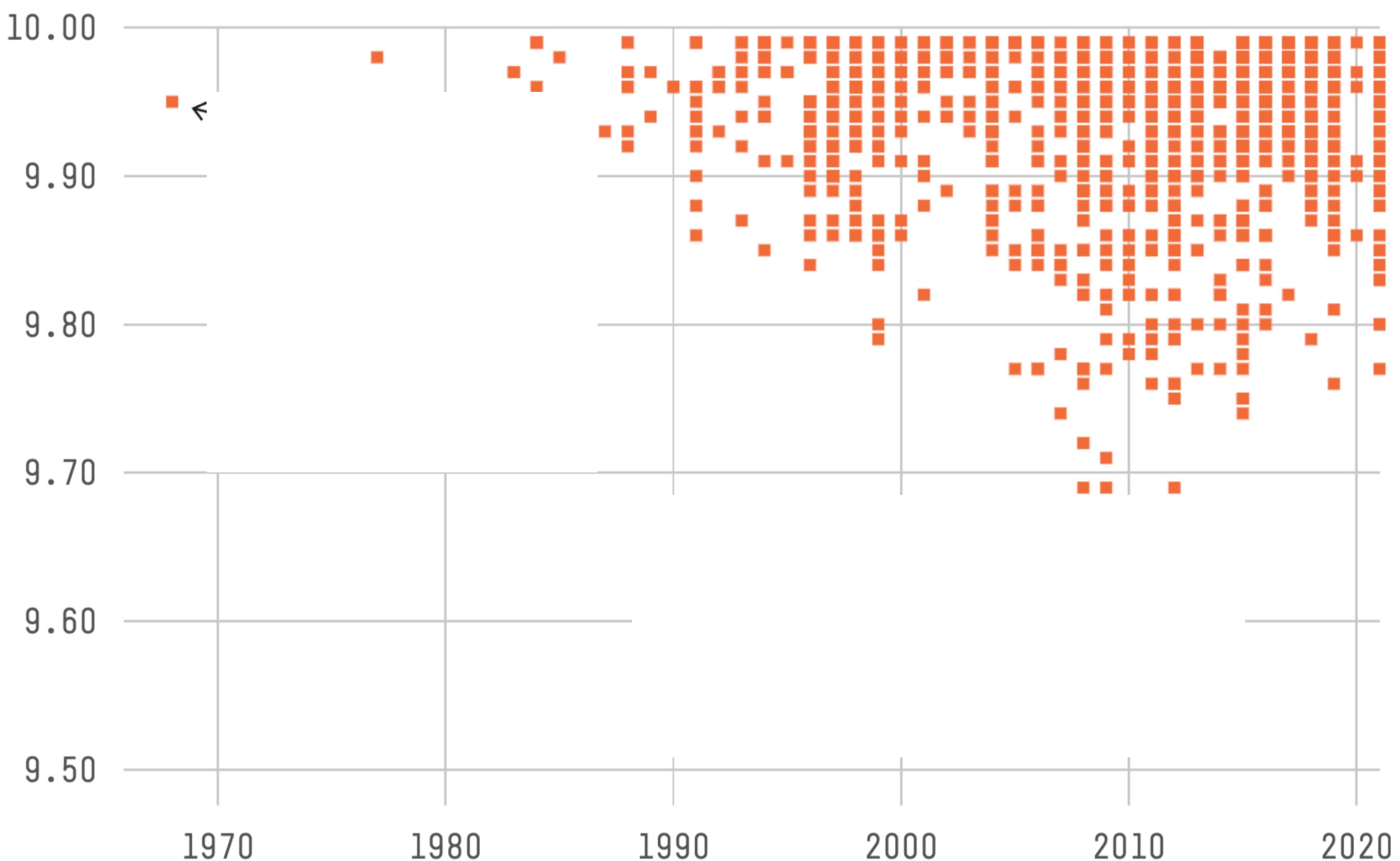
Mistakes (overplotting, ineffective encodings) = minus points.

9/10 means that you made a good visualization with no issues.

10/10 means that you made an outstanding visualization that could be published in the news / a scientific paper.

9/10: Solid visualization with no issues.

How have race times changed over the years?



9/10: Solid visualization with no issues.

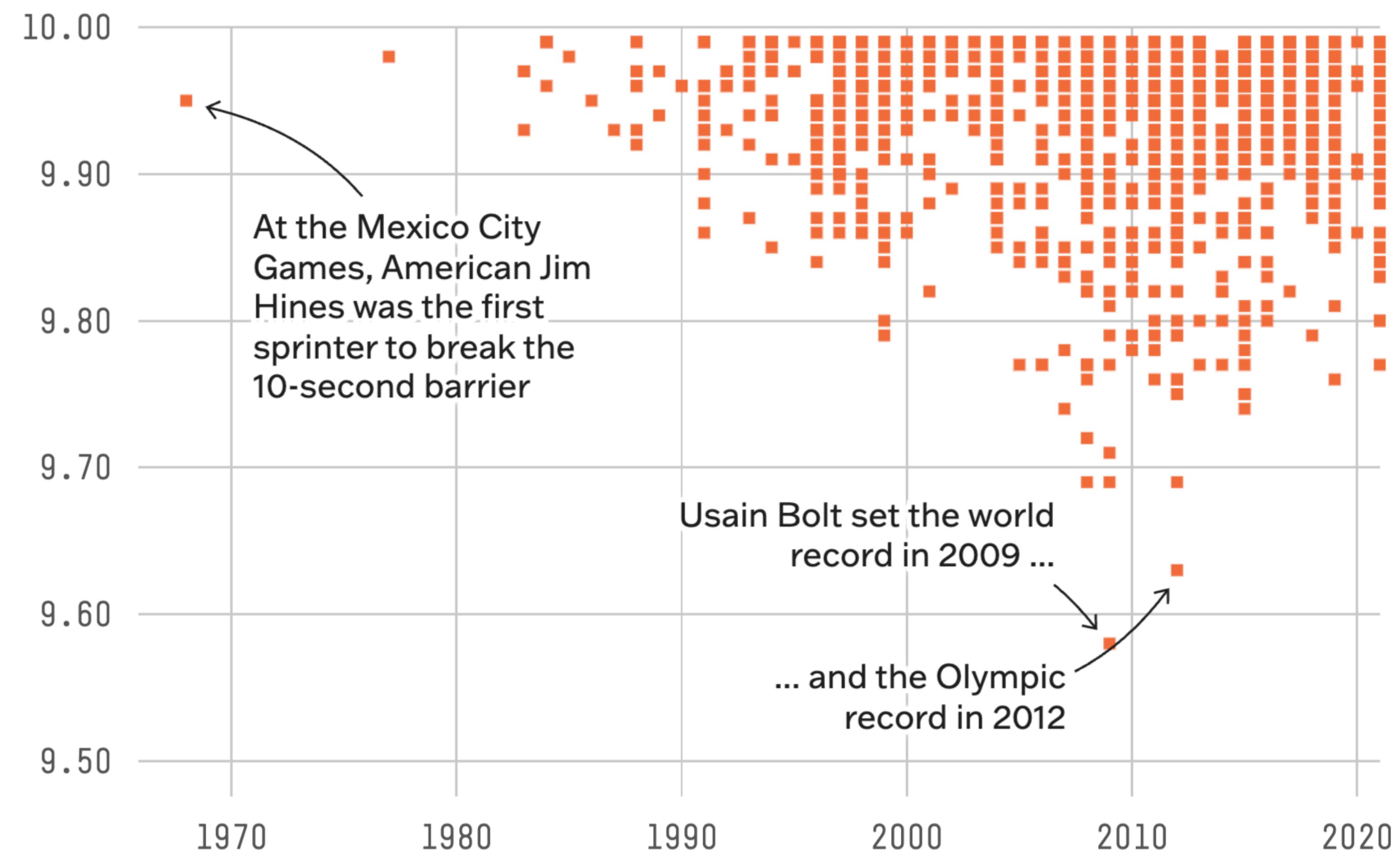
10/10: Publication-ready visualization:

Title states most important takeaway.

Annotations tell story.

No one is coming close to Usain Bolt's best times

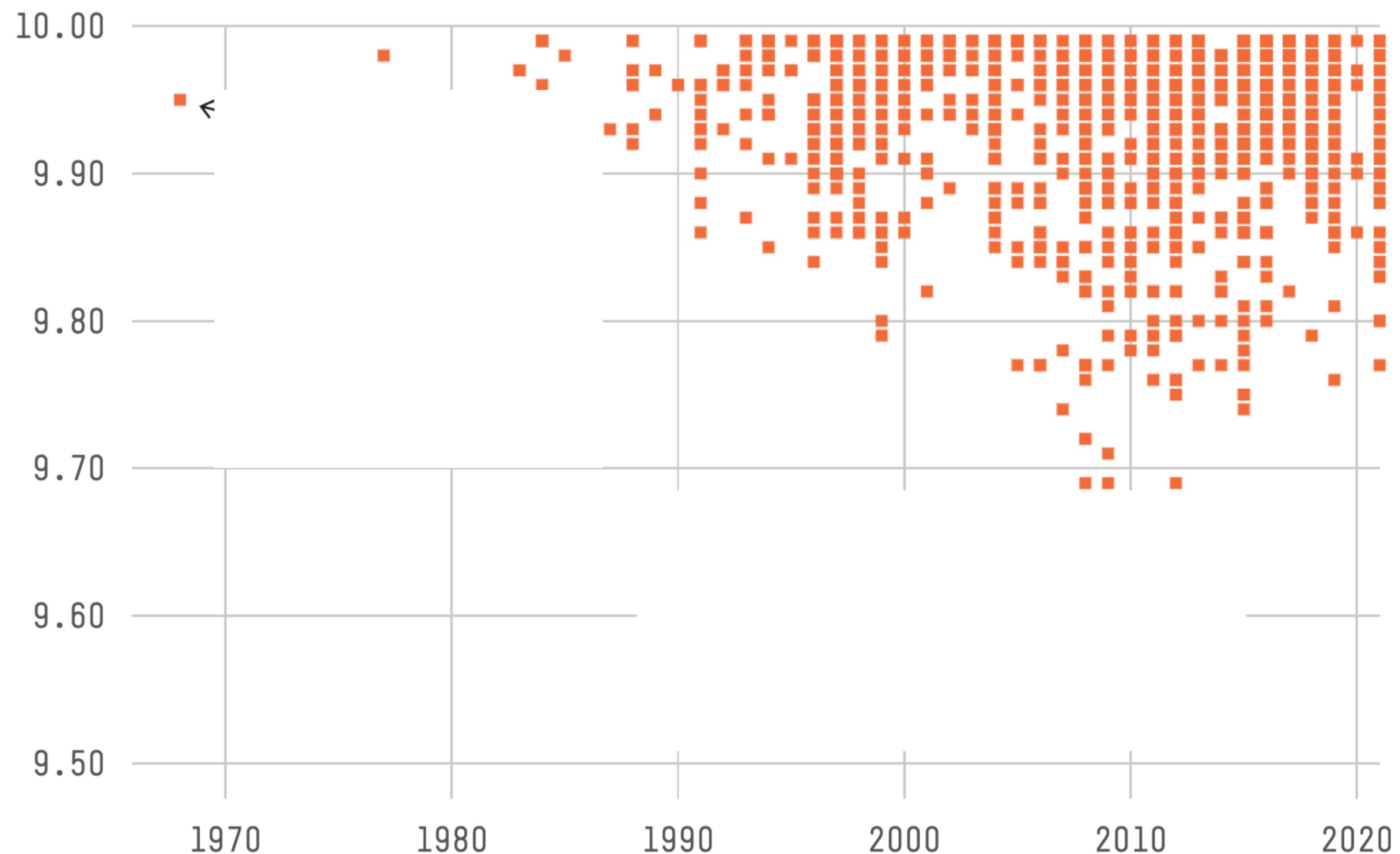
All times under 10 seconds in the outdoor men's 100-meter sprint, using only electronic readings and under regular wind conditions



9/10: Solid visualization with no issues.

8.5/10: Title not a research question or an interesting takeaway

100m Sprint race times vs. year



Why 9/10 if I met requirements?

Fulfilling requirements = visualization that's useful for **you**.

But goal of the class is to have you create visualizations that are useful for **other people**, which means going above basic requirements.

That said, we will create clearer rubrics from now on!

Interactive Articles

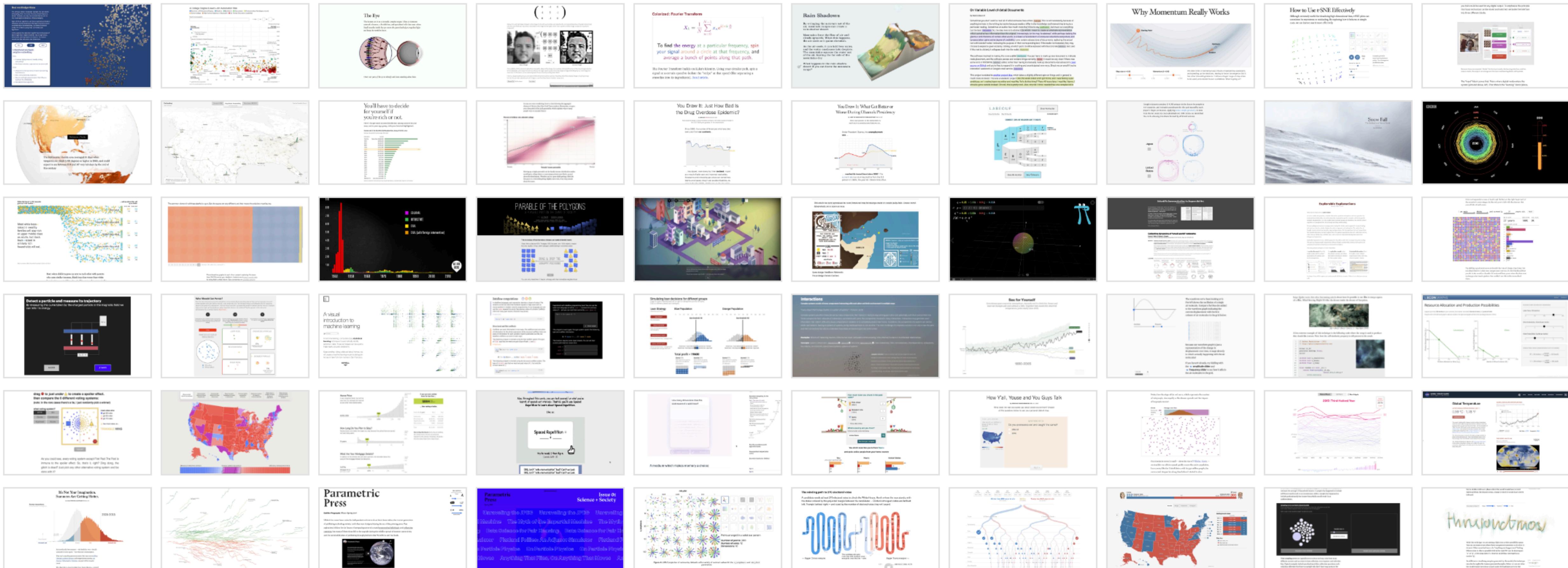


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

4 affordances of the format:

- Connecting people and data
- Making systems playful
- Promoting self reflection
- Personalizing reading

FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

<https://distill.pub/2020/communicating-with-interactive-articles/>

4 affordances of the format:

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Making systems playful

Promoting self reflection

Personalizing reading

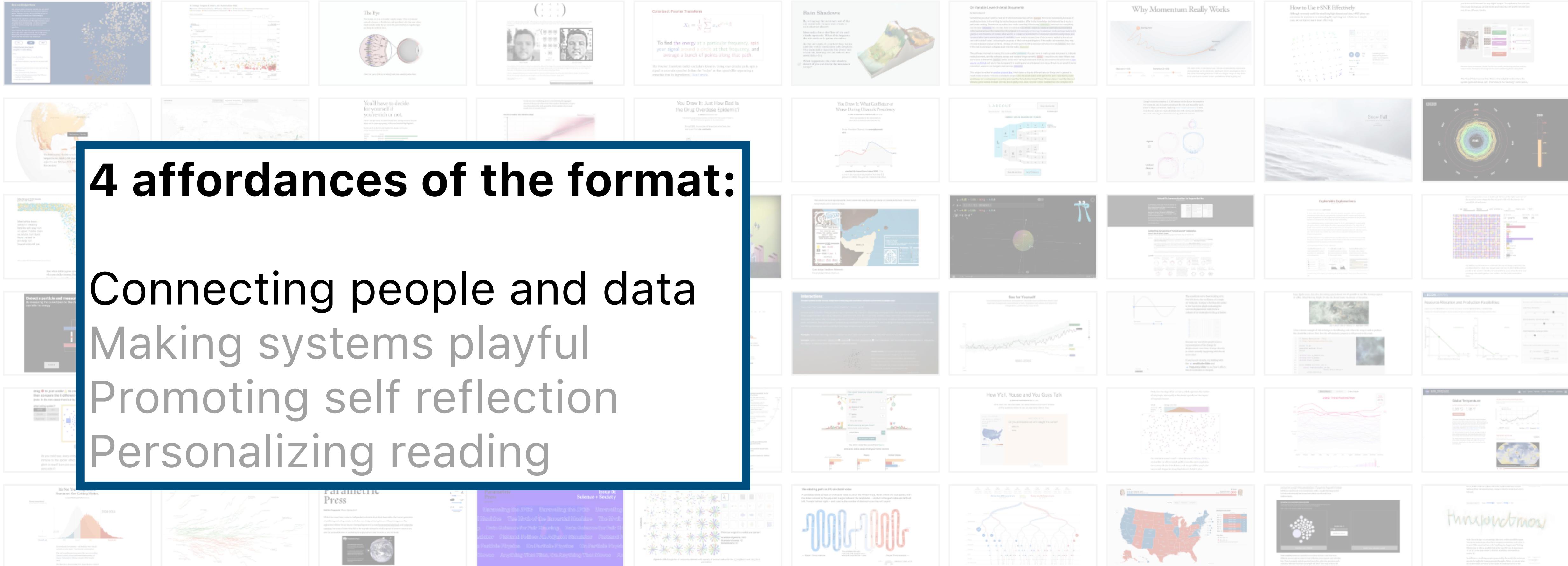
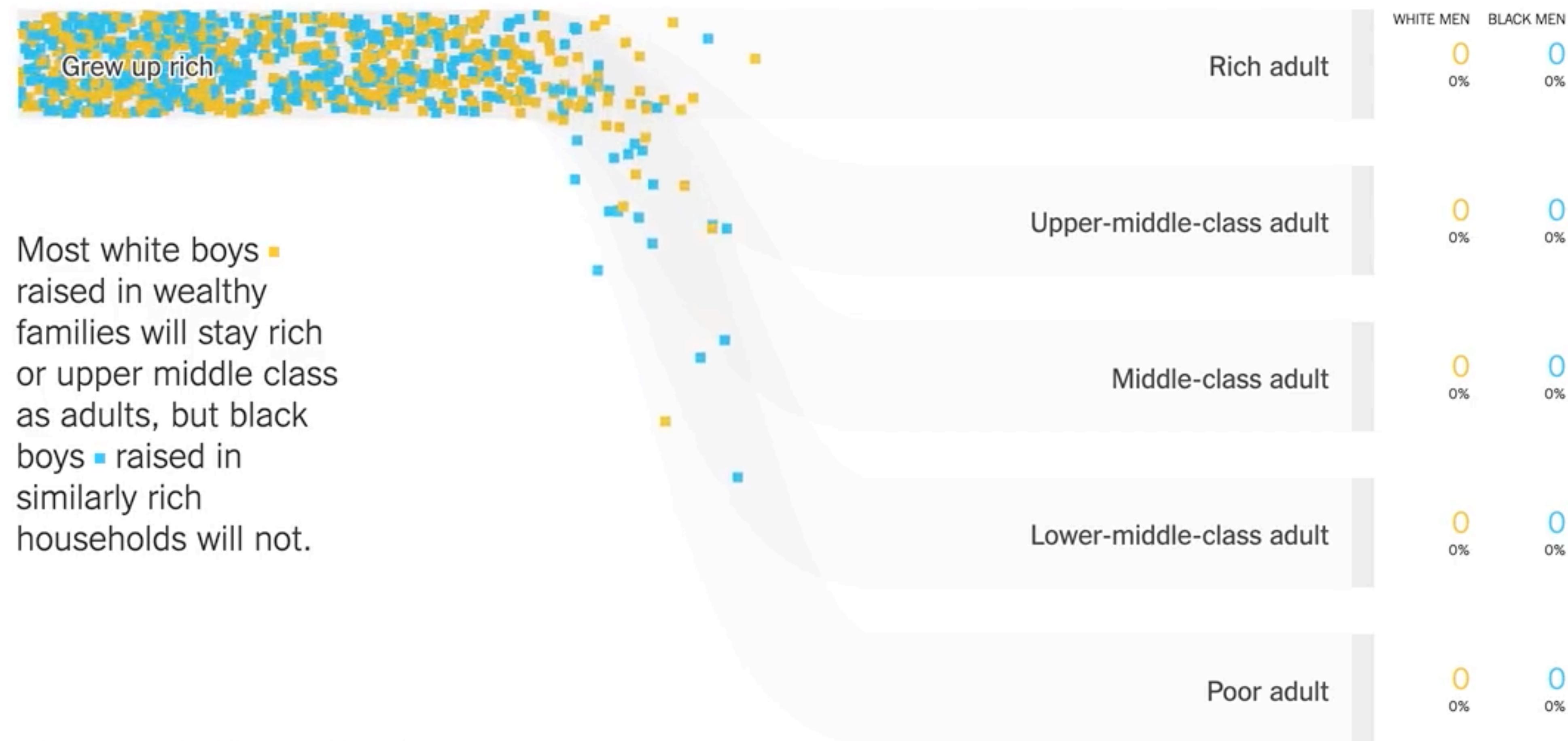


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

Follow the lives of 932 boys who grew up in rich families ...

...and see where they end up as adults:



Even when children grow up next to each other with parents who earn similar incomes, black boys fare worse than white

Gun Deaths In America

By Ben Casselman, Matthew Conlen and
Reuben Fischer-Baum

CLICK to advance

1 2 3 4 5 6 7 8 9 10 11 12

Explore the data for yourself »

fivethirtyeight.com/features/gun-deaths

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4 affordances of the format:

Connecting people and data
 Making systems playful
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 Personalizing reading

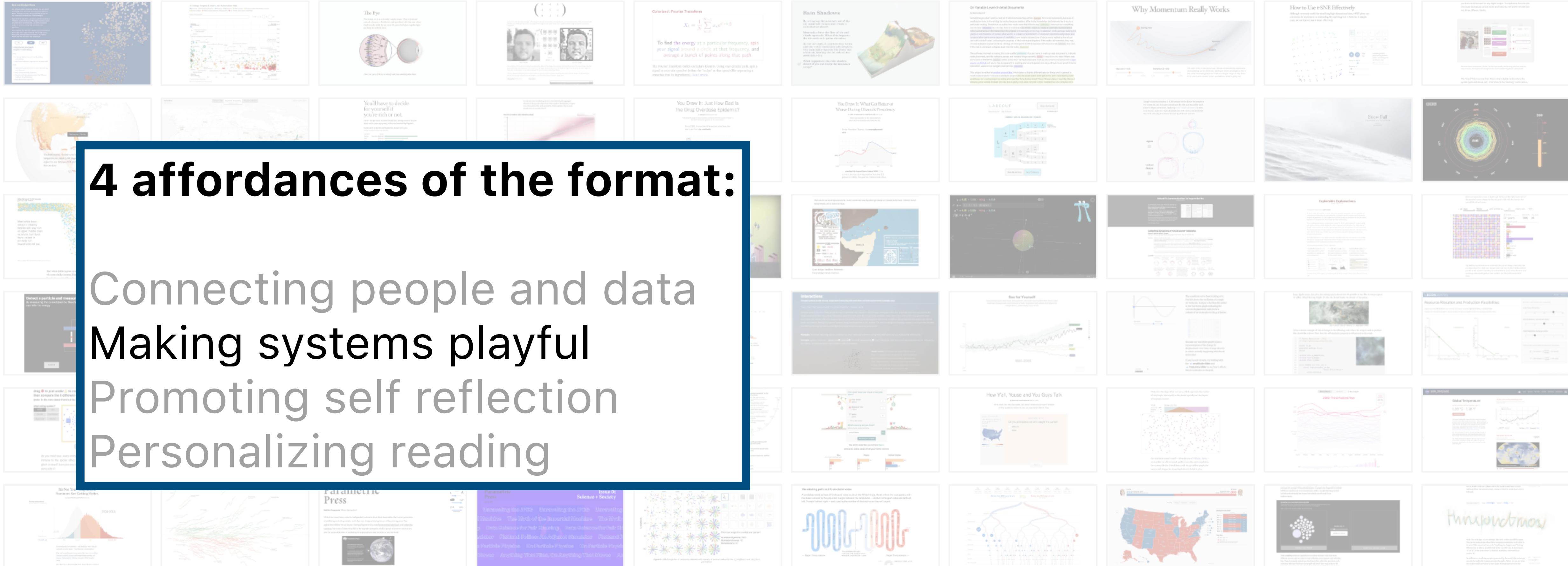
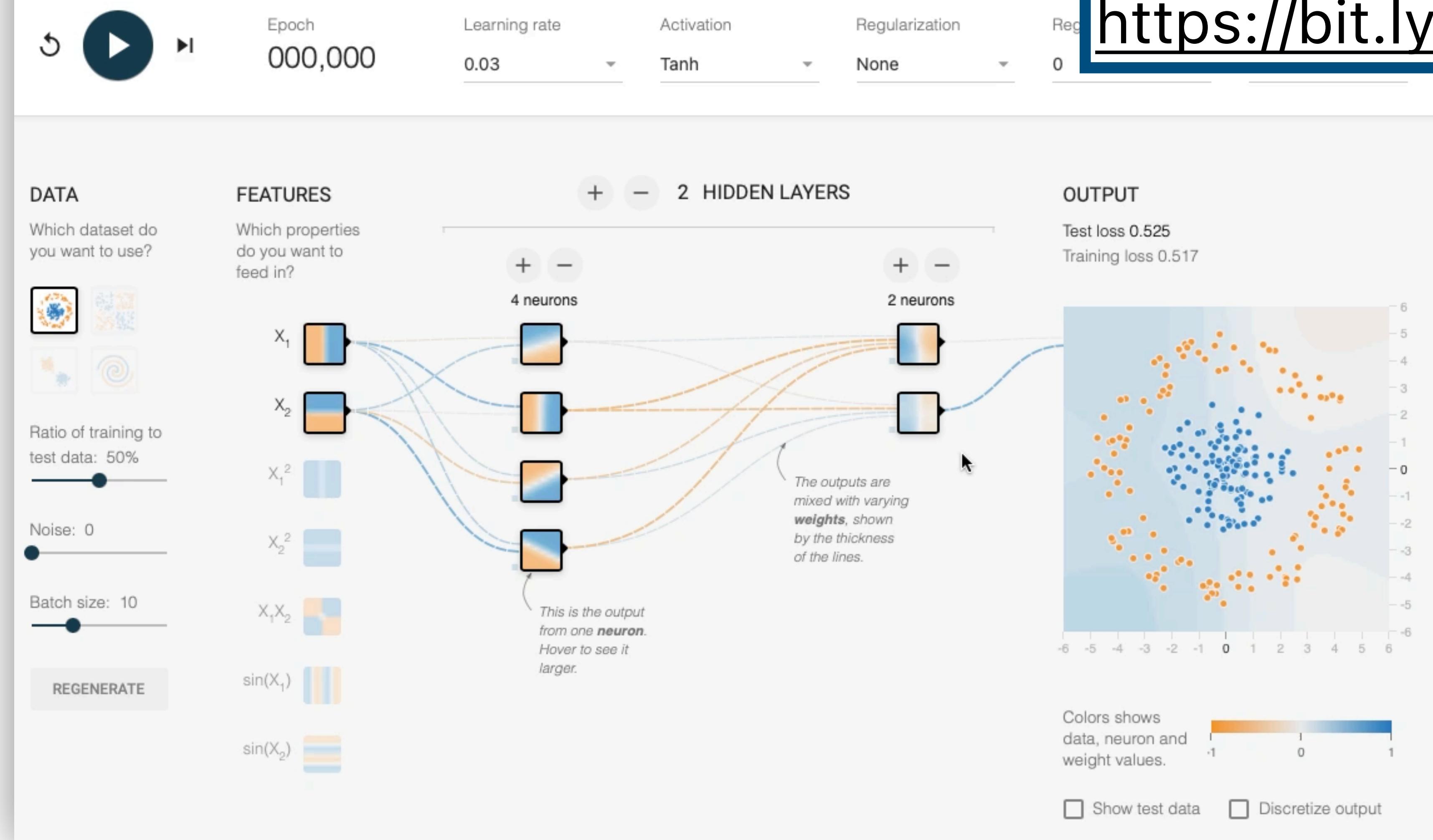


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

Tinker With a Neural Network Right Here in Your Browser.
Don't Worry, You Can't Break It. We Promise.

You Try:
<https://bit.ly/nn-play>



SPIN

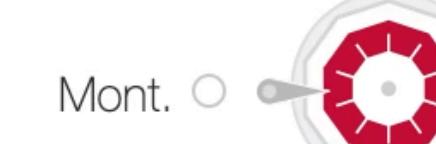
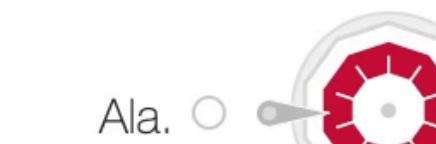
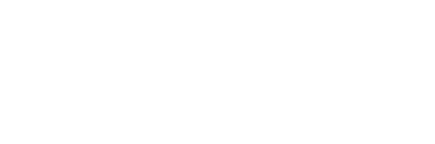
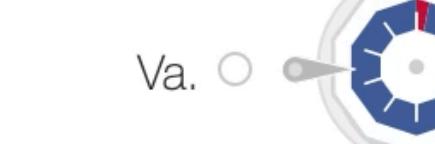
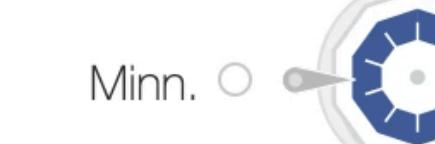
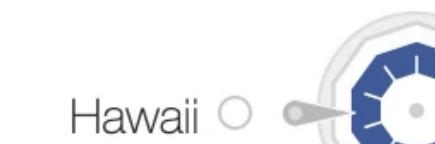
Democrats: ??

Republicans: ??

Likely Democratic

Competitive

Likely Republican



4 affordances of the format:

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Personalizing reading

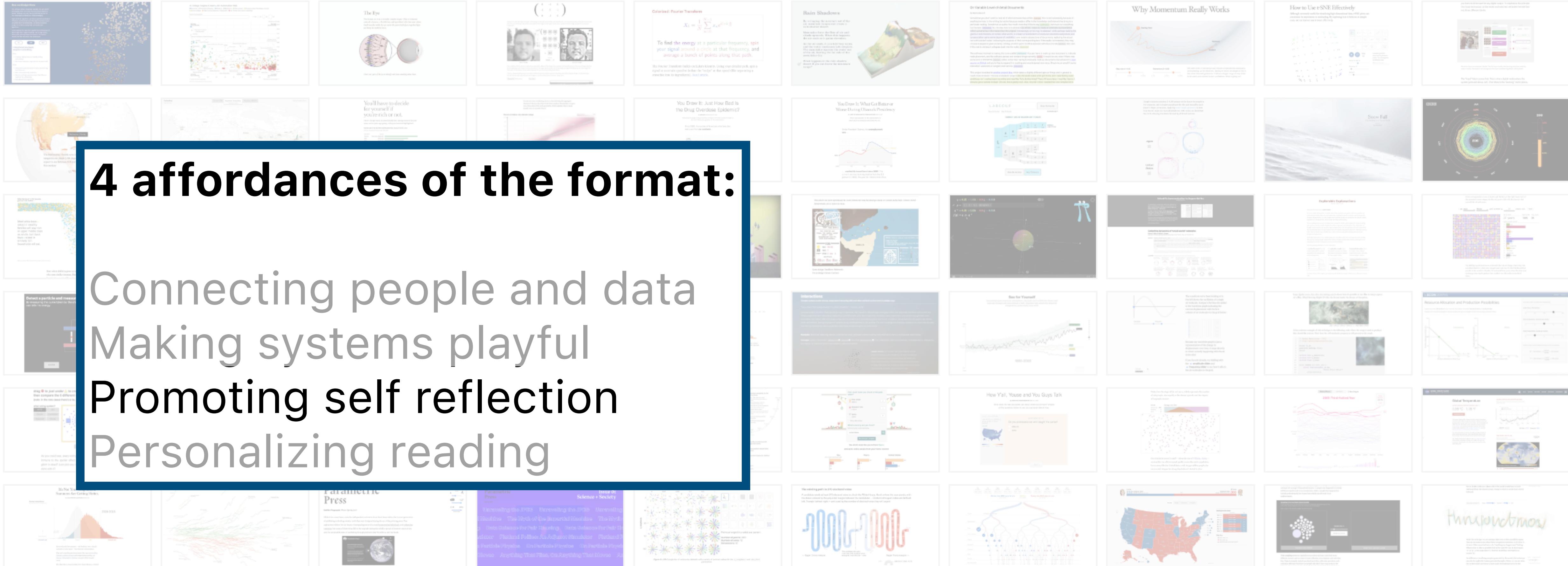
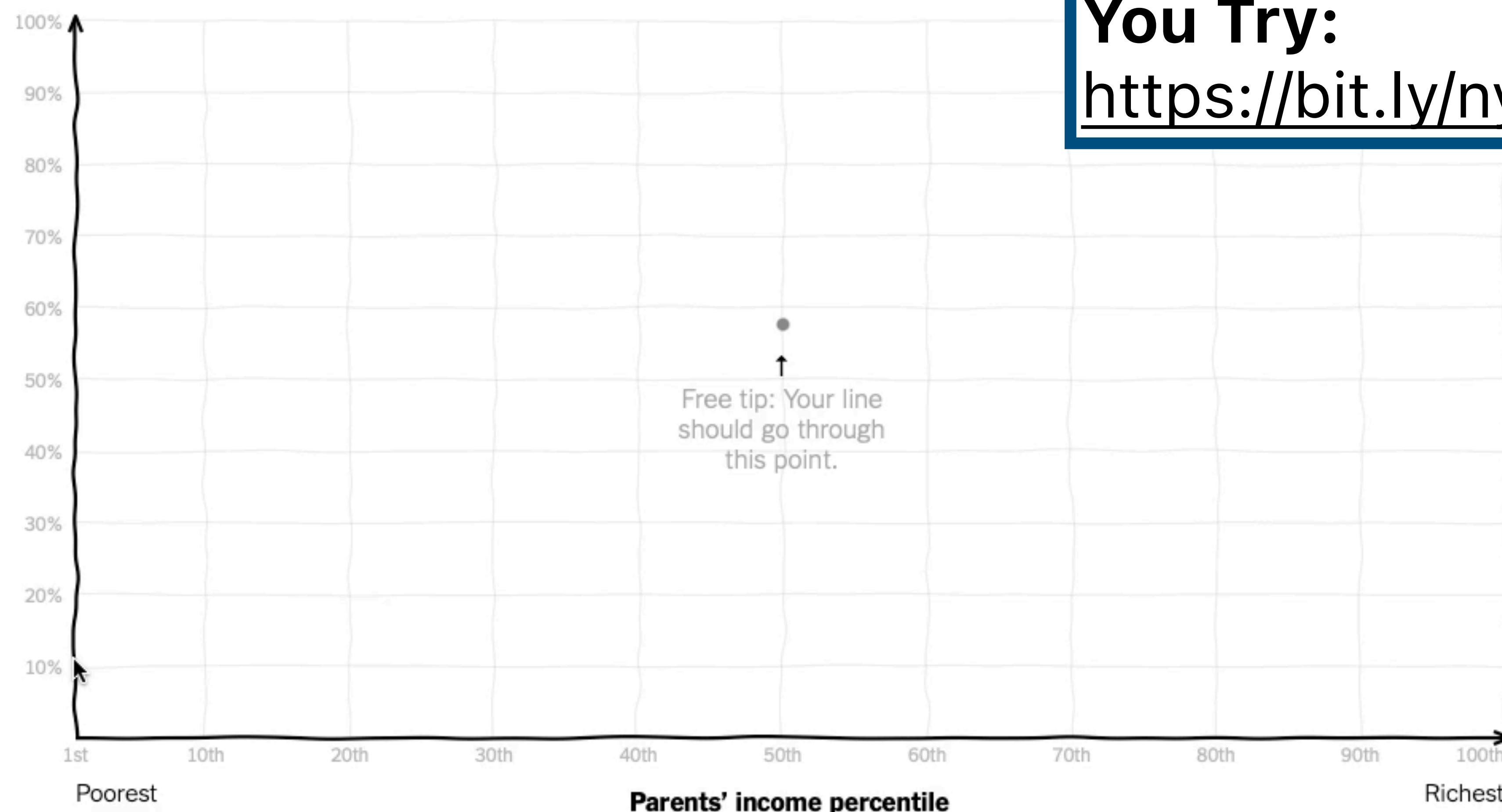


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

Draw your line on the chart below

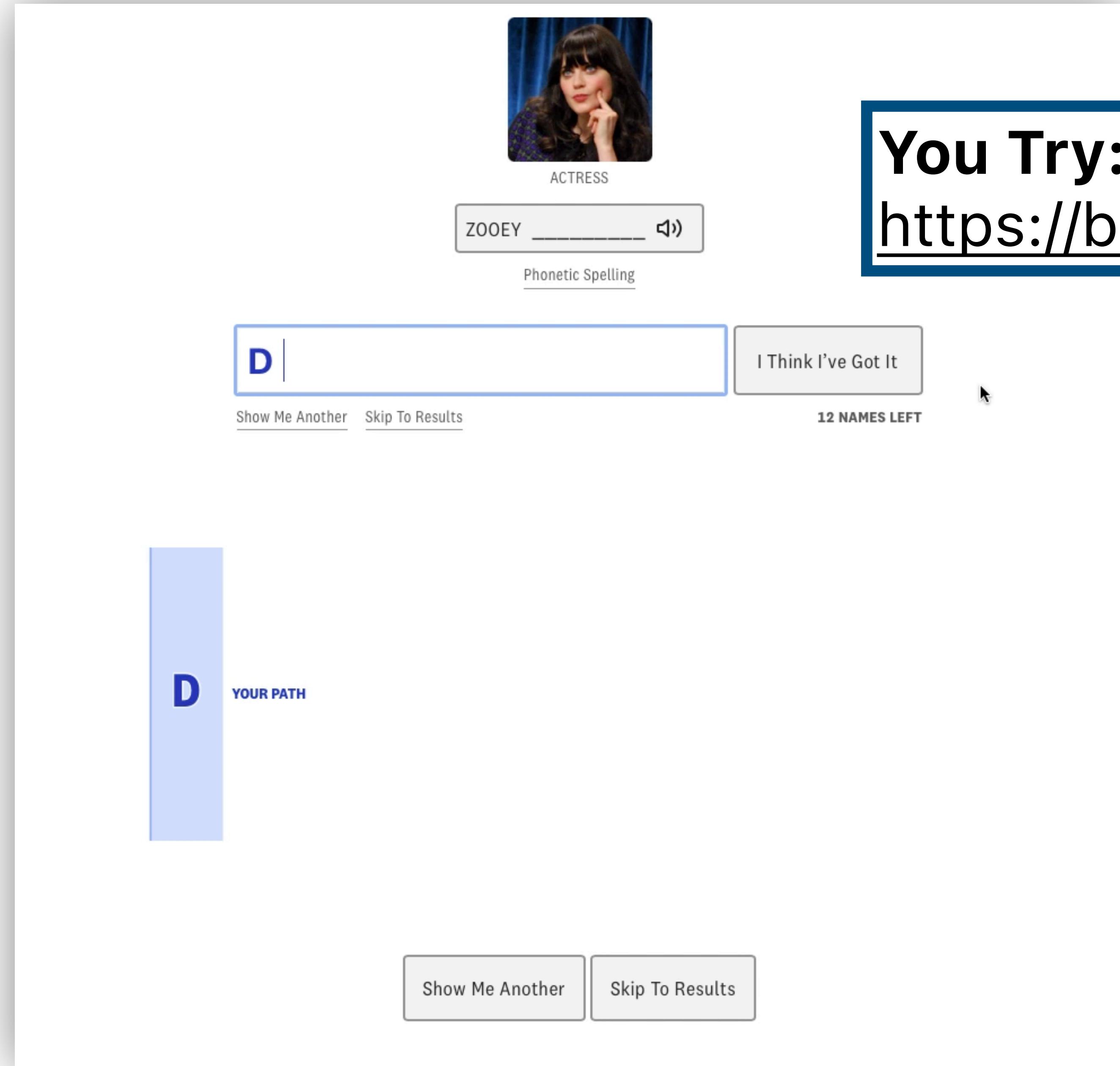
Percent of children who attended college



You Try:
<https://bit.ly/nyt-college>

I'm done

Start over



A screenshot of a web-based game interface. At the top, there is a portrait of Zooey Deschanel with the text "ACTRESS" below it. Below the portrait is a search bar containing "ZOOEY" with a phonetic spelling link underneath. A large blue search bar is centered, with the letter "D" typed into it. To the right of the search bar is a button labeled "I Think I've Got It". Below the search bar, there are two links: "Show Me Another" and "Skip To Results". On the left side of the interface, there is a vertical blue sidebar with the letter "D" and the text "YOUR PATH". At the bottom of the interface are two more "Show Me Another" and "Skip To Results" buttons.

You Try:
<https://bit.ly/pudding-gy>

4 affordances of the format:

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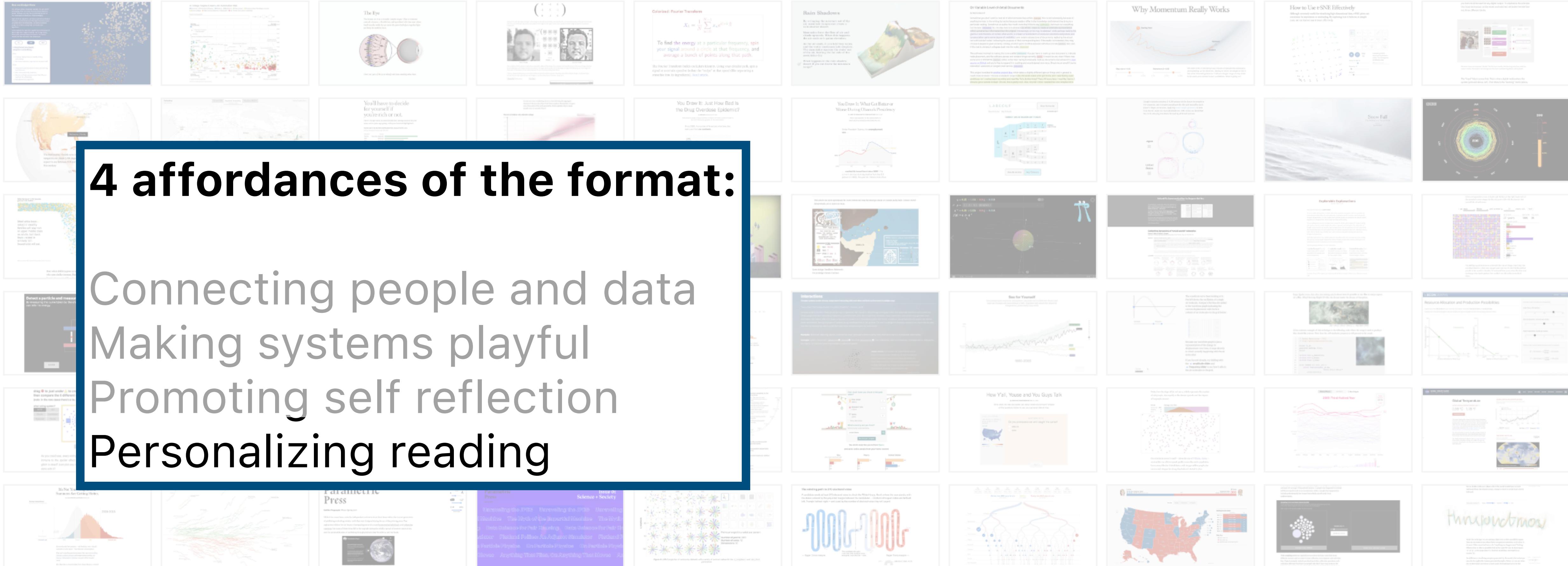


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

How Much Hotter Is Your Hometown Than When You Were Born?

You Try:
<https://bit.ly/nyt-hot>

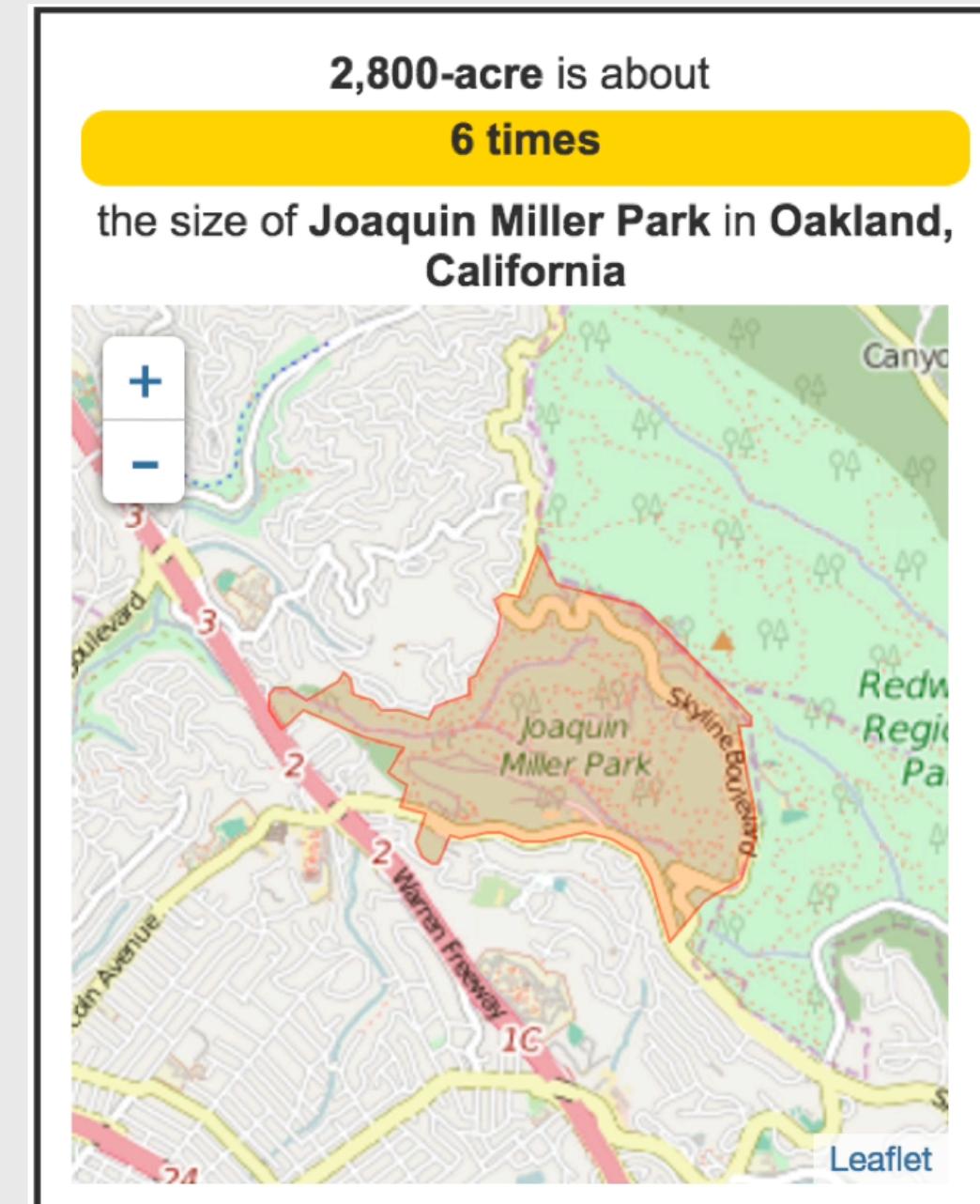
As the world warms because of human-induced climate change, most of us can expect to see more days when temperatures hit 90 degrees Fahrenheit (32 degrees Celsius) or higher. See how your hometown has changed so far and how much hotter it may get.

Your hometown

Birth year

Please enter your information to continue.

350



ATLAS OF ME



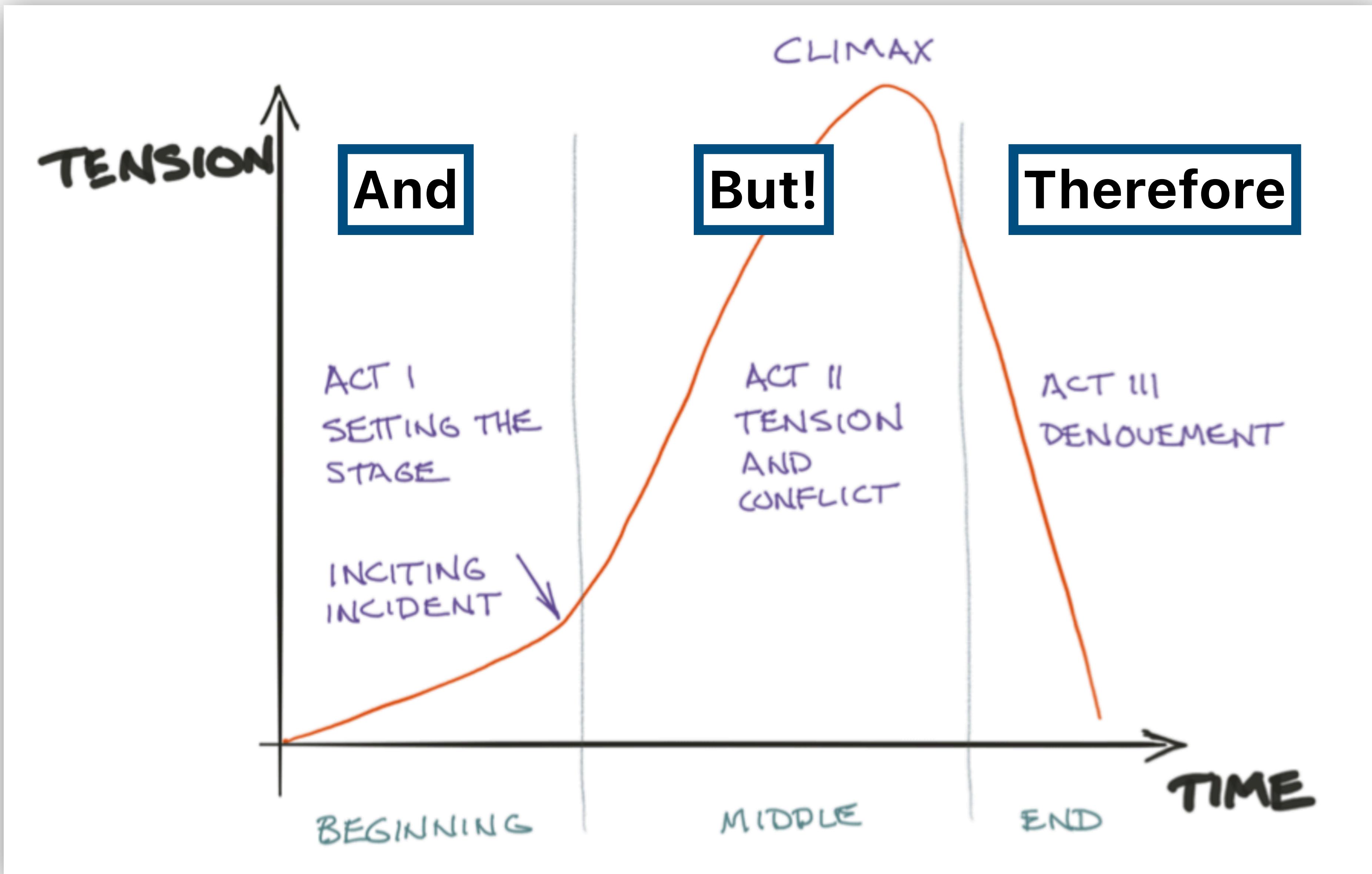
On-demand personalized maps for
unfamiliar distances, areas, and locations.

Created by Yea-Seul Kim, Francis Nguyen, and Jessica Hullman, University of Washington

Narrative Visualization

Aka: Telling a story using data

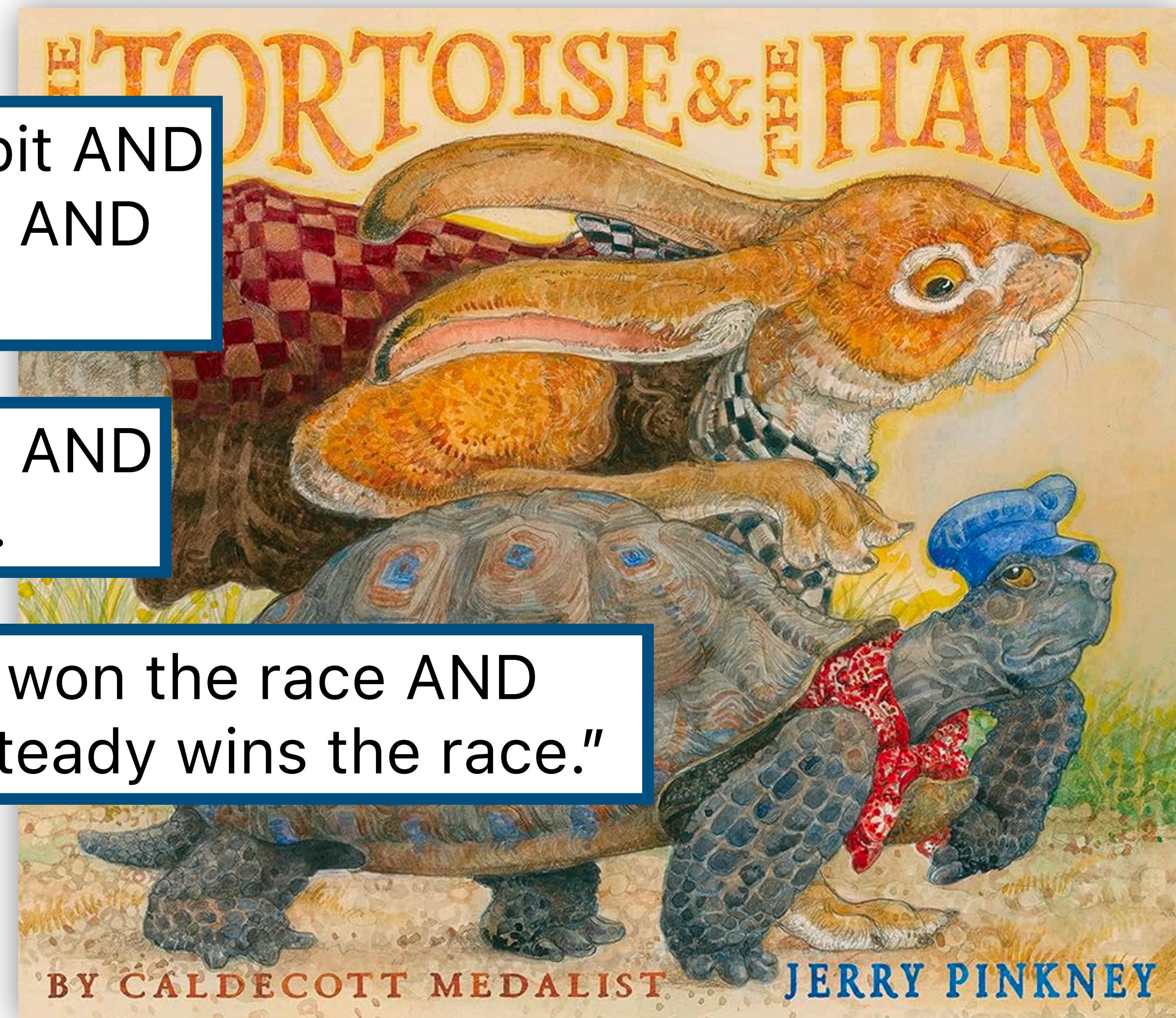
You'll make one for your final project!



There was a boastful rabbit AND
There was a slow tortoise AND
They decided to race...

BUT the rabbit fell asleep AND
The tortoise plodded on...

THEREFORE the tortoise won the race AND
The moral is: "Slow and steady wins the race."



Gun Deaths In America

By Ben Casselman, Matthew Conlen and
Reuben Fischer-Baum

CLICK to advance

1

2

3

4

5

6

7

8

9

10

11

12

Explore the

**How does this visualization use
and-but-therefore?**

fivethirtyeight.com/features/gun-deaths

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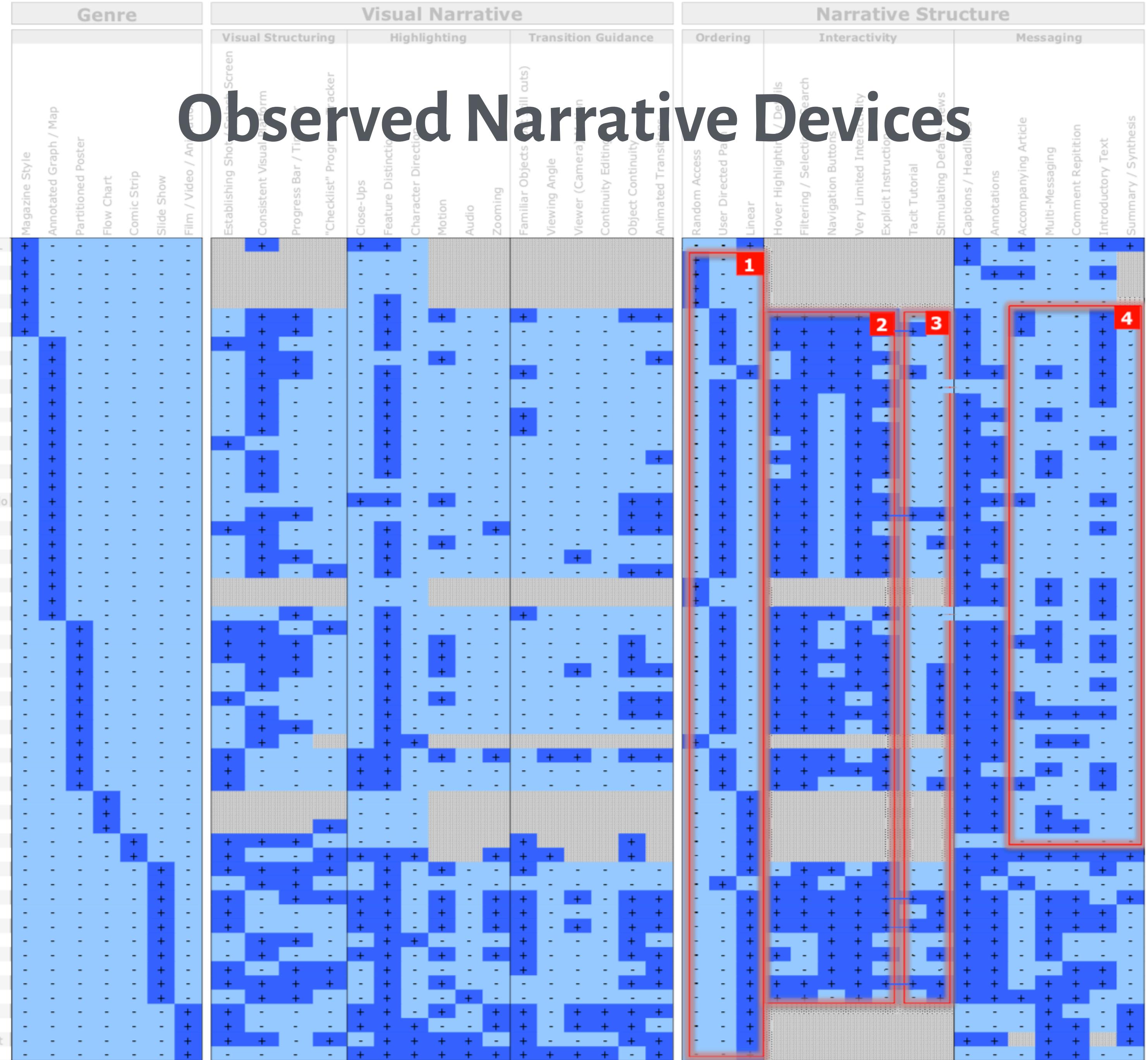


Observed Narrative Devices

Visualization Description

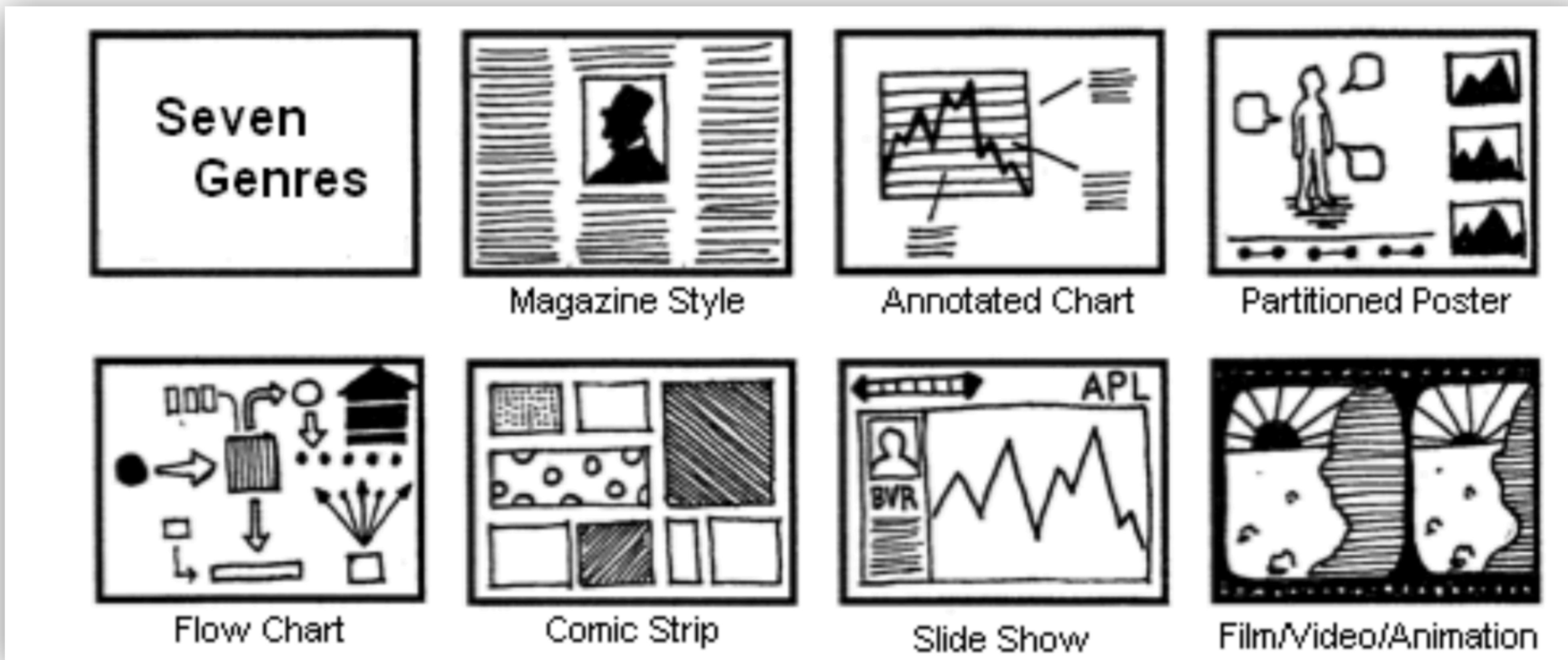
Source

Architecture and Justice (Brooklyn Crime Blocks)	Columbia Univ. SIDL
John Snow's Chart of Deaths from Cholera	Edward Tufte
Politicians Abuse their Free-mailing Privileges before Elected	Edward Tufte
Football Drawings	Visual Complexity
Pedestrians Crossing the Street	Visual Complexity
The Climate Agenda	Washington Post
When Did Your County's Jobs Disappear?	Washington Post
Academetrics House Price Index	Financial Times
Banks' Earnings: How Compensation Relates to Performance	Financial Times
Deadly Offensive: Taliban Attacks in Pakistan	Financial Times
GDP Moves by Sector	Financial Times
UK Economic Data	Financial Times
Budget 2010: Reaction from around the UK	Guardian
Formula One 2010: Driver's Rankings	Guardian
Lighting Up Hadrian's Wall	Guardian
Mapping Hydropower Hotspots across the UK	Guardian
Moscow Metro Bombs: interactive map	Guardian
The World Economy Turns the Corner	Guardian
Minnesota Employment Explorer	Minnesota Public Radio
A Map of Olympic Medals	New York Times
All of Inflation's Little Parts	New York Times
Paths to the Top of the Home Run Charts	New York Times
The Ebb and Flow of Movies: Box Office Receipts 1986 –	New York Times
The Jobless Rate for People Like You	New York Times
Advertisement: Bus	United Technology
Advertisement: Helicopter	United Technology
Analyzing Obama's Schedule	Washington Post
Oscars 2010: The Big Picture	Guardian
The Consumer Price Index in 2009	Guardian
UK Voting Patterns	Guardian
Comparison of Bear Markets	New York Times
Faces of the Dead	New York Times
How Americans Spend Their Day	New York Times
Michelle Obama's Family Tree	New York Times
NetFlix Rentals	New York Times
Steroids or Not, the Pursuit is On	New York Times
Vancouver's Olympic Venue	New York Times
On the Map: Five Major North Korean Prison Camps	Washington Post
Spheres of Influence: The Bush Campaign Pioneers	Washington Post
A Visual Guide to the Financial Crisis	Flowing Data
Economic Meltdown of 2008-2009	Flowing Data
Where Did All the Money Go?	Flowing Data
Life Cycle of a Beetle through a Year	Edward Tufte
McCloud's Making Comics	Scott McCloud
Afghanistan: Behind the Front Line	Financial Times
Toyota Timeline: A Company History	Financial Times
Gapminder Human Development	Gapminder
Earthquakes: Why They Happen	Guardian
Iran's Nuclear Programme	Guardian
Shaun White's Double McTwist	Guardian
Toyota's Stick Accelerator Problem	Guardian
Alpine Skiing, From Technical Turns to Tucks and Speed	New York Times
Budget Forecasts vs. Reality	New York Times
How the Government Dealt with Past Recessions	New York Times
Mac Orientation Video	Apple
Delta Airplane Safety Video	Delta
The Story of Stuff	Story of Stuff Project
Virgin America Airplane Safety Video	Virgin America



Case Studies

Narrative Visualization Genres





Magazine Style

The Economist

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even more sharply in Germany than in Italy, which is in recession, note economists at Goldman Sachs, a bank. Yet Germany's service sector appears to be growing strongly, as does that of the euro zone as a whole.

Production lines
Purchasing managers' indices*

Manufacturing

Year	Euro area	United States	China
2017	58	56	52
2018	55	54	50
2019	48	52	48

Services

Year	Euro area	United States	China
2017	58	56	52
2018	55	54	50
2019	52	54	50

Sources: IHS Markit; Caixin *Based on surveys of executives. A reading above/below 50 indicates an expansion/contraction compared with the previous month

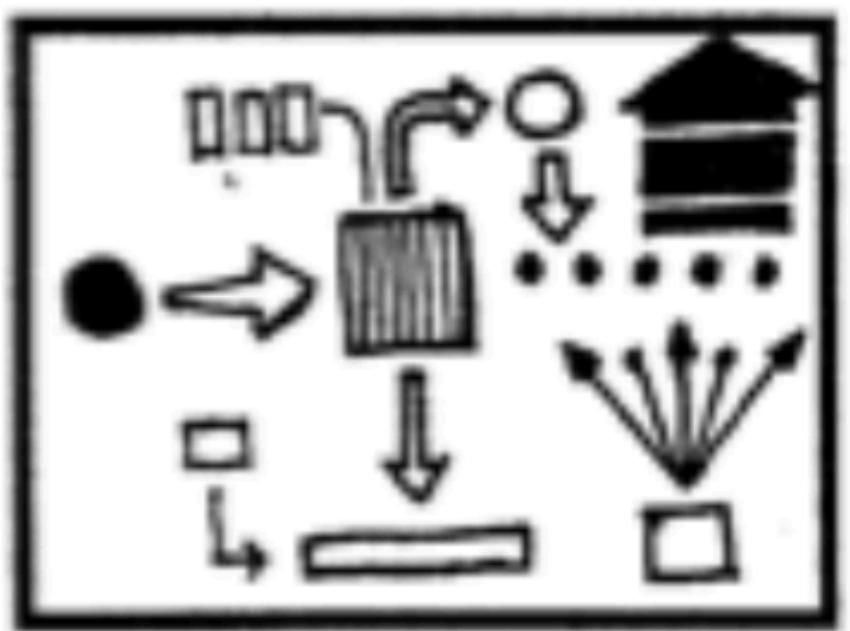
The Economist

Service industries are less volatile than manufacturing, make up a bigger slice of rich-world GDP and, by their nature, trade less. That they remain strong largely reflects relatively buoyant labour markets and consumers (German unemployment is only 3.1%). One exception has been Britain, where survey data released on April 1st and 3rd appear to show growth in manufacturing at its strongest in over a year and services shrinking. Both findings are Brexit-related. The British economy is suffering from falling confidence, while manufacturing appears so strong only because firms are stockpiling in case Britain soon crashes out of the EU without a deal.

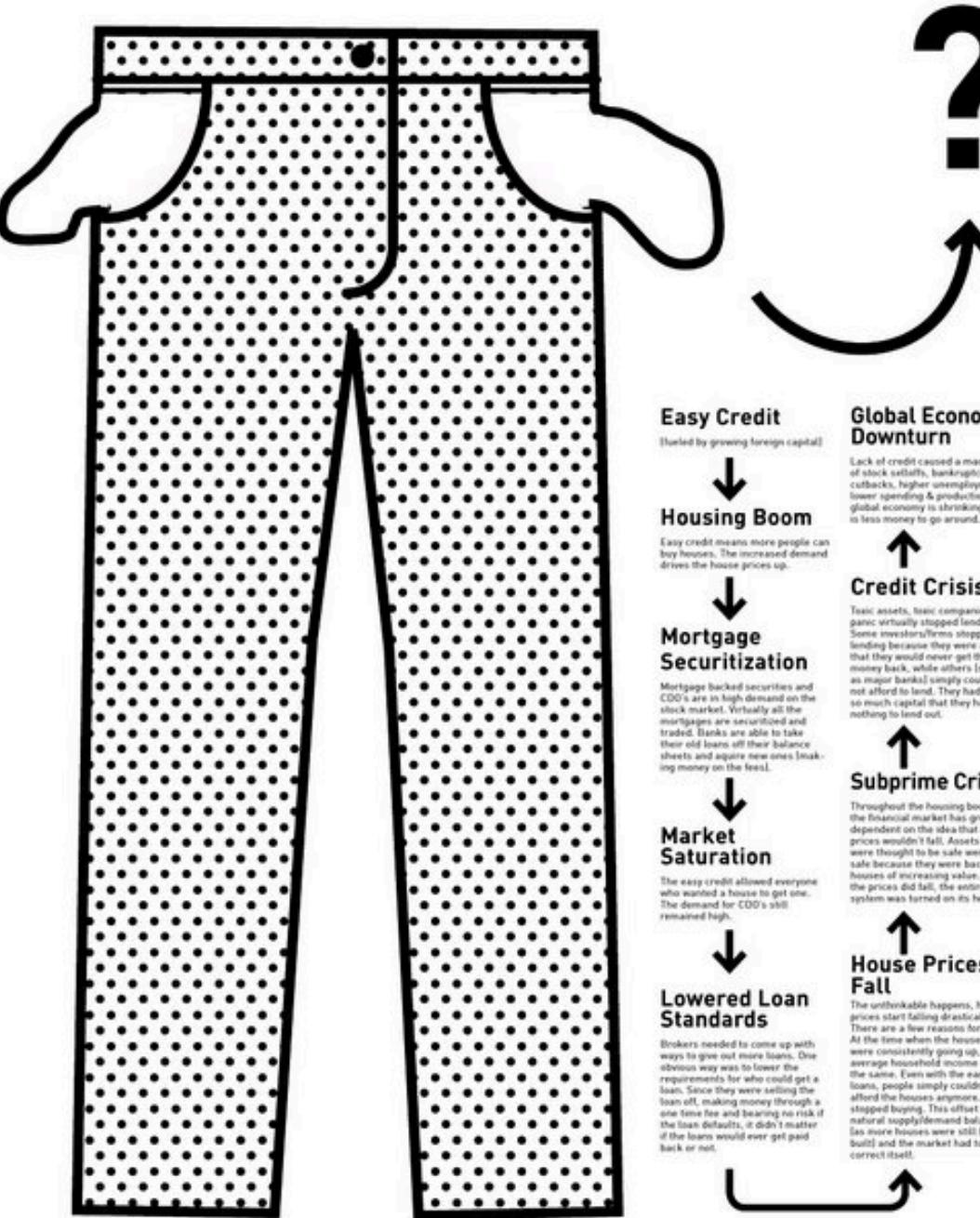
Display a menu

In the 2000s some economists speculated that the growing weight of

WHERE DID ALL THE MONEY GO?



Flow Chart



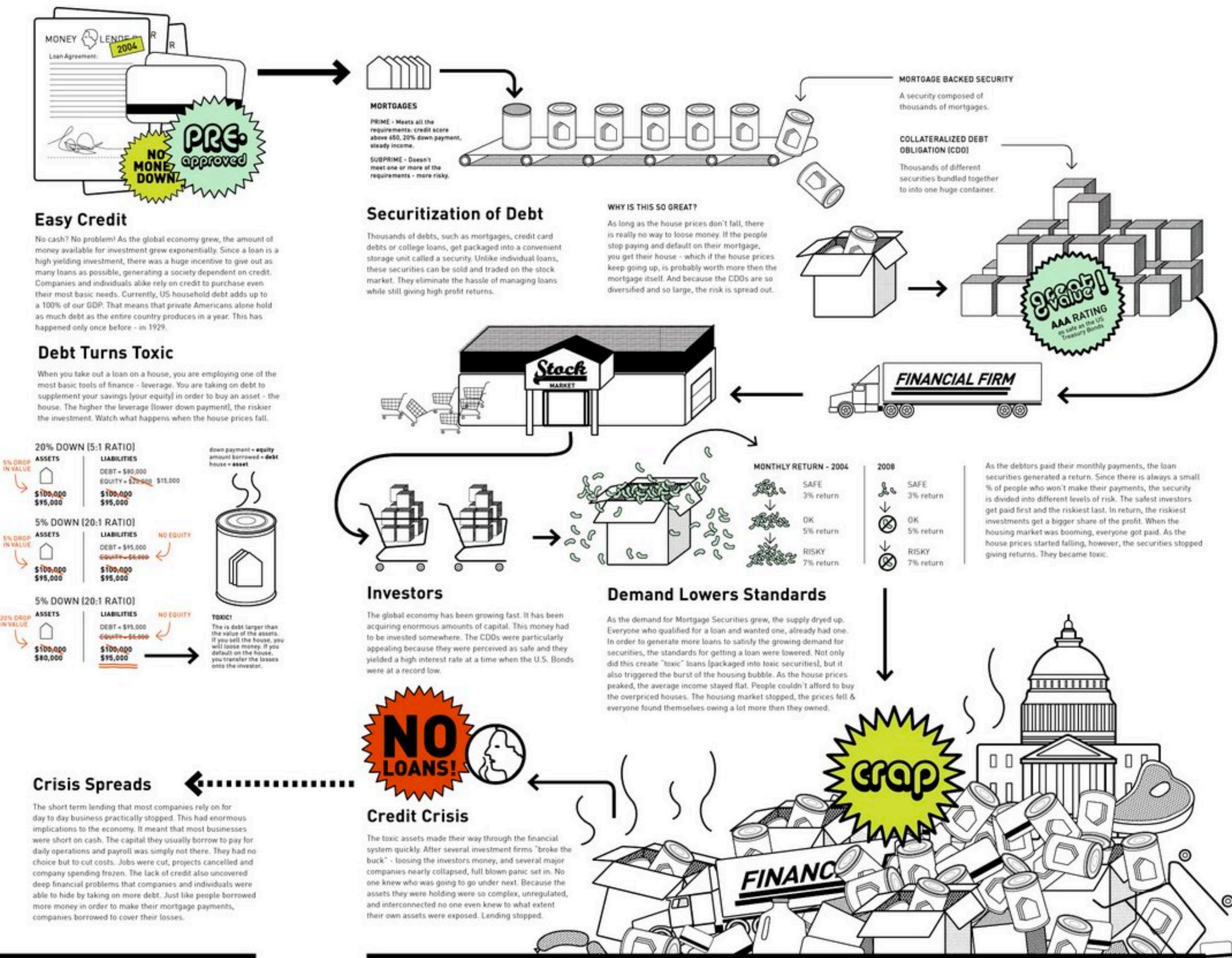
What is money?

Money can be anything. Rare & valuable resources have been used historically because they are easy to control, but anything that people collectively agree on can be used as money. There are four general functions money fulfills: medium of exchange, unit of account, store of value & standard of deferred payment. Money needs to have a perceived value. This is an overview of the different forms of money and where their value comes from.

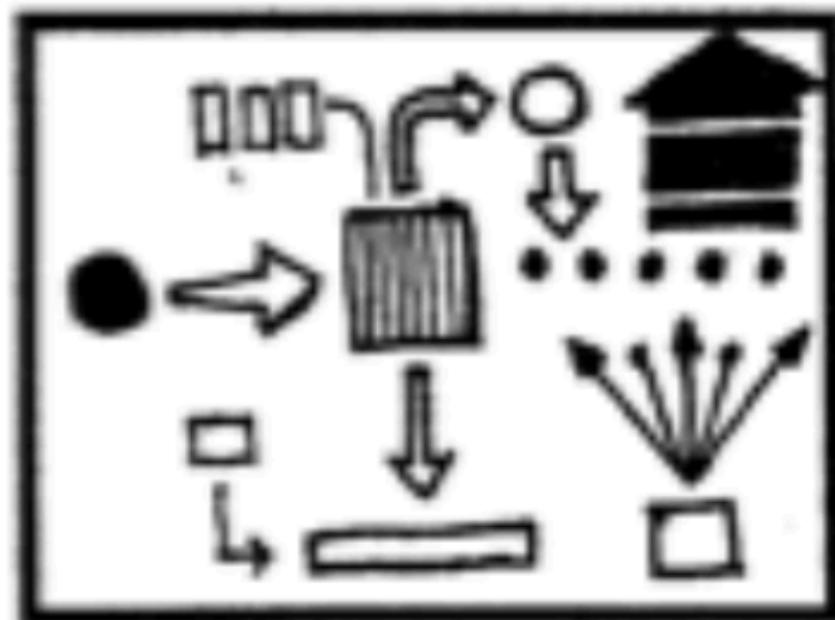


Money Supply

The Money Supply is the amount of available money in the economy. It fluctuates with the market. In times of economic growth, the money supply is high. In a recession, the money supply is low. Lending and spending are two major factors that influence the money supply.



755



Flow Chart



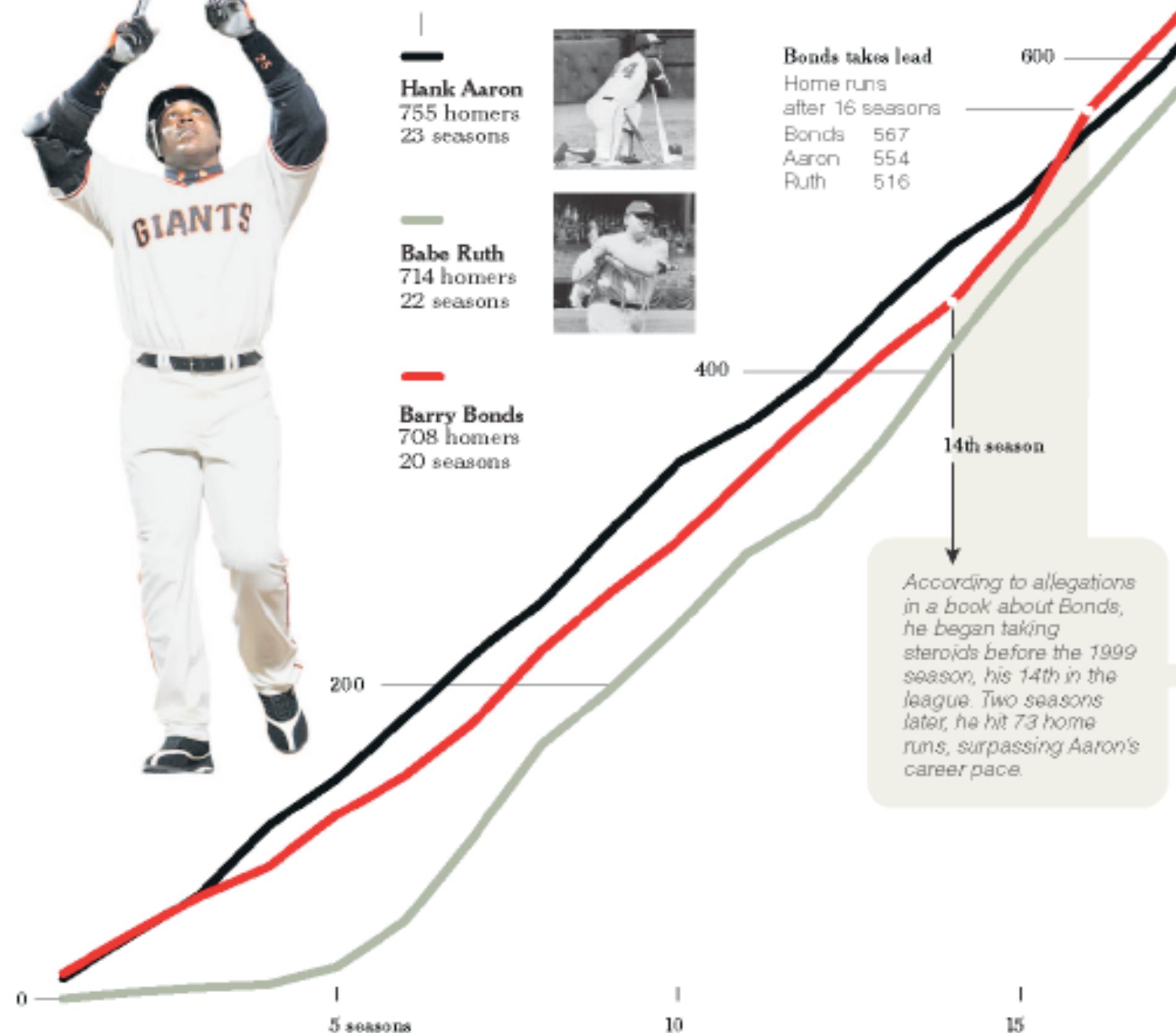
Partitioned Poster



Steroids or Not, the Pursuit Is On

Barry Bonds is taking aim at the career home run record. He needs only six more to tie Babe Ruth and 47 to equal Hank Aaron.

Lines are cumulative home runs.



755
23 seasons

714
22 seasons

20 seasons

Bonds was injured last season. He played 14 games and hit 5 homers.

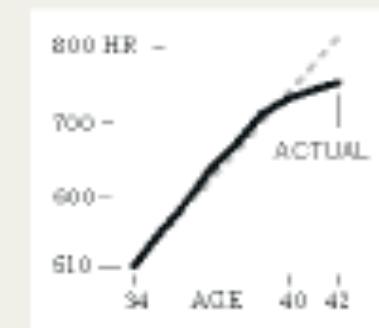
Homer Pace After Age 34

If the accusations are correct, Bonds was 34 in his first season on steroids. Here are projected home run paces for each player after age 34.

PROJECTED PACE BASED ON AVERAGE OF PREVIOUS FIVE SEASONS

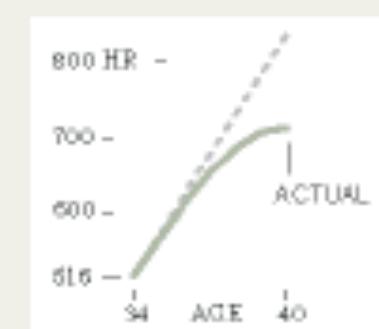
Aaron

Actual homers slightly outpace projected homers for five seasons.



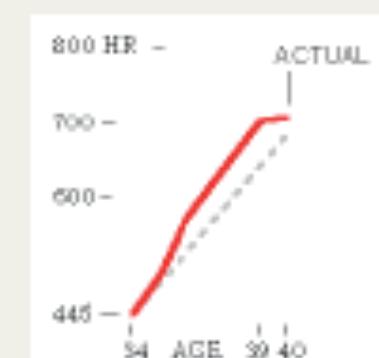
Ruth

Averaged 46.4 homers a season from age 30 to 34. Averaged 42.5 for next four seasons.



Bonds

From age 35 to 39, he averaged 14 more homers a season than projected.



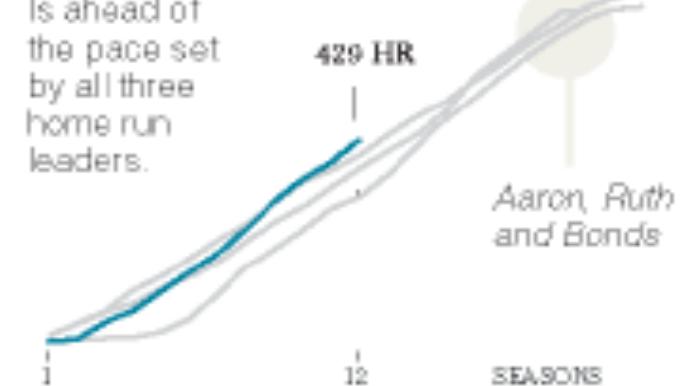
Note: Ages as of July 1 of each season.

Others Taking Aim



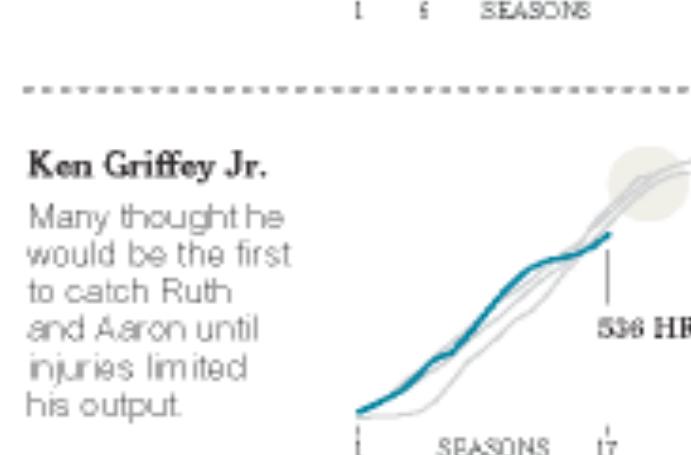
Alex Rodriguez

Is ahead of the pace set by all three home run leaders.



Albert Pujols

Averaging 40 homers a season, he has started stronger than the three leaders did.



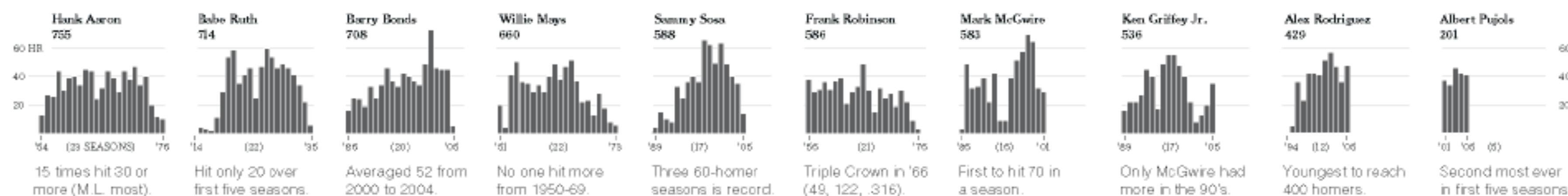
Ken Griffey Jr.

Many thought he would be the first to catch Ruth and Aaron until injuries limited his output.

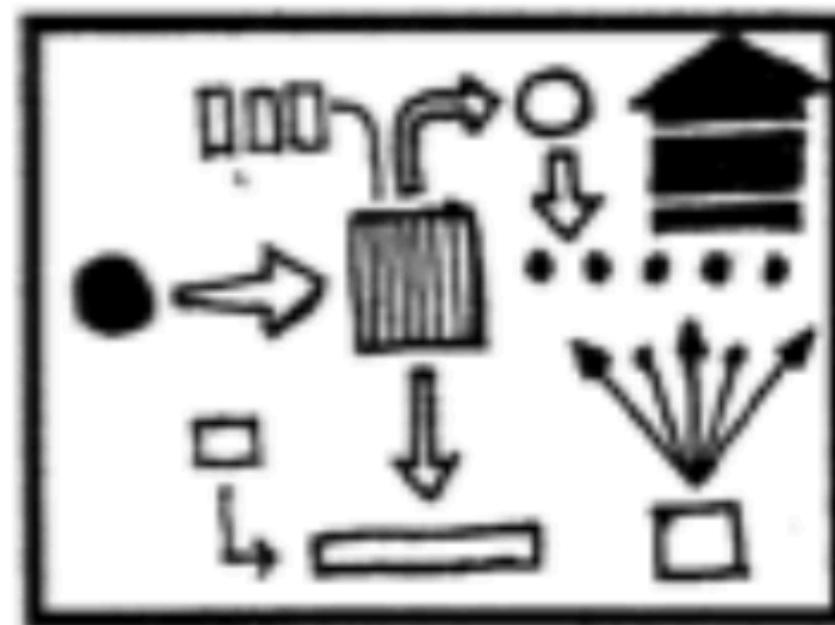


Differing Paths to the Top of the Charts

The top seven players on the career home run list, along with a look at Griffey (12th), Rodriguez (37th) and Pujols (tied 257th).



ANDREW COX AND JOE WOOD/The New York Times



Flow Chart



Partitioned Poster

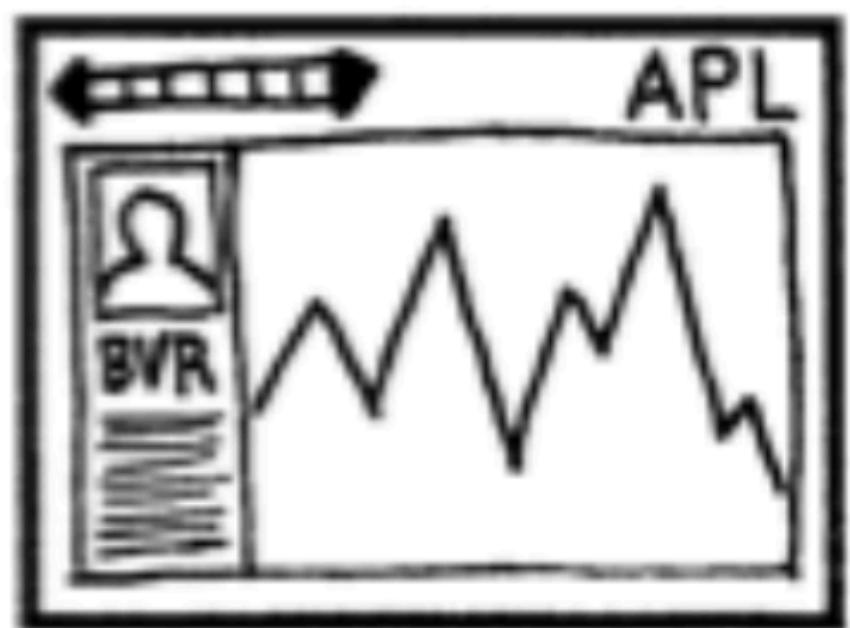


Published: February 2, 2010

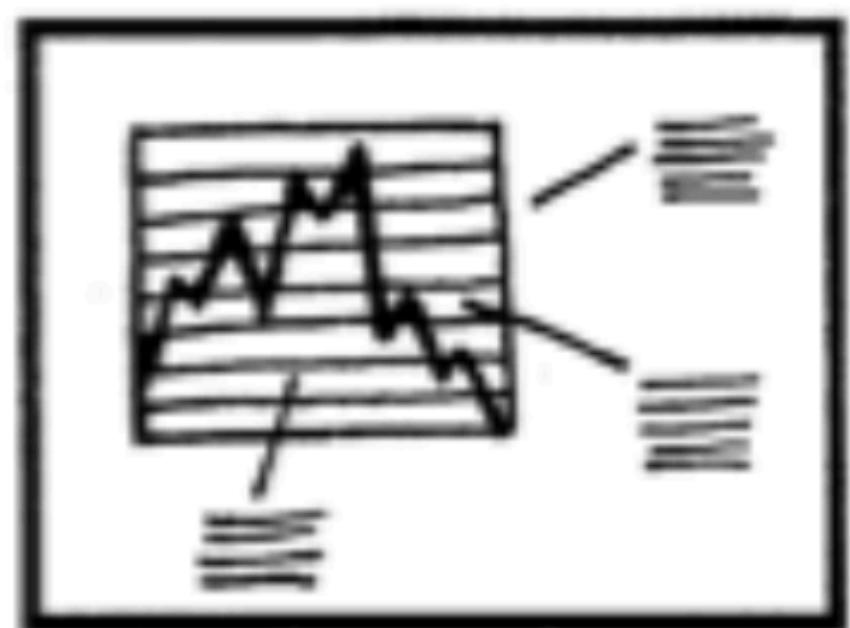
Budget Forecasts, Compared With Reality

Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

1 2 3 4 5 6 **NEXT ►**



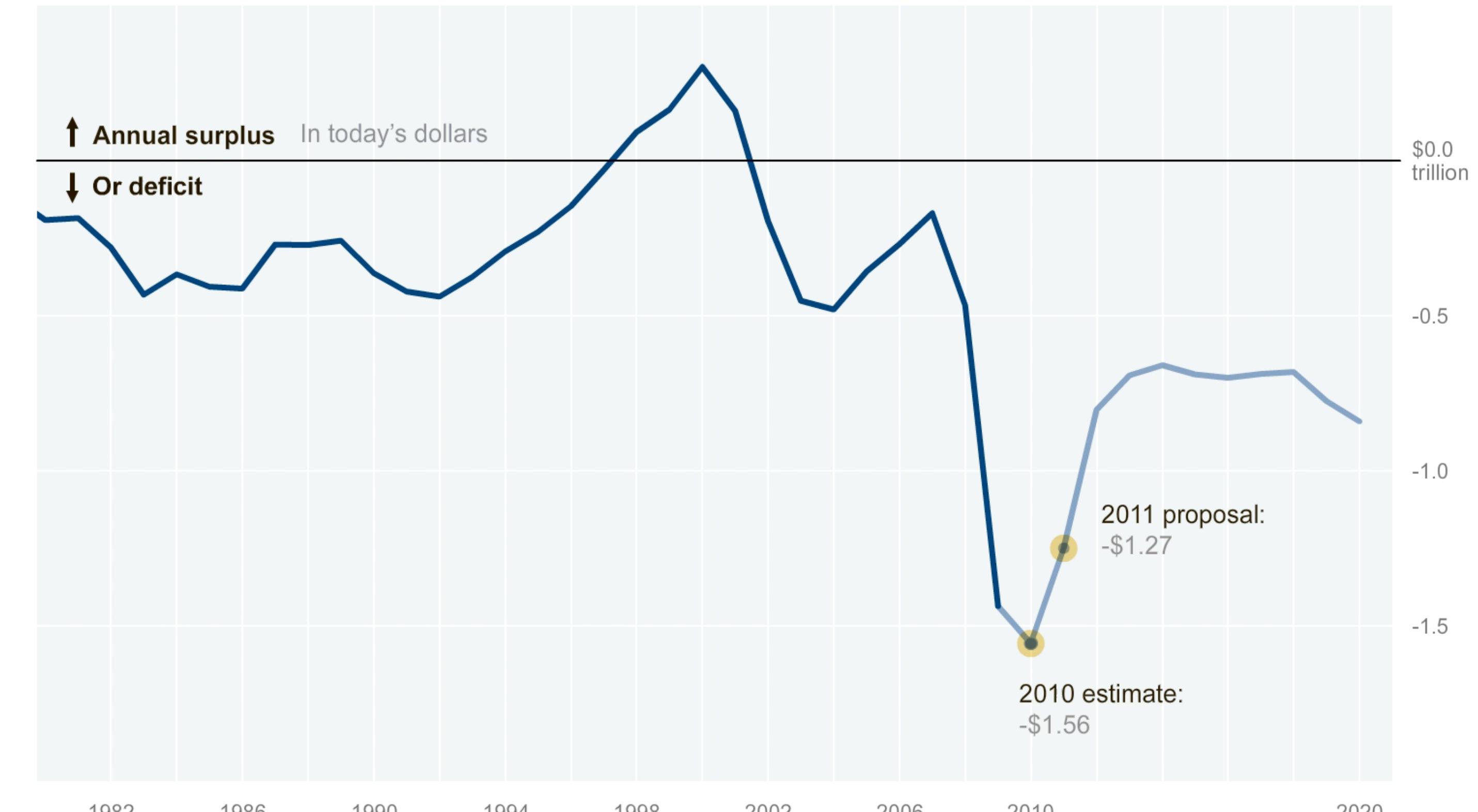
Slide Show



Annotated Chart

Falling short

President Obama's budget proposal estimates a deficit of \$1.6 trillion for the current fiscal year and \$1.3 trillion in 2011.

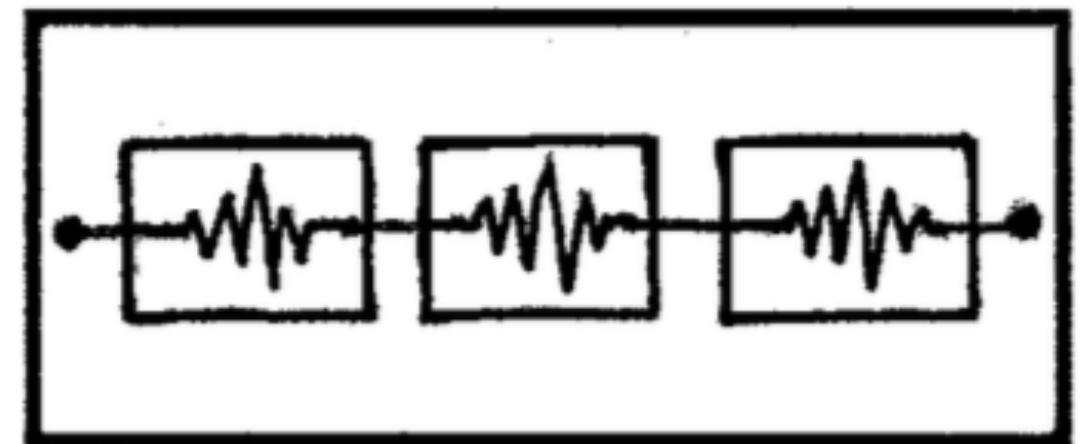


By AMANDA COX | [Send Feedback](#)

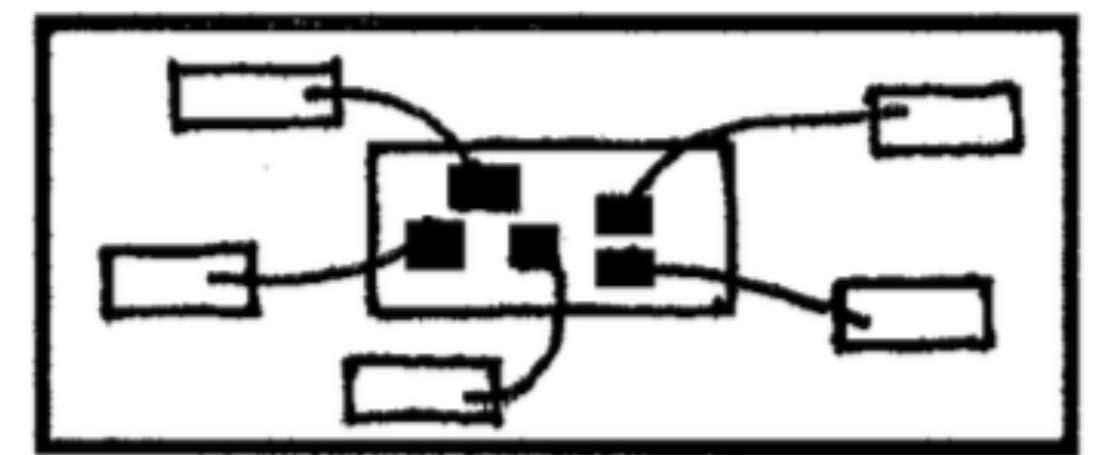
Source: Office of Management and Budget

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Interactive Slideshow



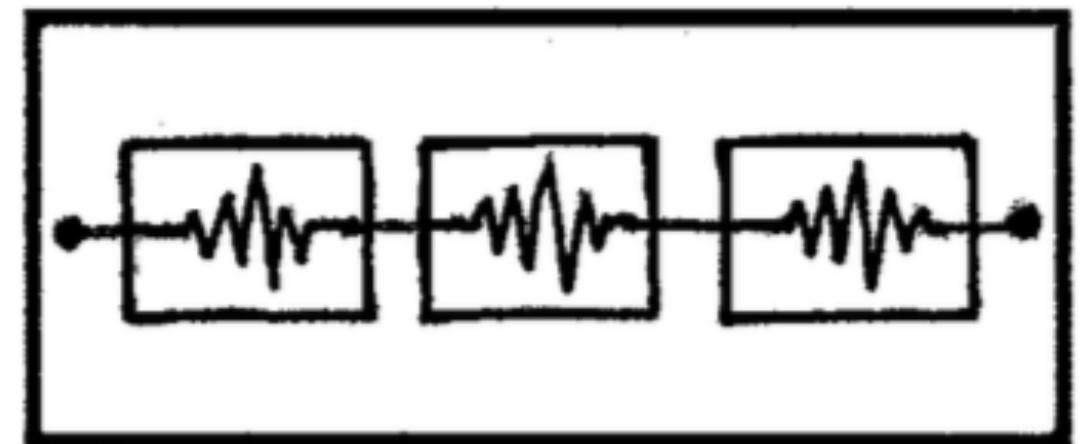
Drill-Down



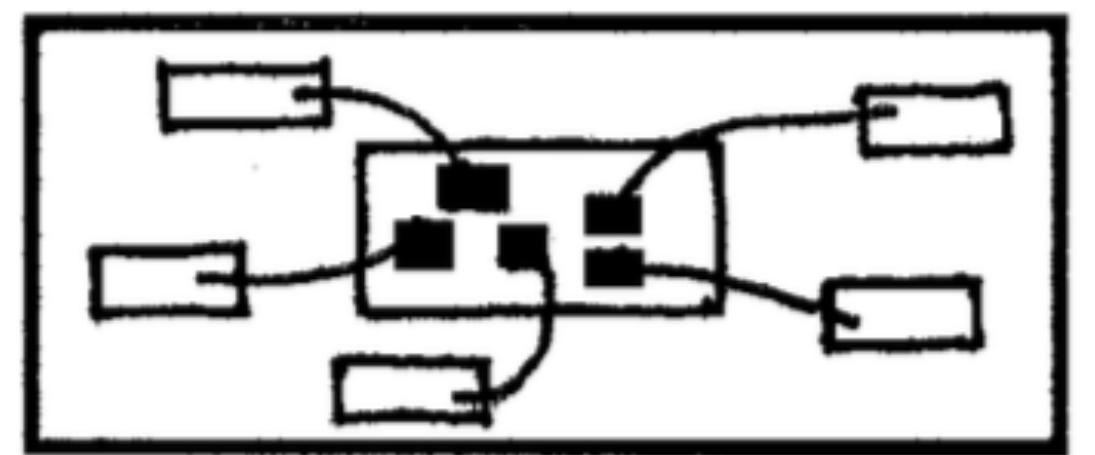
Author-Driven

Reader-Driven

Interactive Slideshow



Drill-Down



Author-Driven

Reader-Driven

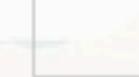
On the Map: Five Major North Korean Prison Camps

North Korea has operated political prison camps for more than 50 years, twice as long as the Gulag in the former Soviet Union. People suspected of opposing the government are forced to do slave labor in the camps, which hold an estimated 200,000 prisoners. North Korea's government says the camps don't exist, but high-resolution satellite images show otherwise.

RELATED

- Article: [On the Diplomatic Back Burner](#)
- [Google Earth: North Korea Uncovered](#)

Click on the  map markers below for more information on each site.

Now Viewing:  Overview  Up Close: Camp 15

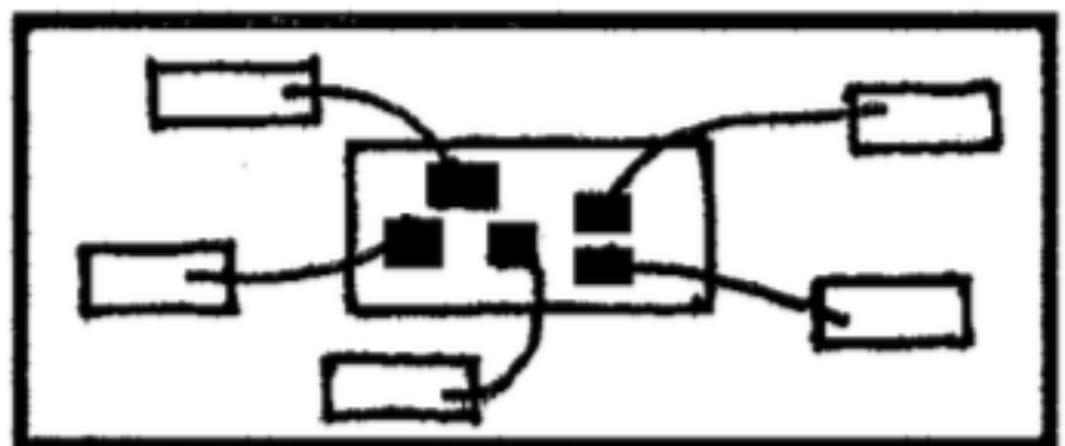


Learn more about five major prison camps at right, or take a closer look at life in Camp 15.

Scale varies in this perspective.
Distances from Pyongyang: 120 miles to Seoul, 427 miles to Vladivostok

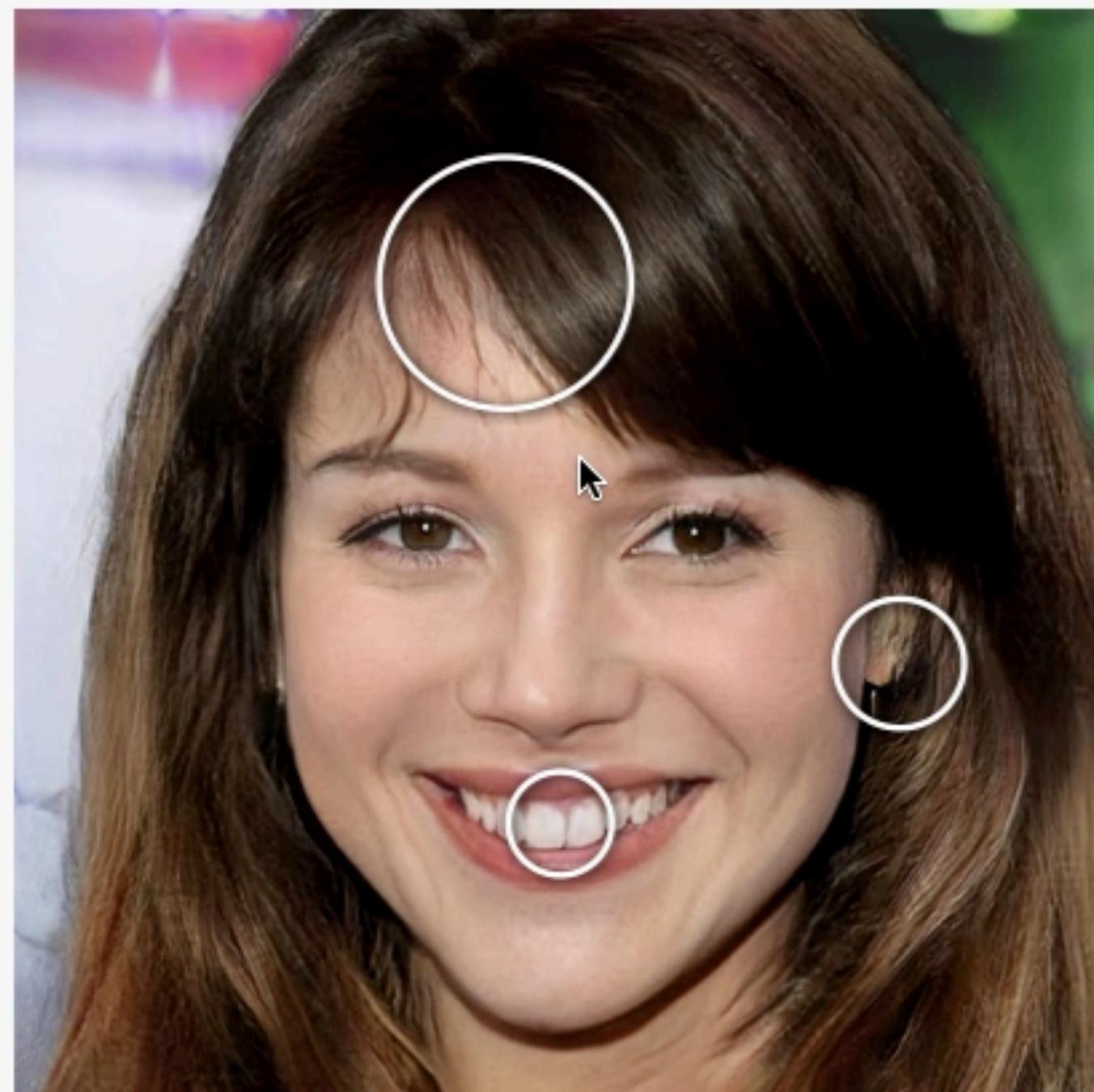
SOURCES: North Korea Uncovered; Korean Bar Association ("2008 White Paper on Human Rights in North Korea"); "The Hidden Gulag," David Hawk, U.S. Committee for Human Rights in North Korea; Joshua Stanton, One Free Korea; interviews with former prisoners and guards; Satellite Images: Google Earth; GRAPHIC: Kat Downs, Blaine Harden, Liz Heron, Laris Karklis and Francine Uenuma - The Washington Post

Drill-Down



What gives away a machine-generated image?

Interactivity on illustrations can help people get more context around certain objects that may not have clear and separable boundaries.



Select region for more information.

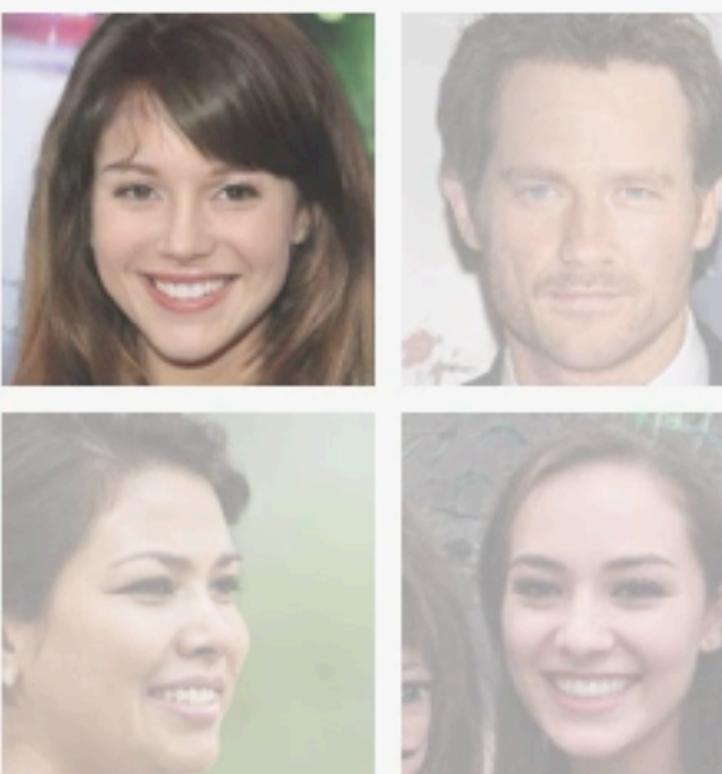
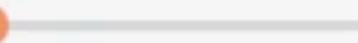


FIGURE 7: Choose between 1 of 4 machine-generated images and brush over the circle callouts to display a short message about each region. Generated images from [128, 129].

The Universal Approximation Theorem in 3 levels of detail.

Readers come with different backgrounds. What if our content could be tailored to their level of knowledge about certain topics?

ILLUSTRATIVE  PRECISE

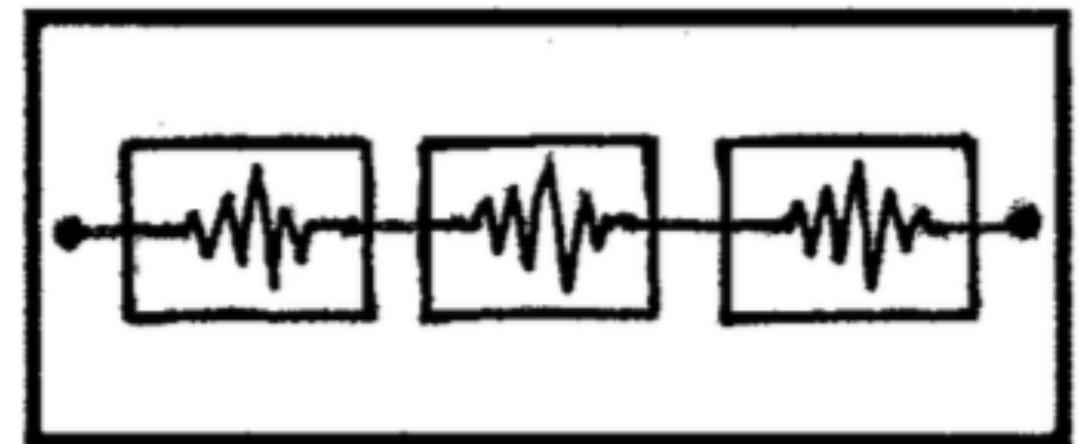
Neural networks can approximate any function that exists. However, we do not have a guaranteed way to obtain such a neural network for every function.

FIGURE 9: Drag the slider to display the theorem's statement in increasing levels of detail.

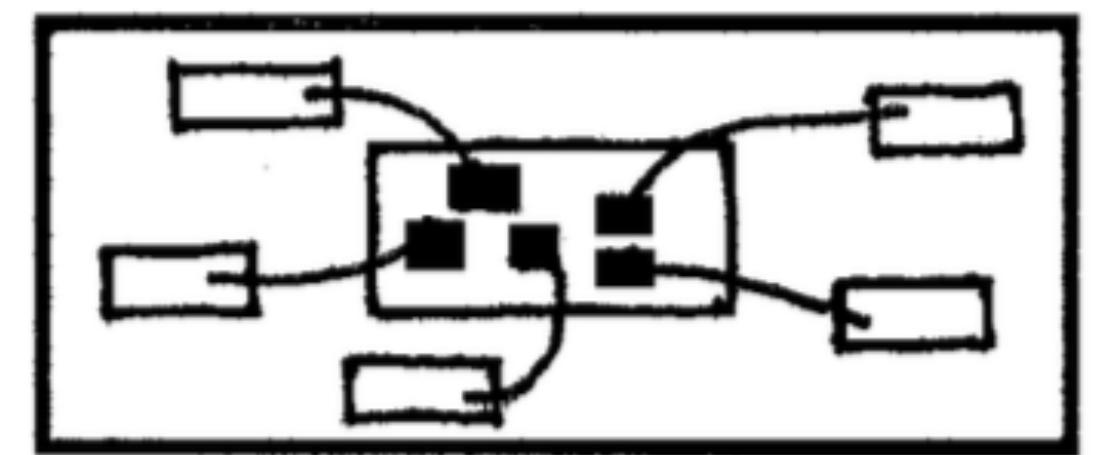
PREVIEWING CONTENT

Details-on-demand can also be used as a method for previewing content without committing to another interaction or change of view. For example, when hovering over a hyperlink on Wikipedia a preview card is shown that can contain an image and brief description: this

Interactive Slideshow



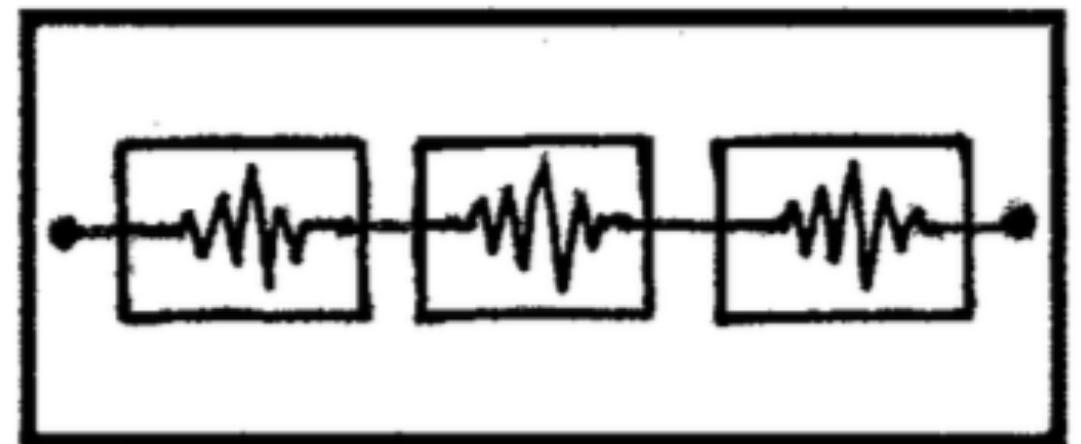
Drill-Down



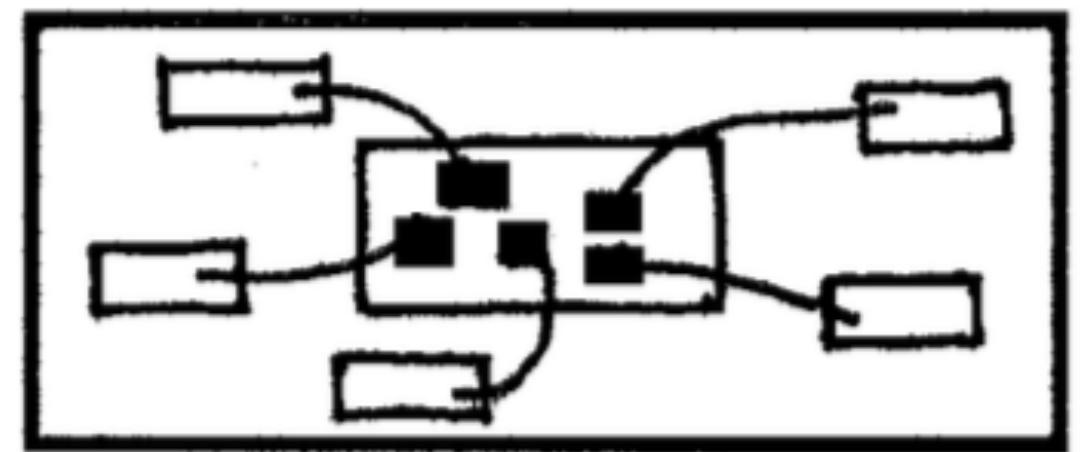
Author-Driven

Reader-Driven

Interactive Slideshow



Drill-Down



Author-Driven

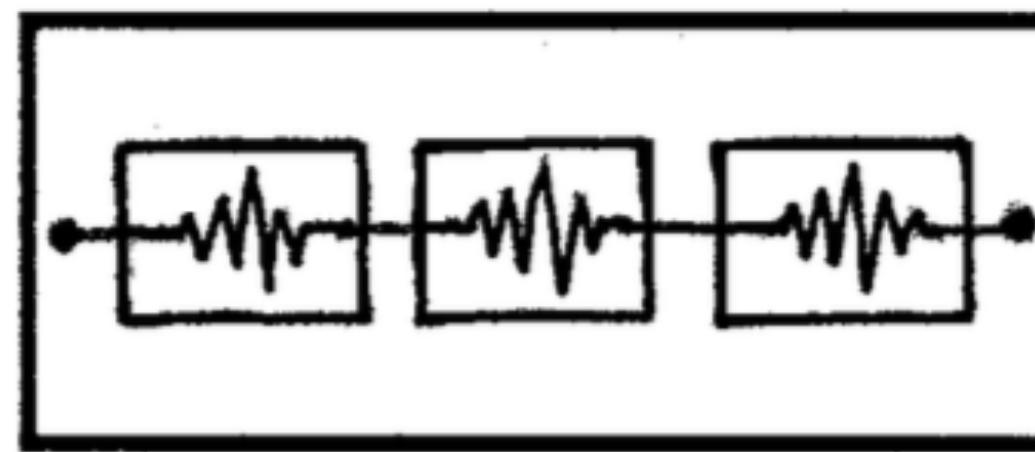
Reader-Driven

Copenhagen: Emissions, Treaties and Impacts

At the Copenhagen climate conference, discussions are likely to cover emissions levels, the legacy of the Kyoto Protocol and the risks of inaction on global warming. Explore each issue in the tabs below.

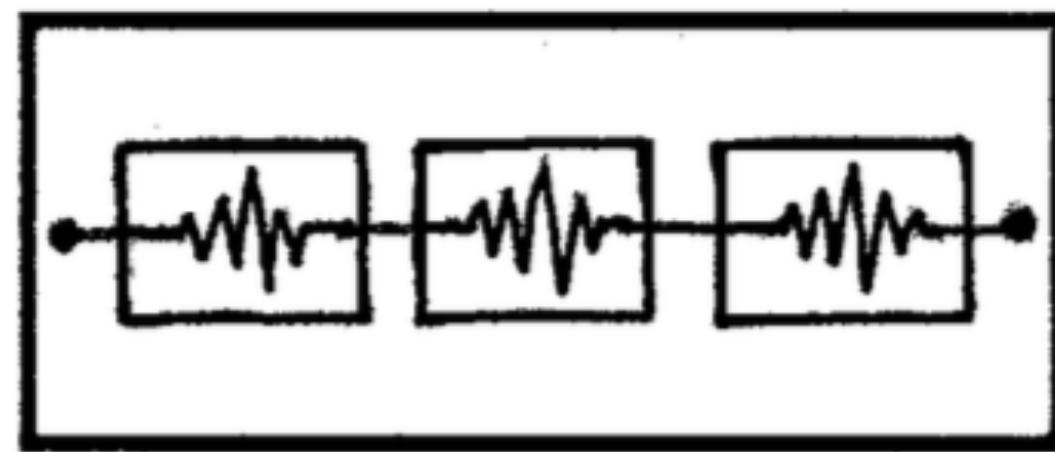
Stepper

Interactive Slideshow



Global Emissions	Lessons From Kyoto	Possible Impact
<p>1 2 3 4 5 6 7 8 9 10 11 NEXT ►</p> <p>Almost every country in the world signed and ratified the protocol. The treaty's aim was to provide a starting point for reducing global carbon dioxide emissions.</p> <p>Countries that ratified Kyoto</p>  <p><i>Roll over countries to learn more</i></p>		

Interactive Slideshow



R2
D3

A visual
introduction to
machine learning

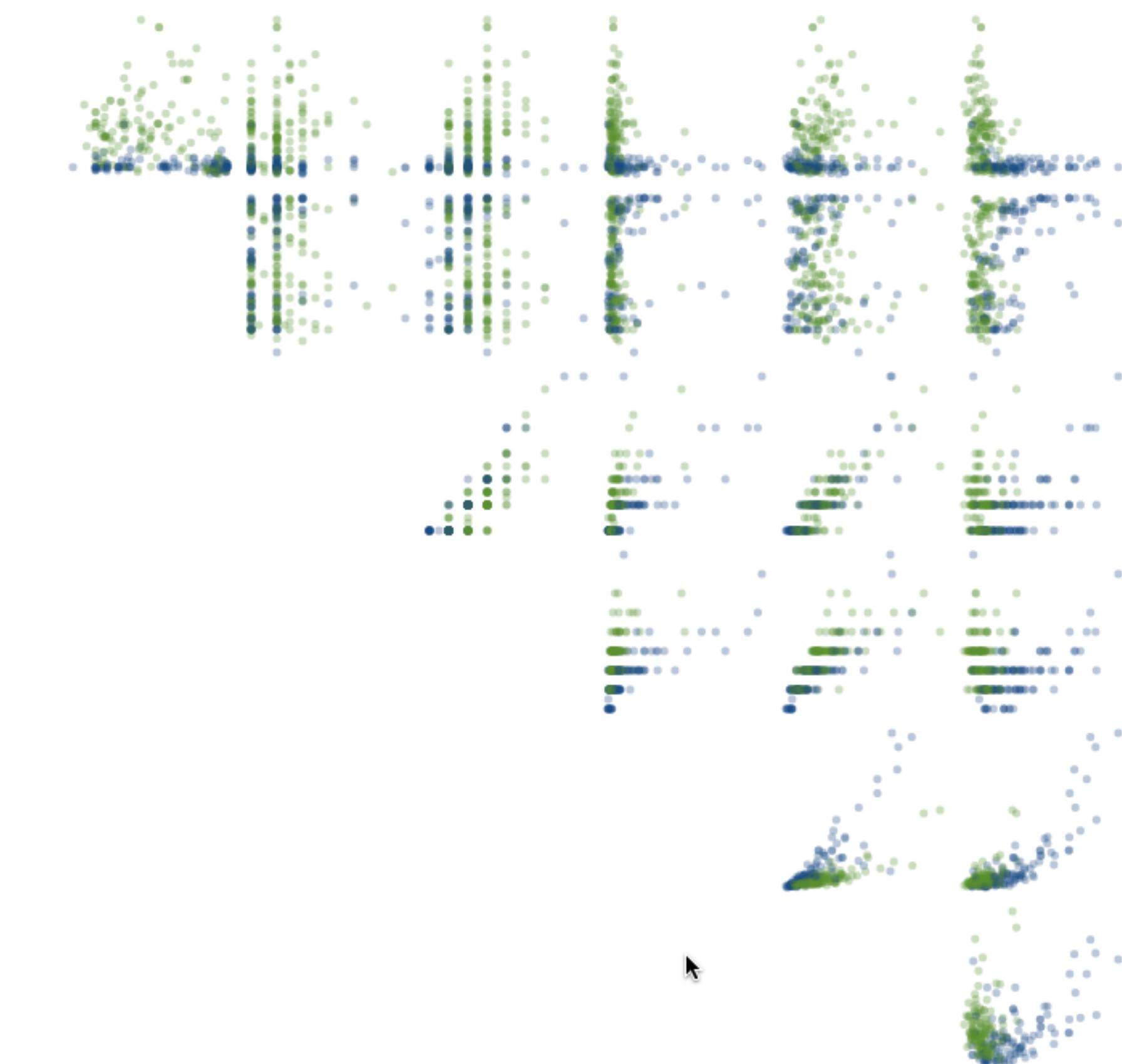
🌐 English

In machine learning, computers apply **statistical learning** techniques to automatically identify patterns in data. These techniques can be used to make highly accurate predictions.

Keep scrolling. Using a data set about homes, we will create a machine learning model to distinguish homes in New York from homes in San Francisco.

“Scrolly”-telling

SCROLL



Discrete vs. Continuous Steps

A source of debate among practitioners!

Interactive Slideshow



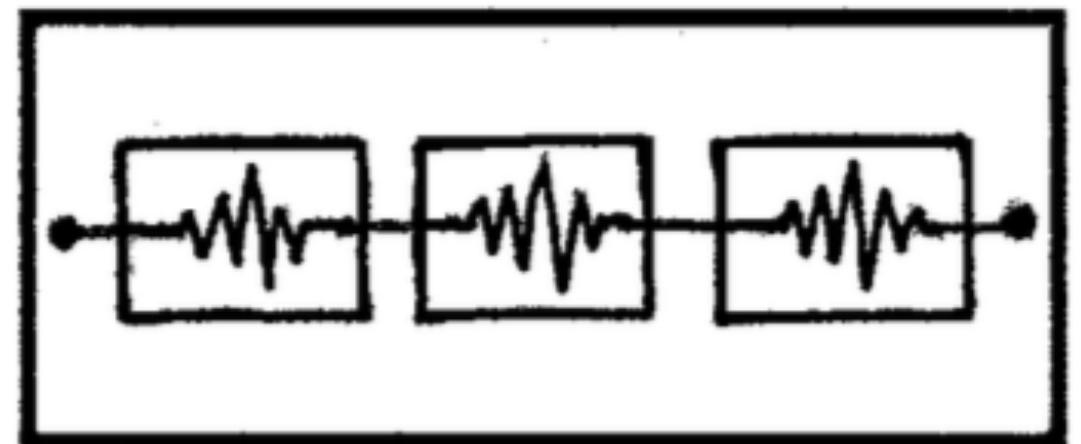
Discrete

- ✓ Simple & familiar.
- ✗ But less engaging?

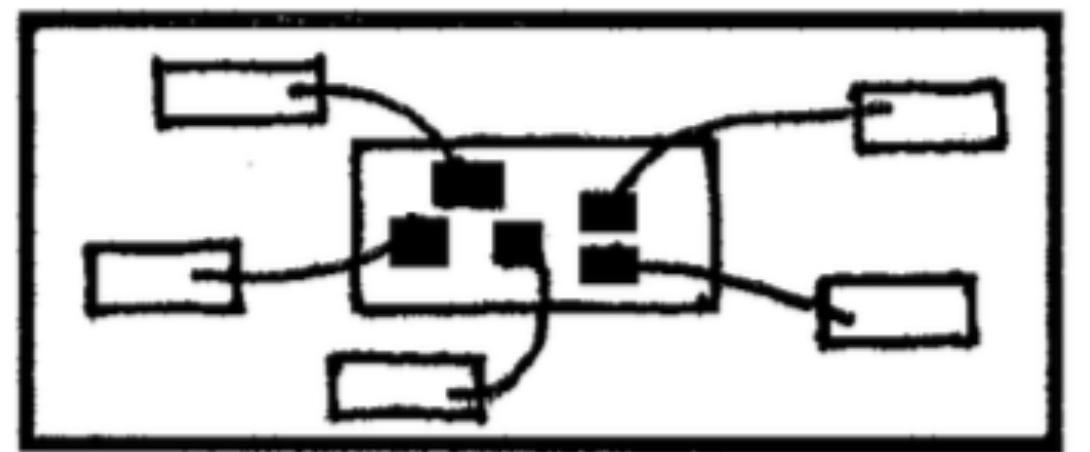
Continuous

- ✓ Less “activation energy” required.
- ✓ More fluid/direct: parameterized by scroll position = rapid, incremental experience.
- ✗ But, difficult to implement properly. Can result in “*scrolljacking*.”

Interactive Slideshow



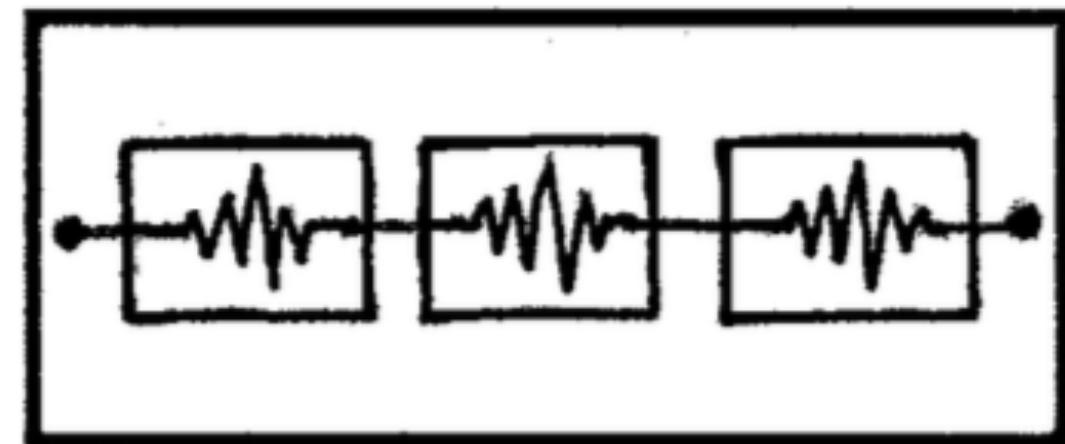
Drill-Down



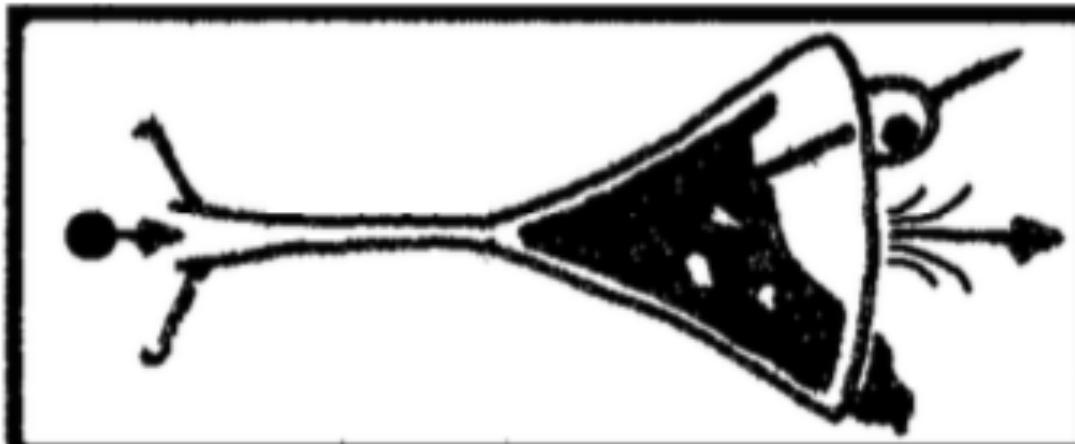
Author-Driven

Reader-Driven

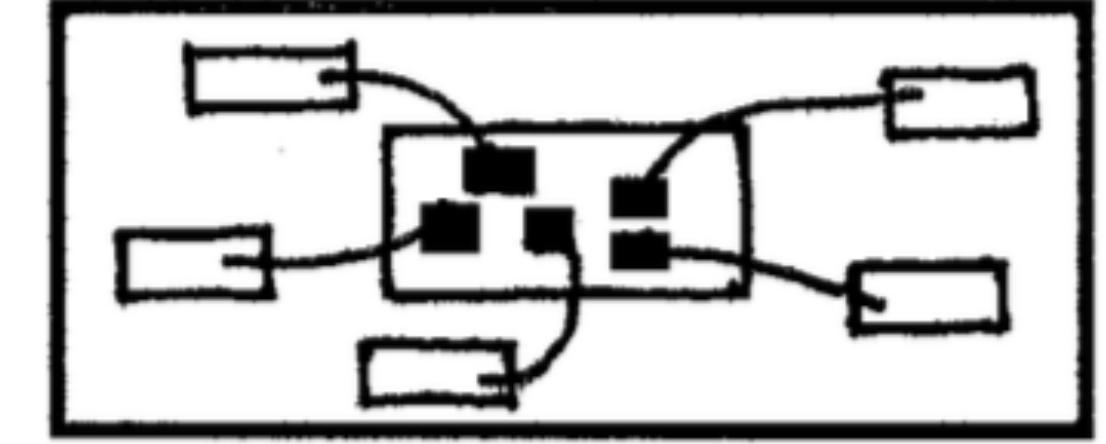
Interactive Slideshow



Martini Glass



Drill-Down



Author-Driven

Reader-Driven

Kernel Density Estimation

By: [Matthew Conlen](#)



What do **matrices** mean to you?

Why do we need a way to represent an array of rows and columns of numbers, and to execute computations and operations between them?

$$\begin{bmatrix} 1 & 2 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

In school, you may recall reluctantly performing drill after drills of matrix-vector multiplications mechanically. You may even have been taught to memorize several inane formulas.

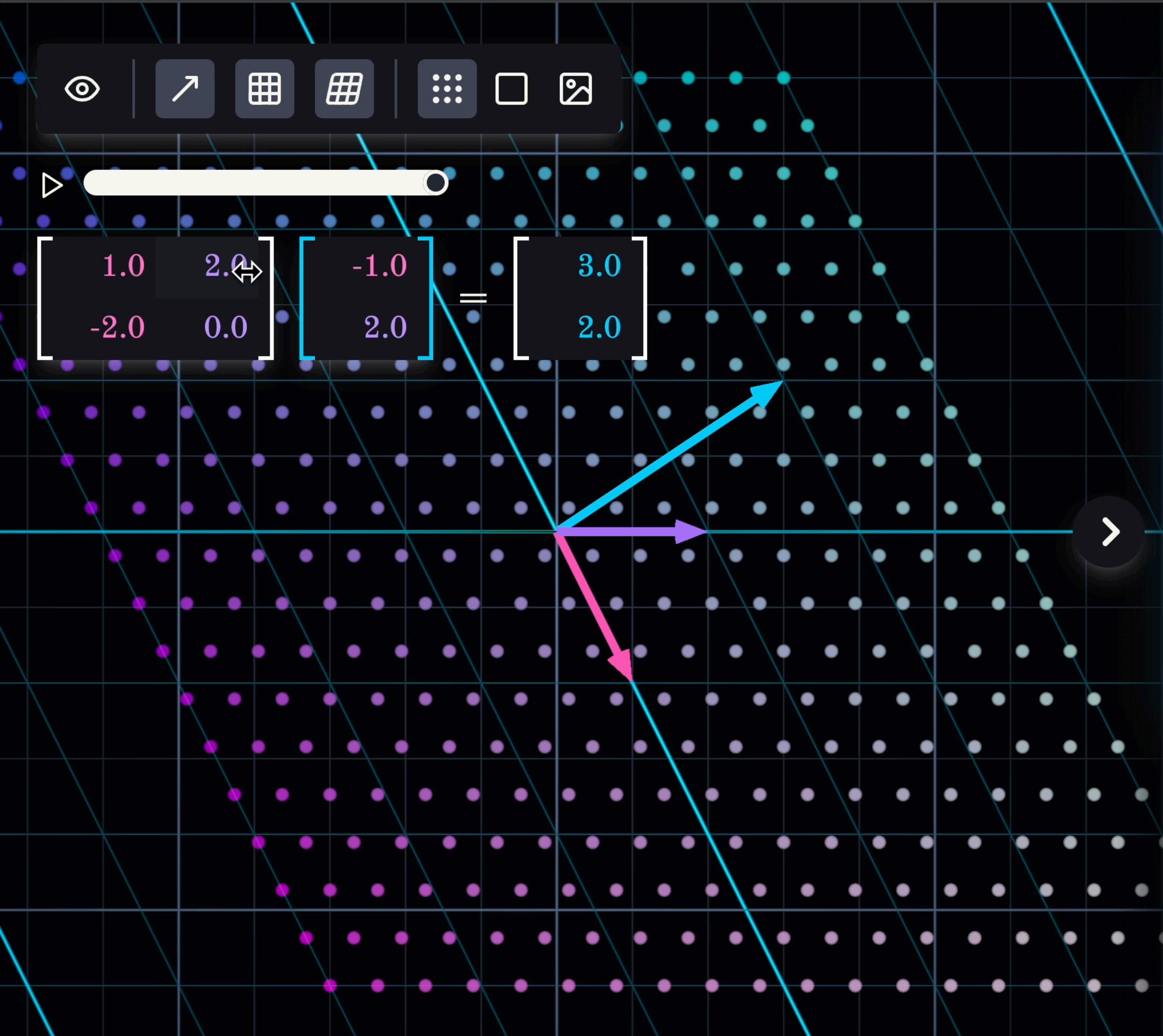
$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = x \begin{bmatrix} a \\ c \end{bmatrix} + y \begin{bmatrix} b \\ d \end{bmatrix}$$
$$= \begin{bmatrix} ax + by \\ cx + dy \end{bmatrix}$$



RECAP

- Any vector can be expressed as the addition of scaled basis vectors, i.e. a **linear combination of basis vectors**.
- A matrix can be viewed as a way to **package information about a linear transformation**. The columns of a matrix represent where the new basis vectors land after the transformation.
- Matrix-vector multiplication is a way to compute where a given vector lands after the transformation defined by a matrix.

With our understanding so far, try to tinker about and figure out what kinds of transformations are possible with matrices!



Final Project:

Explorable Explanation

Final Project

Create an **Explorable Explanation**: interactive article that explains something complex to the reader.

Examples: Any example shown during today's lecture, sociological theory, scientific phenomenon, algorithm, etc.

Banned: sorting + searching algorithms. (Too common!)

Teams of 2-3. **No solo projects.**

Final Project Milestones

Proposal + Team: Feb 23 (this Friday)

Prototype: Mar 1

Demo Video: Mar 8

Final Project: Mar 16

No slip days allowed for final deadline

