

Narrative Visualization

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 6 due today.

Project 3 due next Tuesday.

FAQs:

- 1.

Interactive Articles

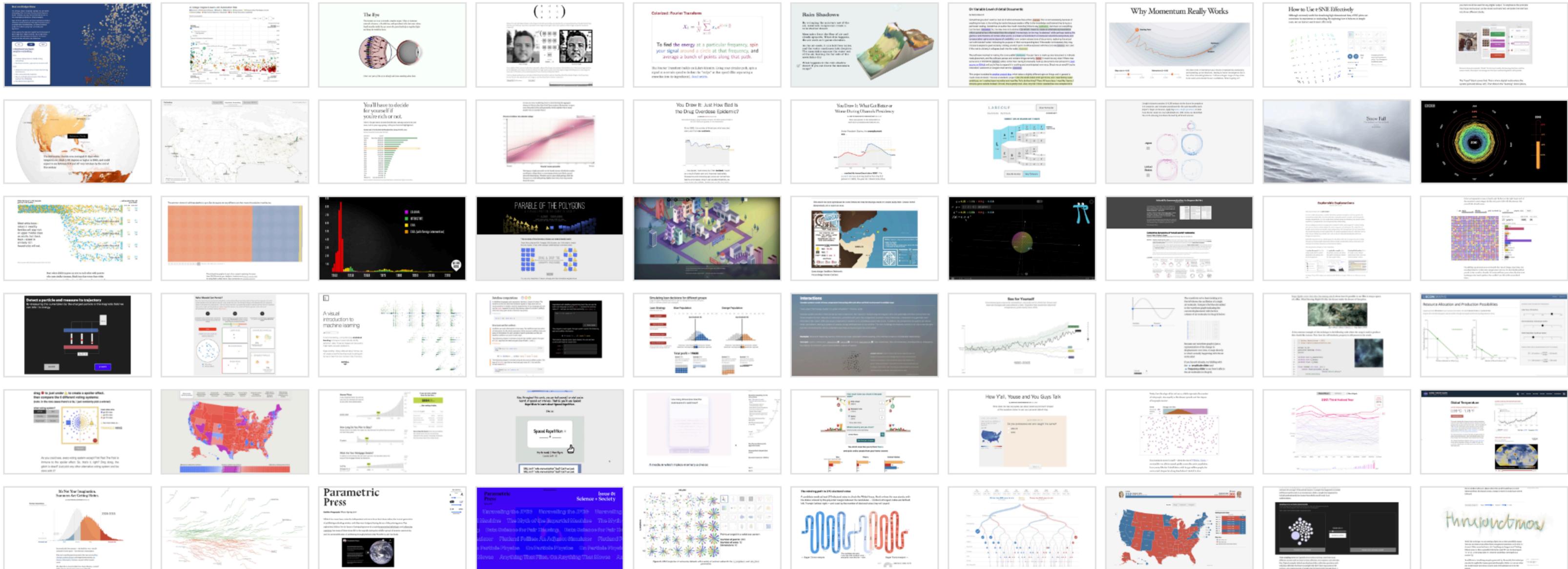


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

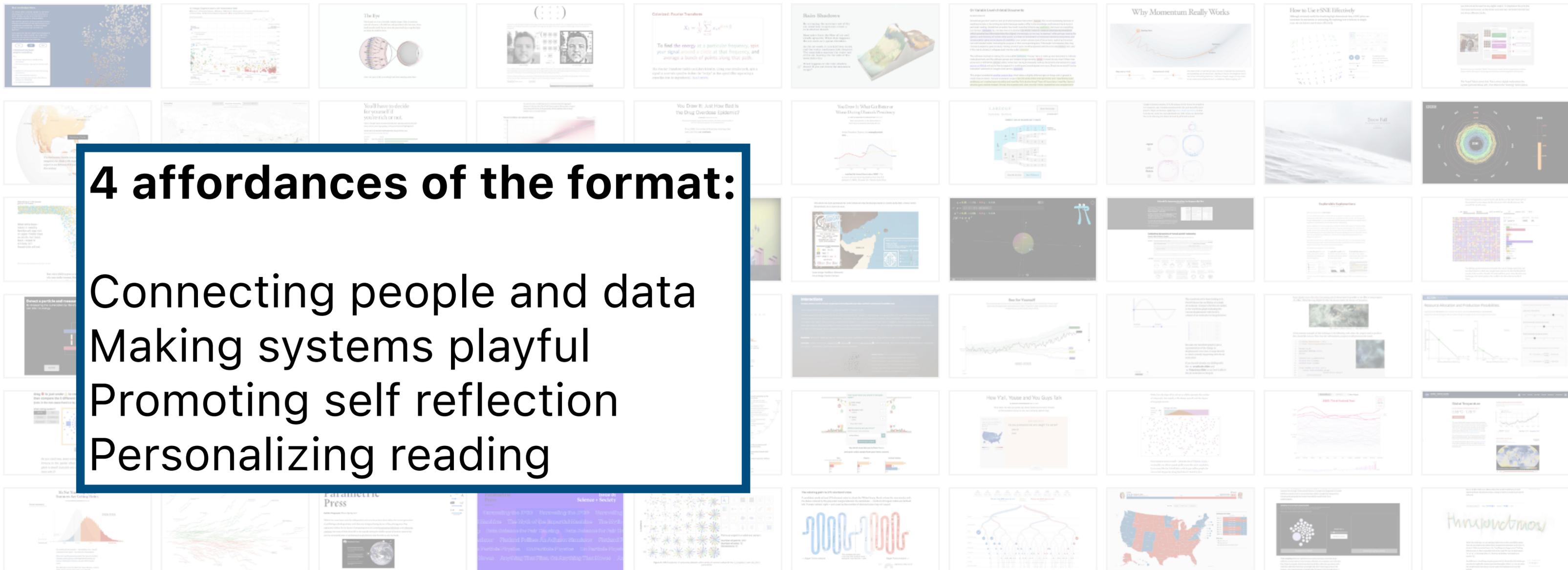


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

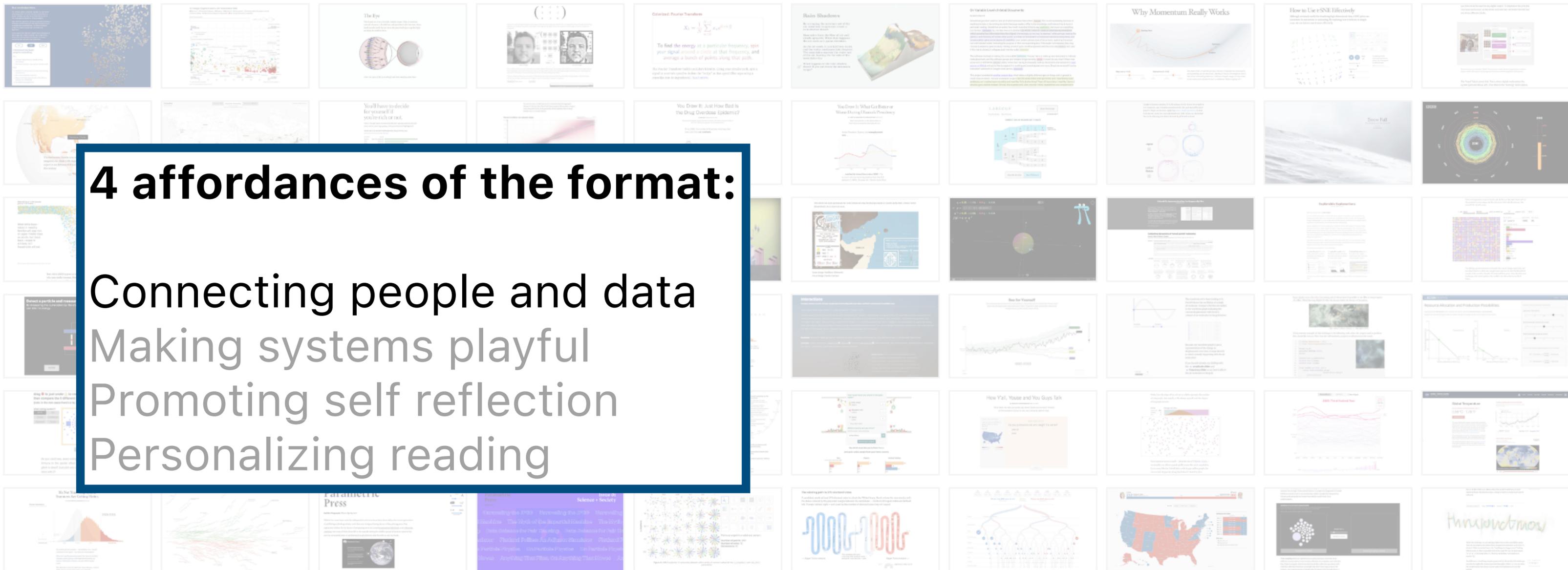
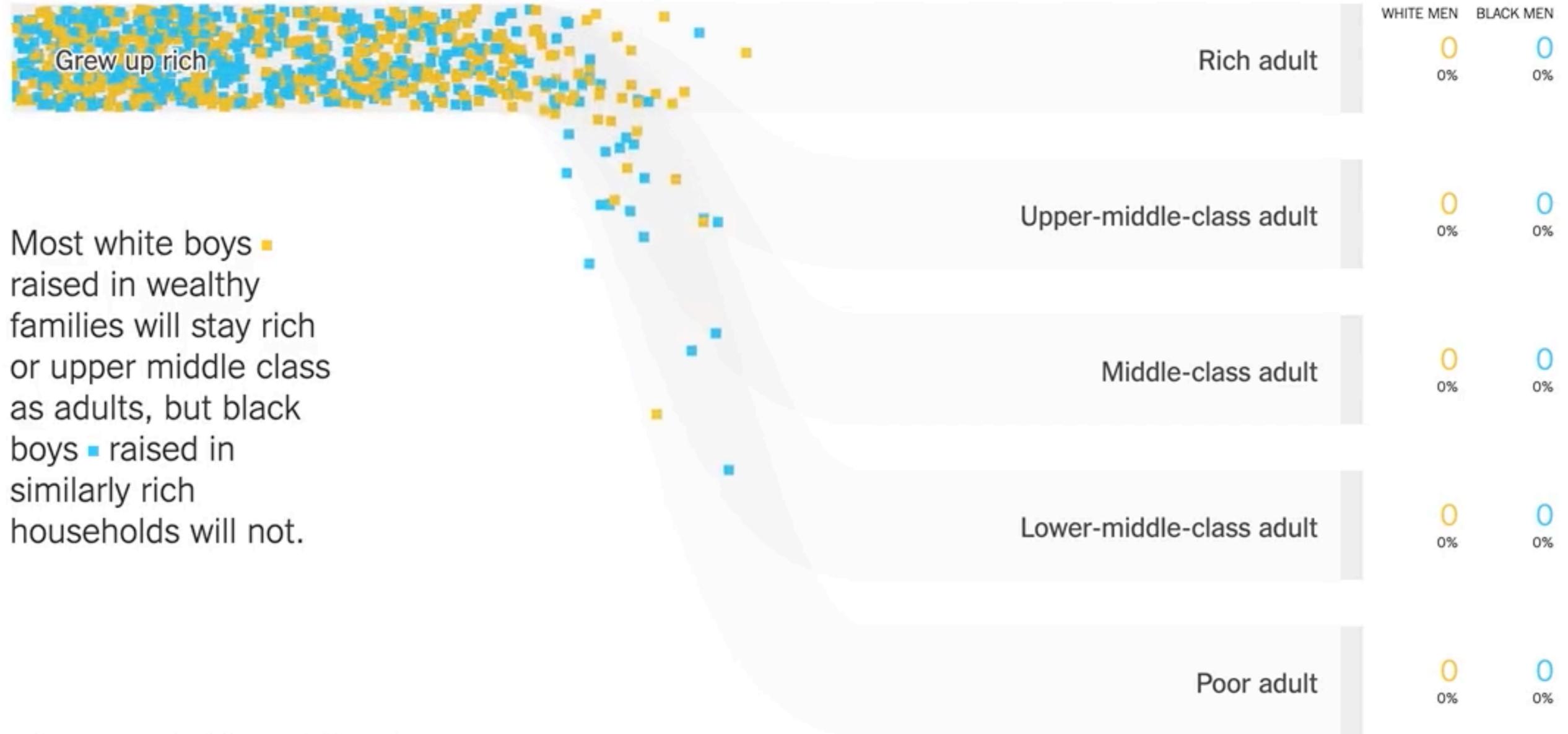


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

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

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



Most white boys raised in wealthy families will stay rich or upper middle class as adults, but black boys raised in similarly rich households will not.

Adult outcomes reflect household incomes in 2014 and 2015.

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

Respond: I like, I wish, What if?

tryclassbuzz.com
Code: **guns**



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.

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>

The screenshot shows the TensorFlow Playground interface. At the top, there are controls for Epoch (000,000), Learning rate (0.03), Activation (Tanh), Regularization (None), and a 'Play' button. Below this, the interface is divided into several sections:

- DATA:** Includes a 'Which dataset do you want to use?' section with four icons, a 'Ratio of training to test data: 50%' slider, 'Noise: 0' slider, and 'Batch size: 10' slider. A 'REGENERATE' button is at the bottom.
- FEATURES:** 'Which properties do you want to feed in?' section with a list of features: X_1 , X_2 , X_1^2 , X_2^2 , $X_1 X_2$, $\sin(X_1)$, and $\sin(X_2)$. Each feature has a corresponding colored bar.
- HIDDEN LAYERS:** A central diagram showing a neural network with 4 neurons in the first hidden layer and 2 neurons in the second hidden layer. Lines connect neurons between layers, with thickness representing weights. A tooltip says: 'The outputs are mixed with varying **weights**, shown by the thickness of the lines.' Another tooltip points to a neuron: 'This is the output from one **neuron**. Hover to see it larger.'
- OUTPUT:** Shows 'Test loss 0.525' and 'Training loss 0.517'. A scatter plot displays data points (orange and blue) and decision boundaries. A color scale at the bottom indicates data, neuron, and weight values from -1 to 1. There are checkboxes for 'Show test data' and 'Discretize output'.

SPIN

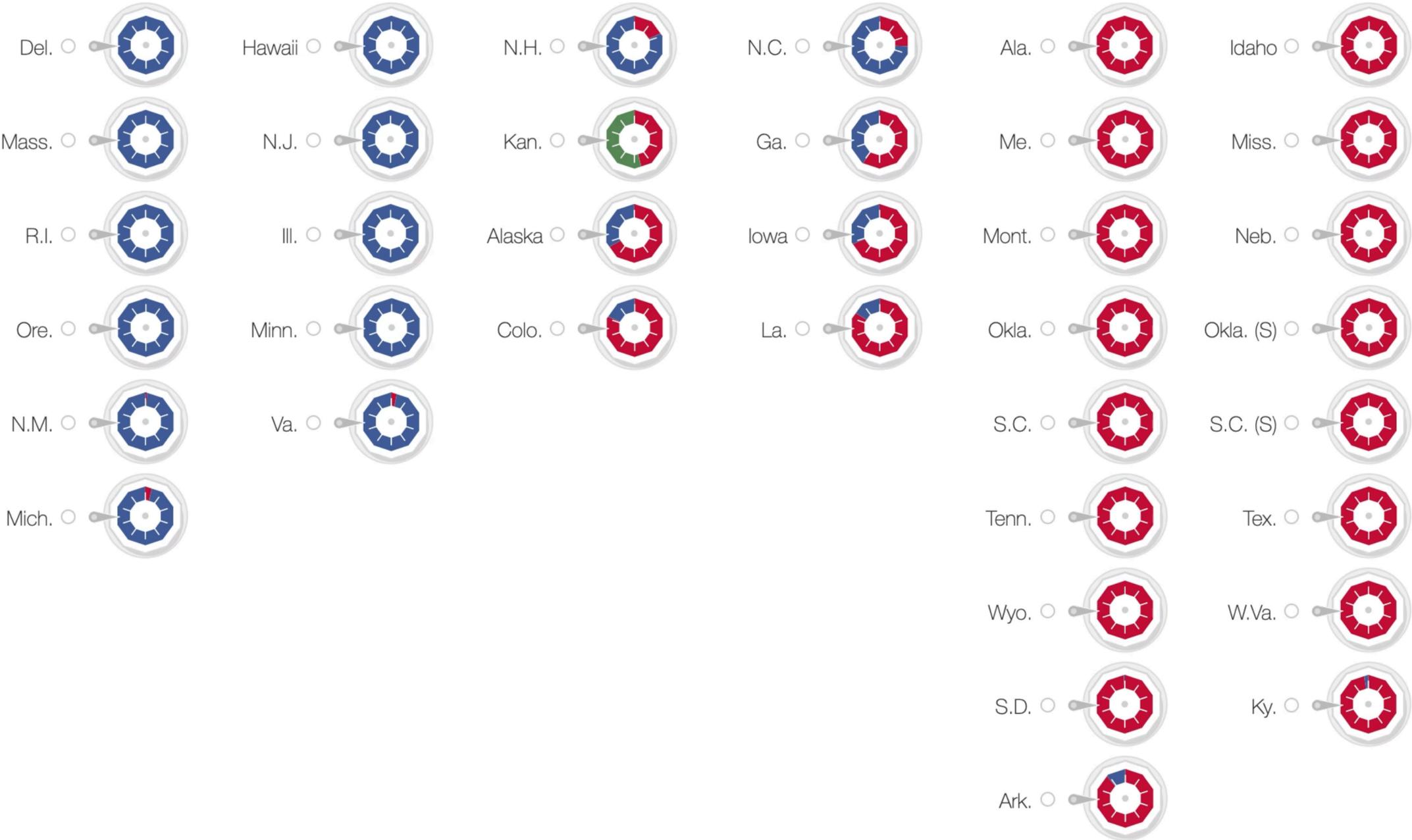
Democrats: ??

Republicans: ??

Likely Democratic

Competitive

Likely Republican



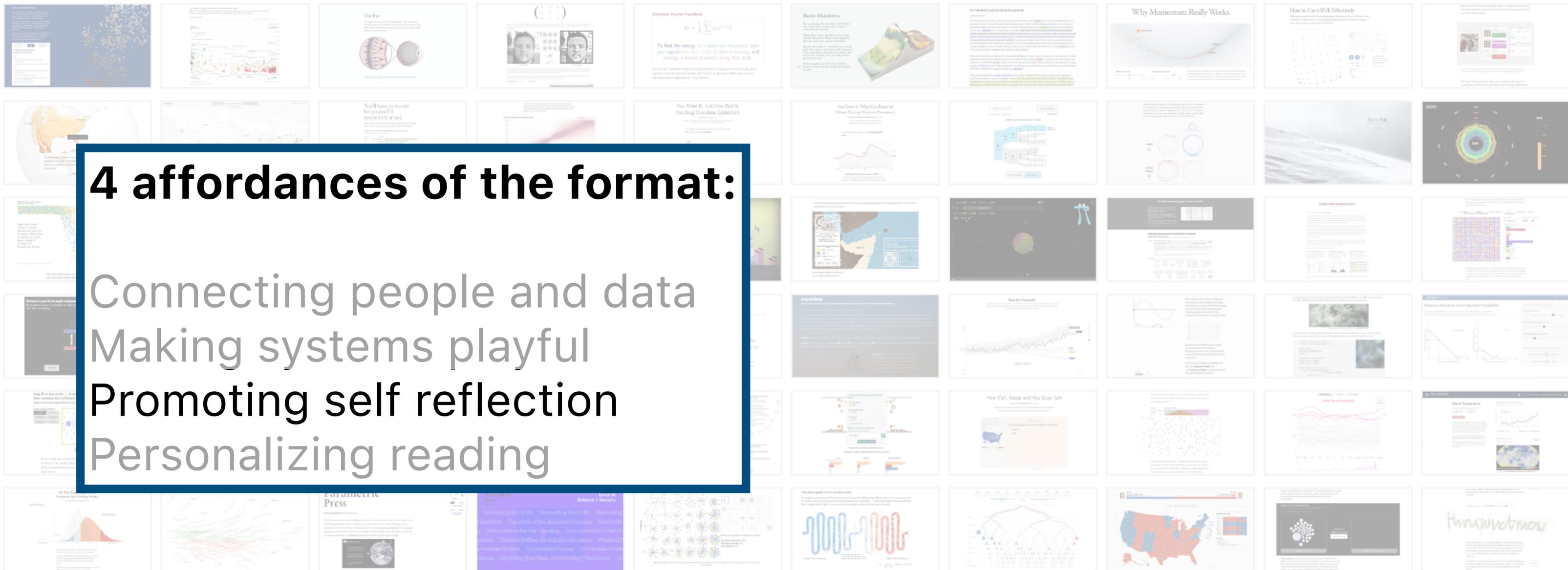
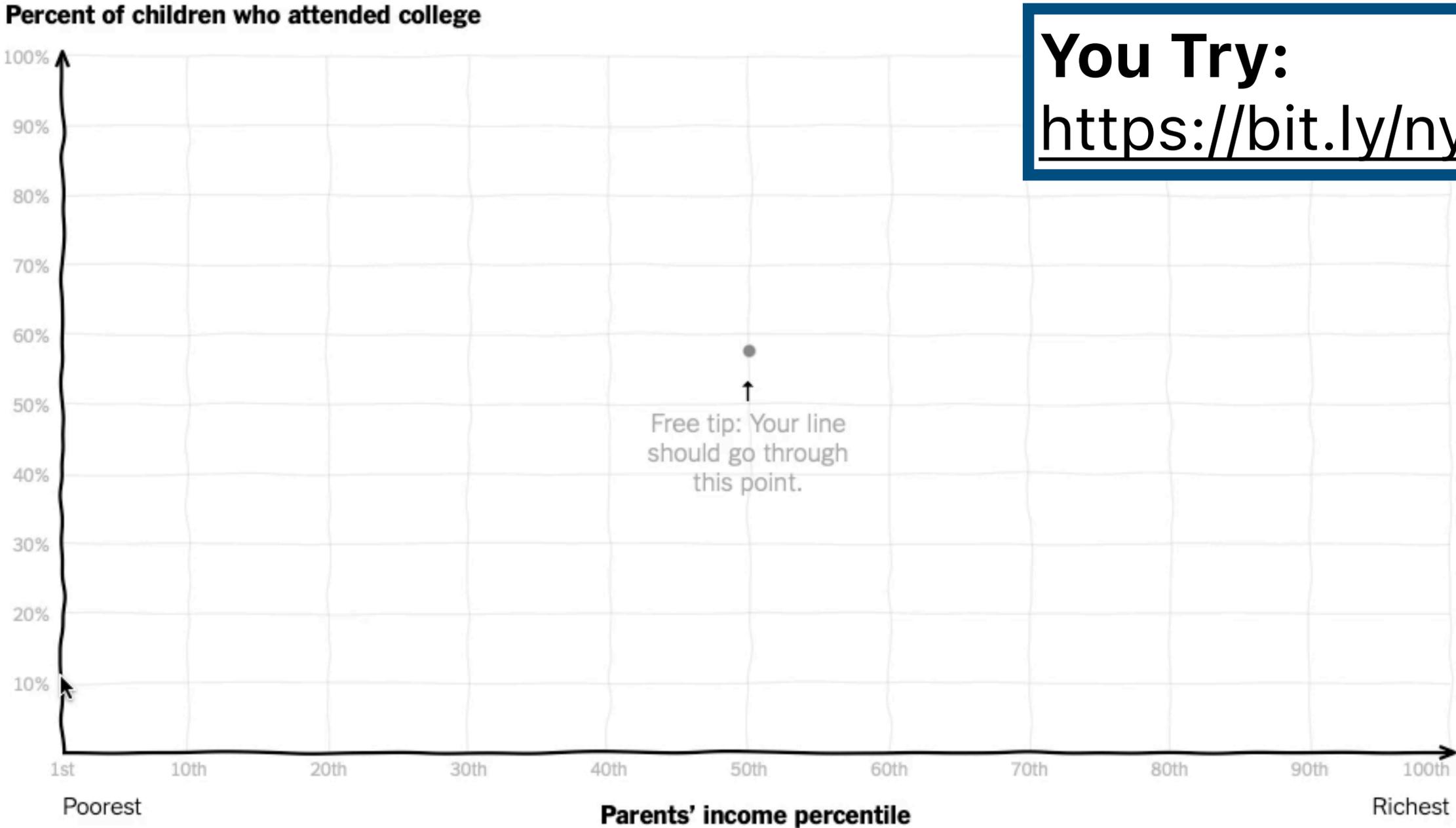


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

Draw your line on the chart below



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

I'm done

Start over



ACTRESS

ZOOEY _____ 🔊

Phonetic Spelling

D | _____

I Think I've Got It

Show Me Another Skip To Results

12 NAMES LEFT

D

YOUR PATH

Show Me Another

Skip To Results

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

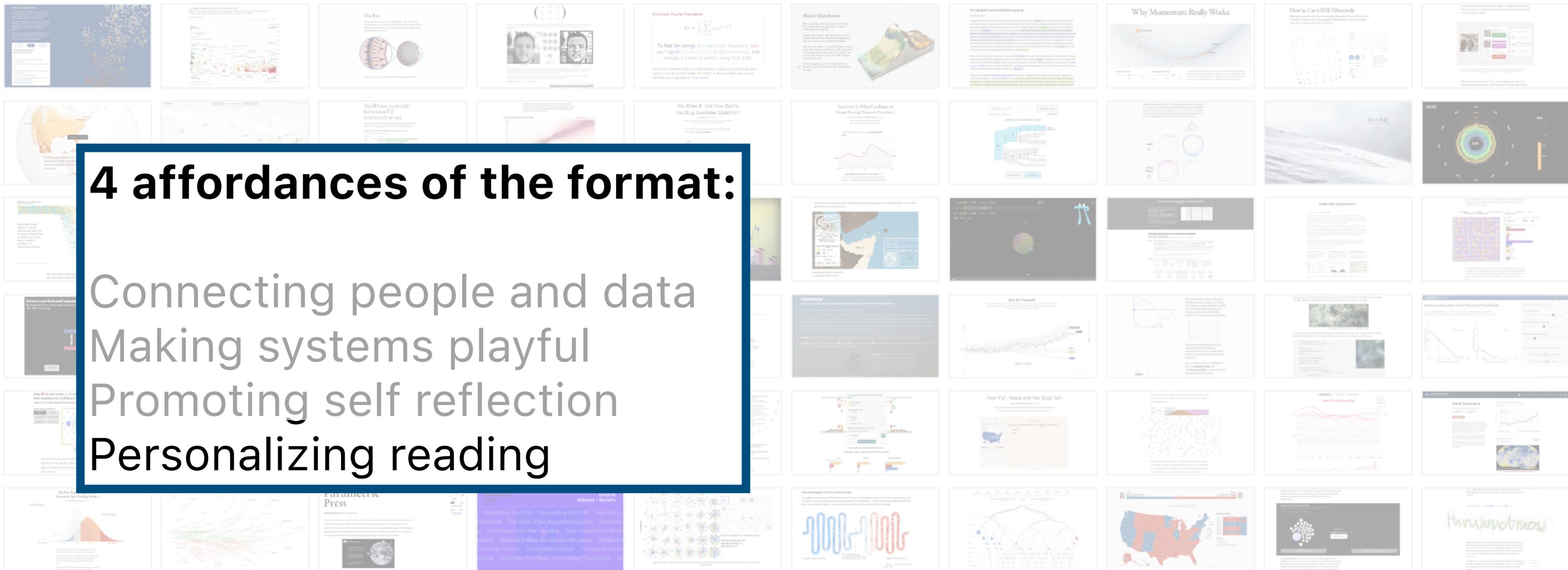


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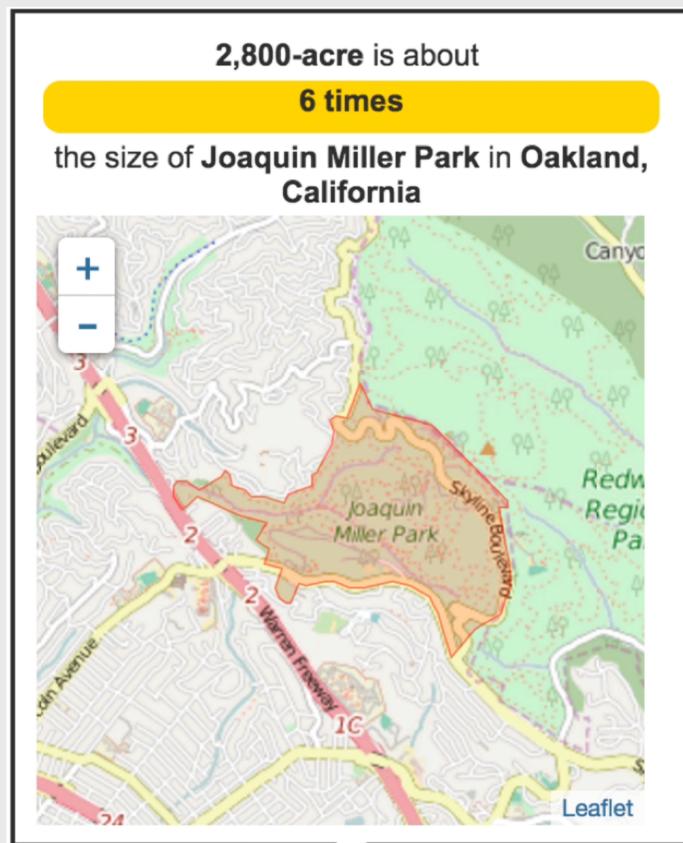
Originally published in 2018

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.

Please enter your information to continue.



ATLAS OF ME



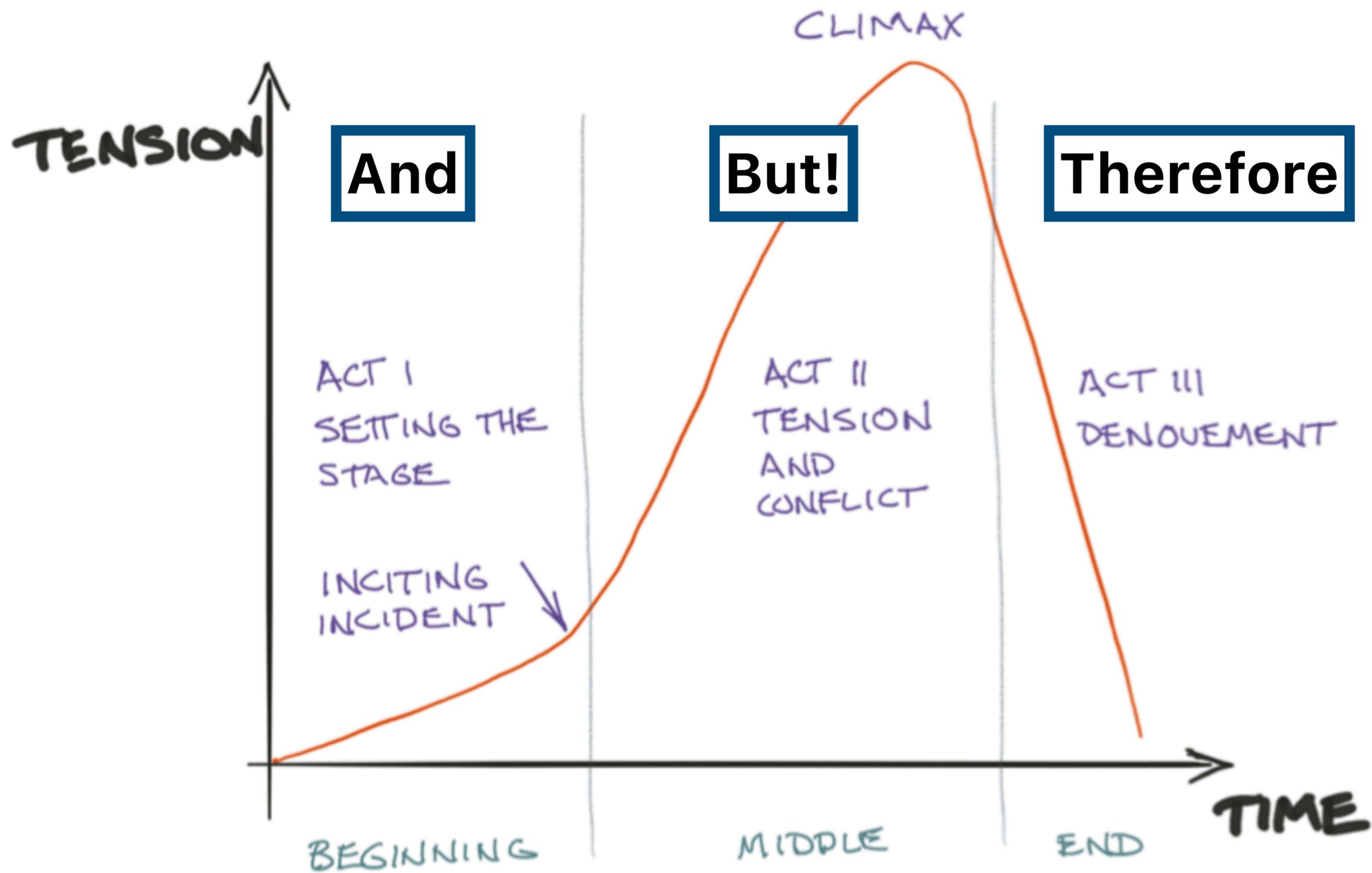
On-demand personalized maps for unfamiliar distances, areas, and locations.

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

Narrative Visualization

Aka: Telling a story using data

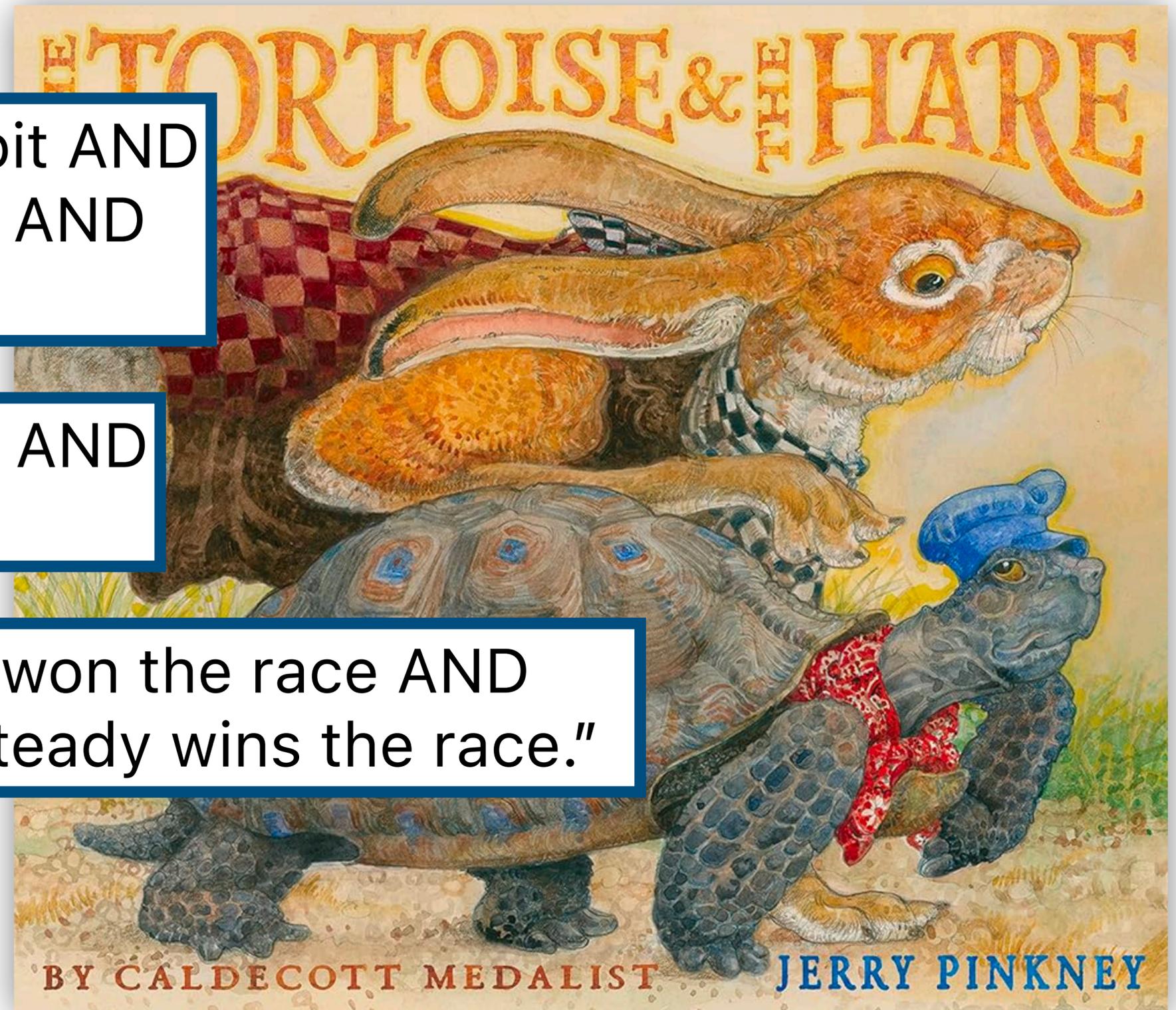
You'll make one for your final project!



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

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

1

2

3

4

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10

11

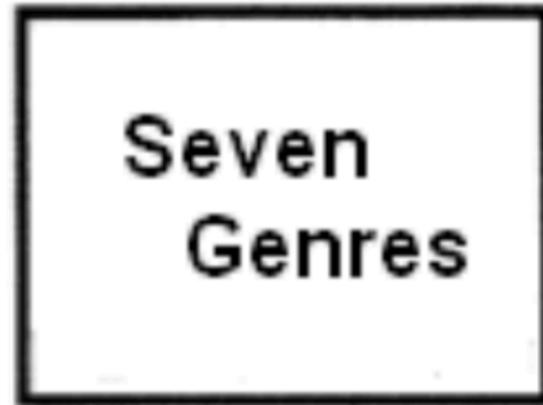
12

Explore the

fivethirtyeight.com/features/gun-deaths

tryclassbuzz.com
Code: **gun2**

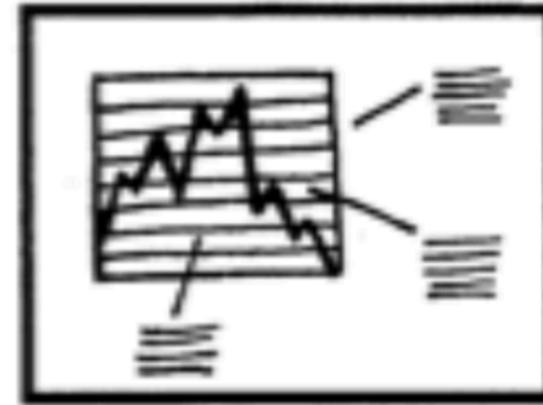
Narrative Visualization Genres



Seven
Genres



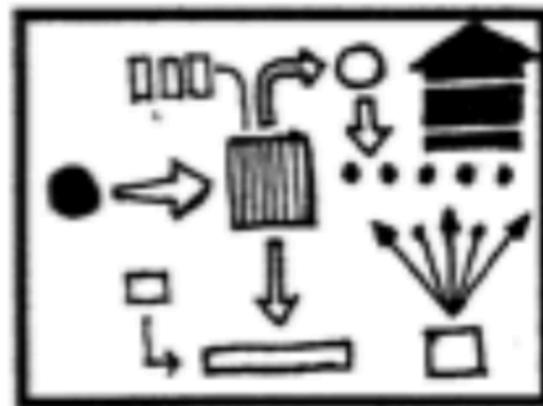
Magazine Style



Annotated Chart



Partitioned Poster



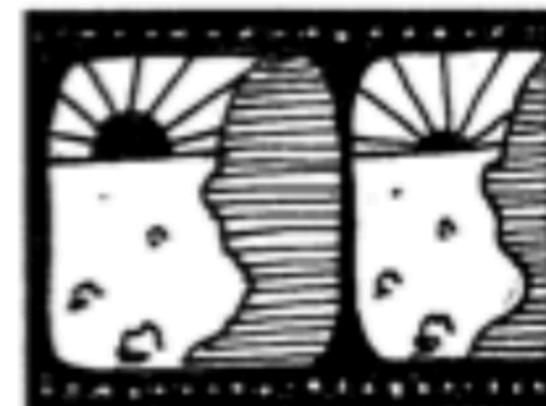
Flow Chart



Comic Strip



Slide Show



Film/Video/Animation



Magazine Style

www.economist.com/finance-and-

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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*

Year	Manufacturing Euro area	Manufacturing United States	Manufacturing China	Services Euro area	Services United States	Services China
2017	58	52	48	55	52	48
2018	52	52	48	52	52	48
2019	46	52	50	52	52	48

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

755

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.



Hank Aaron
755 homers
23 seasons



Babe Ruth
714 homers
22 seasons



Barry Bonds
708 homers
20 seasons

Bonds takes lead
Home runs
after 16 seasons
Bonds 567
Aaron 554
Ruth 516

600

755
23 seasons

714
22 seasons

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

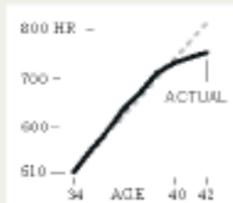
Homer Pace After Age 34

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

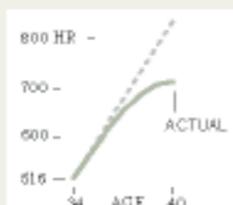
Aaron

Actual homers slightly outpace projected homers for five seasons.



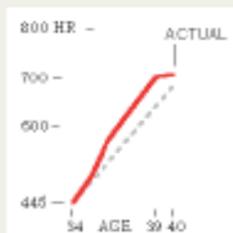
Ruth

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



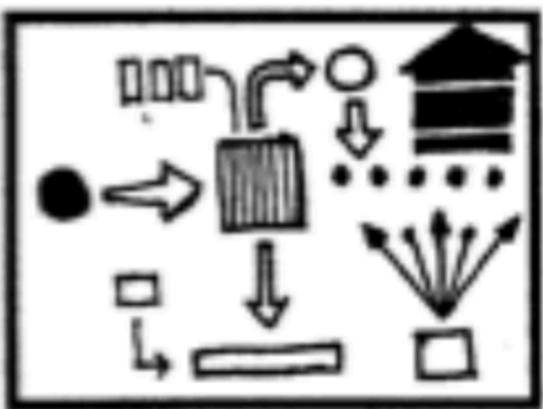
Bonds

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



Note: Ages as of July 1 of each season.

According to allegations in a book about Bonds, he began taking steroids before the 1999 season, his 14th in the league. Two seasons later, he hit 73 home runs, surpassing Aaron's career pace.

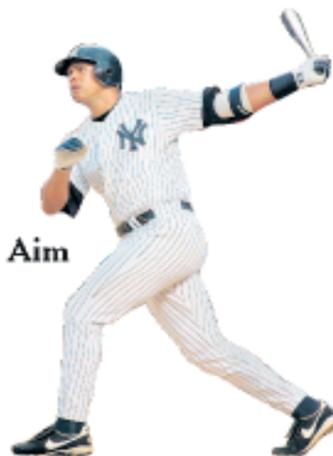


Flow Chart



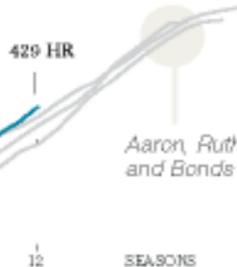
Partitioned Poster

Others Taking Aim



Alex Rodriguez

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

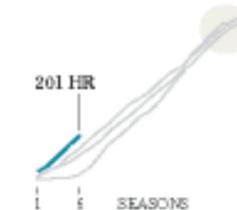


429 HR

Aaron, Ruth and Bonds

Albert Pujols

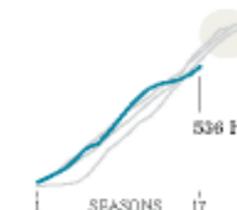
Averaging 40 homers a season, he has started stronger than the three leaders did.



201 HR

Ken Griffey Jr.

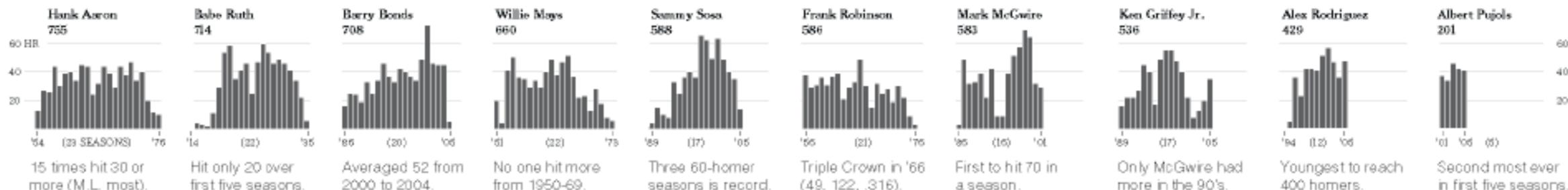
Many thought he would be the first to catch Ruth and Aaron until injuries limited his output.

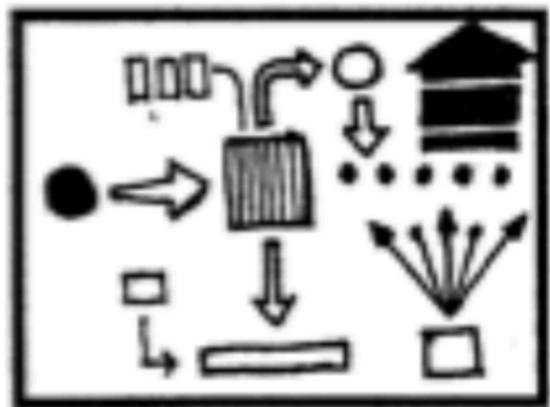


536 HR

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).





Flow Chart



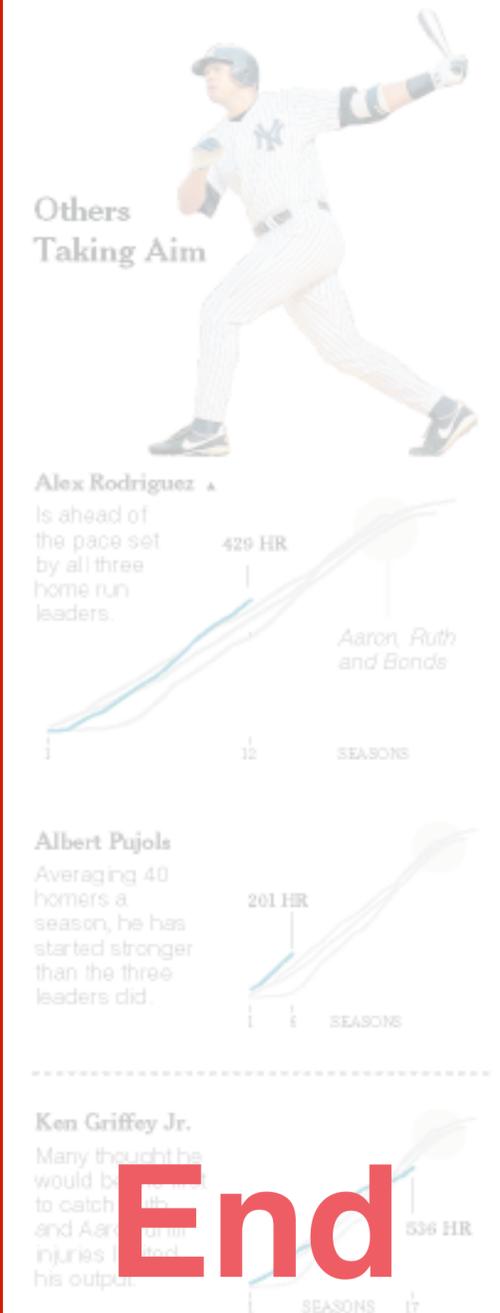
Partitioned Poster

755 Steroids or Not, the Pursuit Is On

Beginning

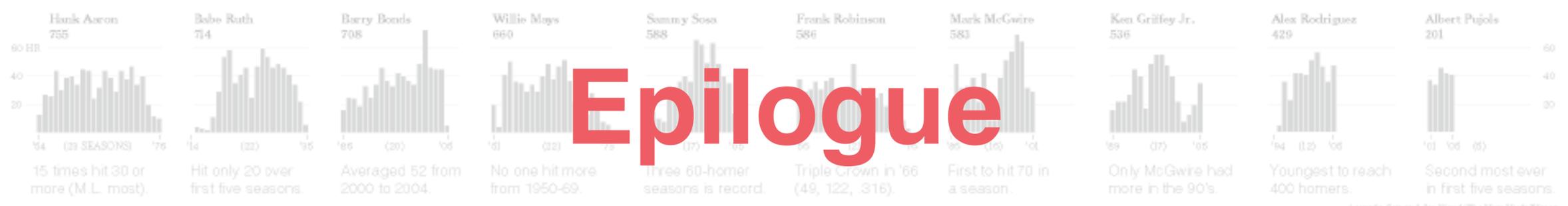


Middle



End

Differing Paths to the Top of the Charts



Epilogue

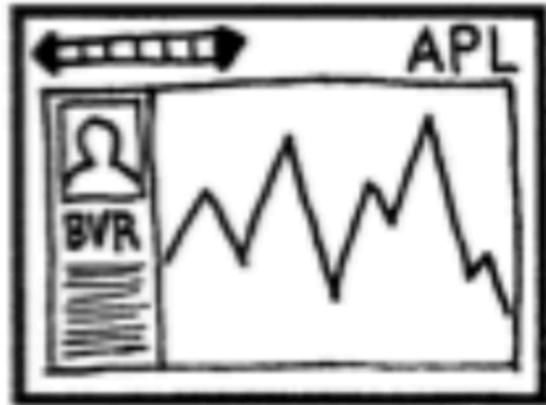
Illustration by Joe Ward/The New York Times

Published: February 2, 2010

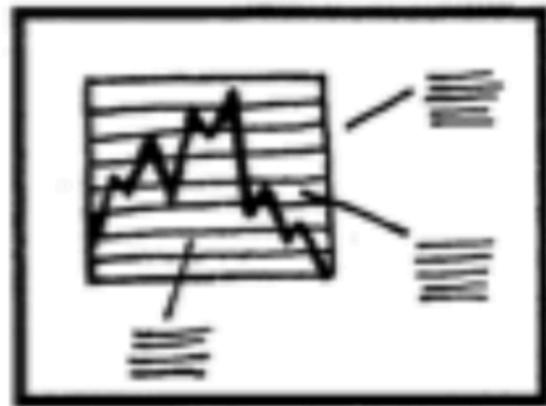
Budget Forecasts, Compared With Reality

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 ▶



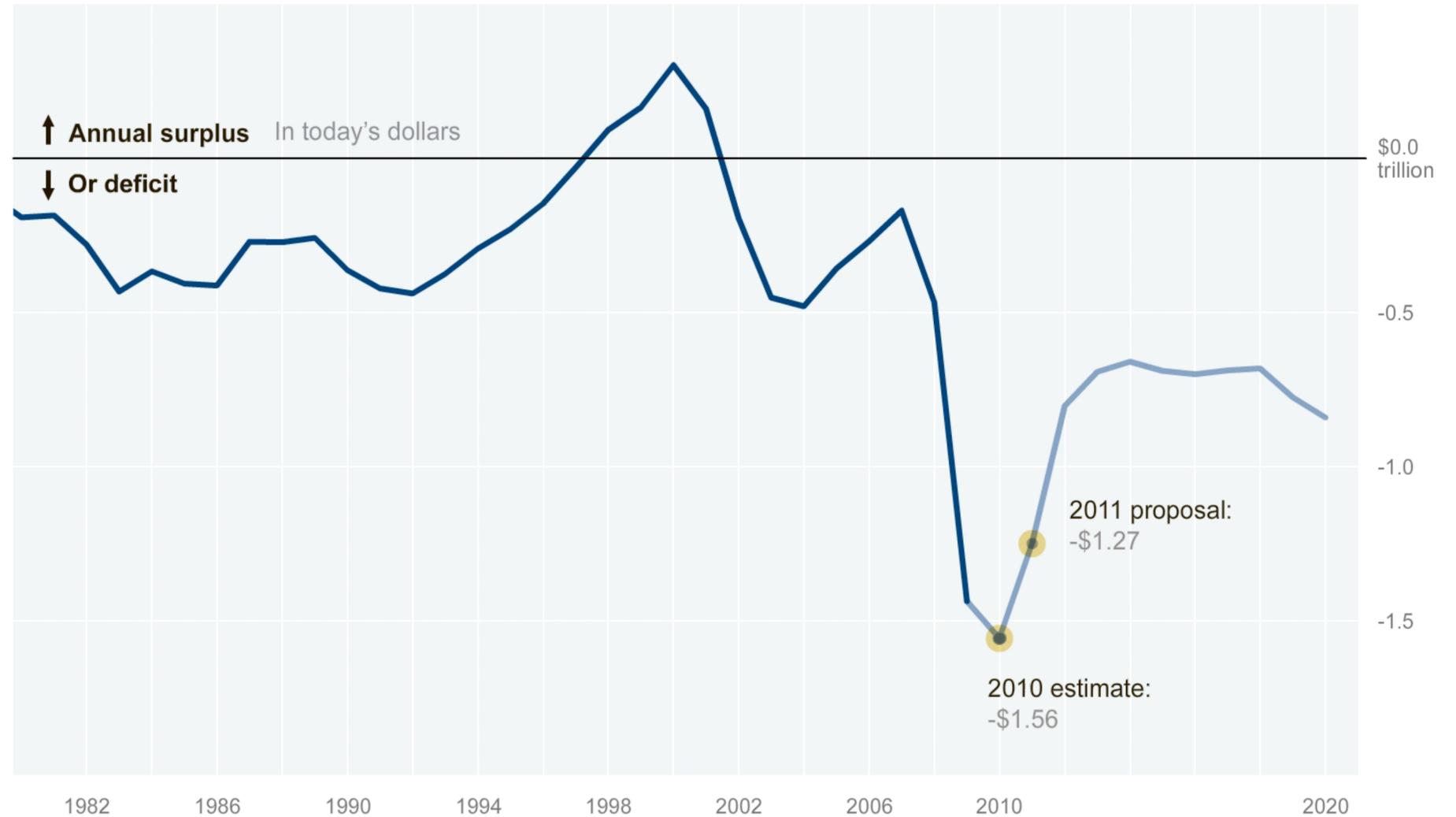
Slide Show



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.

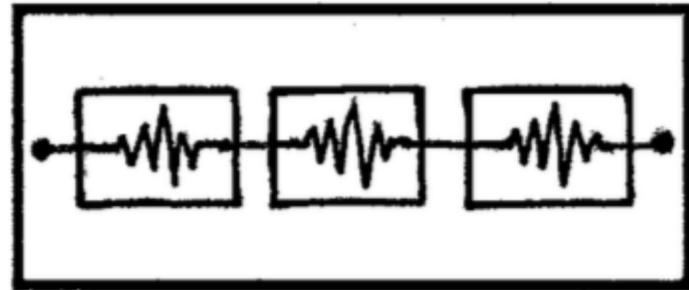


By AMANDA COX | [Send Feedback](#)

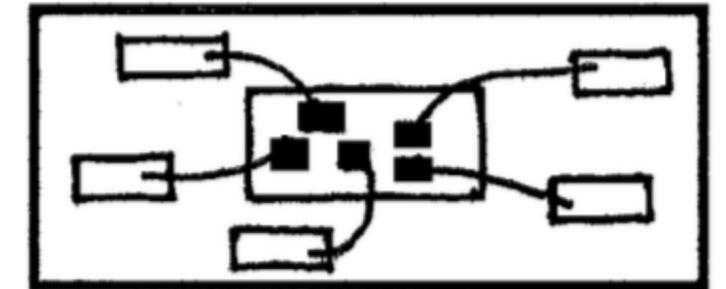
Source: Office of Management and Budget

[TWITTER](#) [LINKEDIN](#) [SHARE](#)

Interactive Slideshow



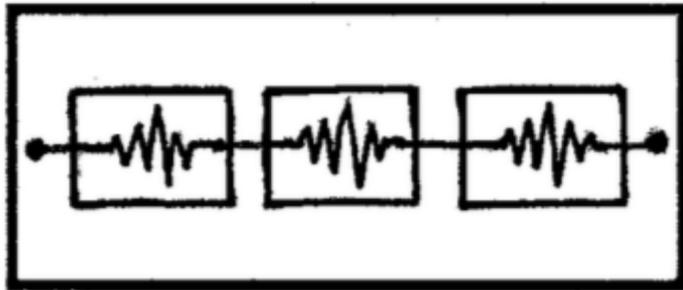
Drill-Down



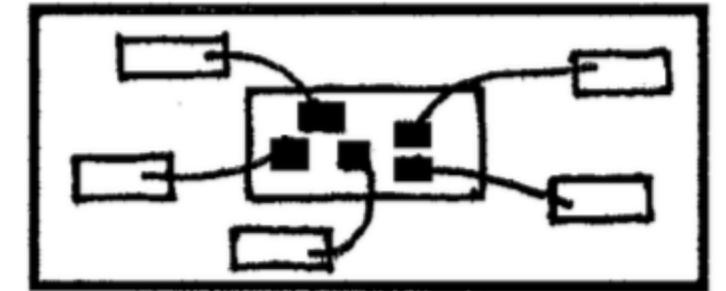
Author-Driven

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.

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

RELATED

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

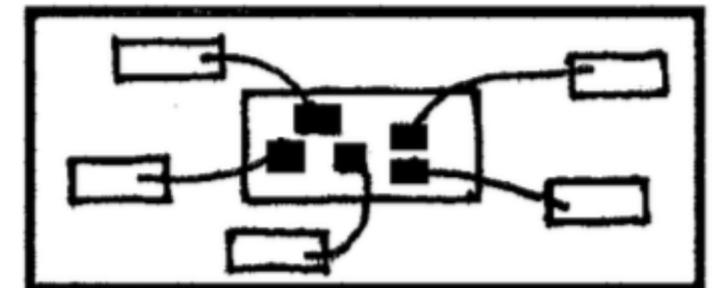
Now Viewing: Overview Up Close: Camp 15



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

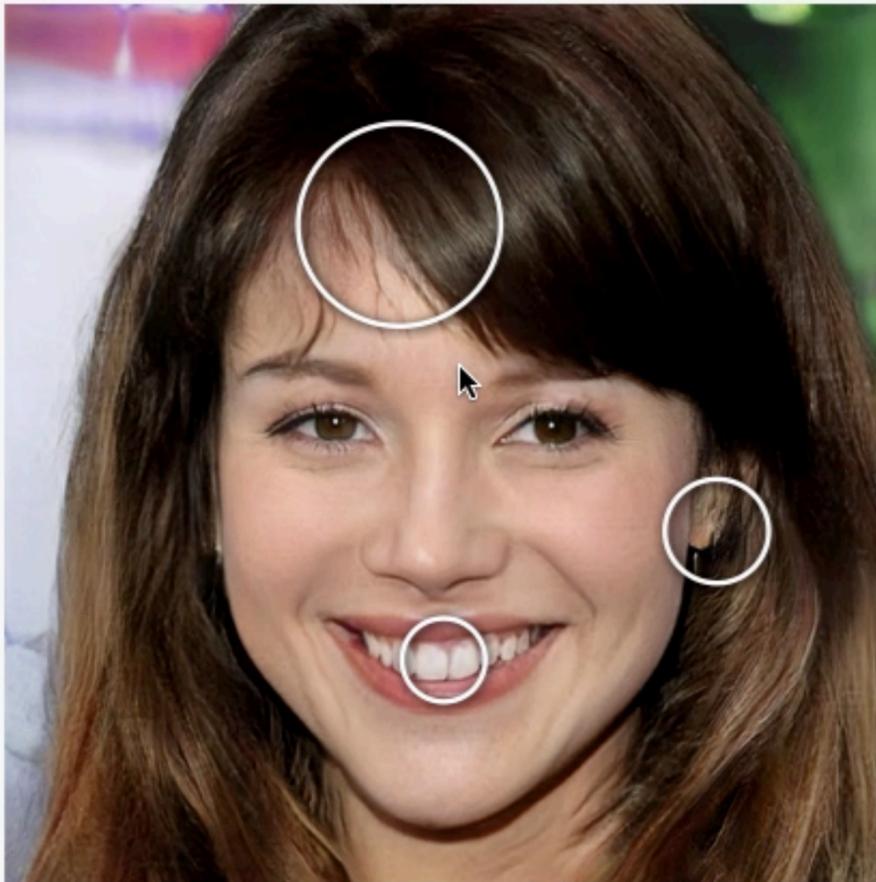
Scale varies in this perspective.
Distances from Pyongyang: 120 miles to Seoul, 427 miles to Vladivostok

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

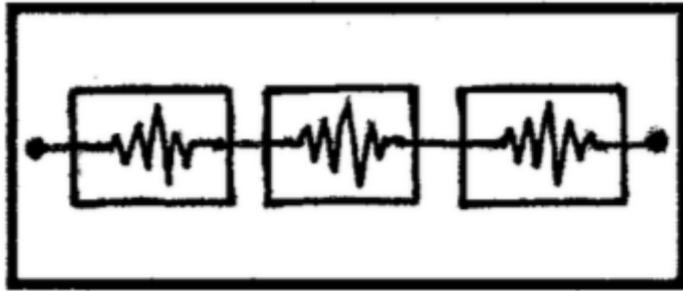
Neural networks can approximate any function that exists. However, we do not have a guaranteed way to obtain such a neural network for every function.

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

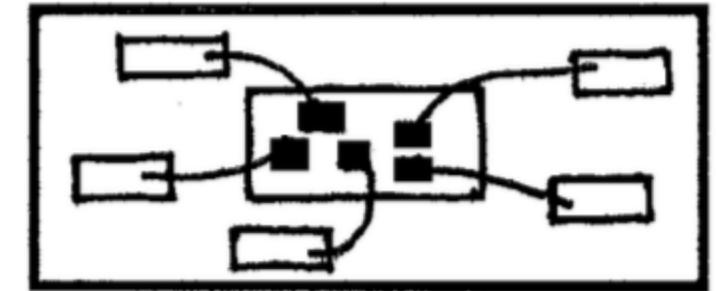
PREVIEWING CONTENT

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



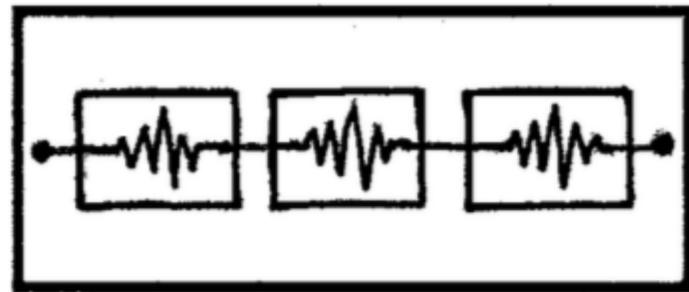
Drill-Down



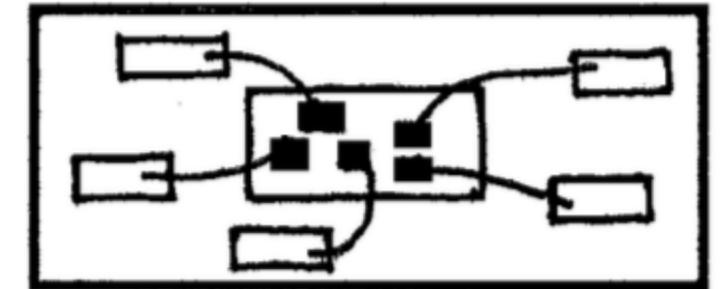
Author-Driven

Reader-Driven

Interactive Slideshow



Drill-Down



Author-Driven

Reader-Driven

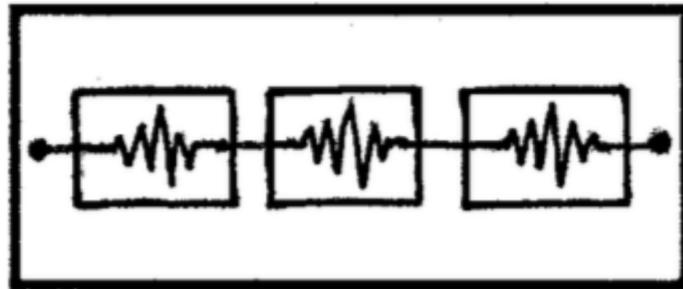
Copenhagen: Emissions, Treaties and Impacts

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.

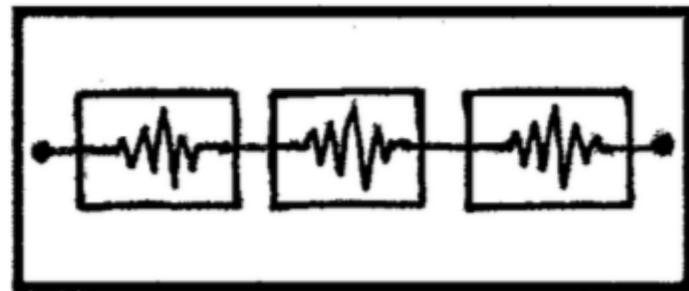
Global Emissions	Lessons From Kyoto	Possible Impact
<p>1 2 3 4 5 6 7 8 9 10 11 NEXT ▶</p> <p>Almost every country in the world signed and ratified the protocol. The treaty's aim was to provide a starting point for reducing global carbon dioxide emissions.</p> <p>Countries that ratified Kyoto</p>  <p>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

Stepper

Interactive Slideshow



Interactive Slideshow



R2
D3

A visual introduction to machine learning

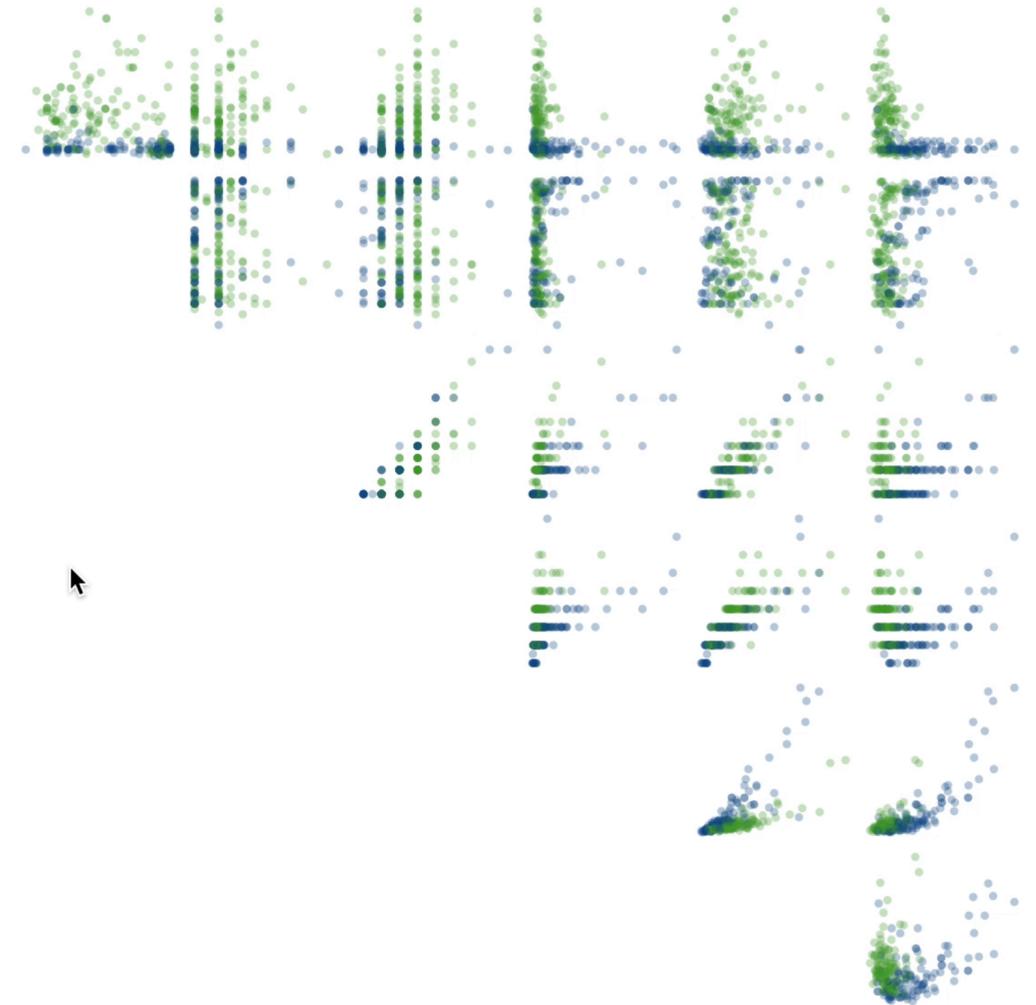
English

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!

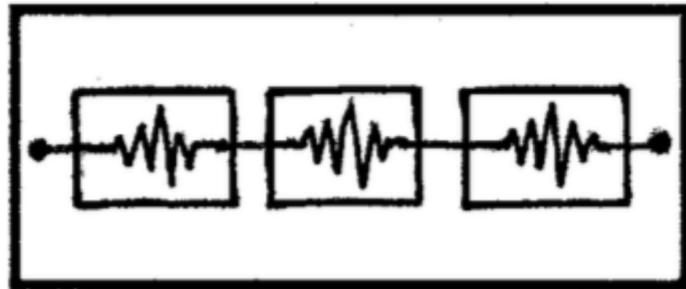
Discrete

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

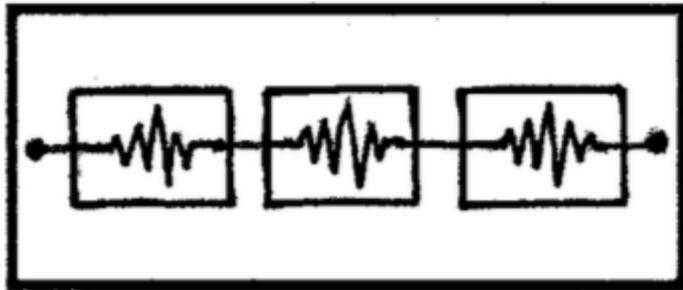
Continuous

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

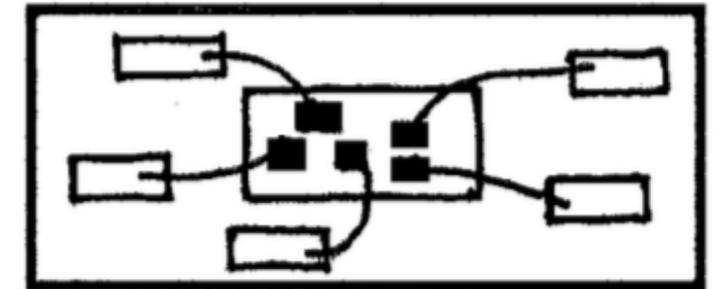
Interactive Slideshow



Interactive Slideshow



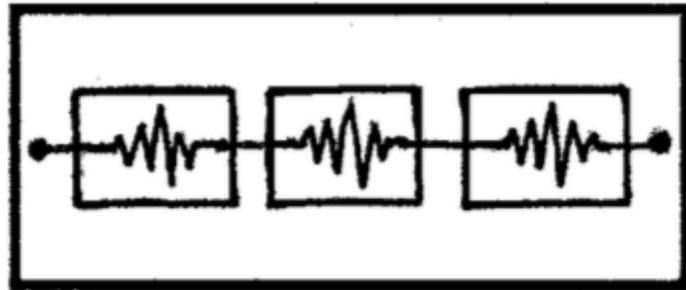
Drill-Down



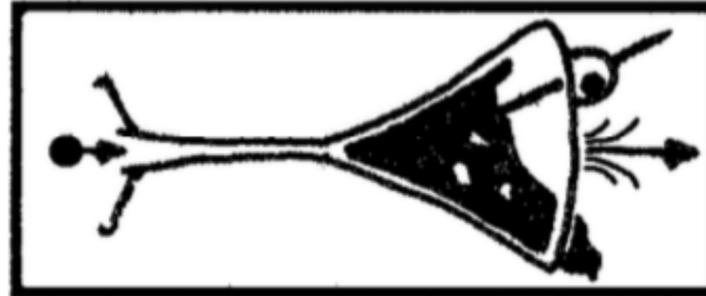
Author-Driven

Reader-Driven

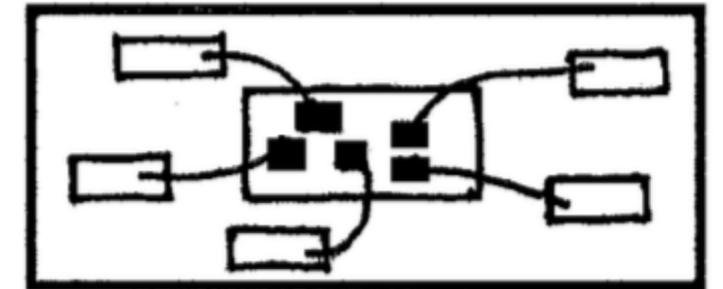
Interactive Slideshow



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?

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

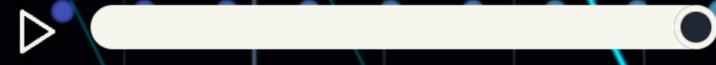

In school, you may recall reluctantly performing drill after drills of matrix-vector multiplications mechanically. You may even have been taught to memorize several inane formulas.

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

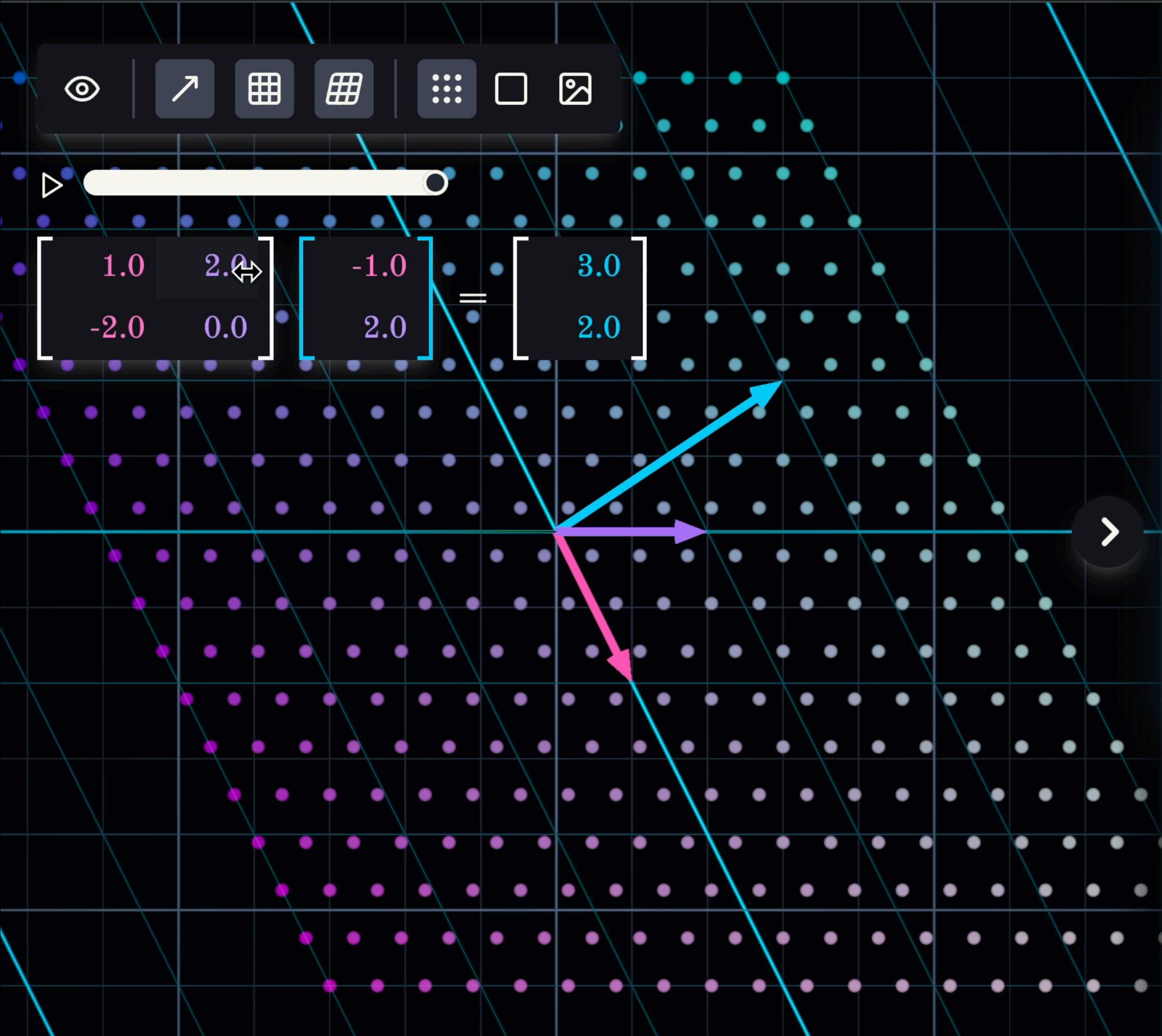
RECAP

- 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!



$$\begin{bmatrix} 1.0 & 2.0 \\ -2.0 & 0.0 \end{bmatrix} \begin{bmatrix} -1.0 \\ 2.0 \end{bmatrix} = \begin{bmatrix} 3.0 \\ 2.0 \end{bmatrix}$$



Final Project:

Explorable Explanation

Final Project (coming out next week)

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

Must use one of the health datasets for the class. Imagine one of the examples shown during today's lecture, but for health.

Teams of 3-4 only.