

Narrative Visualization

DSC 106: Data Visualization

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UC San Diego

Announcements

Lab 7 due today.

Final Project Team formation form due **TODAY at 1pm!!**

Final Project Proposals due next Tuesday.

FAQs:

1. **What if I don't fill out the team formation form?** We will put you in a random group. We will NOT put you back in your Project 3 team, and we will NOT allow you to switch after the fact.
2. **What if I filled out the form before 11:30pm last night?** Please submit again! We weren't collecting emails for teammates (only the submitter).

Interactive Articles

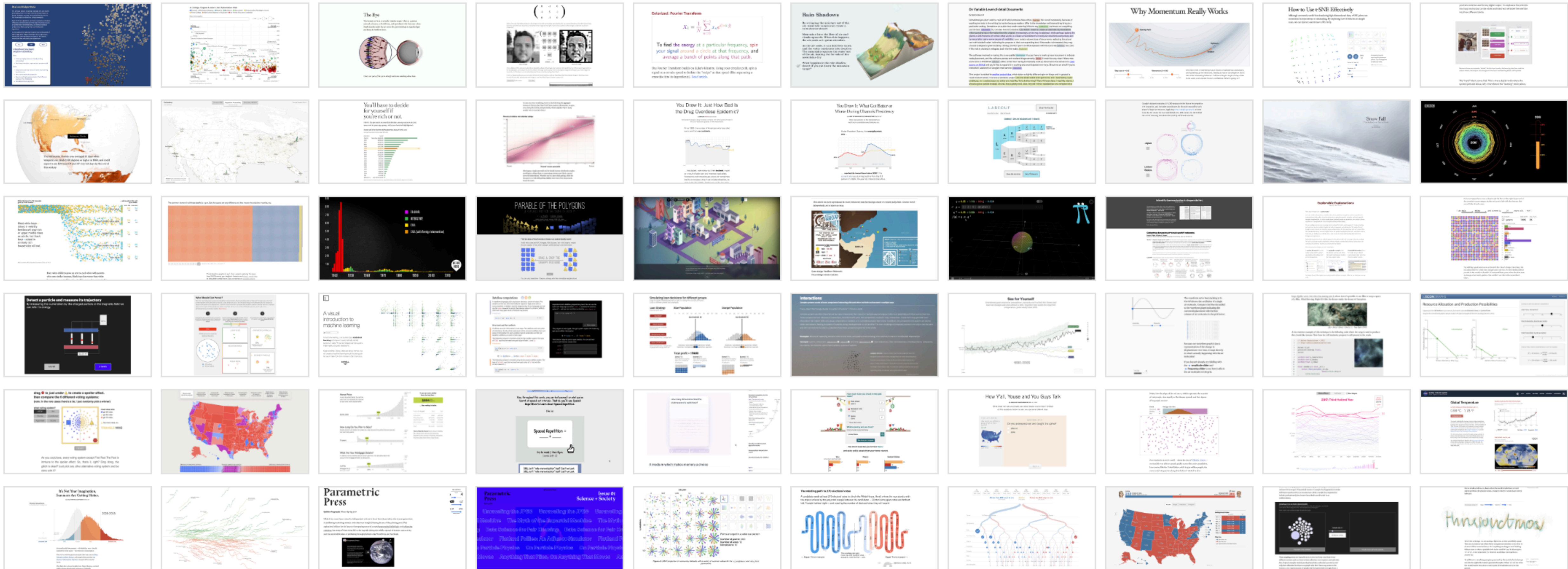


FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

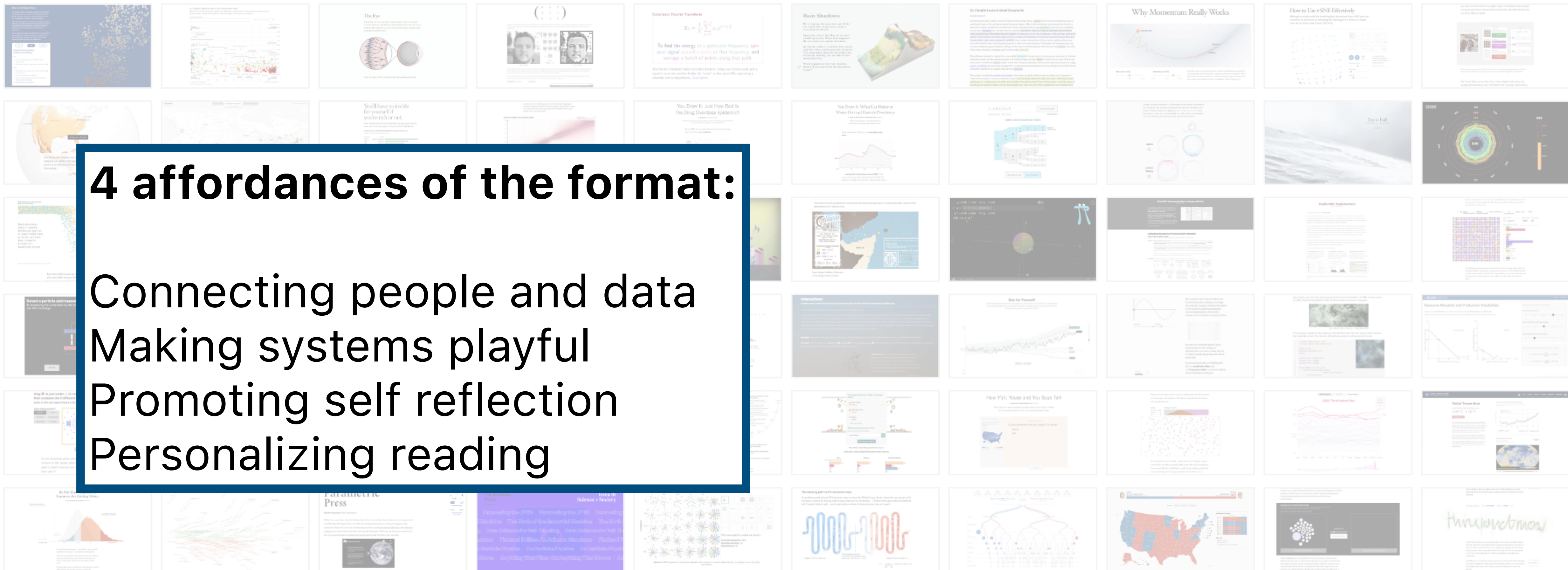


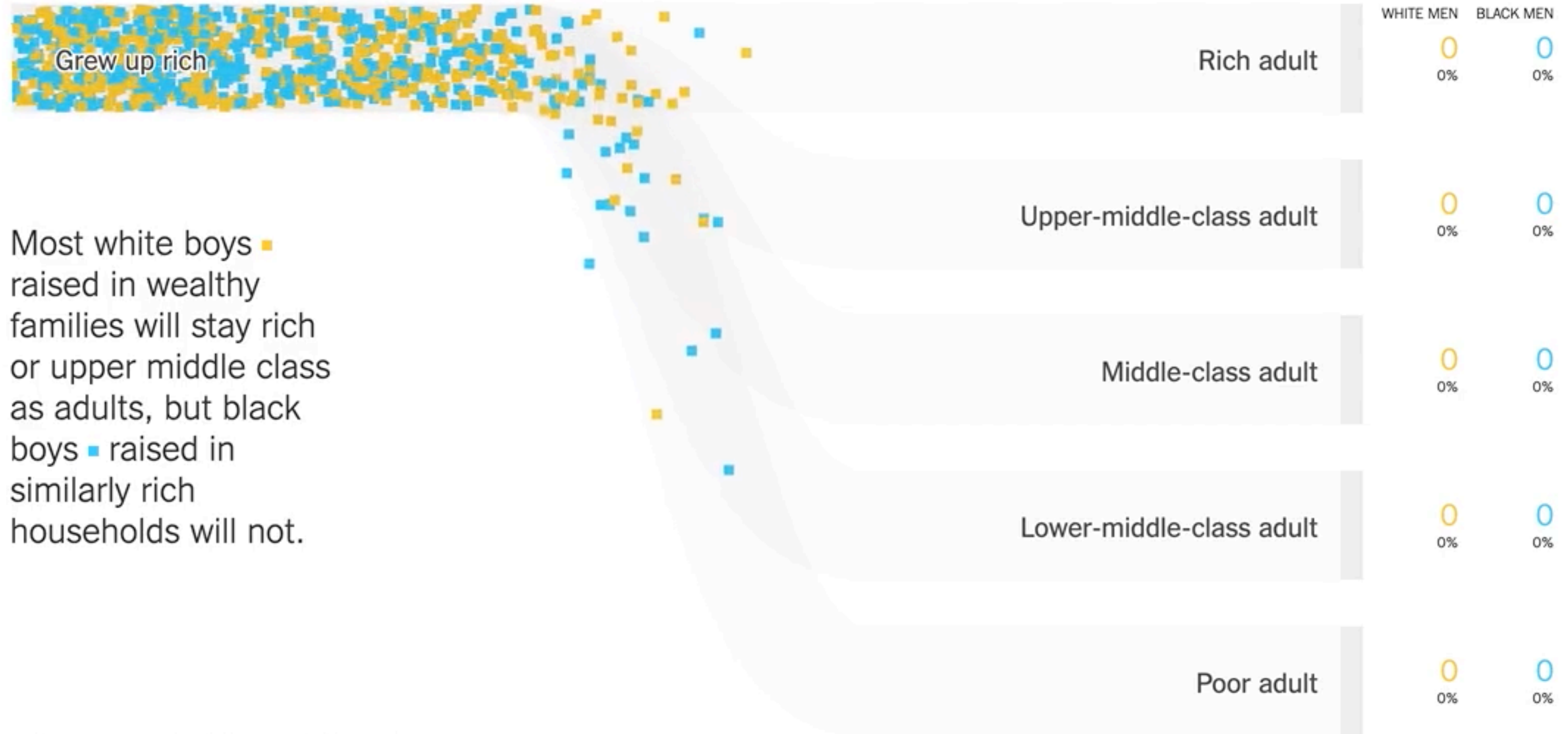
FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.



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 »

<https://bit.ly/guns-538>

Respond: I like, I wish, What if?

tryclassbuzz.com
Code: **guns**



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 'Reg' dropdown. Below this is the 'DATA' section with dataset selection icons, a 50% training to test data ratio slider, Noise (0) slider, and Batch size (10) slider, along with a 'REGENERATE' button. The 'FEATURES' section lists input properties: X_1 , X_2 , X_1^2 , X_2^2 , $X_1 X_2$, $\sin(X_1)$, and $\sin(X_2)$. The neural network structure is shown with 2 hidden layers: the first has 4 neurons and the second has 2 neurons. Weights are visualized as lines of varying thickness between neurons. The 'OUTPUT' section shows a scatter plot with a decision boundary, displaying Test loss (0.525) and Training loss (0.517). A legend indicates that colors represent data, neuron, and weight values, with a color scale from -1 (blue) to 1 (orange). Checkboxes for 'Show test data' and 'Discretize output' are at the bottom right.

SPIN

Democrats: ??

Republicans: ??

Likely Democratic

Competitive

Likely Republican

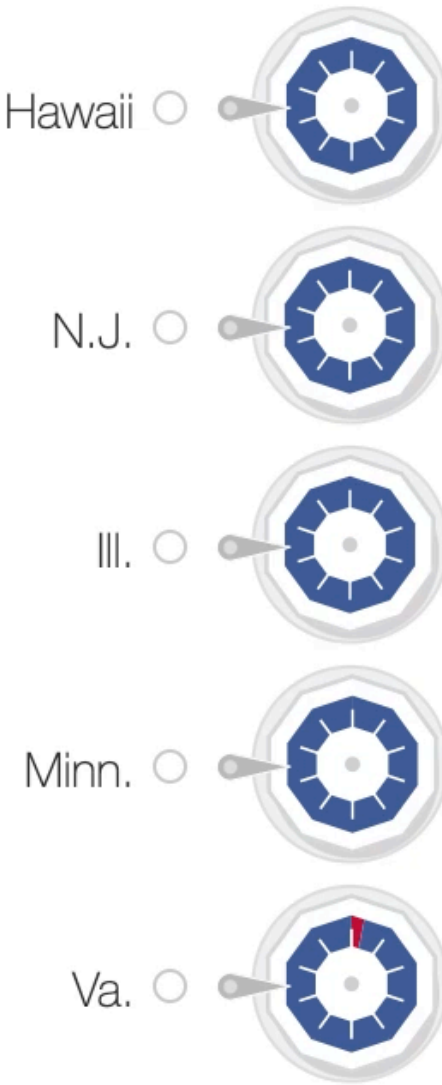
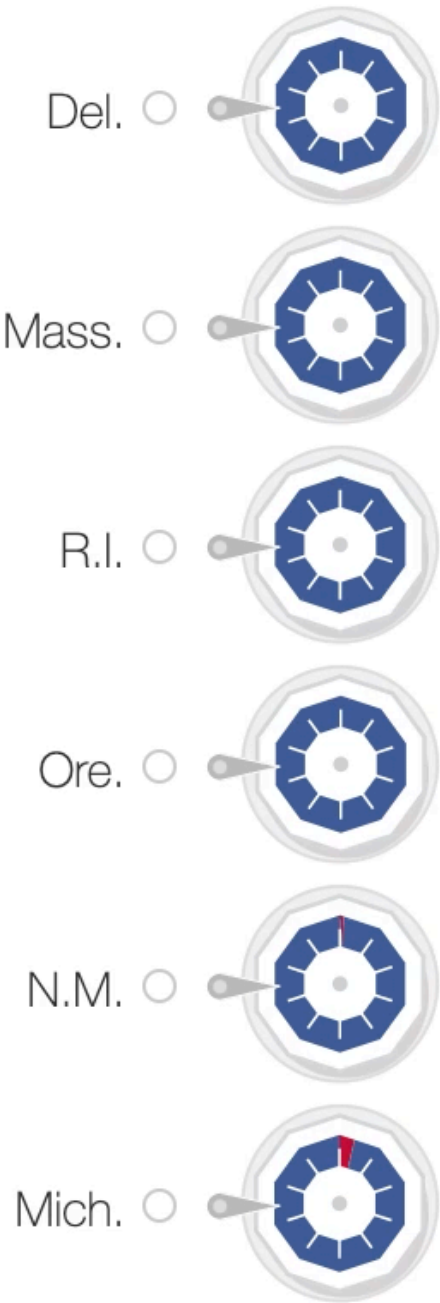
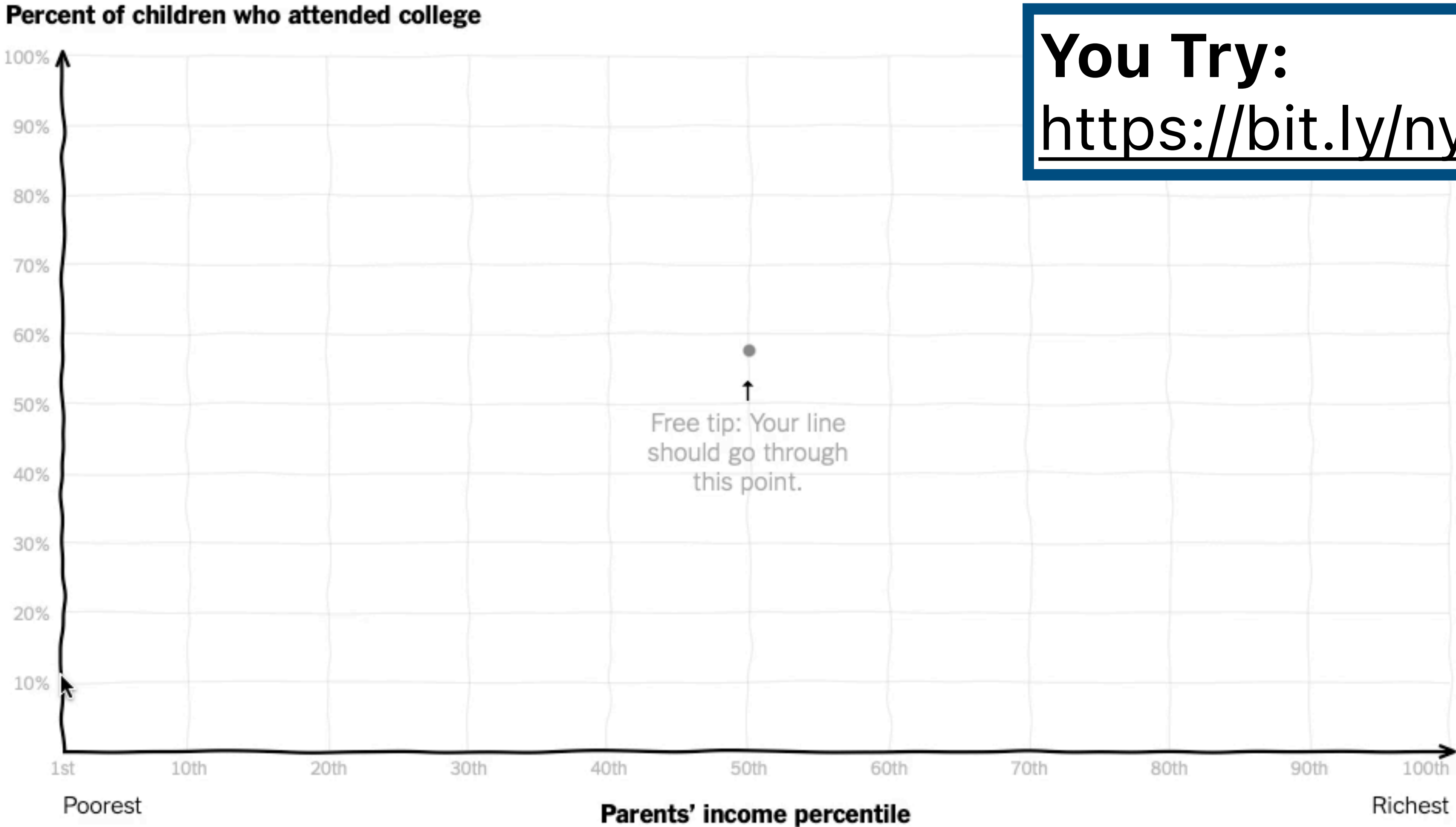




FIGURE 1: Exemplary Interactive Articles From Around The Web. Select an article for more information.

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>



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

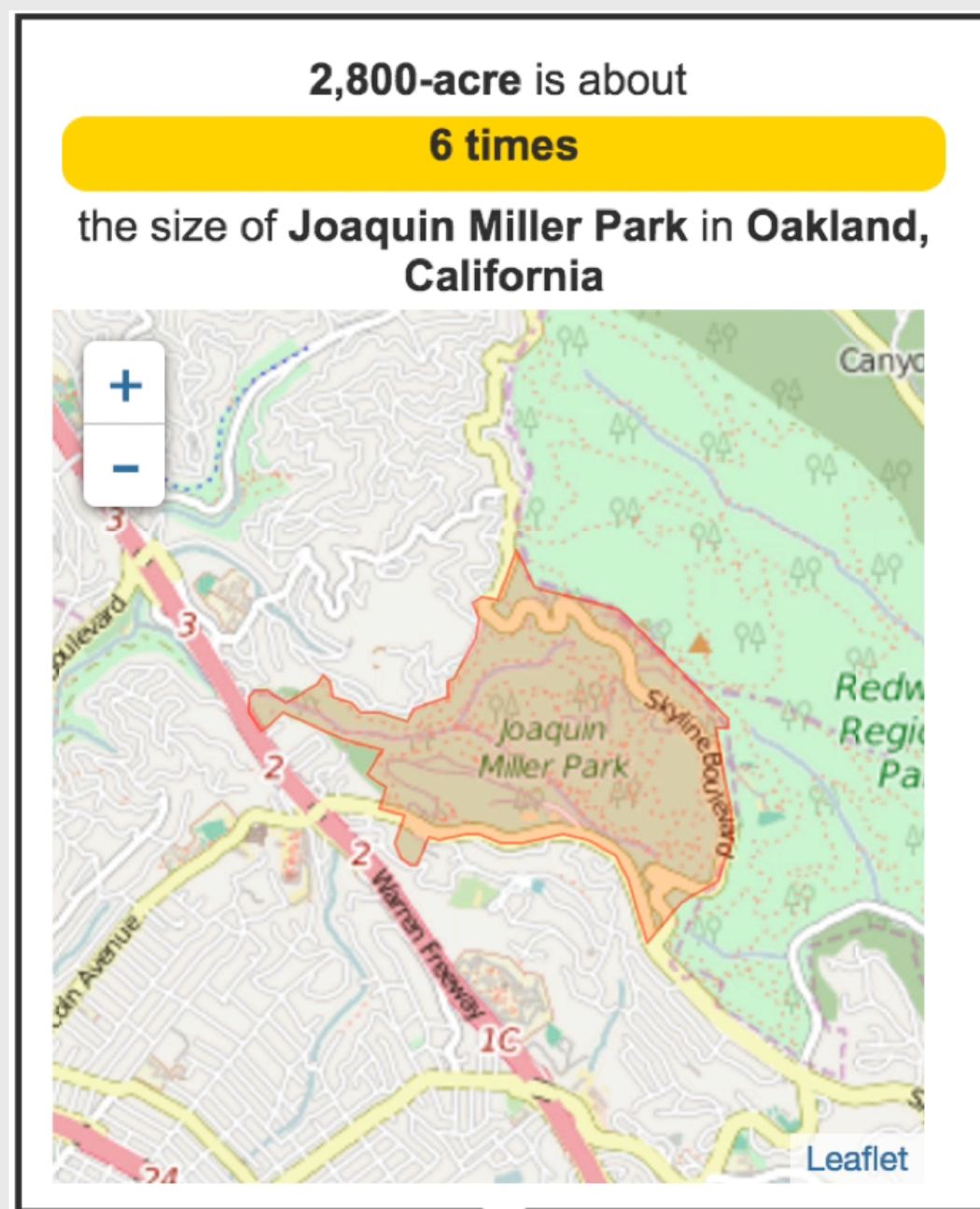
Originally published in 2018

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



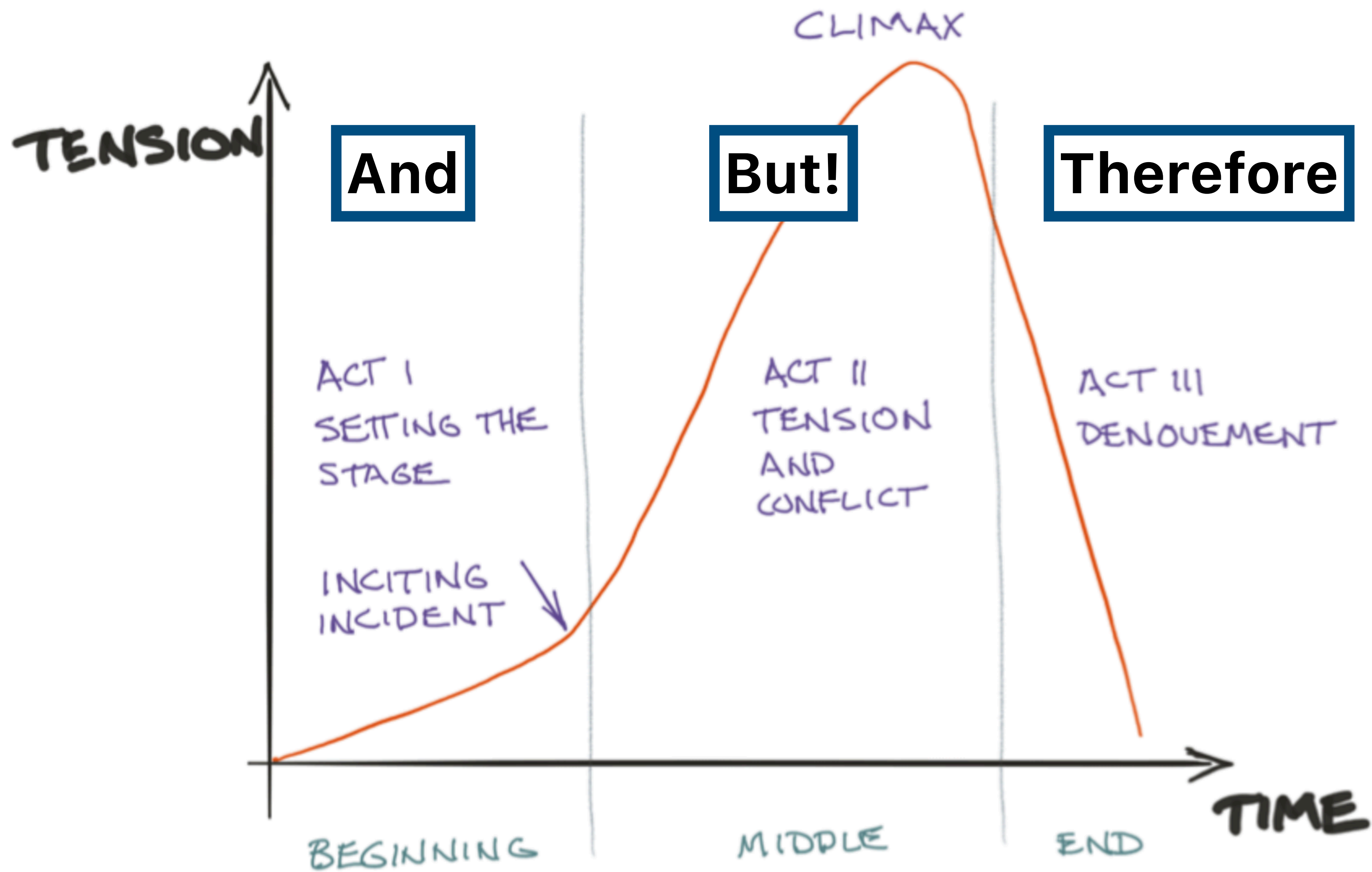
On-demand personalized maps for unfamiliar distances, areas, and locations.

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

Narrative Visualization

Aka: Telling a story using data

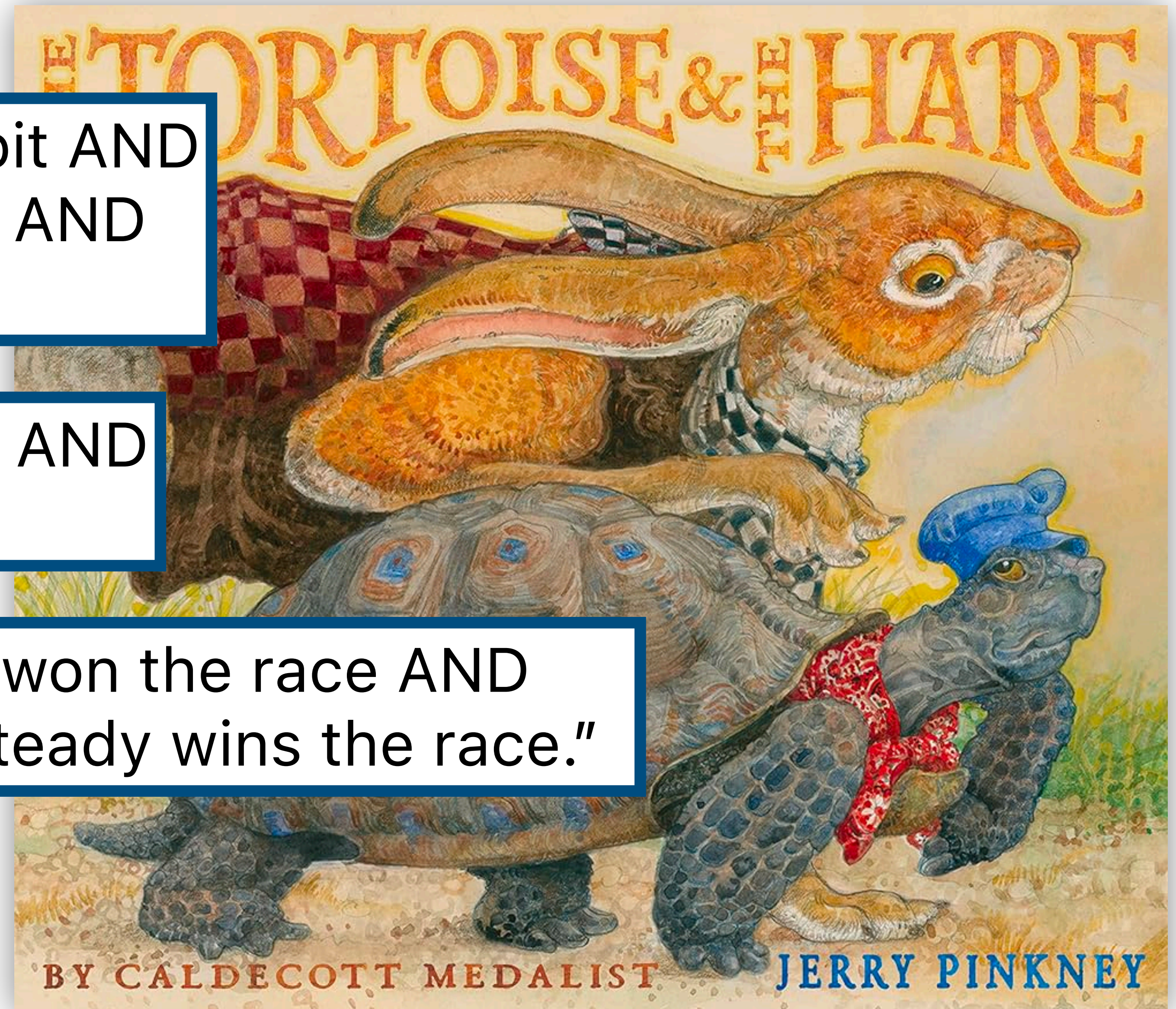
You'll make one for your final project!



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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11

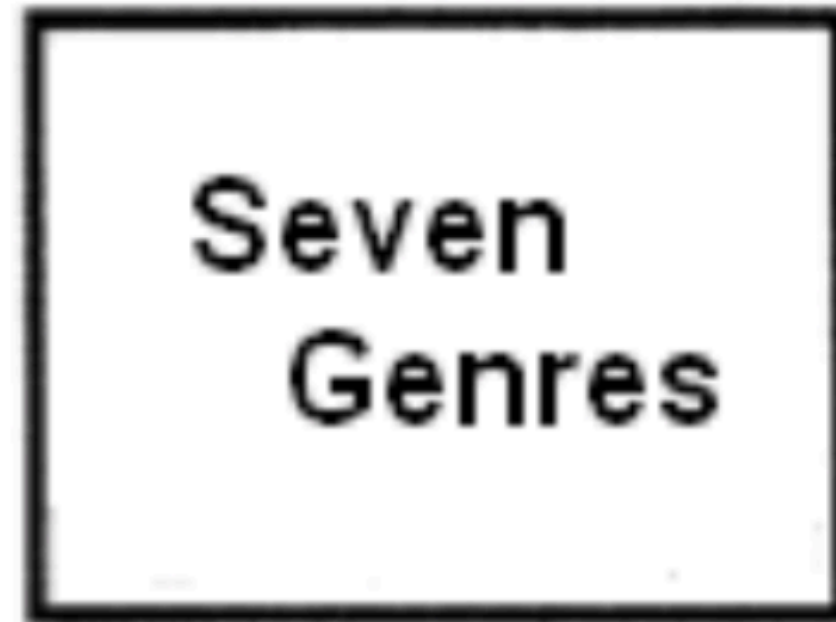
12

Explore the

<https://bit.ly/guns-538>

tryclassbuzz.com
Code: **gun2**

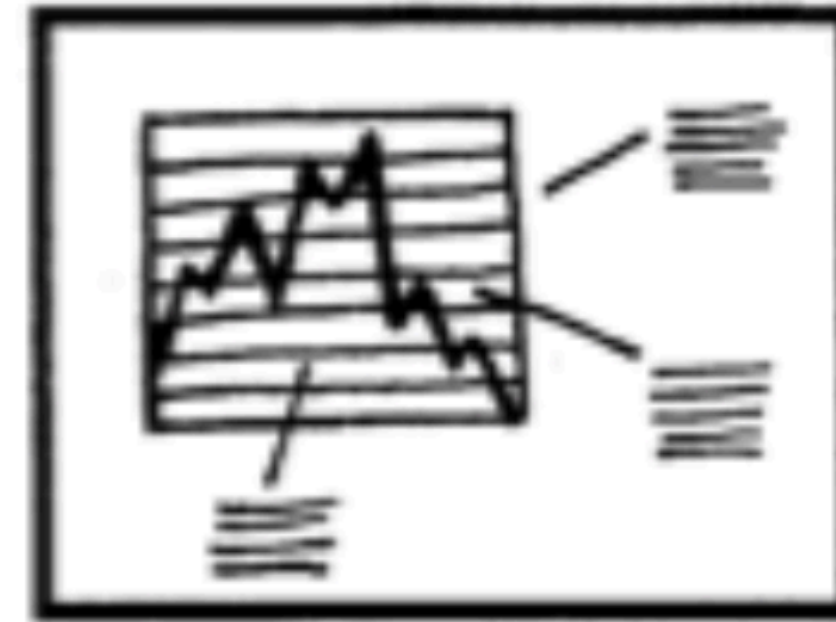
Narrative Visualization Genres



Seven
Genres



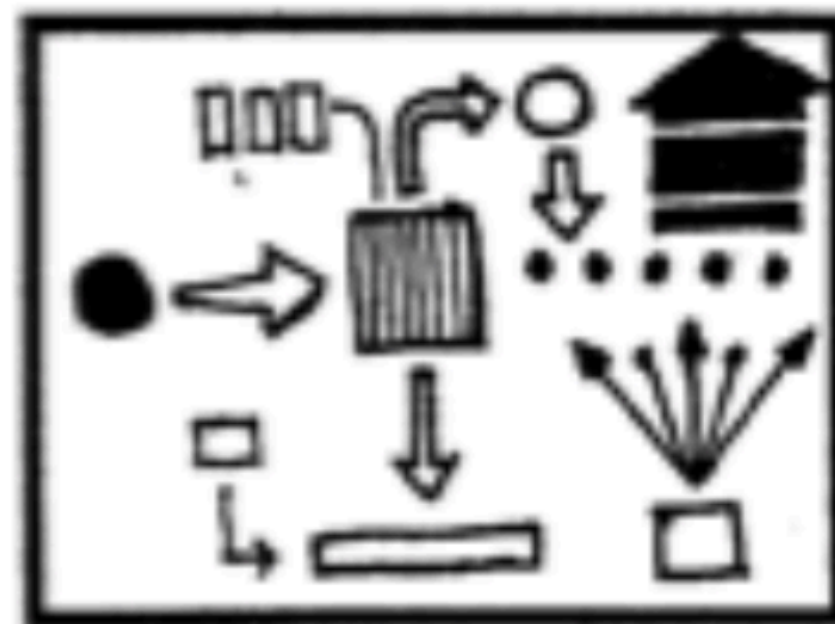
Magazine Style



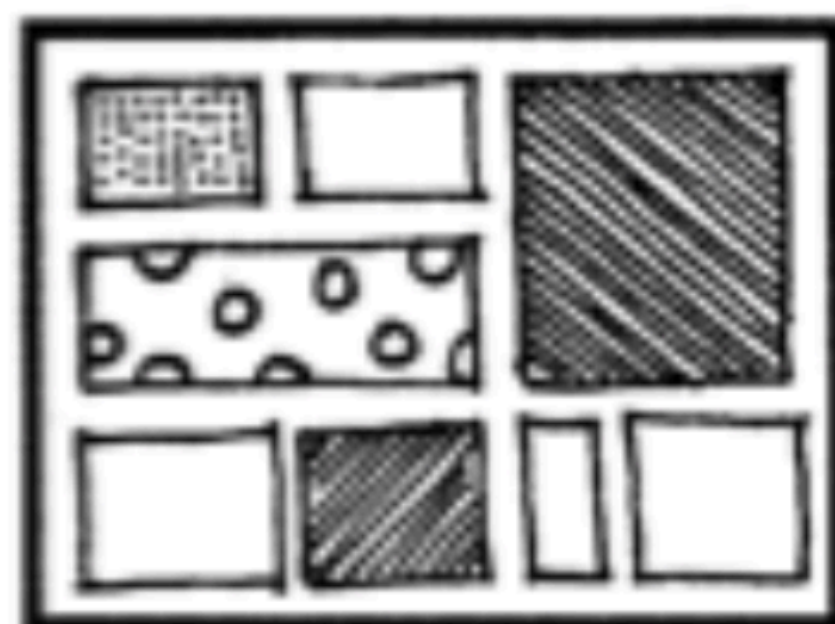
Annotated Chart



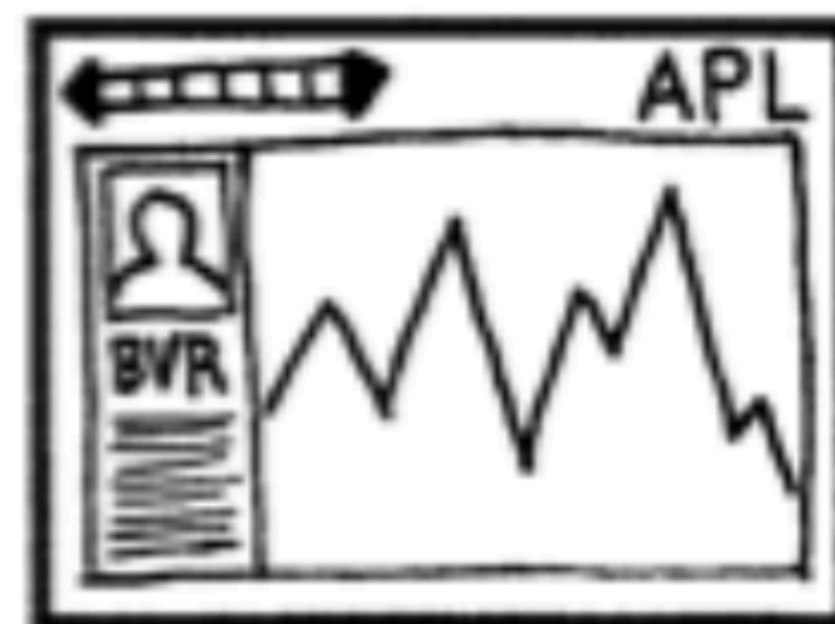
Partitioned Poster



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	45	50	48	50	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

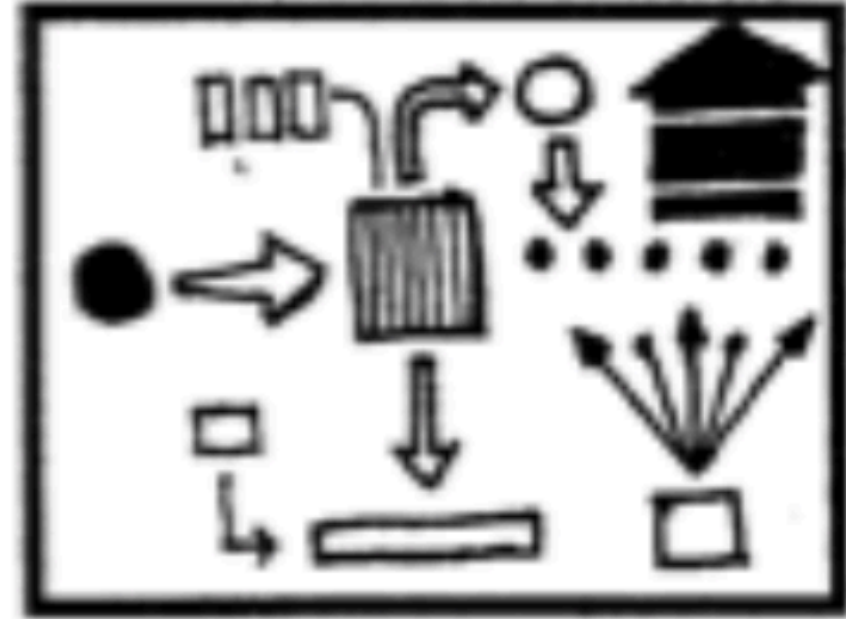
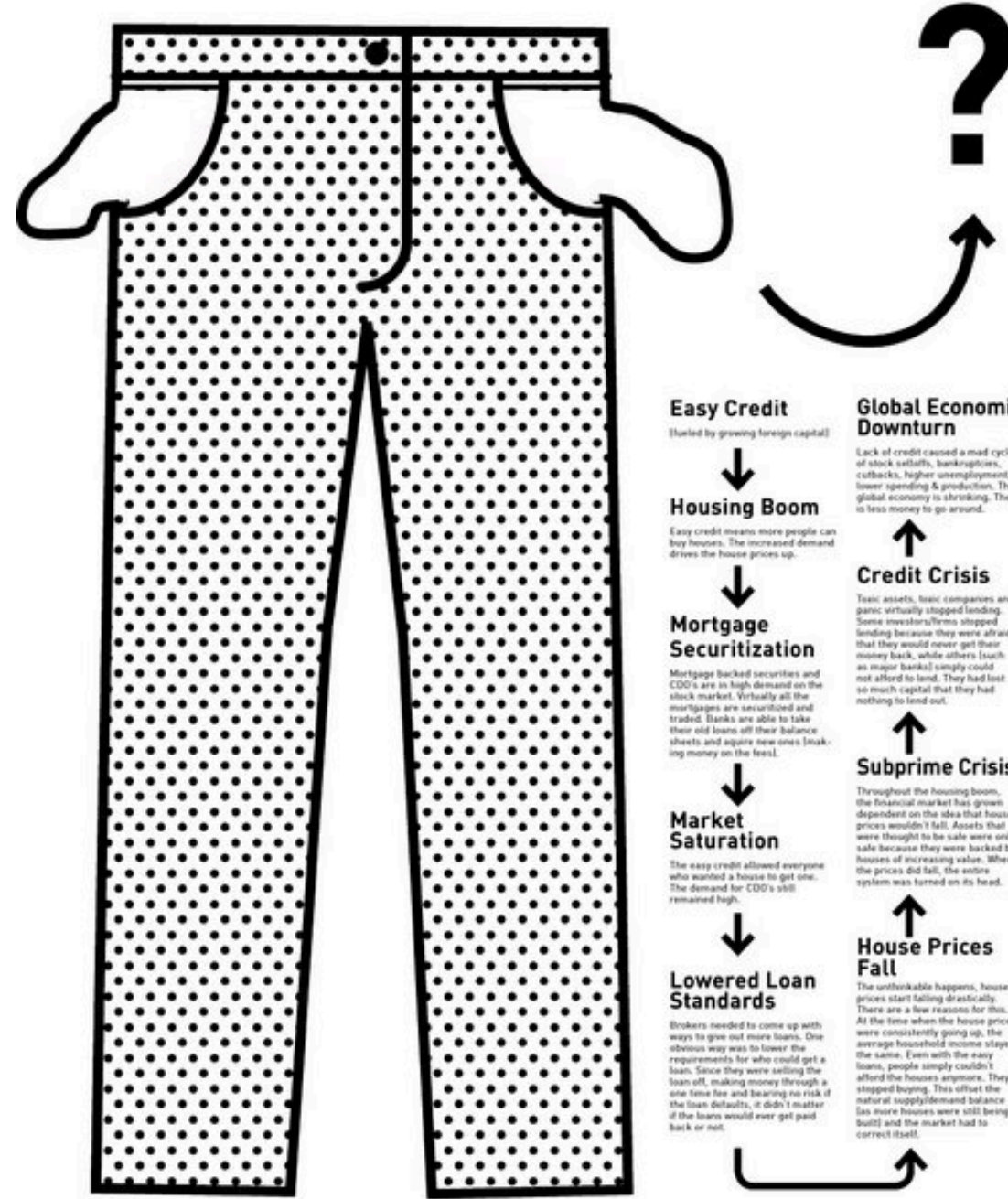
The Economist

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.

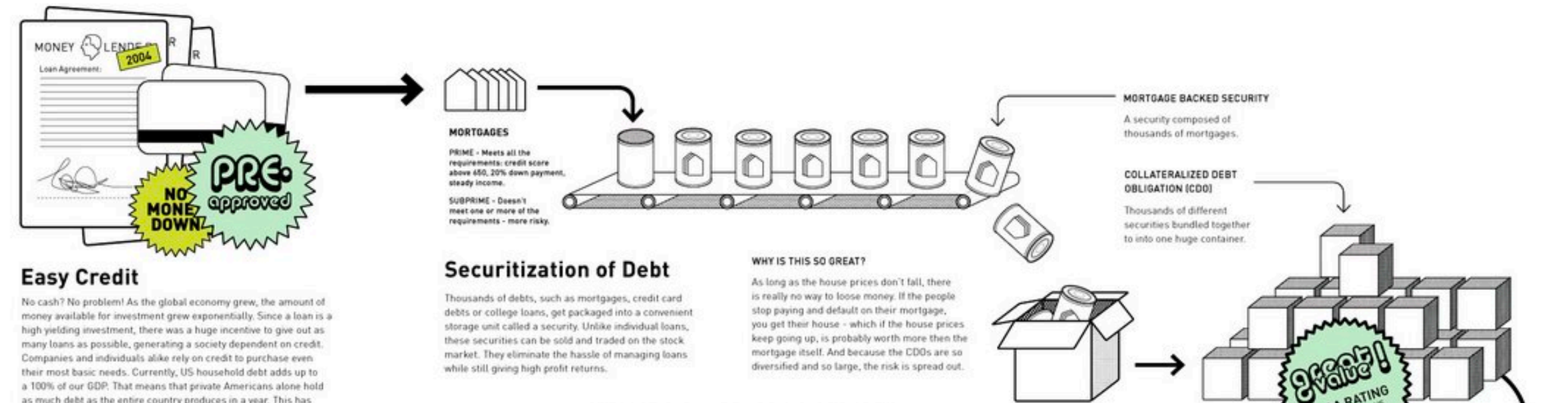
Display a menu In the 2000s some economists speculated that the growing weight of

4

WHERE DID ALL THE MONEY GO?



Flow Chart

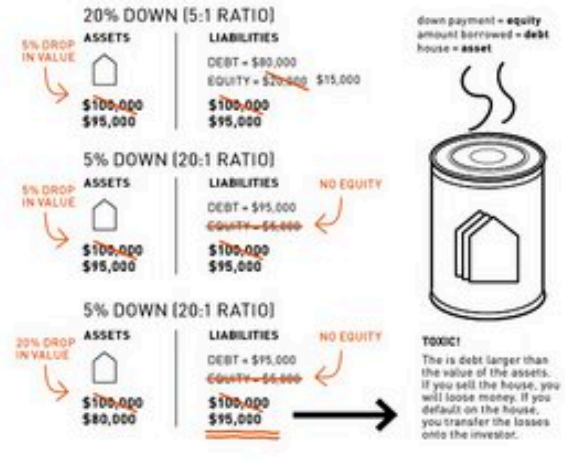


Easy Credit

No cash? No problem! As the global economy grew, the amount of money available for investment grew exponentially. Since a loan is a high yielding investment, there was a huge incentive to give out as many loans as possible, generating a society dependent on credit. Companies and individuals alike rely on credit to purchase even their most basic needs. Currently, US household debt adds up to a 100% of our GDP. That means that private Americans alone hold as much debt as the entire country produces in a year. This has happened only once before - in 1929.

Debt Turns Toxic

When you take out a loan on a house, you are employing one of the most basic tools of finance - leverage. You are taking on debt to supplement your savings (your equity) in order to buy an asset - the house. The higher the leverage (lower down payment), the riskier the investment. Watch what happens when the house prices fall.

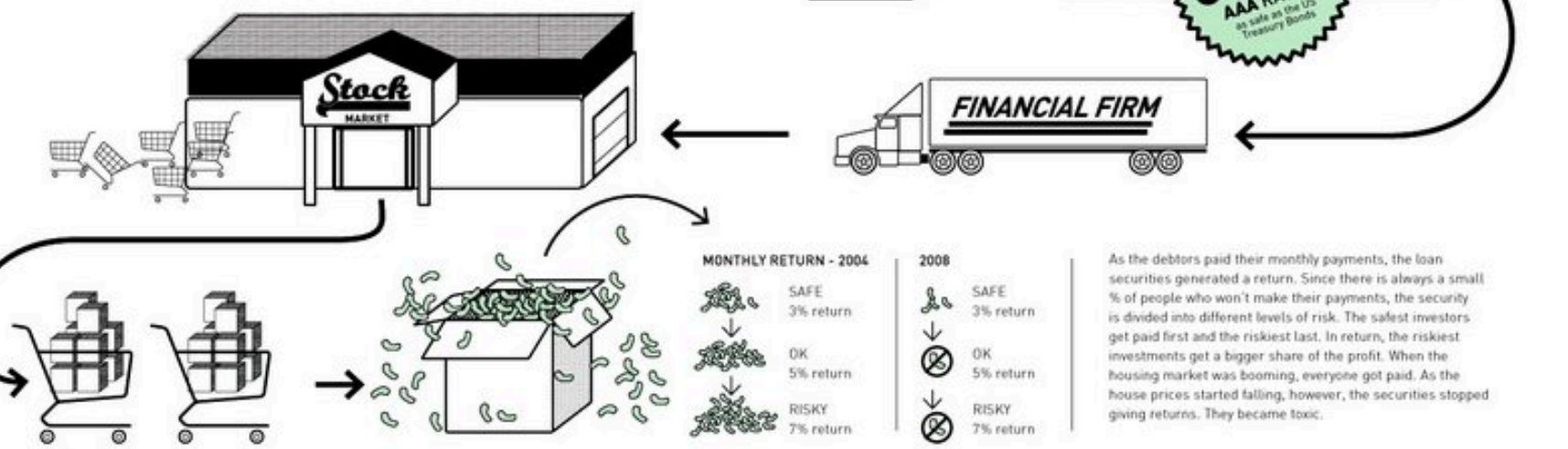


Securitization of Debt

Thousands of debts, such as mortgages, credit card debts or college loans, get packaged into a convenient storage unit called a security. Unlike individual loans, these securities can be sold and traded on the stock market. They eliminate the hassle of managing loans while still giving high profit returns.

WHY IS THIS SO GREAT?

As long as the house prices don't fall, there is really no way to lose money. If the people stop paying and default on their mortgage, you get their house - which if the house prices keep going up, is probably worth more than the mortgage itself. And because the CDOs are so diversified and so large, the risk is spread out.



Investors

The global economy has been growing fast. It has been acquiring enormous amounts of capital. This money had to be invested somewhere. The CDOs were particularly appealing because they were perceived as safe and they yielded a high interest rate at a time when the U.S. Bonds were at a record low.

Demand Lowers Standards

As the demand for Mortgage Securities grew, the supply dried up. Everyone who qualified for a loan and wanted one, already had one. In order to generate more loans to satisfy the growing demand for securities, the standards for getting a loan were lowered. Not only did this create "toxic" loans (packaged into toxic securities), but it also triggered the burst of the housing bubble. As the house prices peaked, the average income stayed flat. People couldn't afford to buy the overpriced houses. The housing market stopped, the prices fell & everyone found themselves owing a lot more than they owned.



Credit Crisis

The toxic assets made their way through the financial system quickly. After several investment firms "broke the bank" - losing the investors' money, and several major companies nearly collapsed, full blown panic set in. No one knew who was going to go under next. Because the assets they were holding were so complex, unregulated, and interconnected no one even knew to what extent their own assets were exposed. Lending stopped.



Easy Credit

Started by growing foreign capital.

Housing Boom

Easy credit means more people can buy houses. The increased demand drives the house prices up.

Mortgage Securitization

Mortgage backed securities and CDOs are in high demand on the stock market. Virtually all the mortgages are securitized and traded. Banks are able to take their old loans off their balance sheets and acquire new ones making money on the loan.

Market Saturation

The easy credit allowed everyone who wanted a house to get one. The demand for CDO's still remained high.

Lowered Loan Standards

Borrowers needed to come up with ways to give out more loans. One obvious way was to lower the requirements for who could get a loan. Since they were selling the loan off, making money through a one time fee and bearing no risk of the loan default, it didn't matter if the loans would ever get paid back or not.

Global Economic Downturn

Lack of credit caused a mad cycle of stock selloffs, bankruptcies, cutbacks, higher unemployment, lower spending & production. The global economy is shrinking. There is less money to go around.

Credit Crisis

Toxic assets, toxic companies and panic virtually stopped lending. Some investors/banks stopped lending because they were afraid that they would never get their money back, while others found no one to lend to. They had lost so much capital that they had nothing to lend out.

Subprime Crisis

Throughout the housing boom, the financial market had grown dependent on the idea that house prices would fall. Assets that were thought to be safe were only safe because they were backed by hours of increasing value. When the prices did fall, the entire system was forced on its head.

House Prices Fall

The unthinkable happens, house prices start falling drastically. There are a few reasons for this. At the time when the house prices were consistently going up, the average household income stayed the same. Even with the easy loans, people simply couldn't afford the houses anymore. They stopped buying. This meant that the natural supply/demand balance (as more houses were sold being built) and the market had to correct itself.

Crisis Spreads

The short term lending that most companies rely on for day to day business practically stopped. This had enormous implications to the economy. It meant that most businesses were short on cash. The capital they usually borrow to pay for daily operations and payroll was simply not there. They had no choice but to cut costs. Jobs were cut, projects cancelled and company spending frozen. The lack of credit also uncovered deep financial problems that companies and individuals were able to hide by taking on more debt. Just like people borrowed more money in order to make their mortgage payments, companies borrowed to cover their losses.

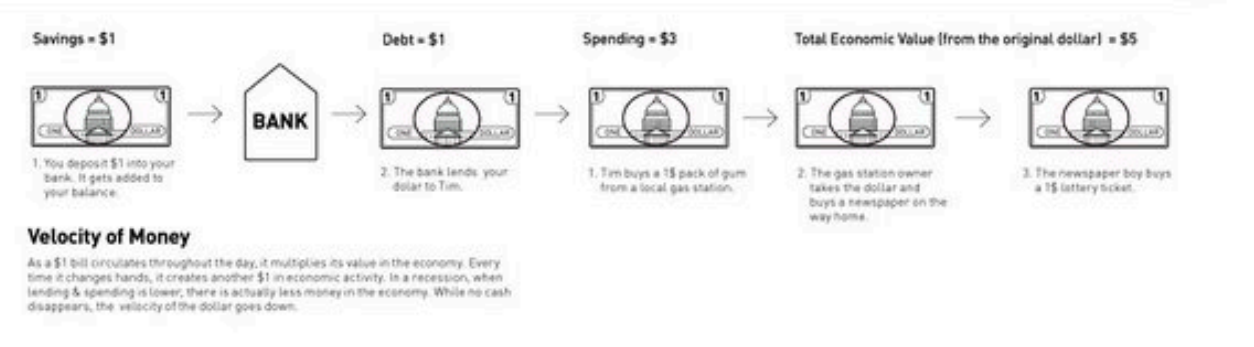
What is money?

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

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.

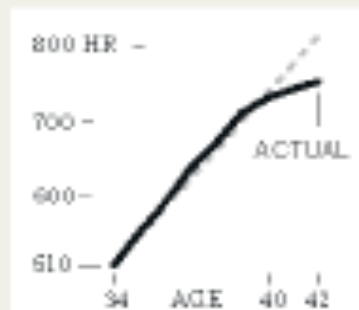
Homer Pace After Age 34

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

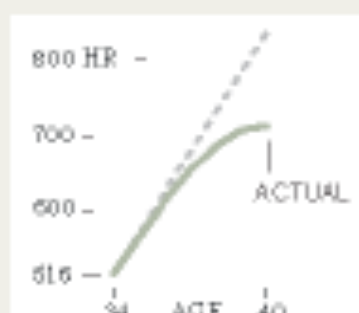
Aaron

Actual homers slightly outpace projected homers for five seasons.



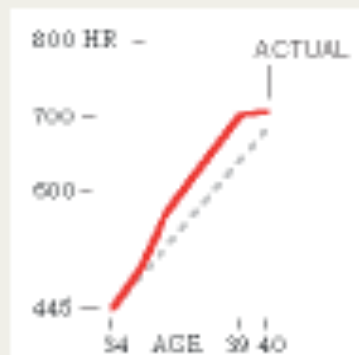
Ruth

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



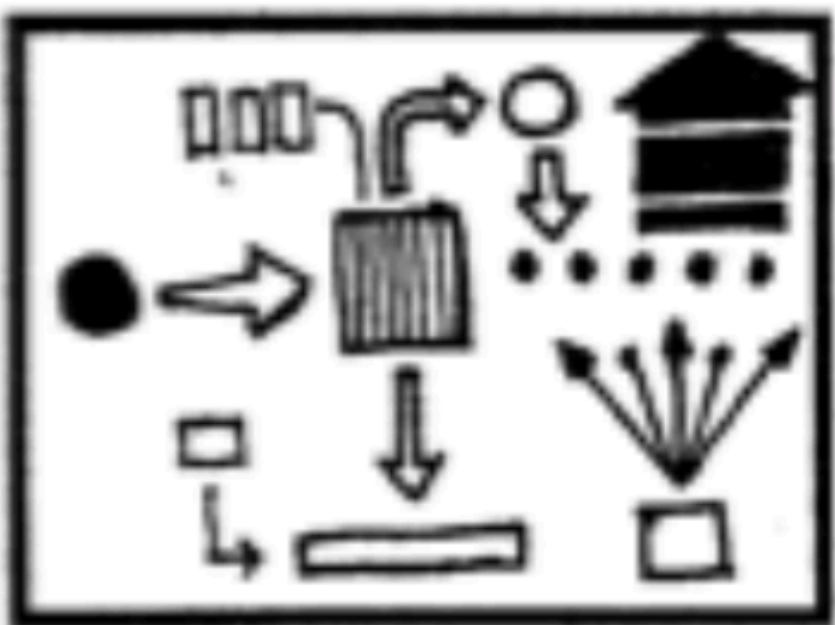
Bonds

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.

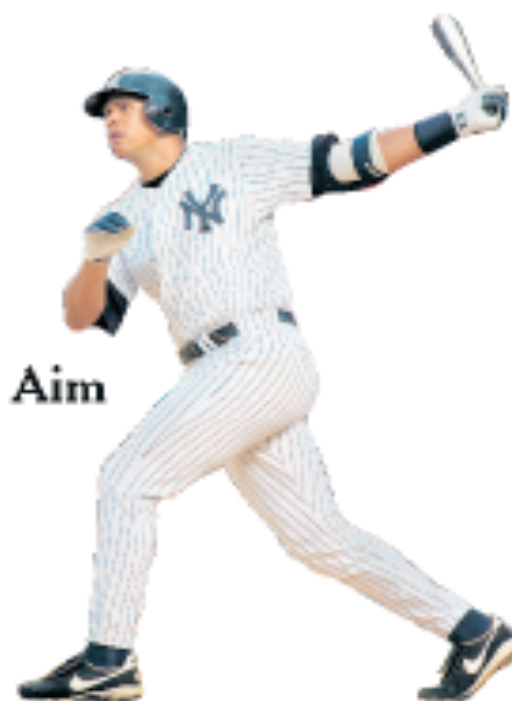


Flow Chart



Partitioned Poster

Others Taking Aim



Alex Rodriguez

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

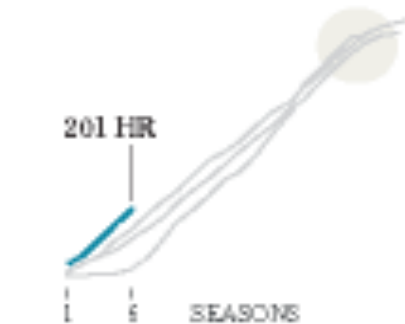


429 HR

Aaron, Ruth and Bonds

Albert Pujols

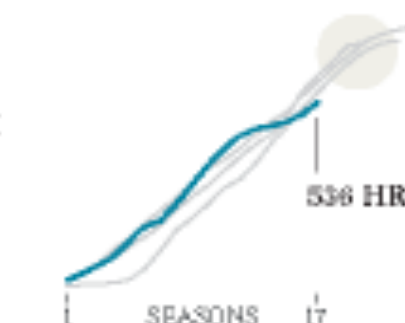
Averaging 40 homers a season, he has started stronger than the three leaders did.



201 HR

Ken Griffey Jr.

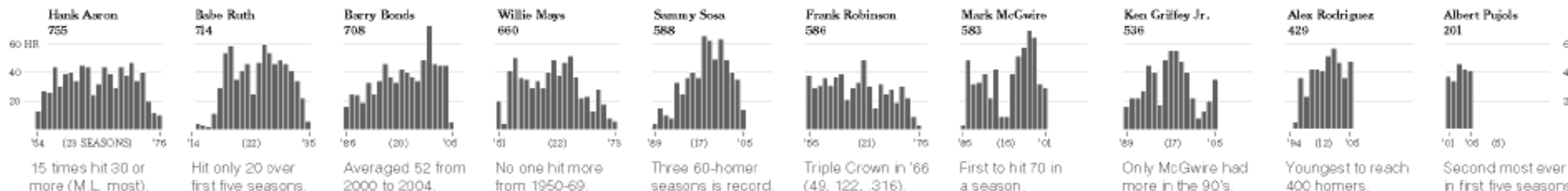
Many thought he would be the first to catch Ruth and Aaron until injuries limited his output.

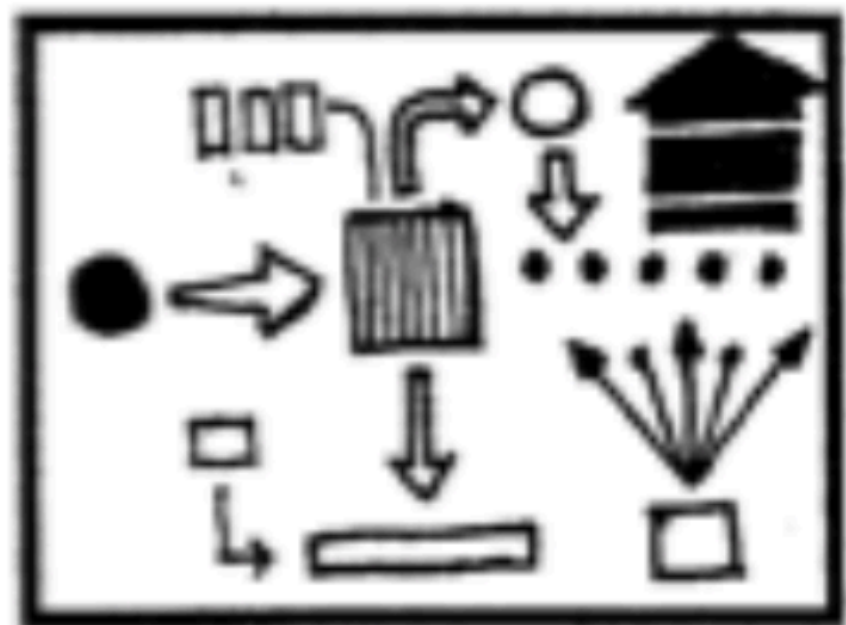


536 HR

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



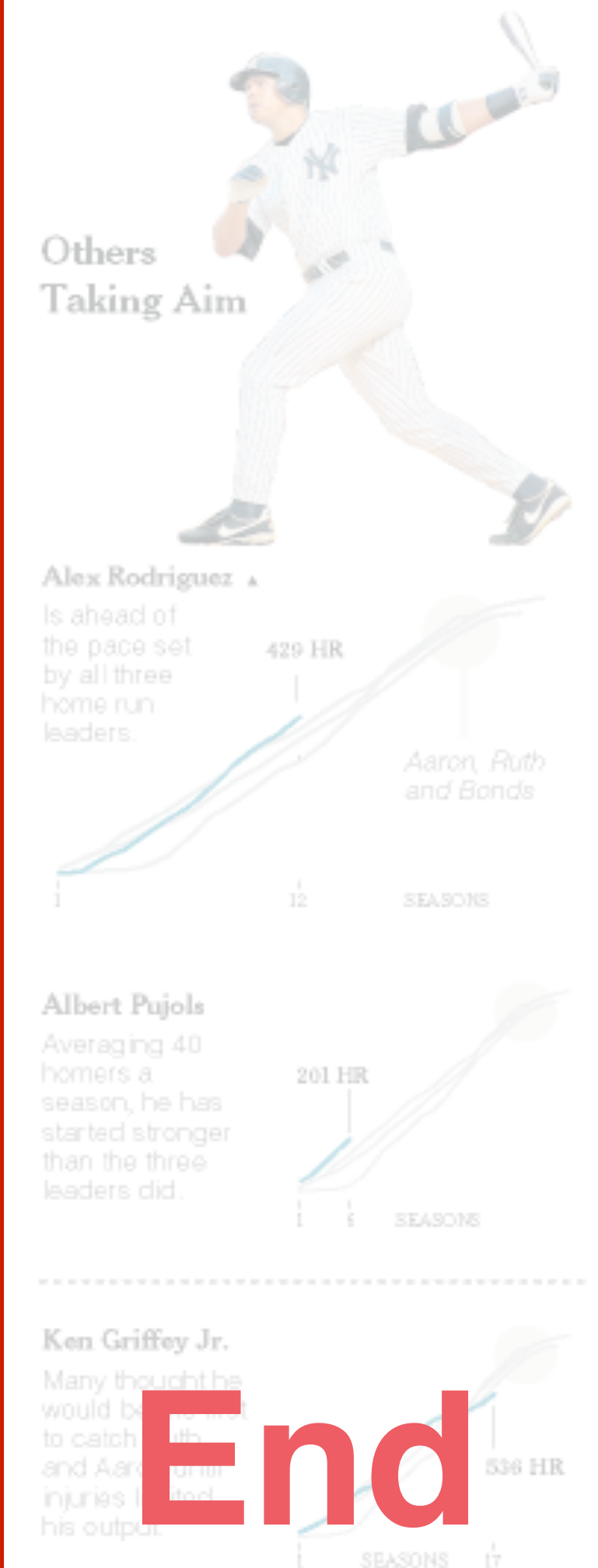
Partitioned Poster

755

Beginning



Middle



End



Epilogue

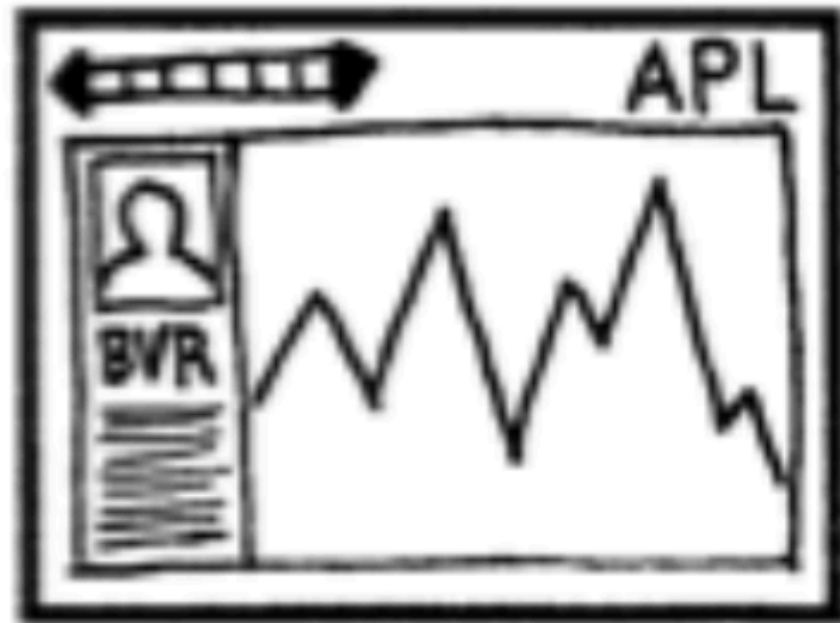
Illustration by Joe Ward/The New York Times

Published: February 2, 2010

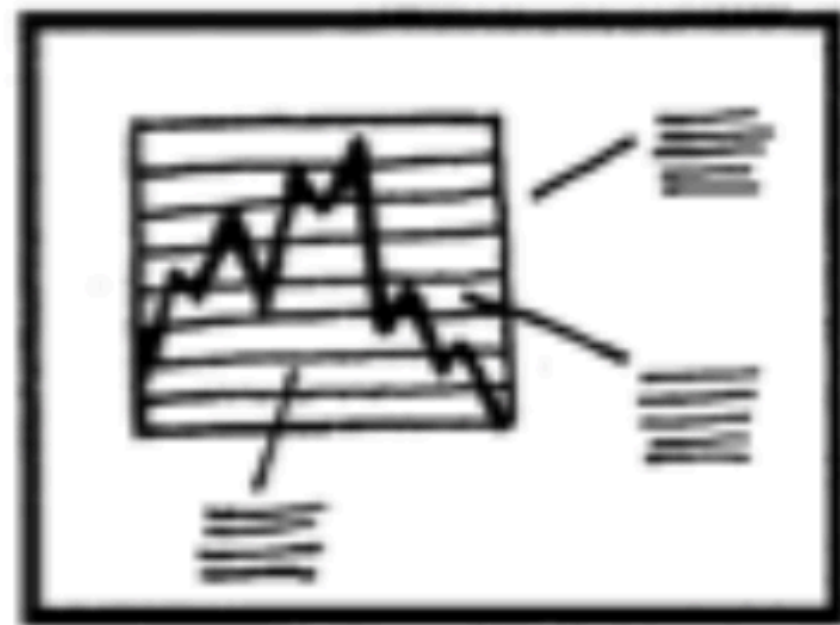
Budget Forecasts, Compared With Reality

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 ▶



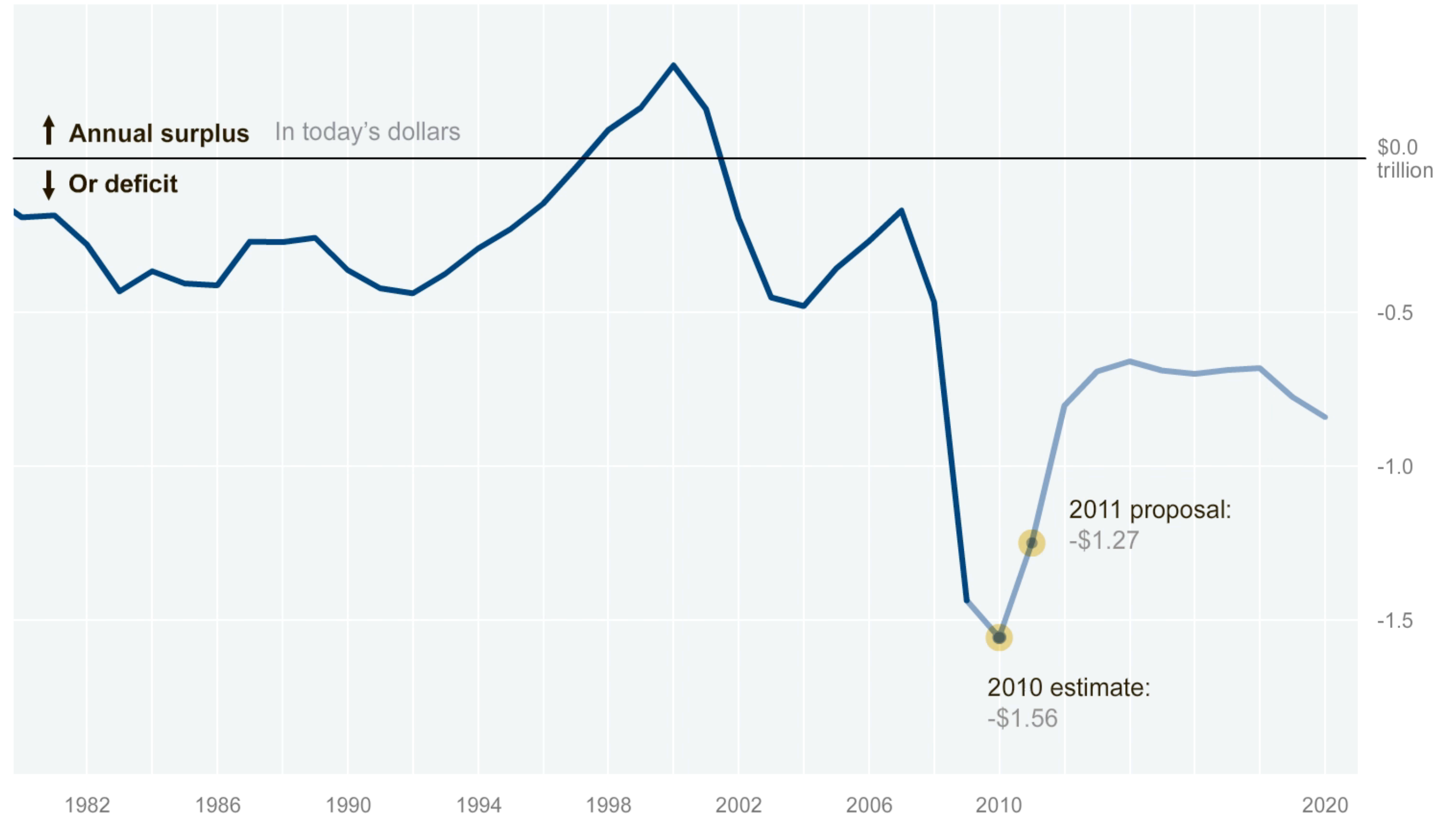
Slide Show



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.

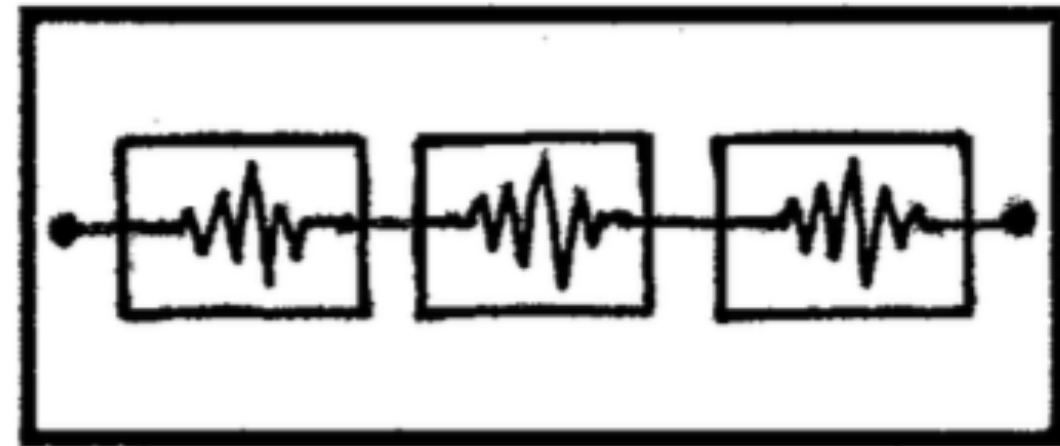


By AMANDA COX | [Send Feedback](#)

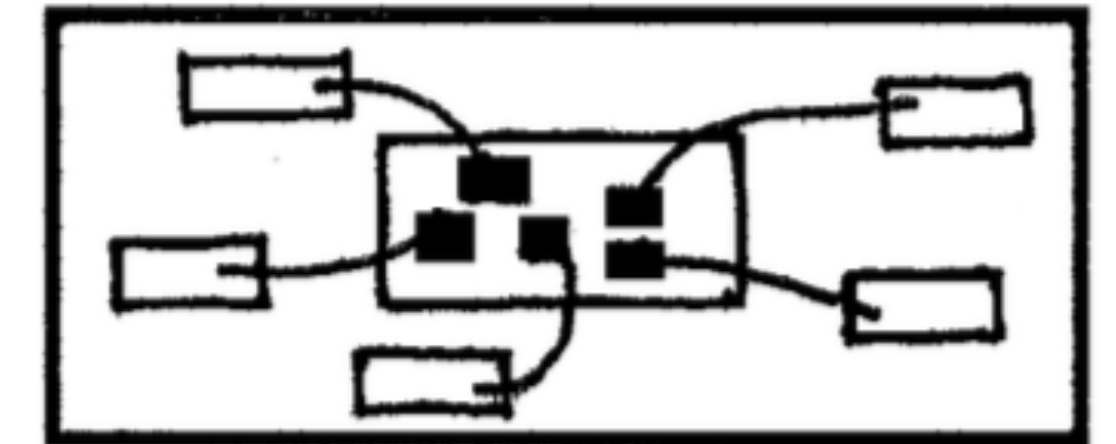
Source: Office of Management and Budget

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

Interactive Slideshow



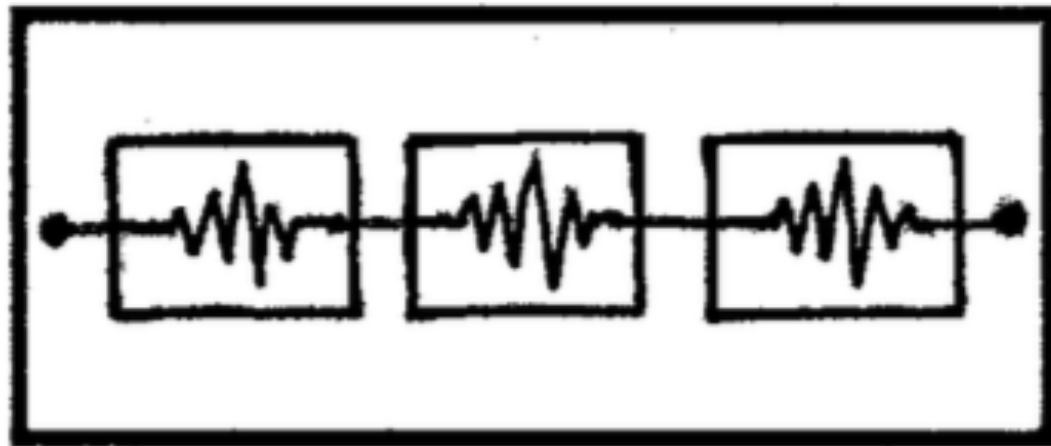
Drill-Down



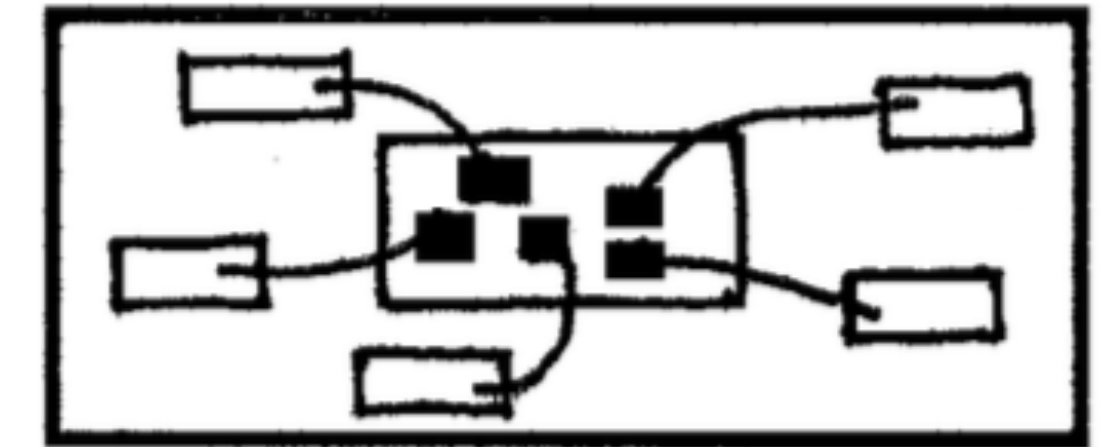
Author-Driven

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](#)

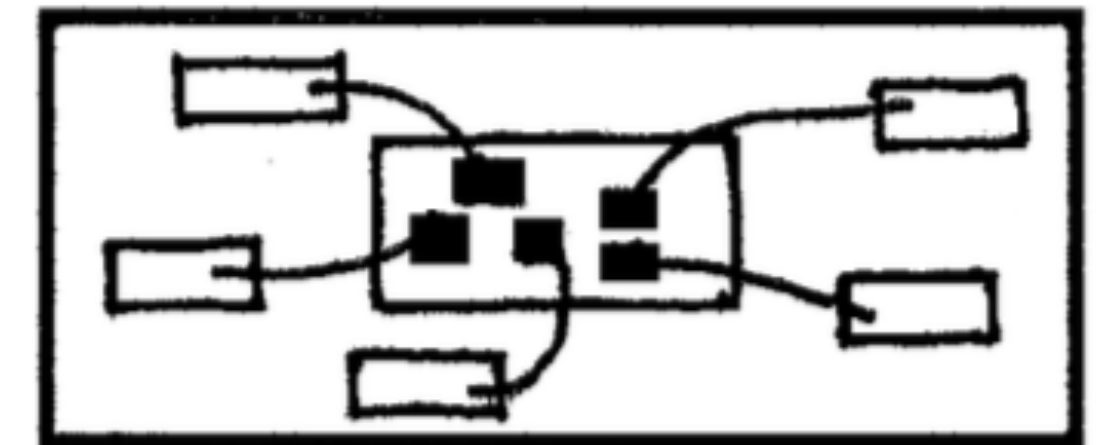
Now Viewing: Overview Up Close: Camp 15



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

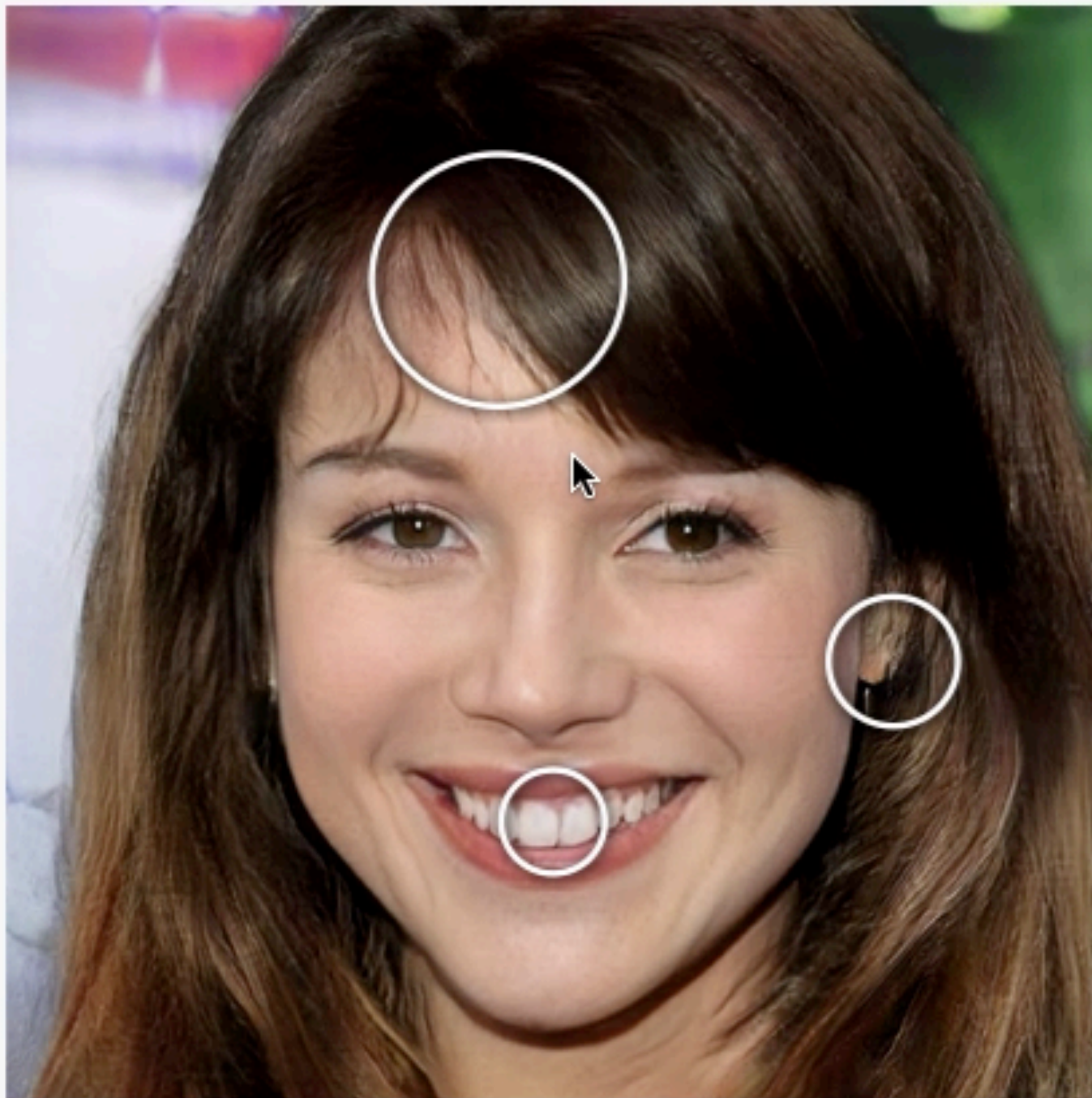
Scale varies in this perspective.
Distances from Pyongyang: 120 miles to Seoul, 427 miles to Vladivostok

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

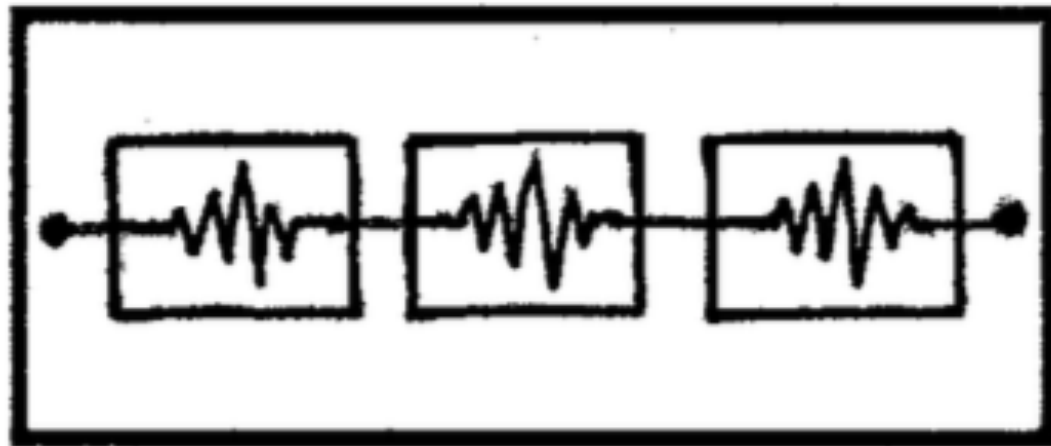
Neural networks can approximate any function that exists. However, we do not have a guaranteed way to obtain such a neural network for every function.

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

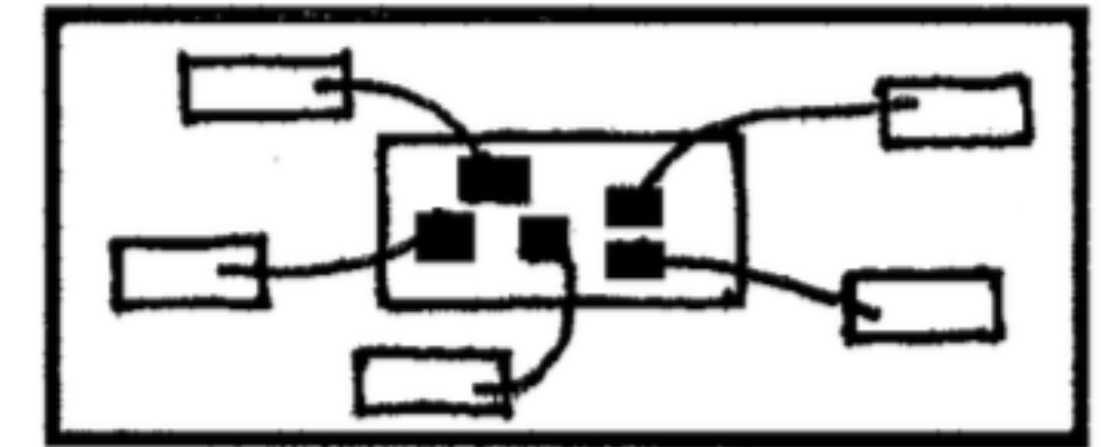
PREVIEWING CONTENT

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



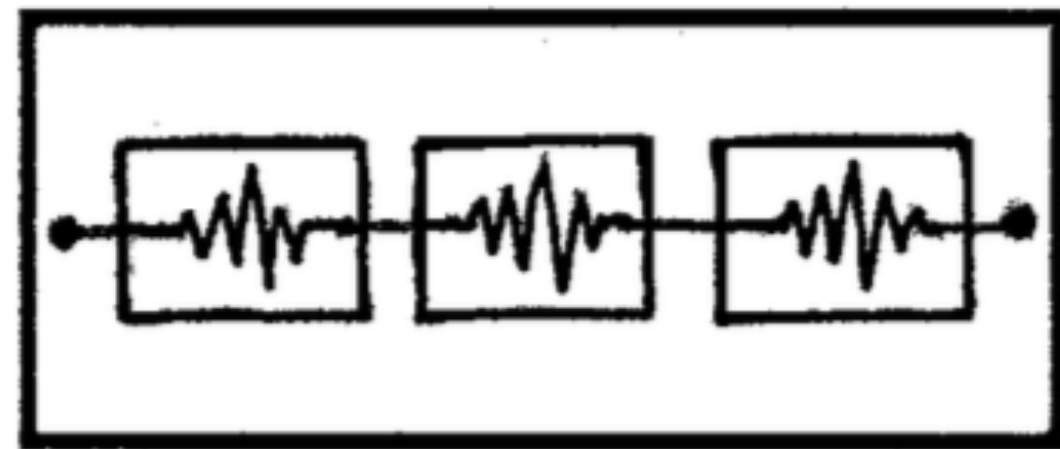
Drill-Down



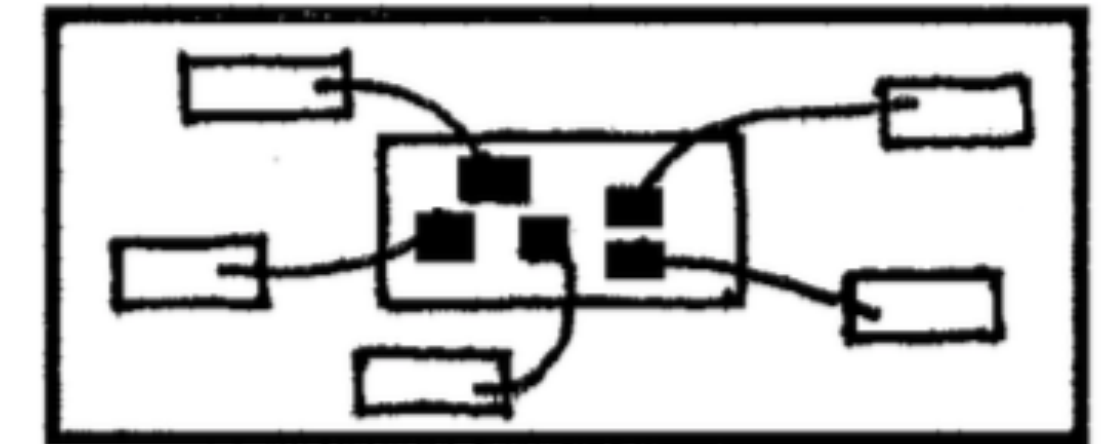
Author-Driven

Reader-Driven

Interactive Slideshow



Drill-Down




Author-Driven

Reader-Driven

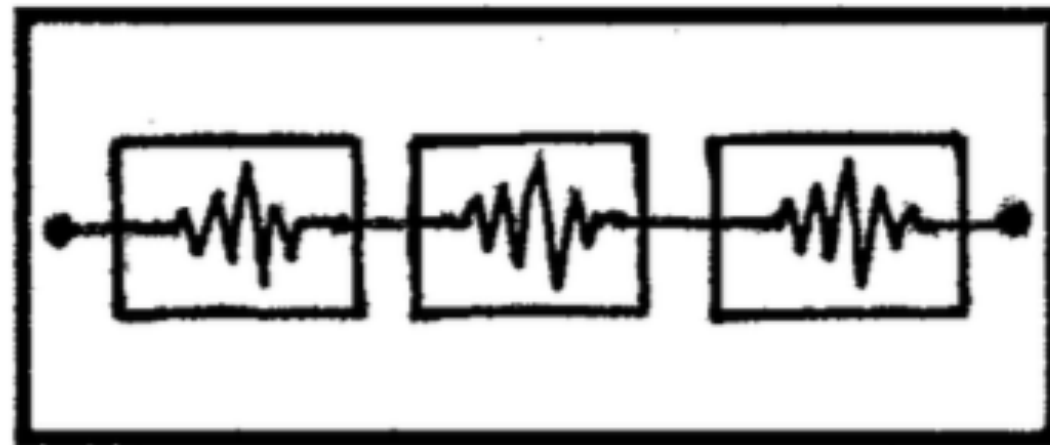
Copenhagen: Emissions, Treaties and Impacts

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.

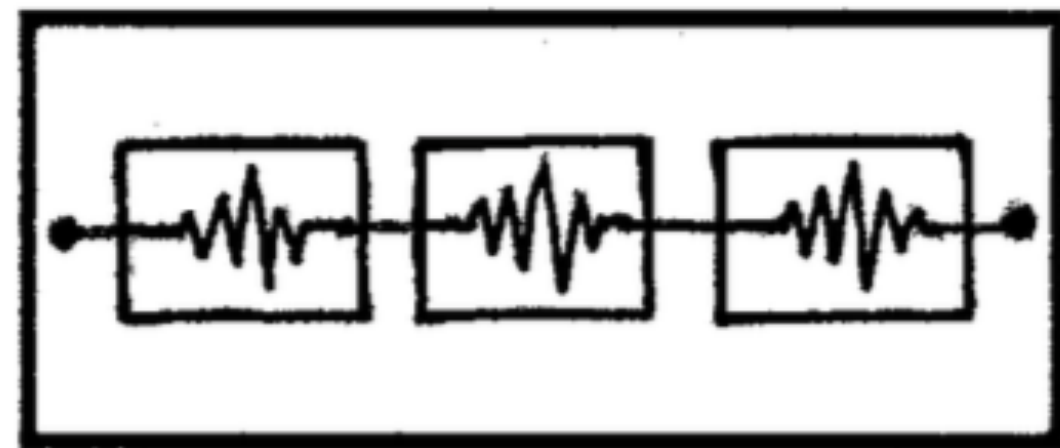
Global Emissions	Lessons From Kyoto	Possible Impact
<p>1 2 3 4 5 6 7 8 9 10 11 NEXT ▶</p> <p>Almost every country in the world signed and ratified the protocol. The treaty's aim was to provide a starting point for reducing global carbon dioxide emissions.</p> <p>Countries that ratified Kyoto</p>  <p>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

Stepper

Interactive Slideshow



Interactive Slideshow



R2
D3

A visual introduction to machine learning

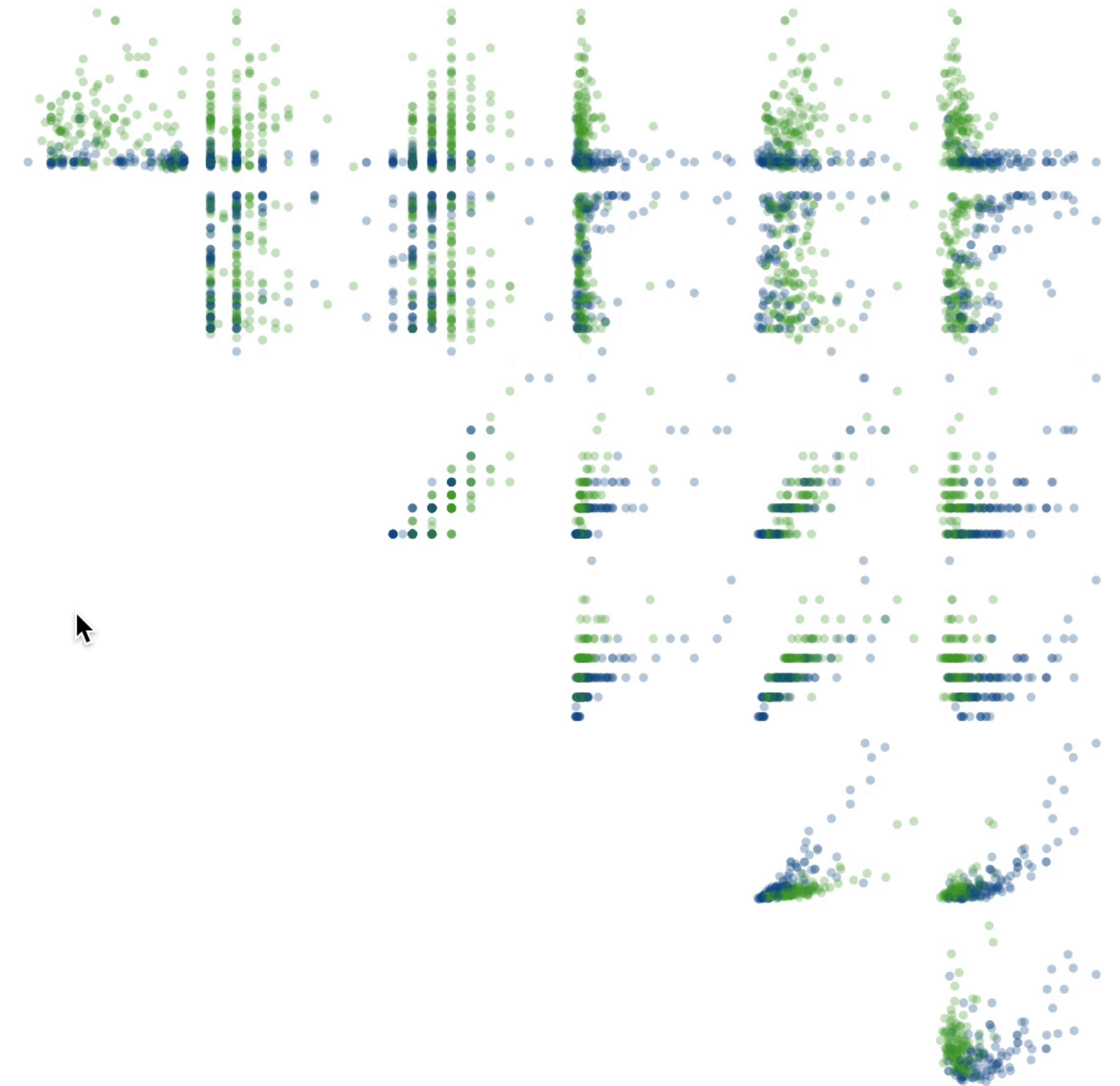
English

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!

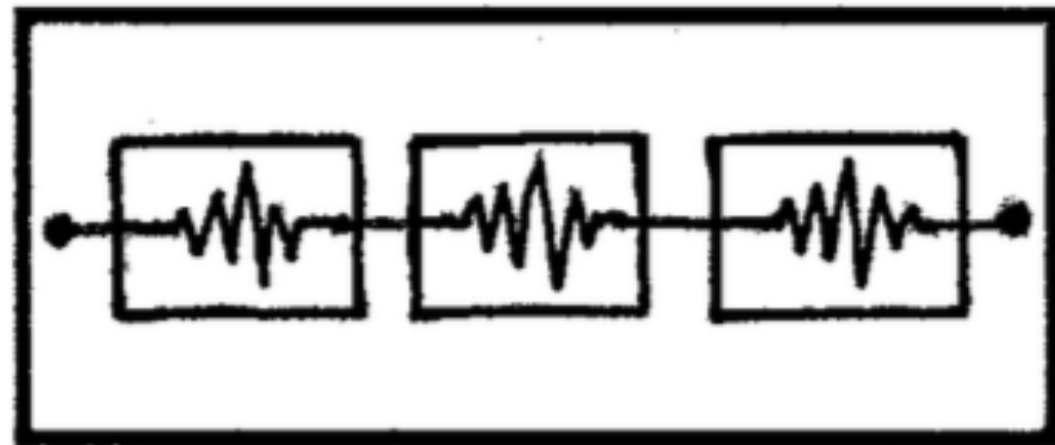
Discrete

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

Continuous

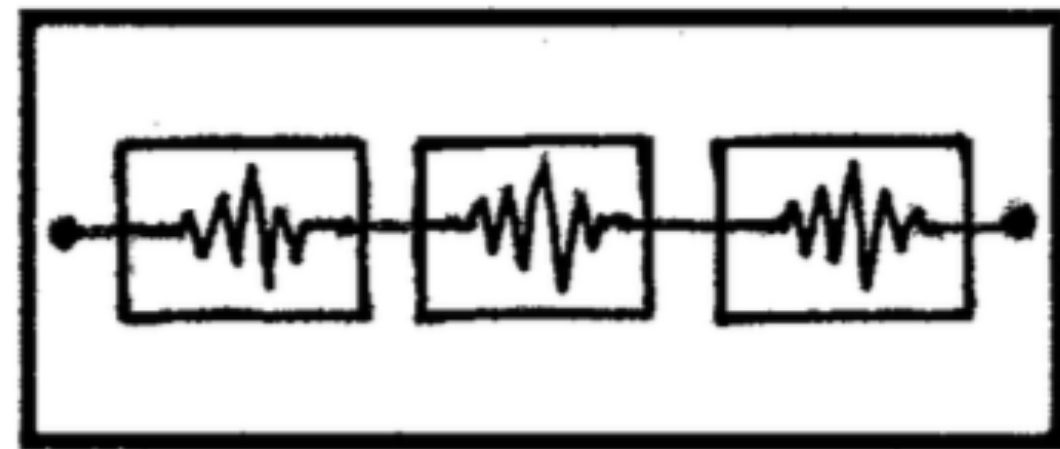
- ✓ Less “activation energy” required.
- ✓ More fluid/direct: parameterized by scroll position = rapid, incremental experience.
- ✗ But, difficult to implement properly.
Can result in “*scrolljacking*.”

Interactive Slideshow

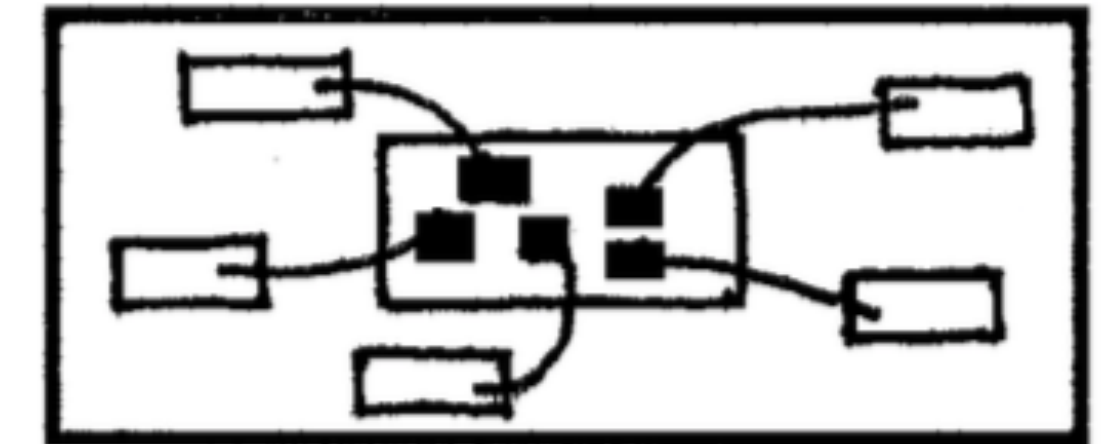


You will make one for Lab 8!

Interactive Slideshow



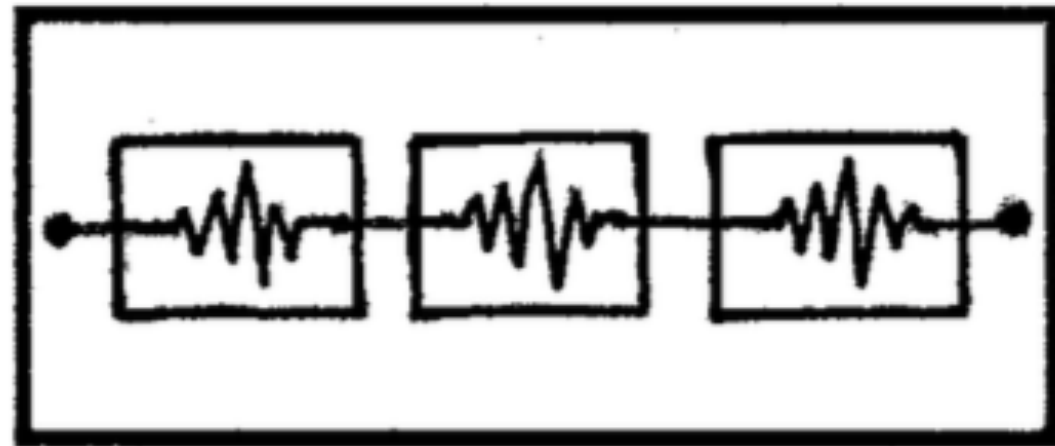
Drill-Down



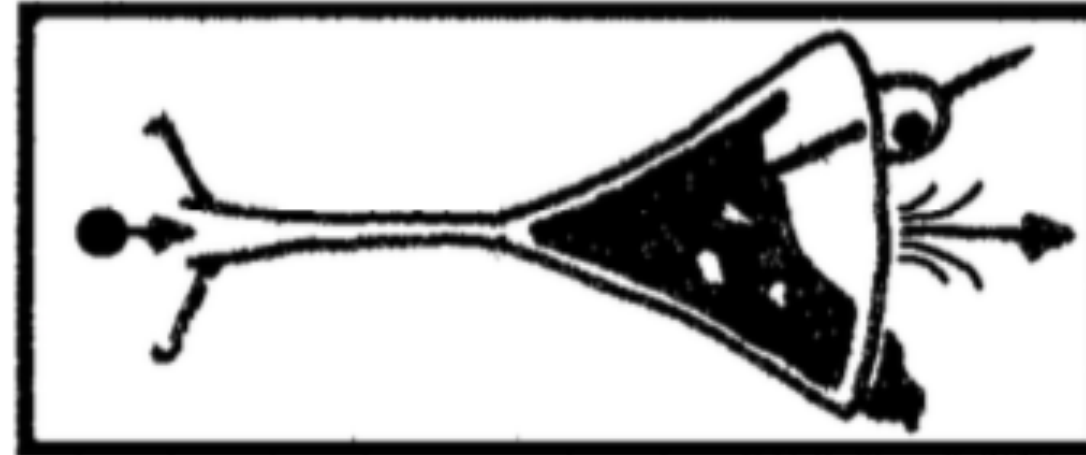
Author-Driven

Reader-Driven

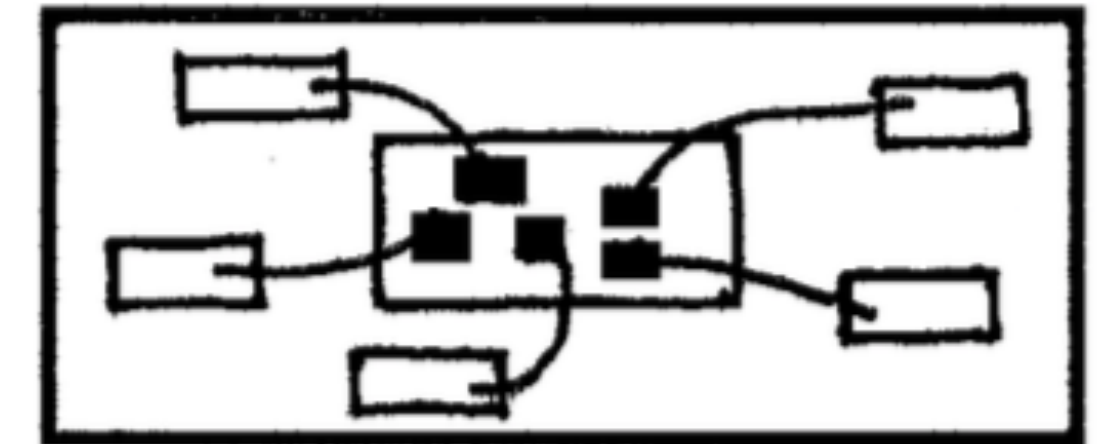
Interactive Slideshow



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?

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

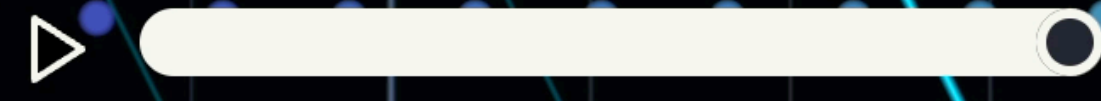
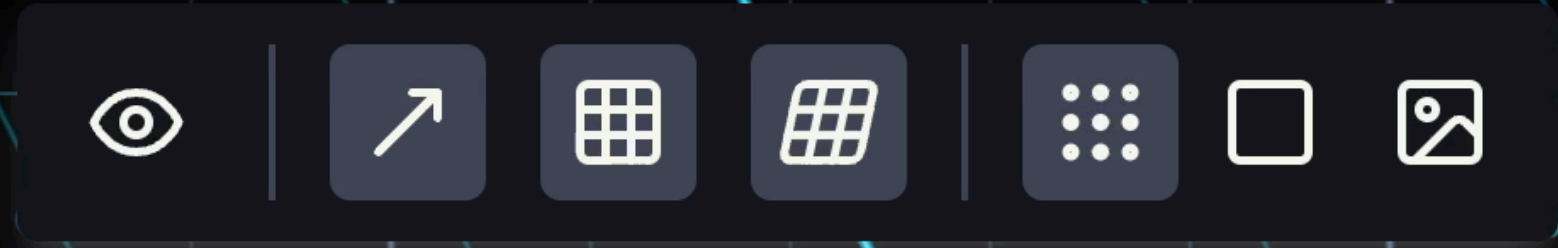

In school, you may recall reluctantly performing drill after drills of matrix-vector multiplications mechanically. You may even have been taught to memorize several inane formulas.

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

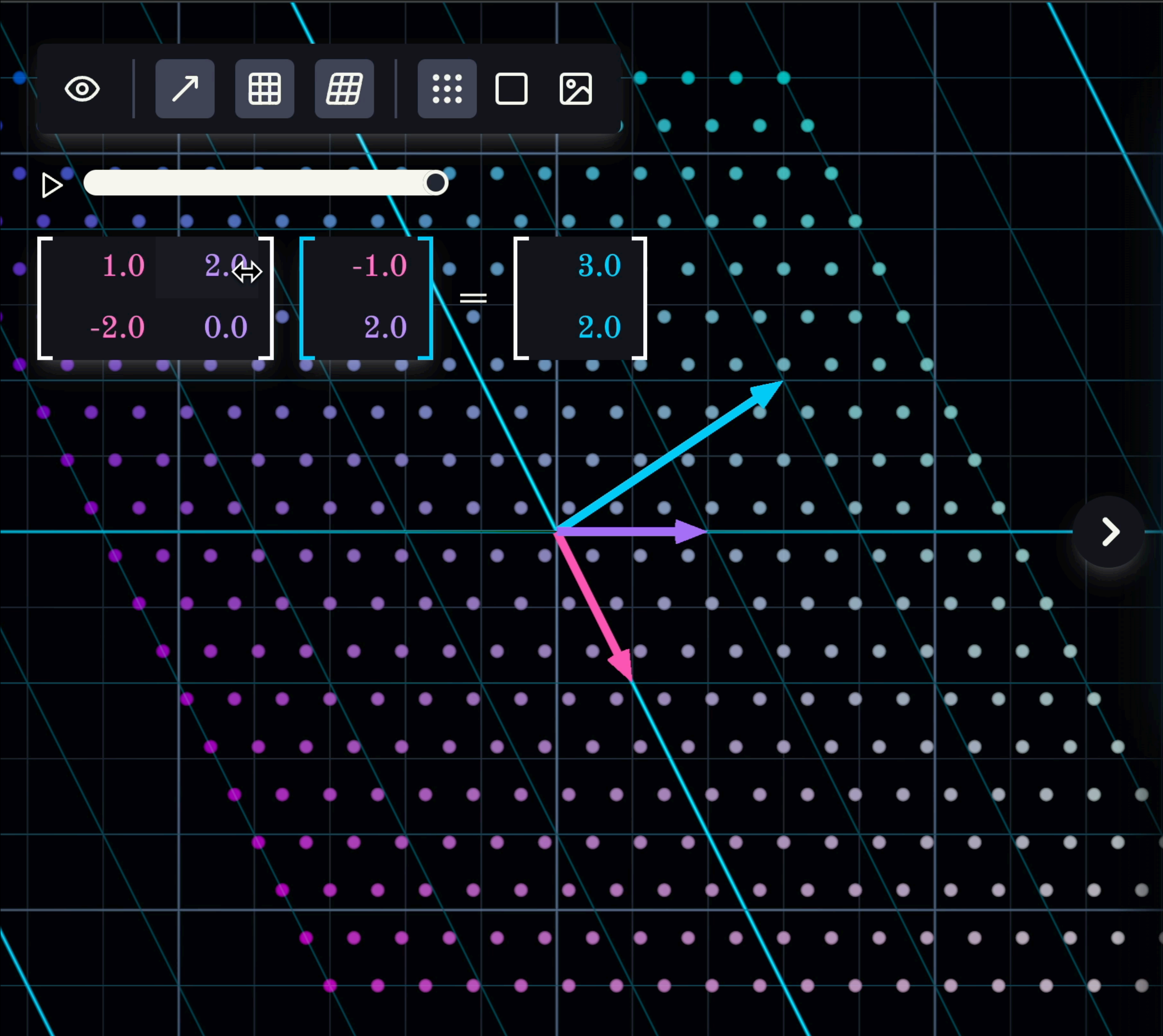
RECAP

- 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!



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



Takeaways

What's your and, but, therefore?

Storytelling	The project tells a compelling story. It follows the and-but-therefore structure and also incorporates elements of surprise, personalization, or emotion. (+3 points)	The project tells a story – it follows the and-but-therefore structure. (+2 points)	The project does not tell a story (e.g. it doesn't follow the and-but-therefore structure or something similar). (+1 point)
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We will grade you on storytelling for your final projects!

Final Project Milestones

Team: Nov 14 (today!)

Proposal: Nov 18

Prototype: Nov 25

Demo Video: Dec 2

Final Project: Dec 8

No slip days allowed for final deadline

Final Project Showcase: Dec 9