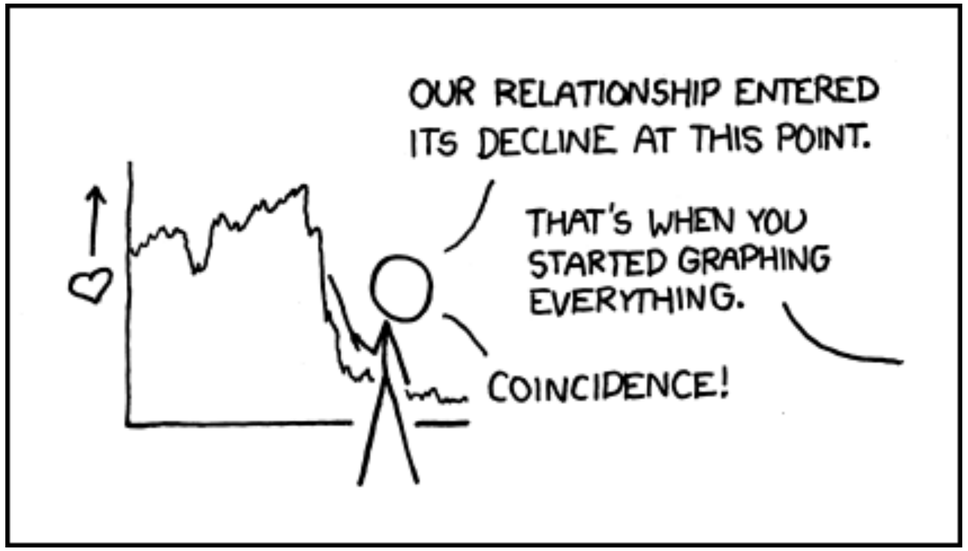
CS-5630 / CS-6630 Visualization Tasks

Alexander Lex
alex@sci.utah.edu

THE UNIVERSITY OF UTAH



[xkcd]

Tasks

Why are we using Visualization?

Domain and Abstract Tasks

Infinite numbers of domain tasks

Can be broken down into simpler abstract tasks

We know how to address the abstract tasks!

Identify task - data combination: solutions probably exist

Tasks

Analyze

- high-level choices
- consume vs produce

Search

- find a known/unknown item

Query

- find out about characteristics of item
- by itself or relative to others

Example 1

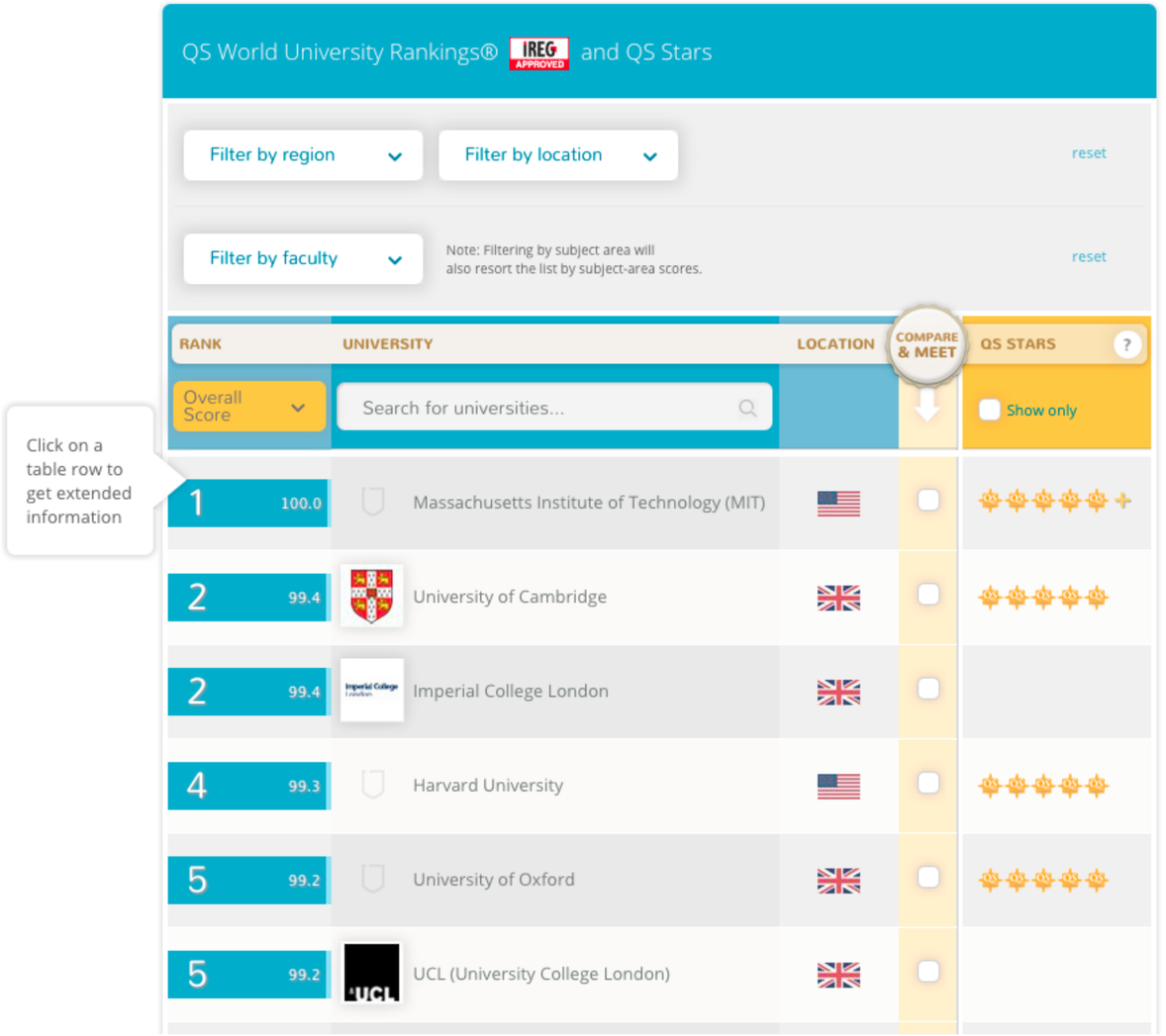
Find good universities with a high faculty student ratio.

Identify high-ranked universities

In this subset: **compare** universities & **identify** high faculty student ratio

OR

Derive a ranking with a high weight for faculty student ratio

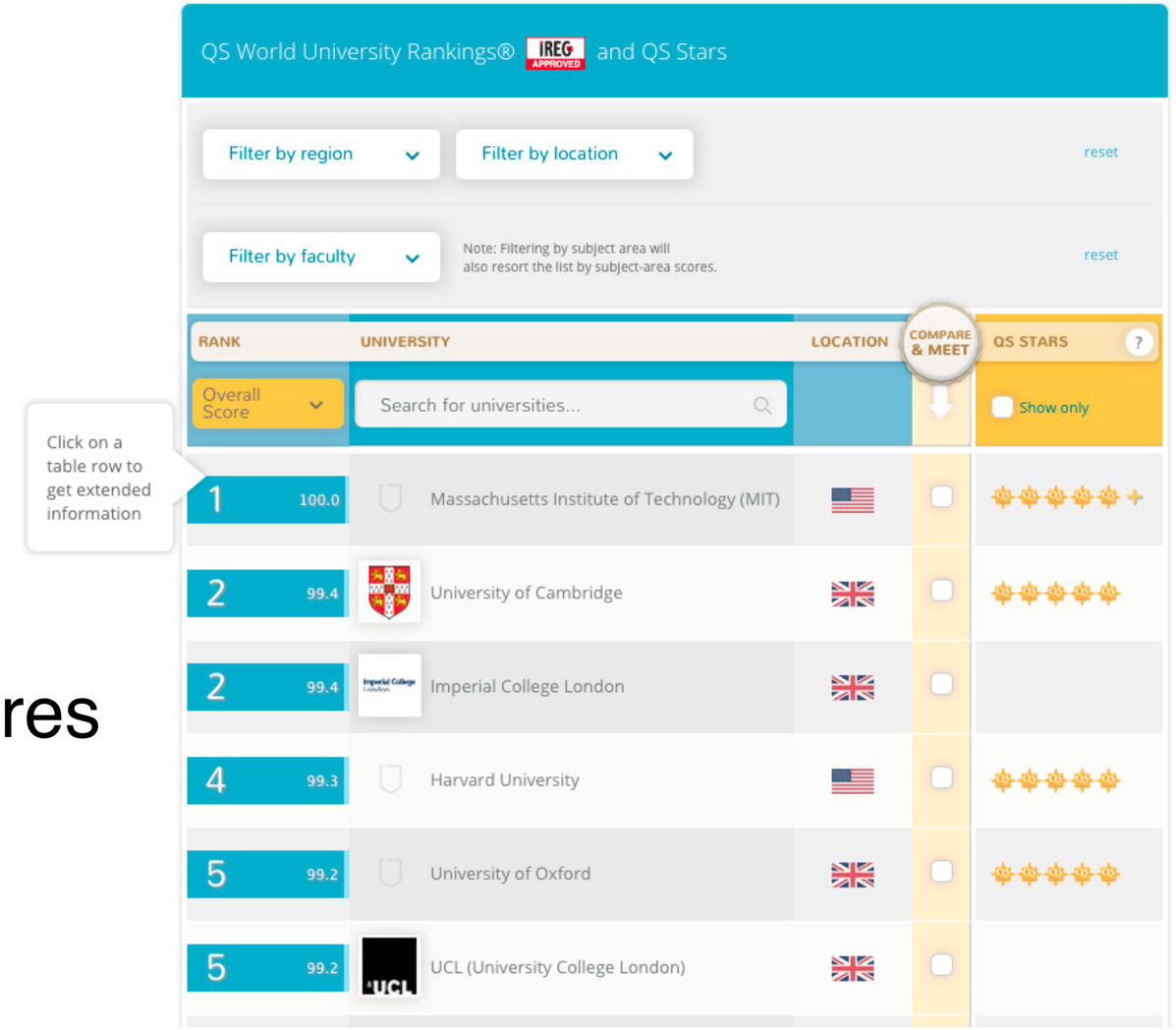


Example 2

Contrast Harvard's reputation scores with MIT's

Match up Harvard with Yale

First, **find** Harvard and Yale, then **compare** their (two) reputation scores



Example 3

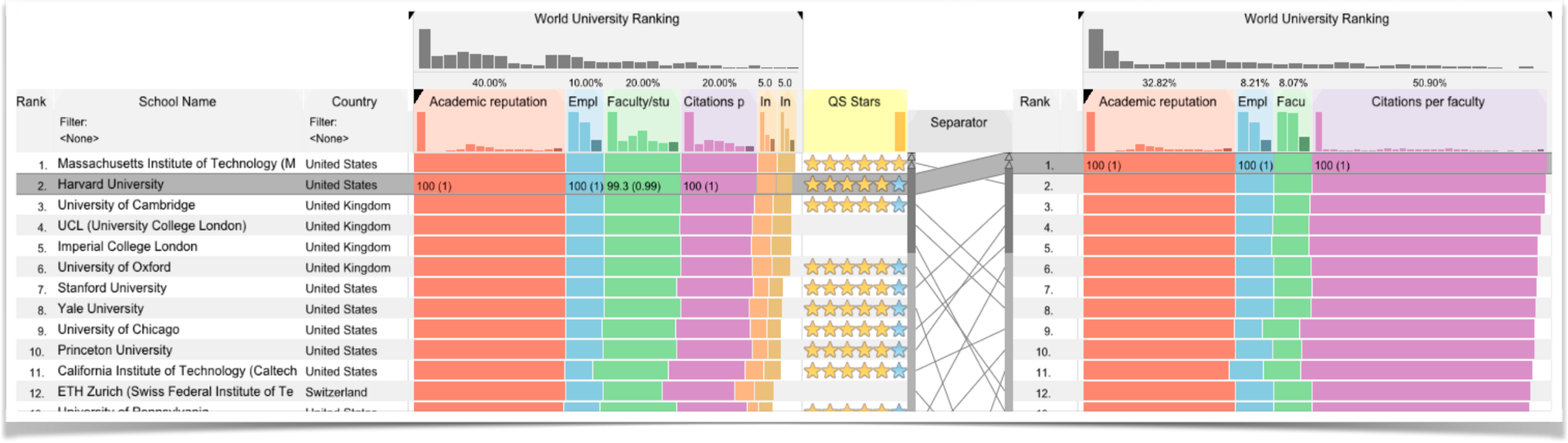
Find a combination of weights and parameters where Harvard is better than MIT

Produce a new dataset by **deriving** from the input parameters

World University Ranking

Rank	School Name	Country	Academic reputation	Empl	Faculty/stu	Citations p	In	In	QS Stars
	Filter: <None>	Filter: <None>	40.00%	10.00%	20.00%	20.00%	5.0	5.0	
1.	Massachusetts Institute of Technology (M	United States							
2.	Harvard University	United States							
3.	University of Cambridge	United Kingdom							
4.	UCL (University College London)	United Kingdom							
5.	Imperial College London	United Kingdom							
6.	University of Oxford	United Kingdom							
7.	Stanford University	United States							
8.	Yale University	United States							
9.	University of Chicago	United States							
10.	Princeton University	United States							
11.	California Institute of Technology (Caltech	United States							
12.	ETH Zurich (Swiss Federal Institute of Te	Switzerland							
13.	University of Pennsylvania	United States							
14.	Columbia University	United States							
15.	Cornell University	United States							

Result


World University Ranking
40.00%
10.00%
20.00%
20.00%
5.0
5.0
Rank
School Name
Country
Filter:
<None>
Filter:
<None>
Academic reputation
Empl
Faculty/stu
Citations p
In
In
QS Stars
Separator
Rank
World University Ranking
32.82%
8.21%
8.07%
50.90%
Academic reputation
Empl
Facu
Citations per faculty
1. Massachusetts Institute of Technology (M United States
2. Harvard University United States 100 (1) 100 (1) 99.3 (0.99) 100 (1)
3. University of Cambridge United Kingdom
4. UCL (University College London) United Kingdom
5. Imperial College London United Kingdom
6. University of Oxford United Kingdom
7. Stanford University United States
8. Yale University United States
9. University of Chicago United States
10. Princeton University United States
11. California Institute of Technology (Caltech United States
12. ETH Zurich (Swiss Federal Institute of Te Switzerland
1. 100 (1) 100 (1) 100 (1)
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

High-level actions: Analyze

Consume

discover vs present

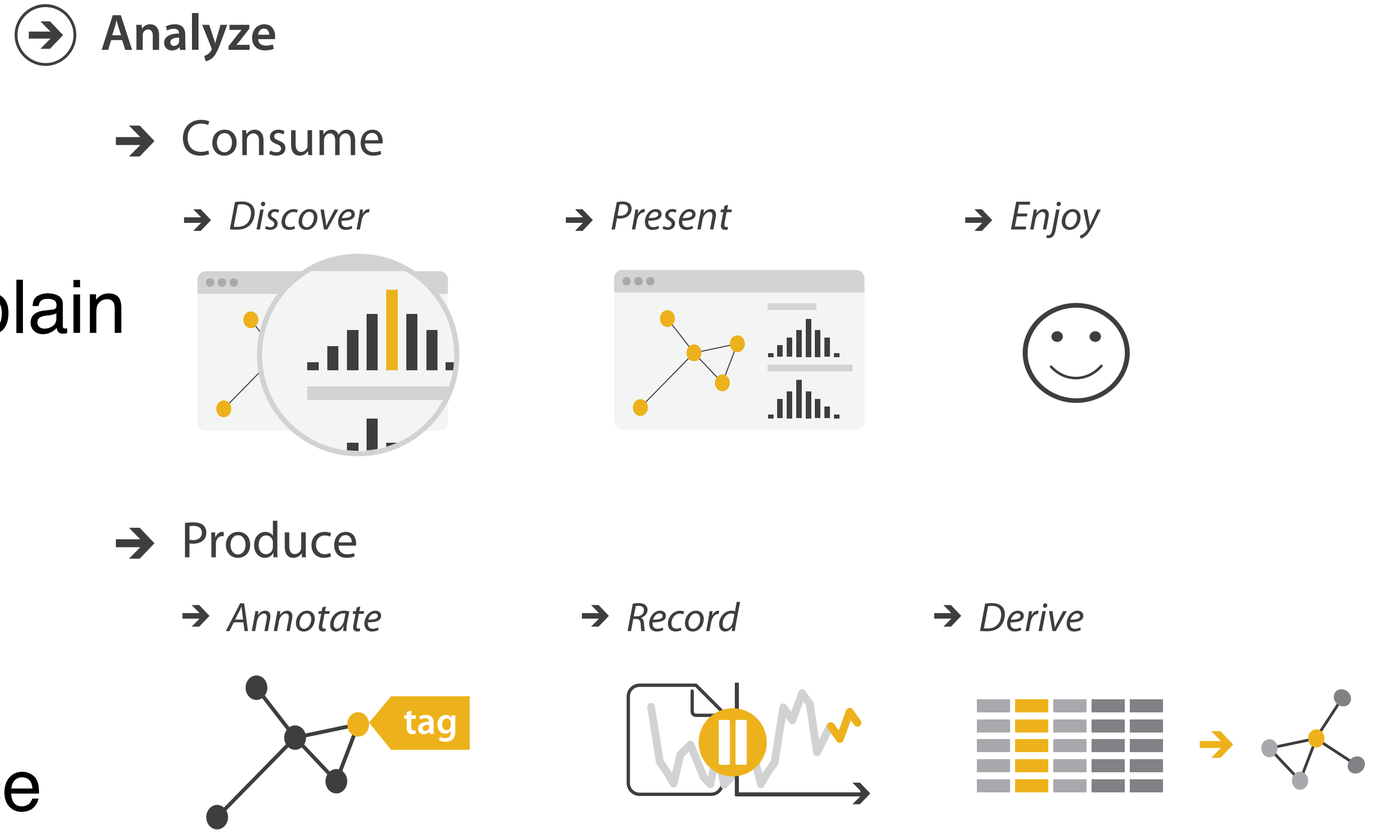
classic split: explore vs explain

enjoy: casual, social

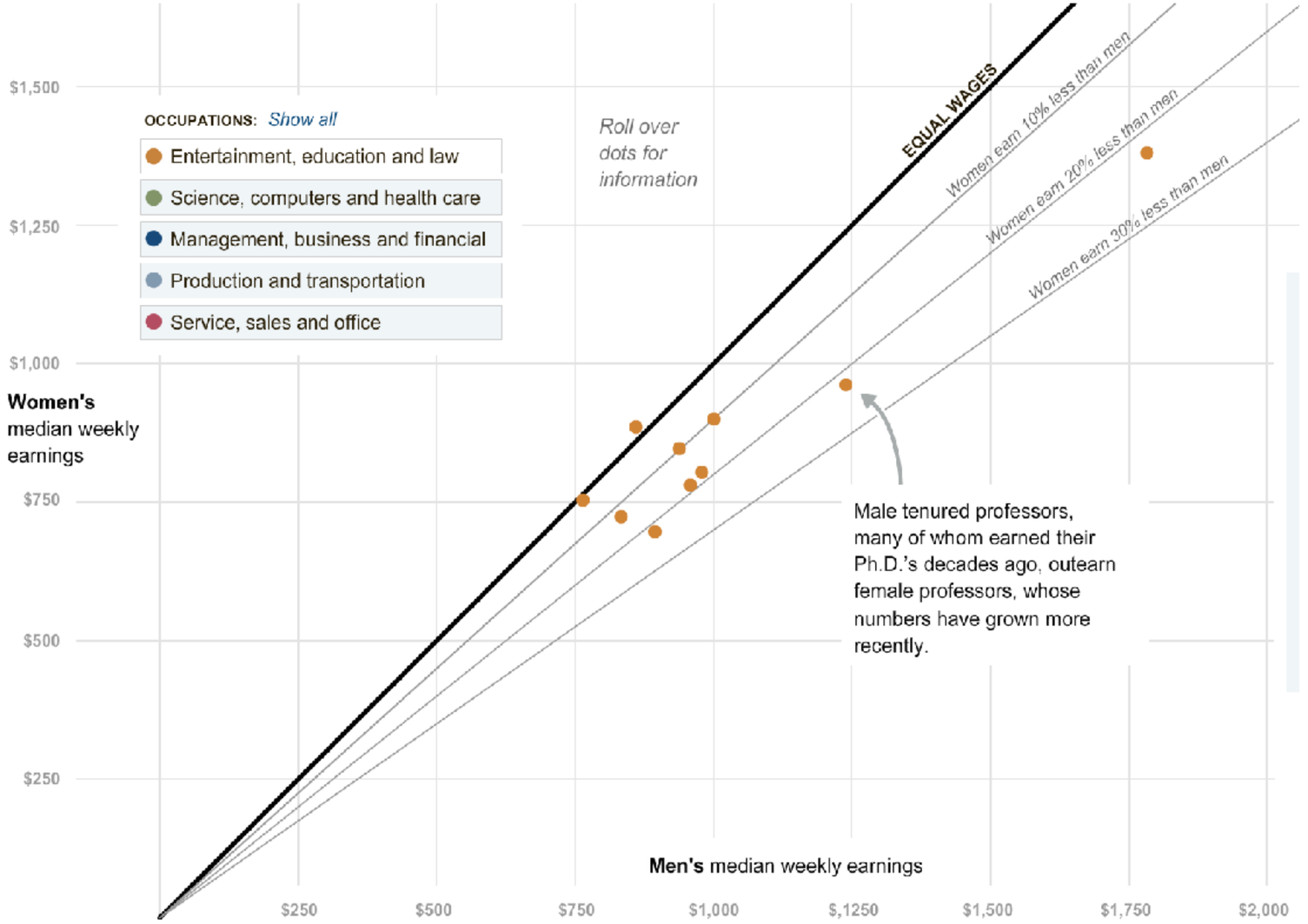
Produce

Annotate, record

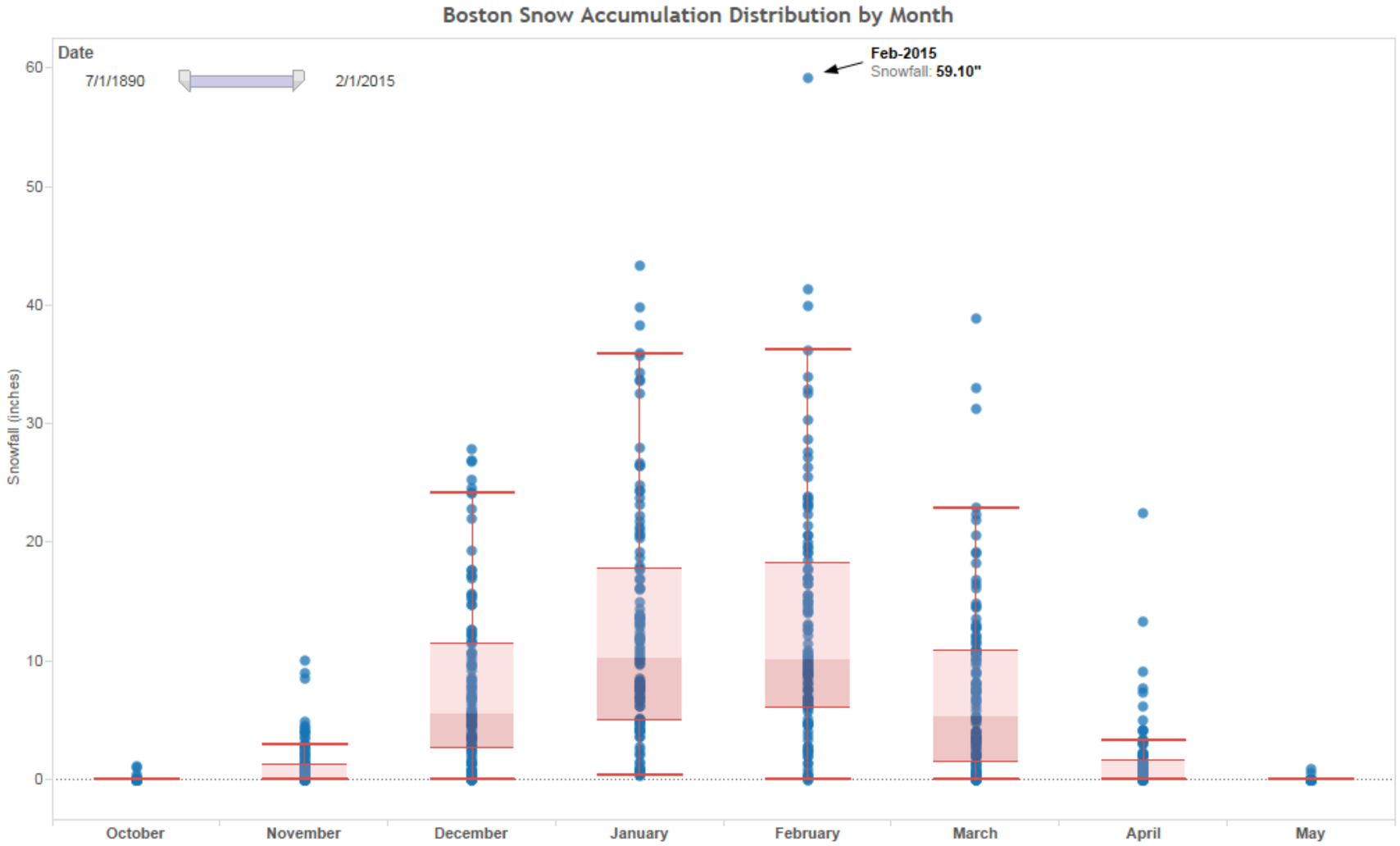
Derive: crucial design choice



Example: Annotate

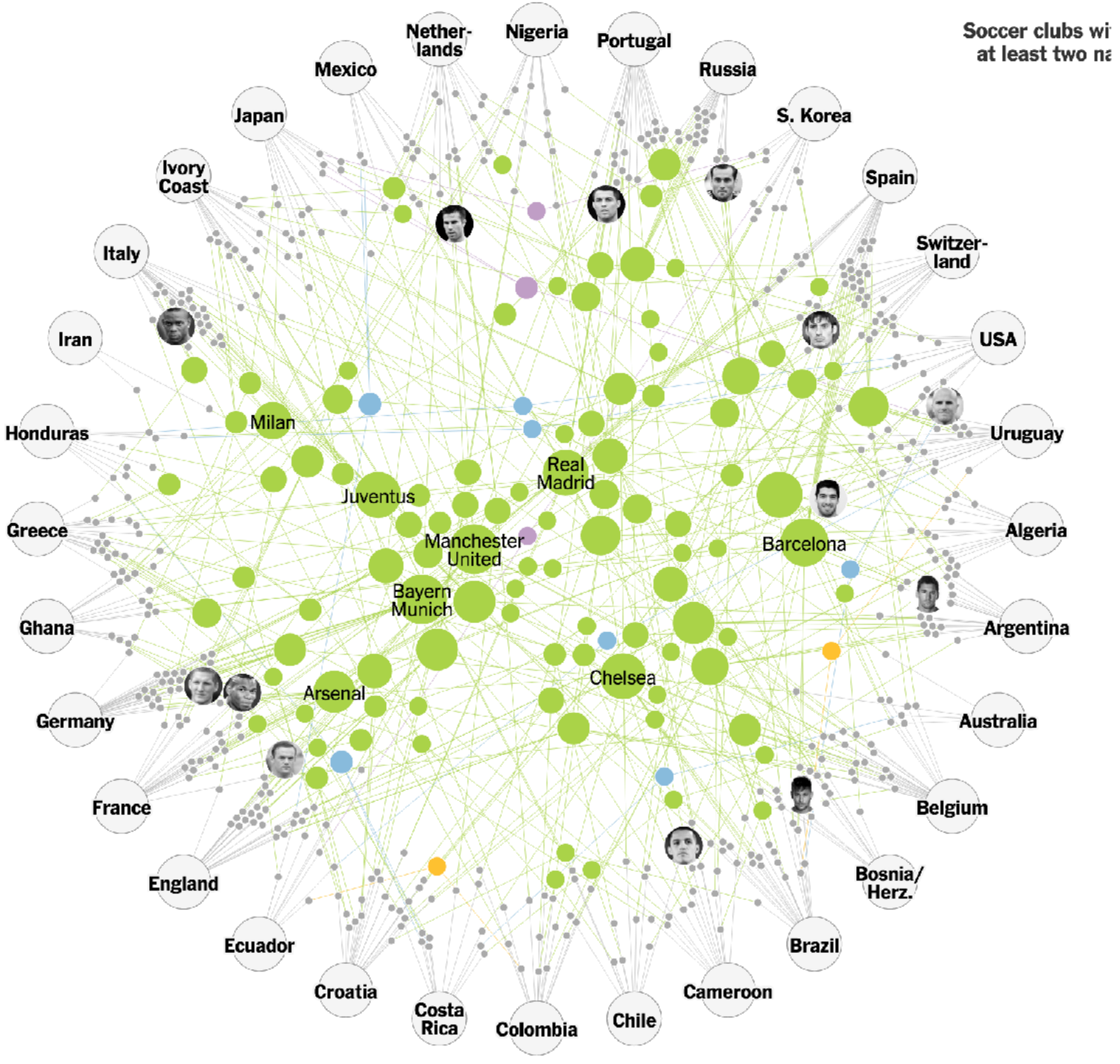


Example: Derive



Example: Derive

	Country	Club	Club Continent
Ronaldo	Portugal	Real Madrid	Europe
Lahm	Germany	Bayern München	Europe
Robben	Netherlands	Bayern München	Europe
Khedira	Germany	Real Madrid	Europe
Phogba	Italy	Juventus	Europe
Messi	Argentina	Barcelona	Europe


Soccer clubs wi
at least two na
Nether-
lands
Nigeria
Portugal
Mexico
Russia
Japan
S. Korea
Ivory
Coast
Spain
Italy
Switzer-
land
Iran
USA
Honduras
Milan
Uruguay
Real
Madrid
Juventus
Greece
Algeria
Manchester
United
Barcelona
Bayern
Munich
Ghana
Argentina
Chelsea
Arsenal
Germany
Australia
France
Belgium
England
Bosnia/
Herz.
Ecuador
Brazil
Croatia
Cameroon
Costa
Rica
Colombia
Chile

Actions: Mid-level search, low-level query

what does user know?

target, location

how much of the data matters?

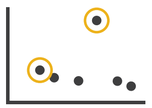
one, some, all

Search

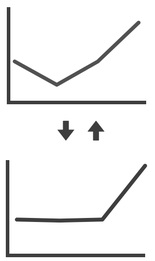
	Target known	Target unknown
Location known	*Lookup*	*Browse*
Location unknown	*Locate*	*Explore*

Query

→ Identify

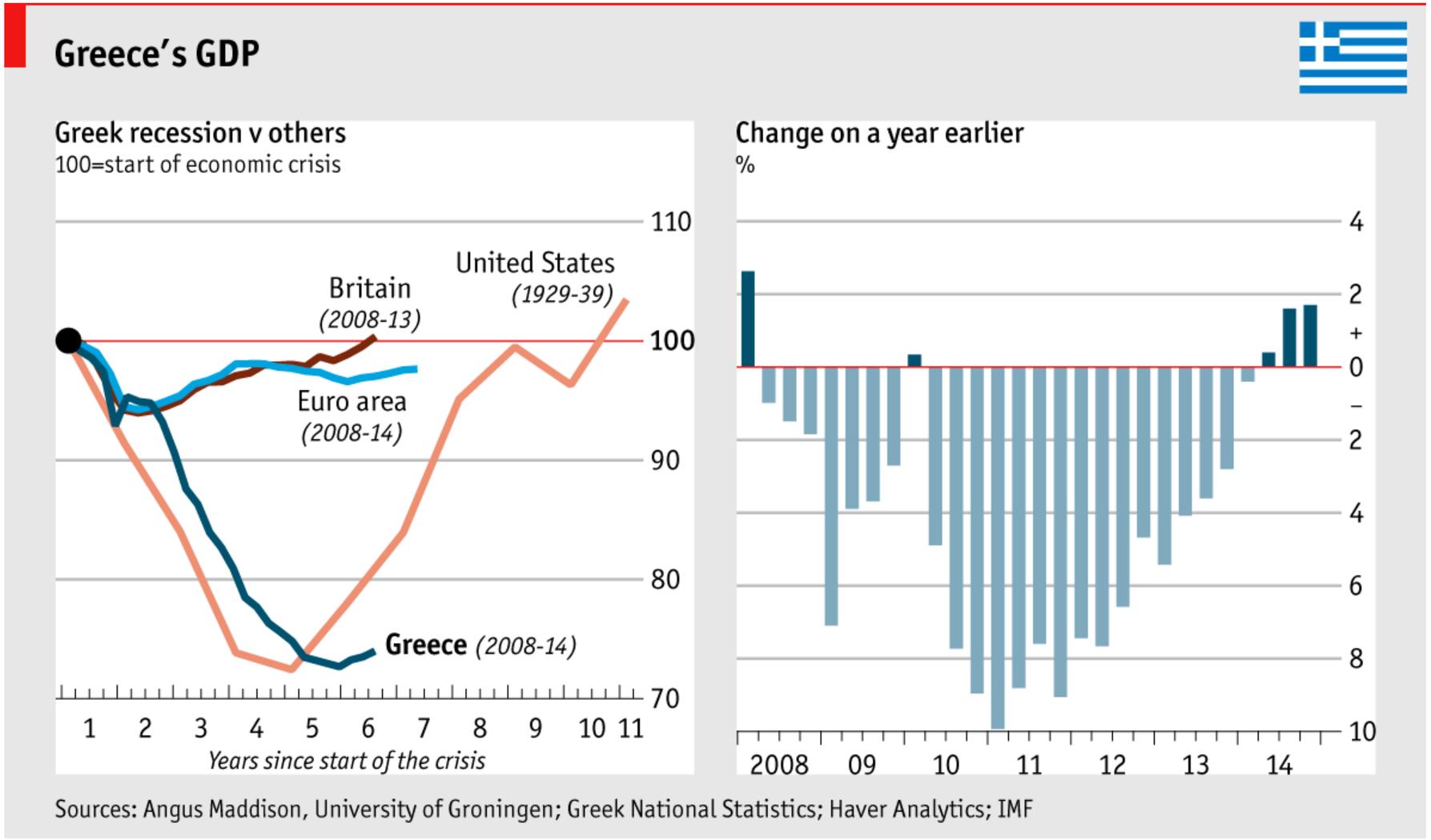


→ Compare



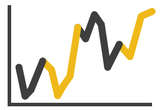
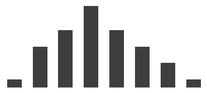
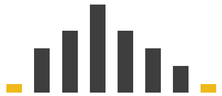
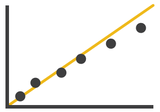
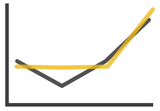
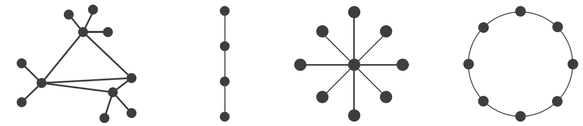
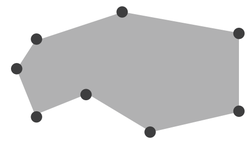
→ Summarize

Example Compare (& Derive)



Economist.com

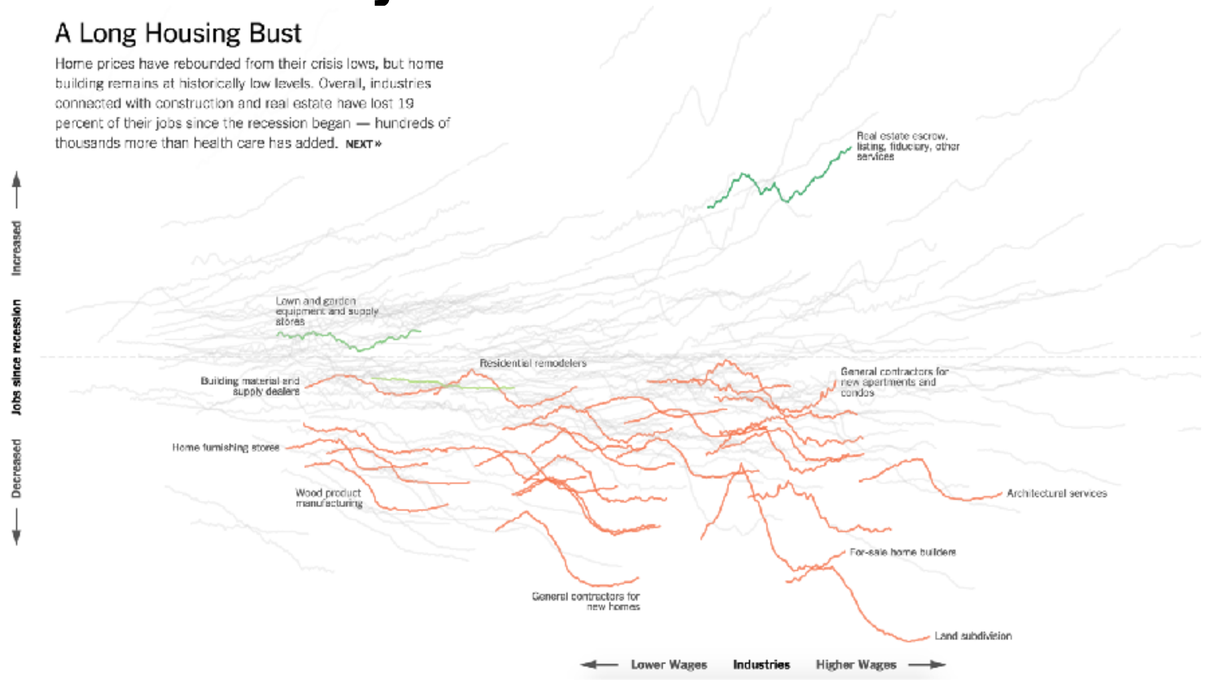
Why: Targets

- ALL DATA
  - Trends
    
  - Outliers
    
  - Features
    
- ATTRIBUTES
  - One
    - *Distribution*
      
    - *Extremes*
      
  - Many
    - *Dependency*
      
    - *Correlation*
      
    - *Similarity*
      
- NETWORK DATA
  - Topology
    
  - *Paths*
    
- SPATIAL DATA
  - Shape
    

Examples

Trends: How did the job market develop since the recession overall?

Outliers: Looking at real estate related jobs

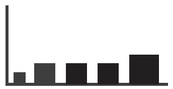


How? A Preview

Encode

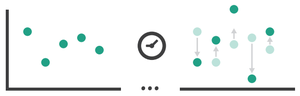
- **Arrange**
  - Express
  - Separate
  - Order
  - Align
  - Use



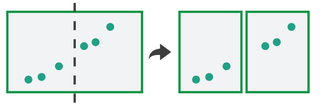

Manipulate

- **Change**
- **Select**
- **Navigate**



Facet

- **Juxtapose**
- **Partition**
- **Superimpose**


Reduce

- **Filter**
- **Aggregate**
- **Embed**