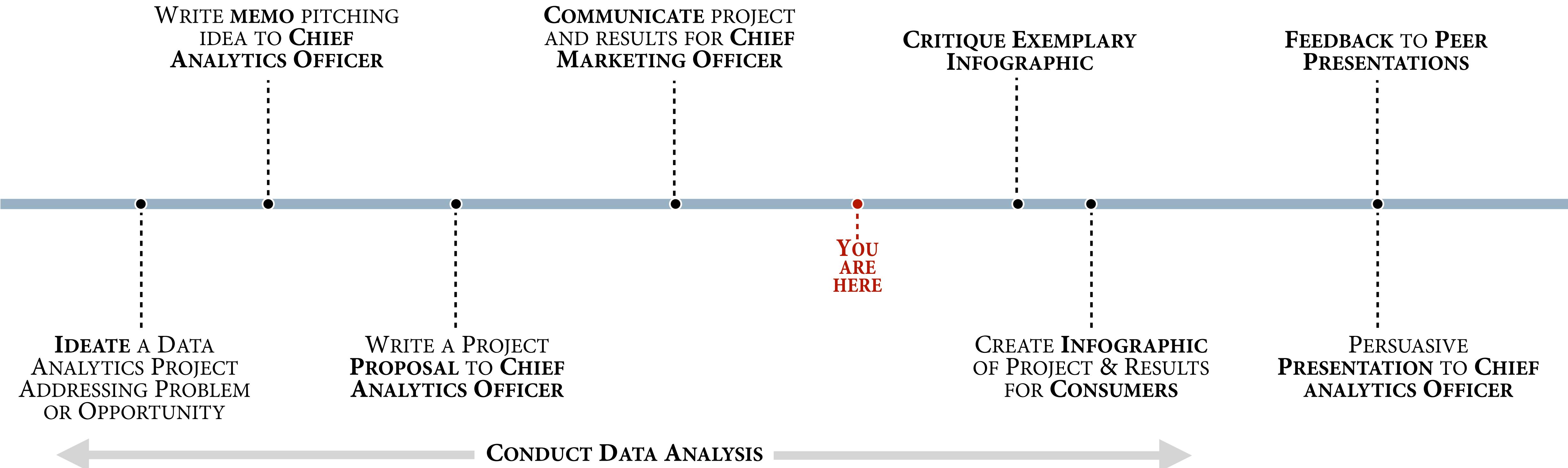


Storytelling With Data  
**uncertainty; information graphics**

# Conceptual project timeline



# **uncertainty**

# uncertainty | *overcoming concerns with communicating uncertainty*

**Concern** | people will misinterpret quantities of uncertainty, inferring more precision than intended.

**Response** | Most people like getting quantitative information on uncertainty, from them can get the main message, and without them are more likely to misinterpret verbal expressions of uncertainty. Posing clear questions guide understanding.



Fischhoff, Baruch

**Concern** | people cannot use probabilities.

**Response** | laypeople can provide high-quality probability judgments, if they are asked clear questions and given the chance to reflect on them. Communicating uncertainty protects credibility.

**Concern** | credible intervals may be used unfairly in performance evaluations.

**Response** | probability judgments give us more accuracy about the information; *i.e.*, won't be too confident or lack enough confidence.

# uncertainty | graphically encoding uncertainty

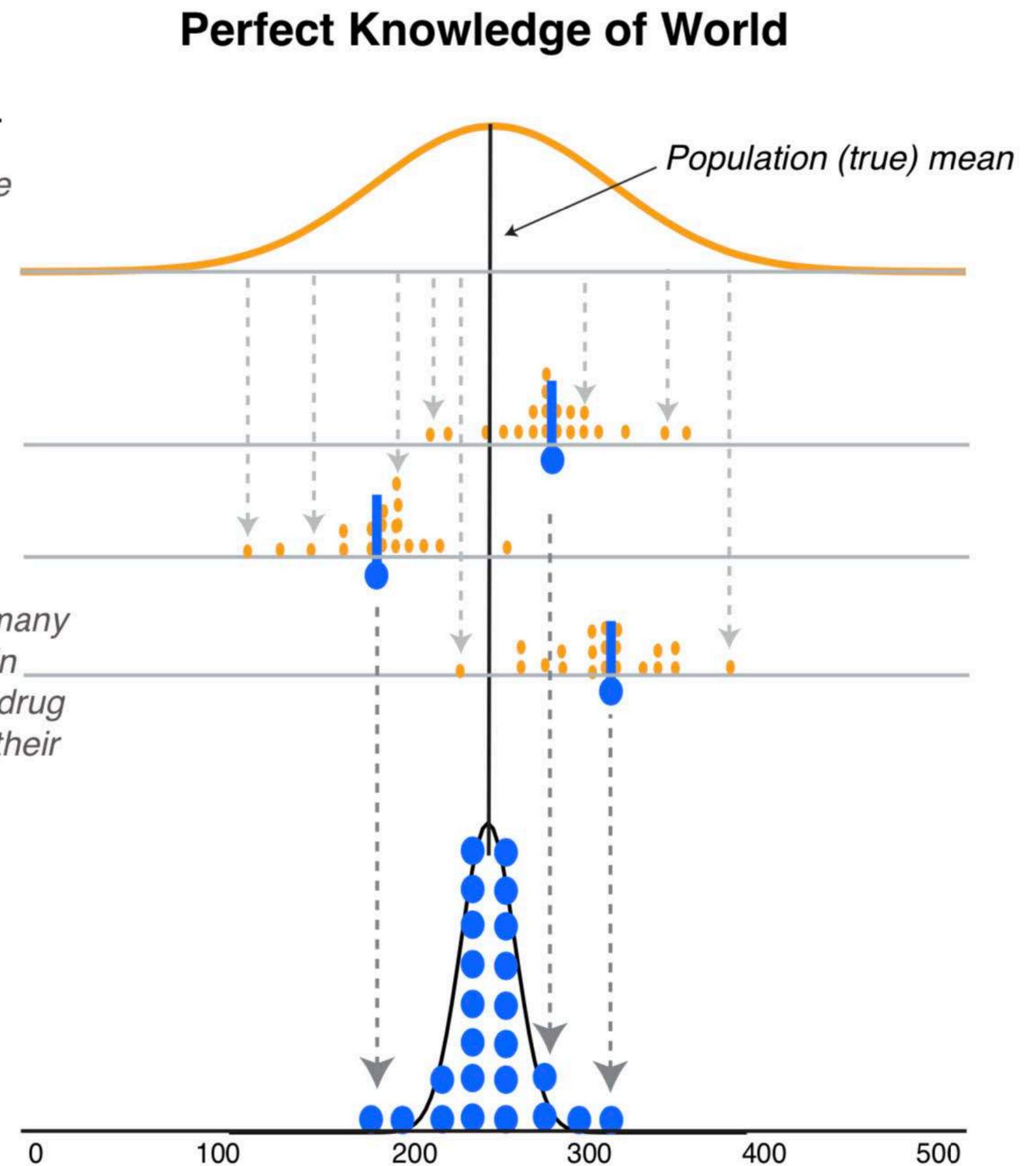
- 1 We assume an (unobserved) **population distribution** of all members of the population.

For example, imagine we are interested in the effect of a drug on a rat's activity level.

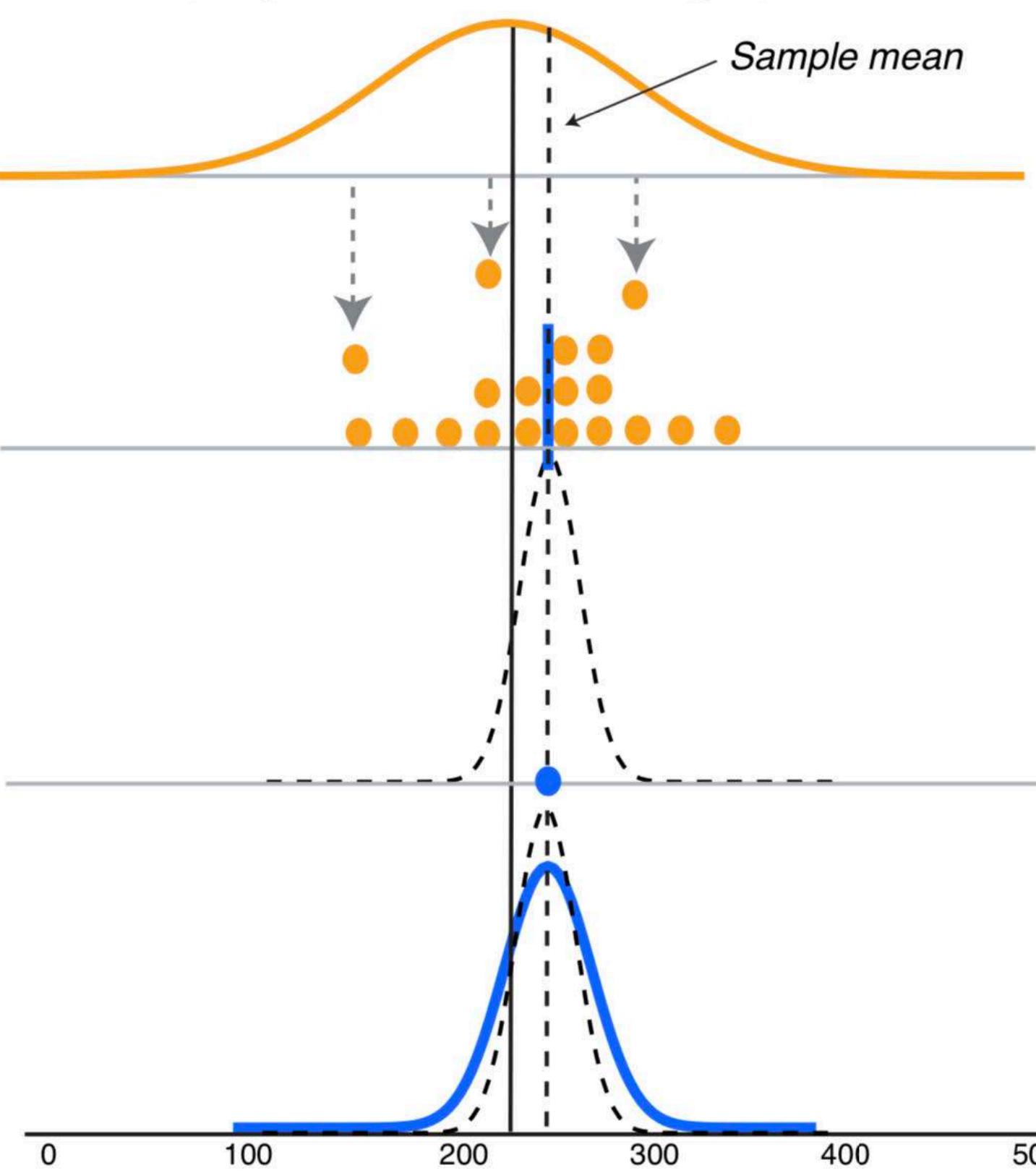
- 2 Ideally, we run an infinite number of experiments, each drawing a **sample** of size N from the population and taking the **mean**.

We might imagine running many iterations of an experiment in which 40 rats are given the drug and the average impact on their activity is calculated.

- 3 The distribution of these **sample means** in many exact replications of this experiment is called the **true sampling distribution**.



### Imperfect Knowledge of World (Experimental Paradigm)



- 4 In the real world, we cannot observe the population distribution directly, run infinite experiments, or observe the true sampling distribution.

- 5 Instead, we often run just one experiment, drawing a **sample** of size N from the population and taking the **mean**.

For example, we might run one experiment to see how 40 rats' activity levels are impacted.

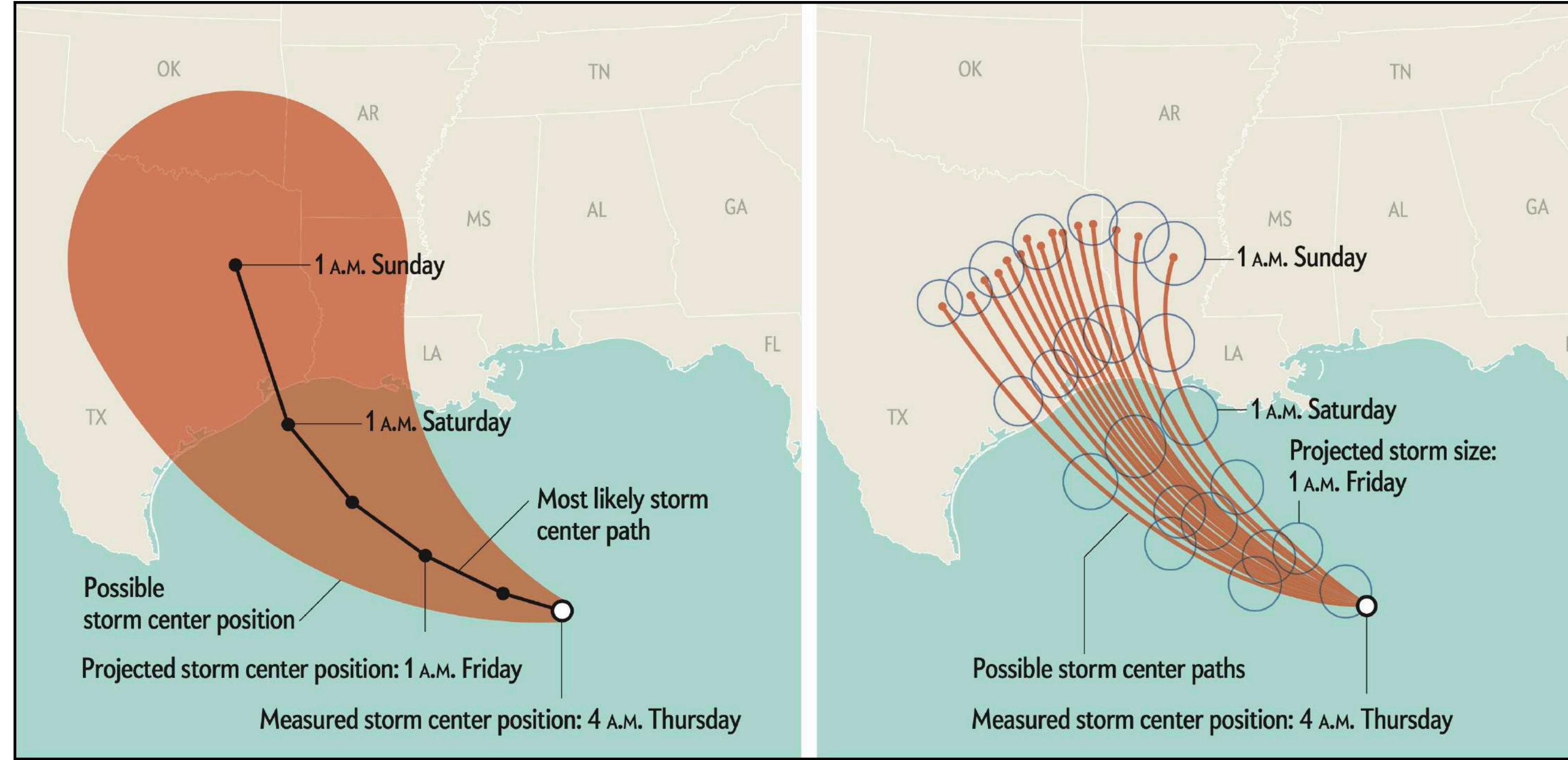
- 6 We can derive the sampling distribution of this **sample mean**--the **observed sampling distribution**--which describes the distribution of **means** in many exact replications if the **sample mean** were exactly equal to the **true mean**. But often it is not!

- 7 Instead, we can use a **replication prediction distribution**, which accounts for the uncertainty in our current estimate of the **mean** and sampling variation in replications to give us a prediction for the **mean** in exact replications of this experiment.



Hullman, Jessica

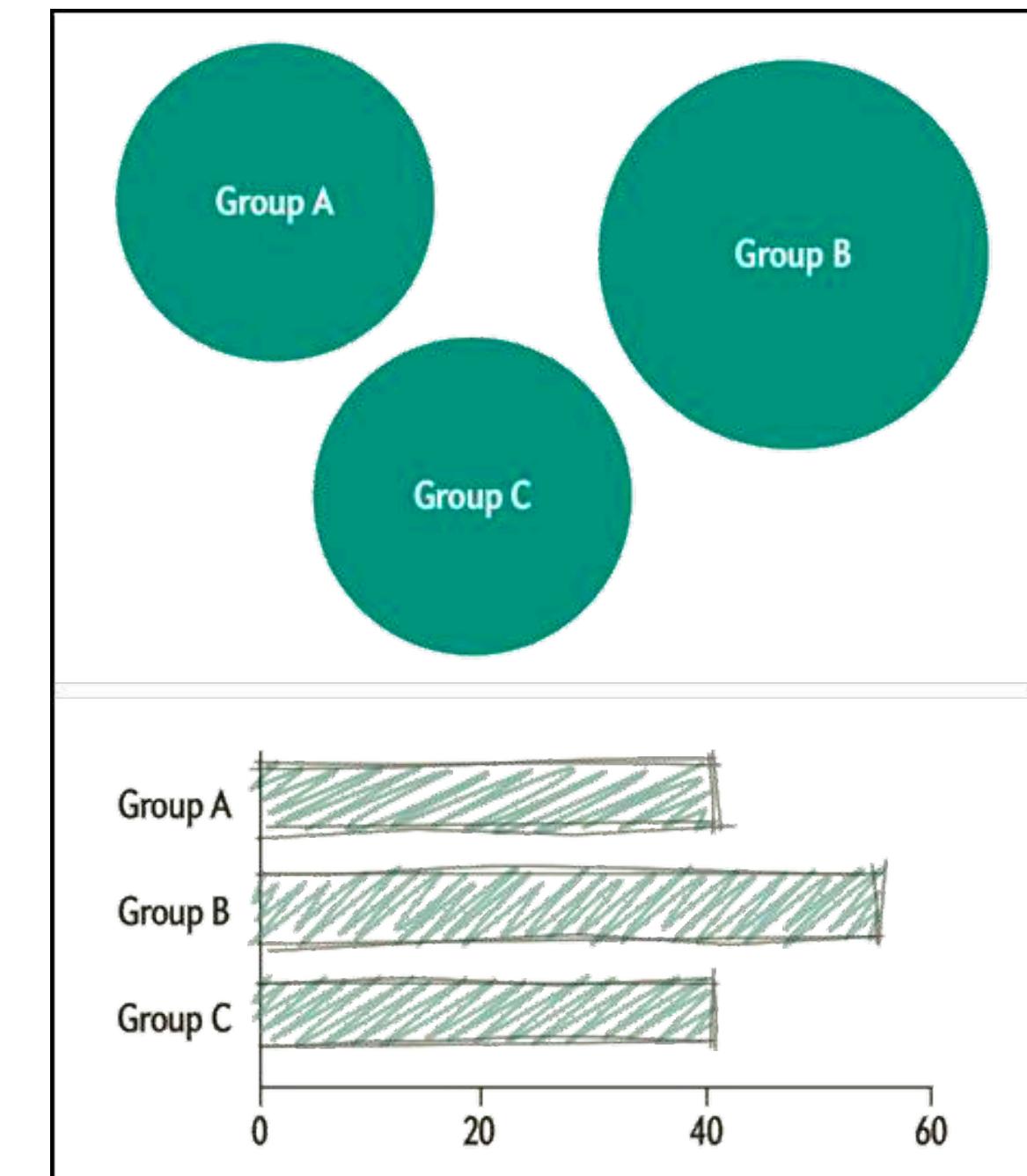
# uncertainty | graphically encoding uncertainty



Hullman, Jessica

# uncertainty | *graphically encoding uncertainty*

no quantification



Hullman, Jessica

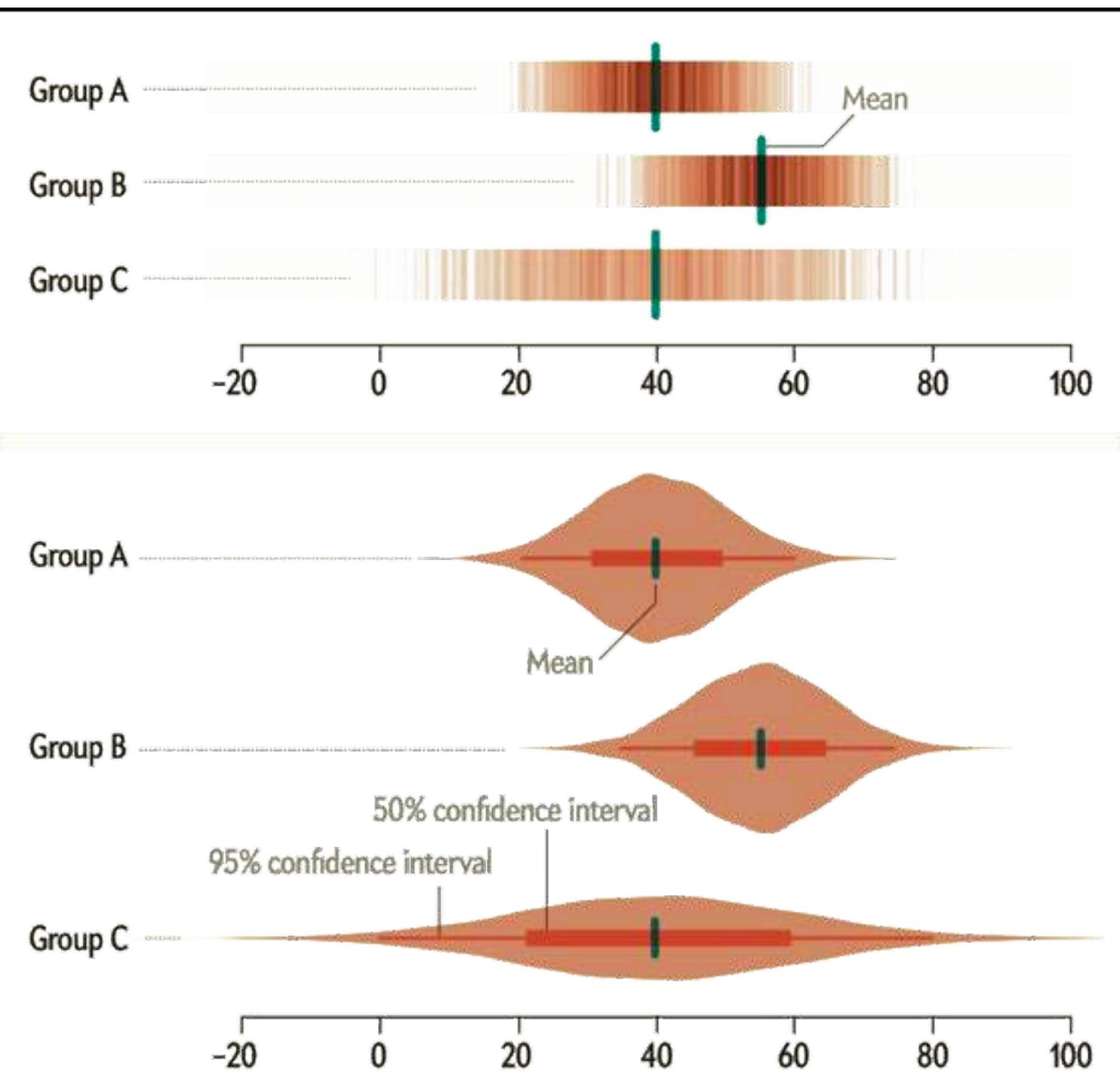
# uncertainty | graphically encoding uncertainty

intervals



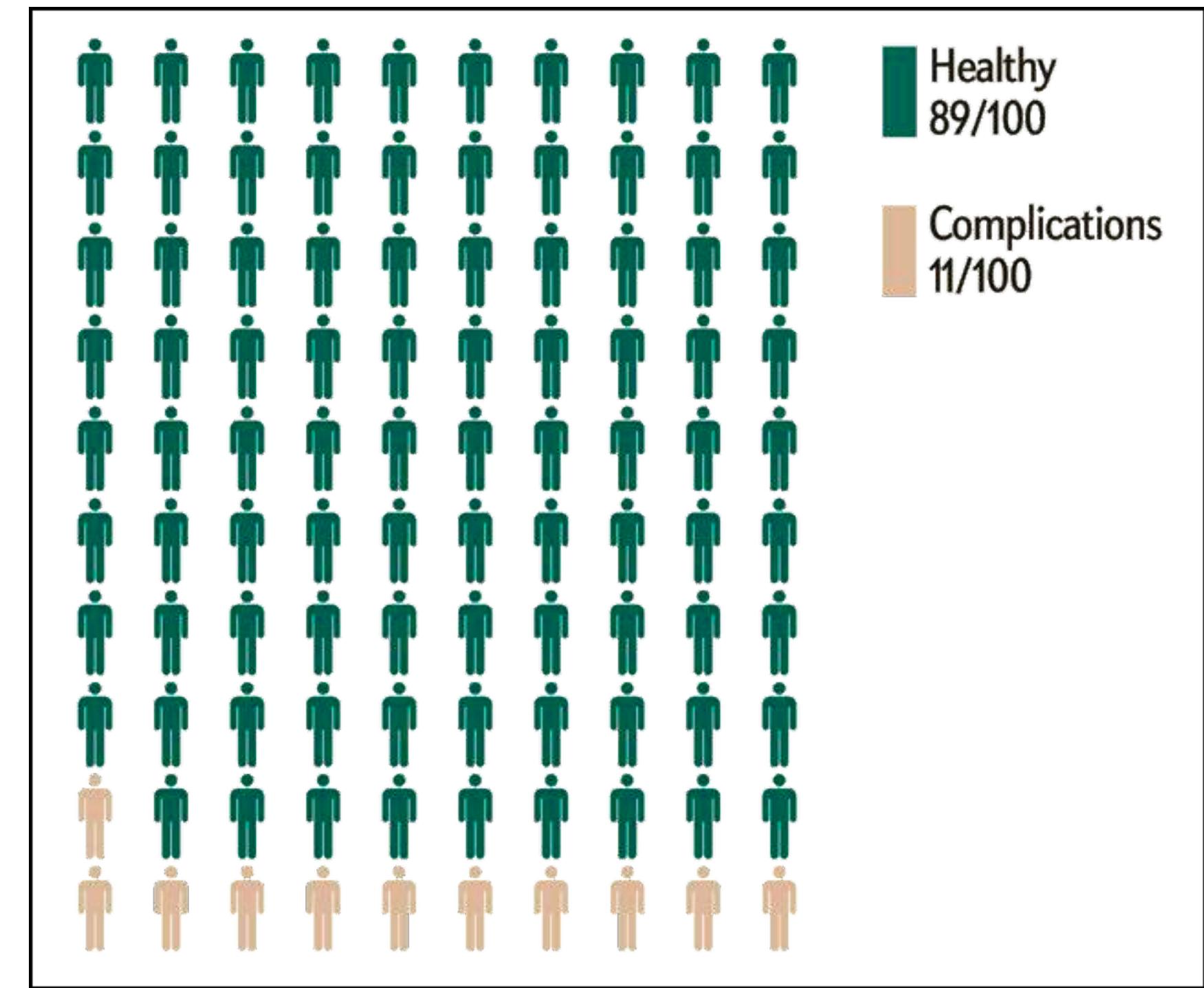
# uncertainty | graphically encoding uncertainty

probability density

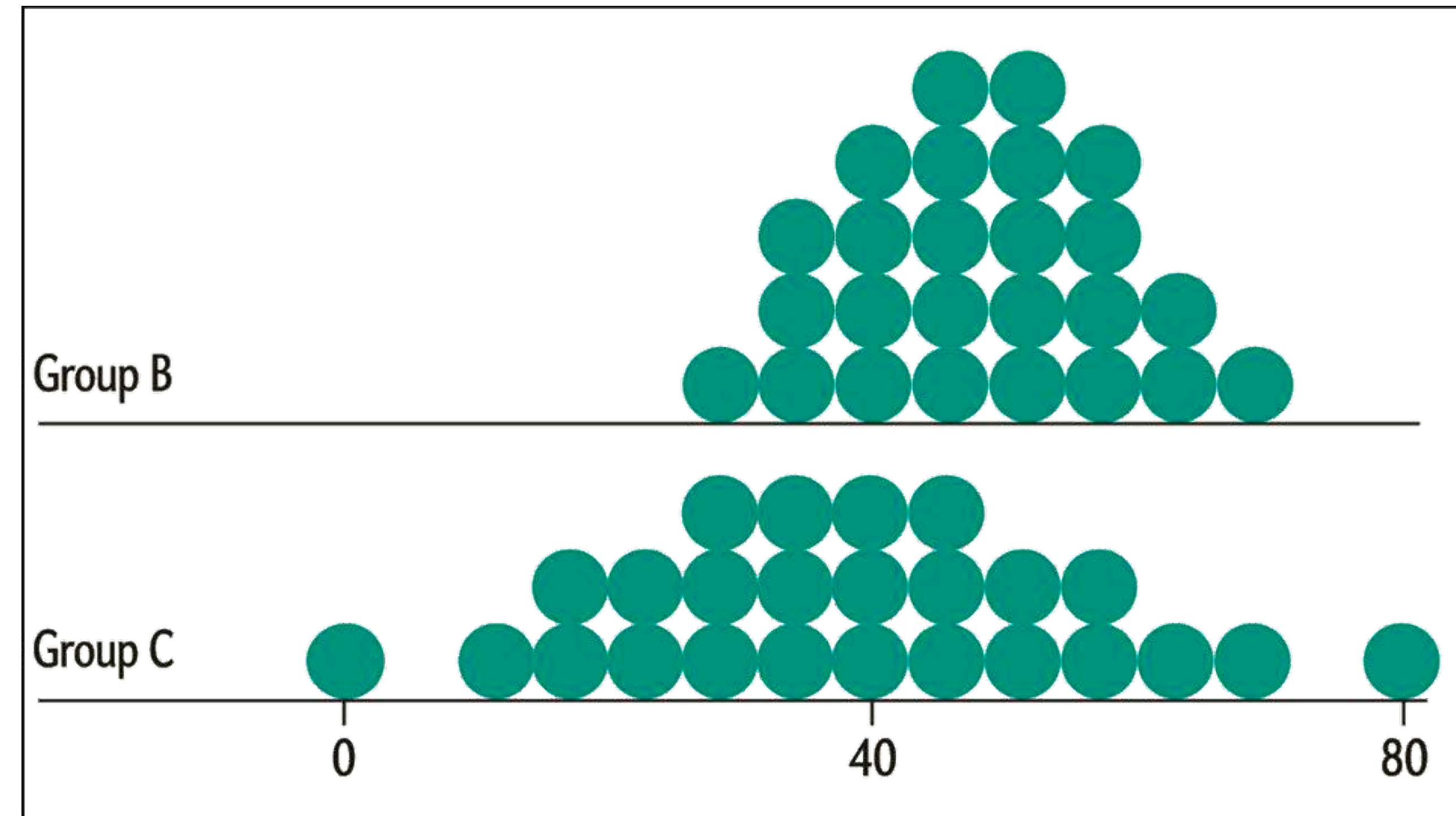


# uncertainty | graphically encoding uncertainty

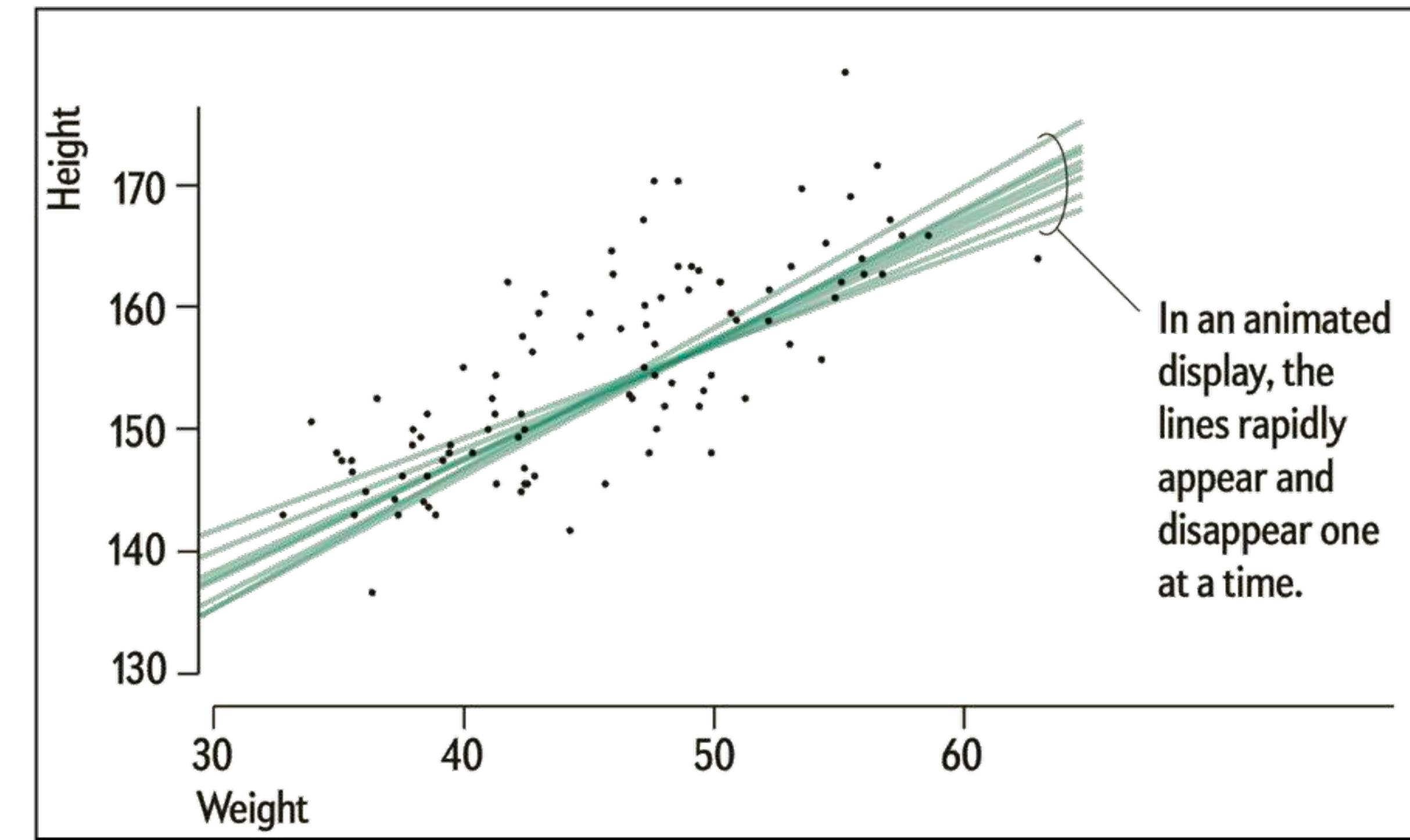
arrays of icons (isotypes)



multiple samples in space (dot plots)



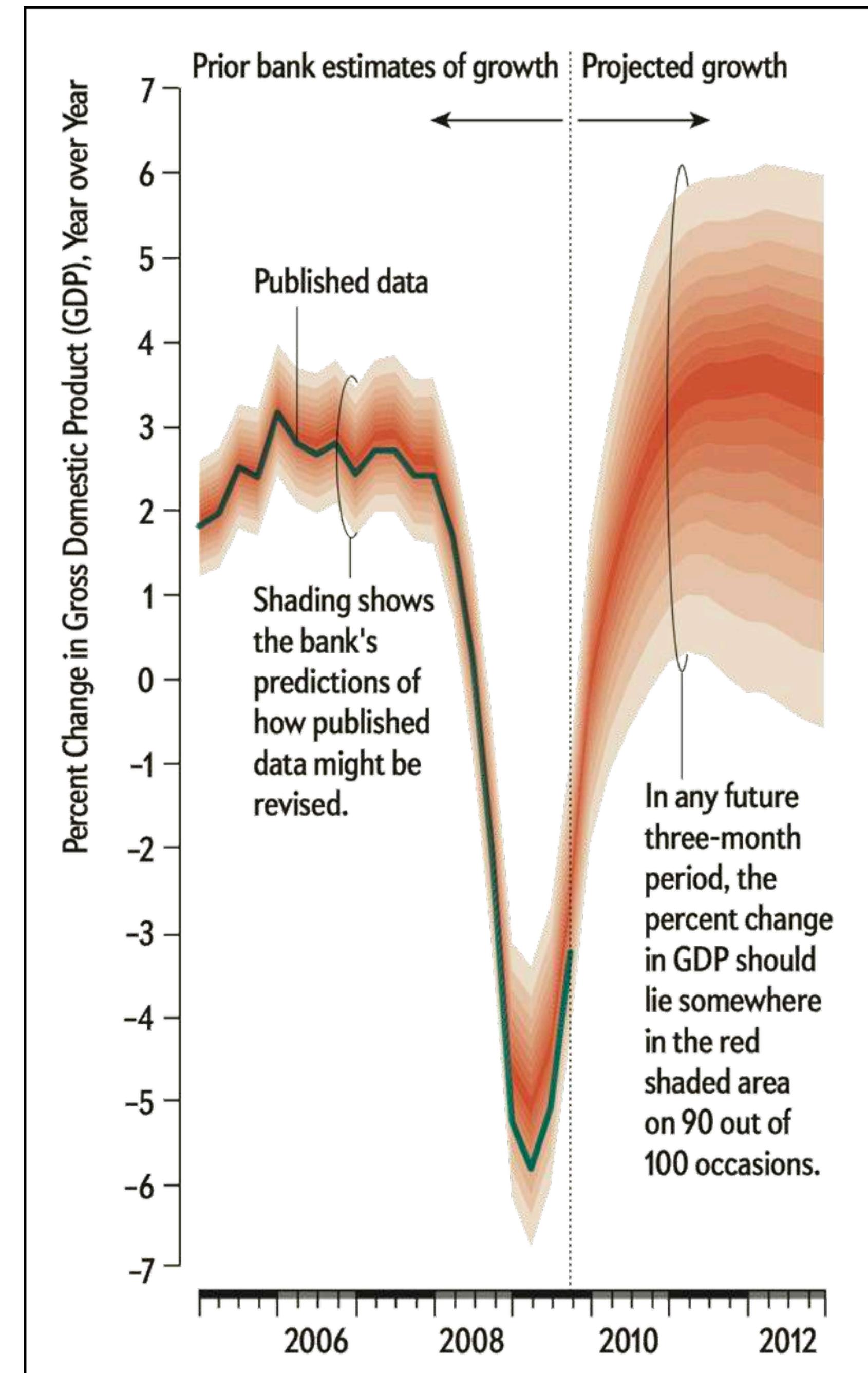
displaying samples in time



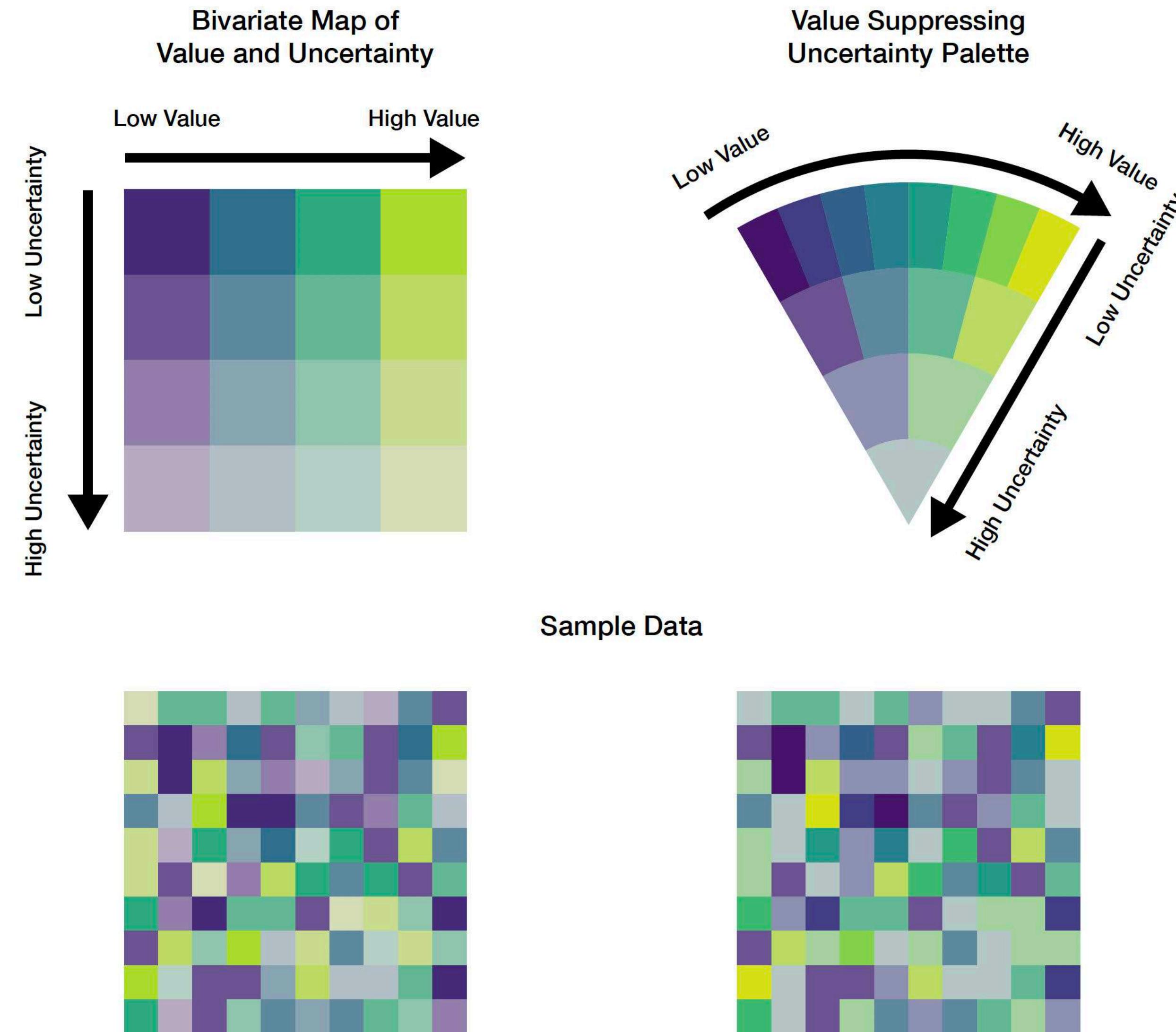
## hybrid approaches



Hullman, Jessica



# uncertainty | *encoding uncertainty with color*



# **What are information graphics?**

# What are information graphics? | *dictionary definition is too broad, generic*

**INFOGRAPHIC** n. a visual image such as a chart or diagram used to represent information or data in an easily understandable form.

# What are information graphics? | *viewpoints at Malofiej — the infographics world summit*



**Gregor Aisch**

Infographics is an abbreviated form of “information graphics”. It seems to mean a lot of different things to different people. I rarely use the term.



**Federica Fragapane**

A **visual translation of data** and information: a language to communicate topics, contents and **stories** to people.



**Laris Karklis**

Infographics is . . . using **visuals** to tell a **story**.

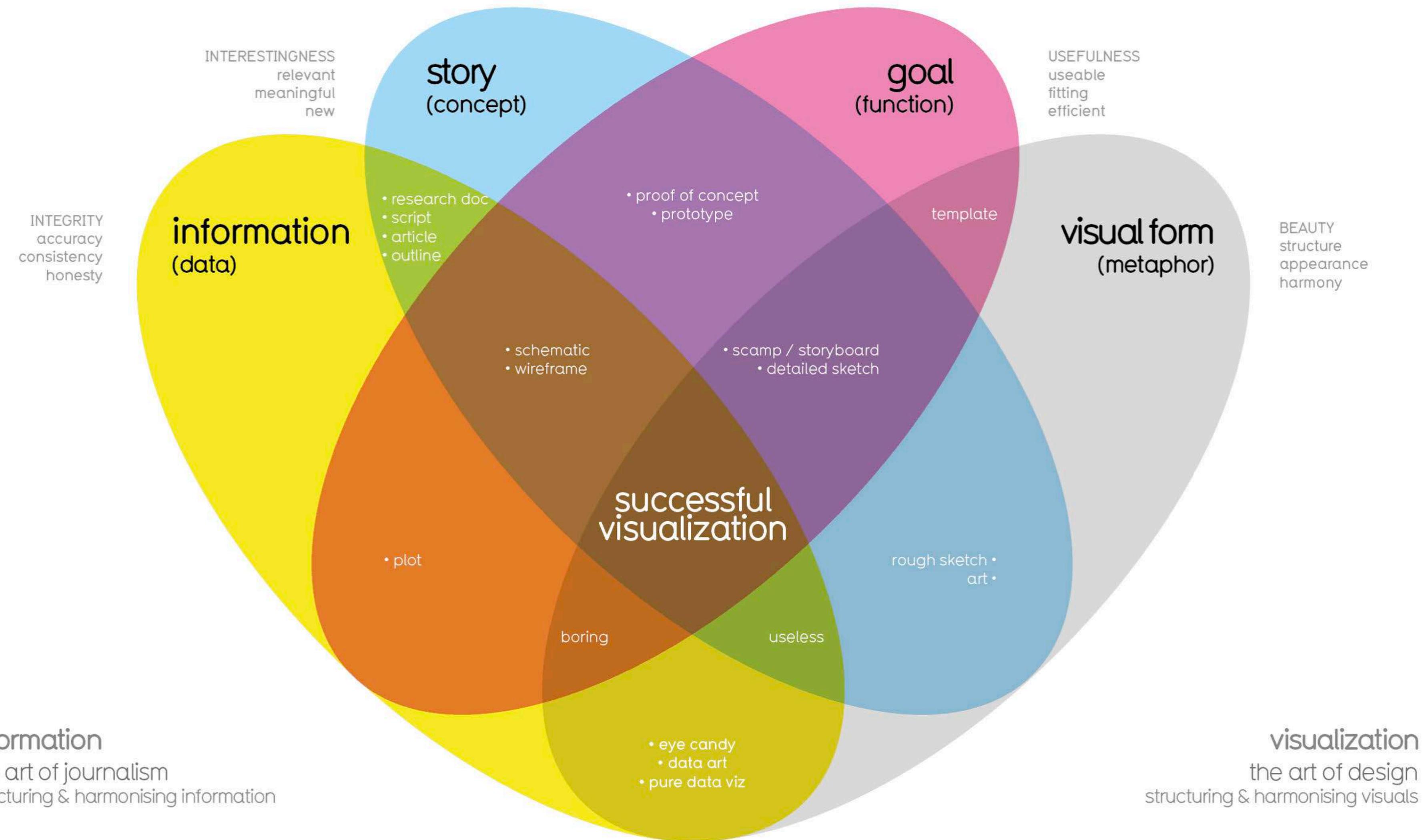


**Nadieh Bremer**

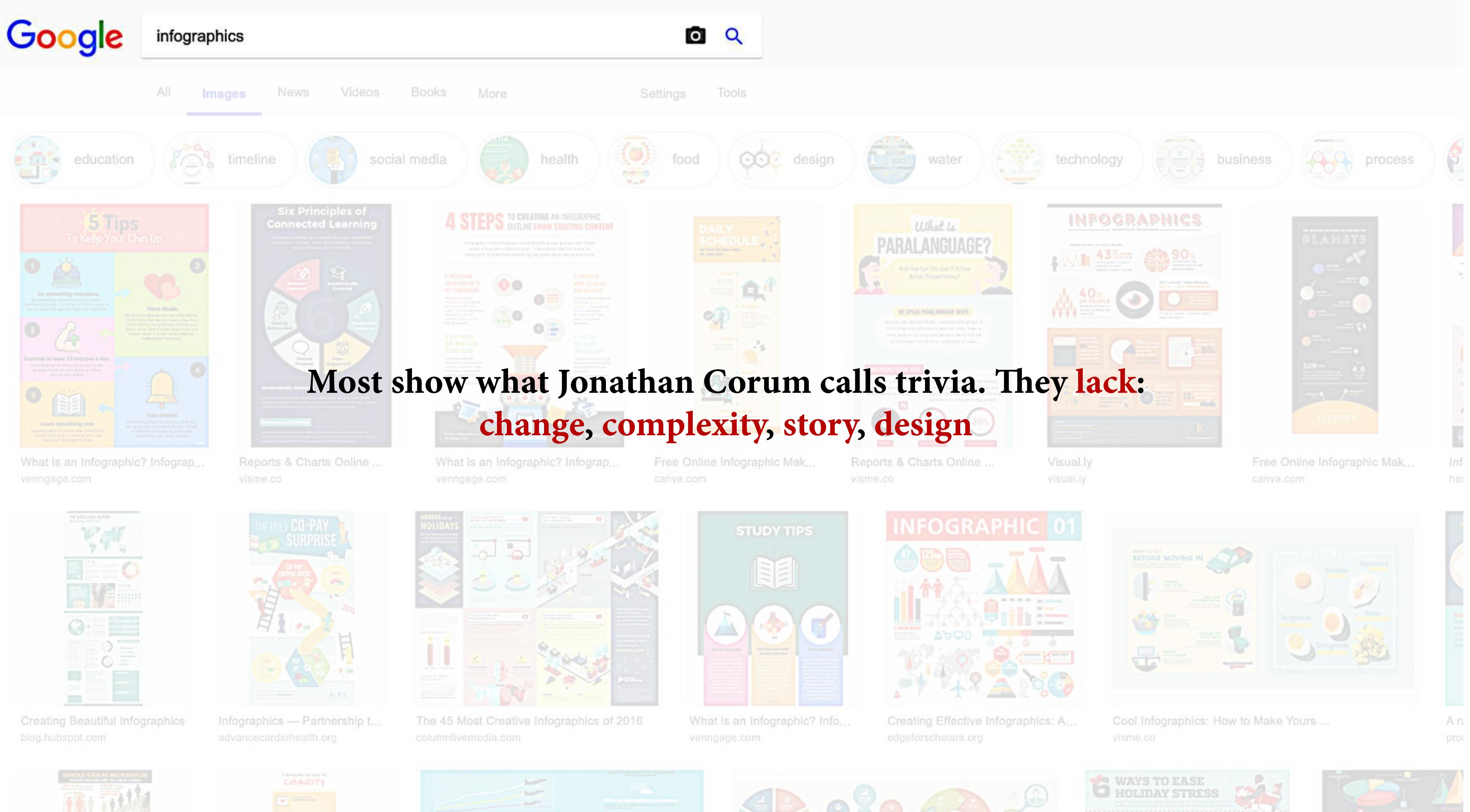
Infographics . . . combine graphical elements, such as a drawn portion of an animal, human, map, etc. with small mini **data visualizations** (a small bar chart for example) and annotations to tell a **story**.

## What Makes a Good Visualization?

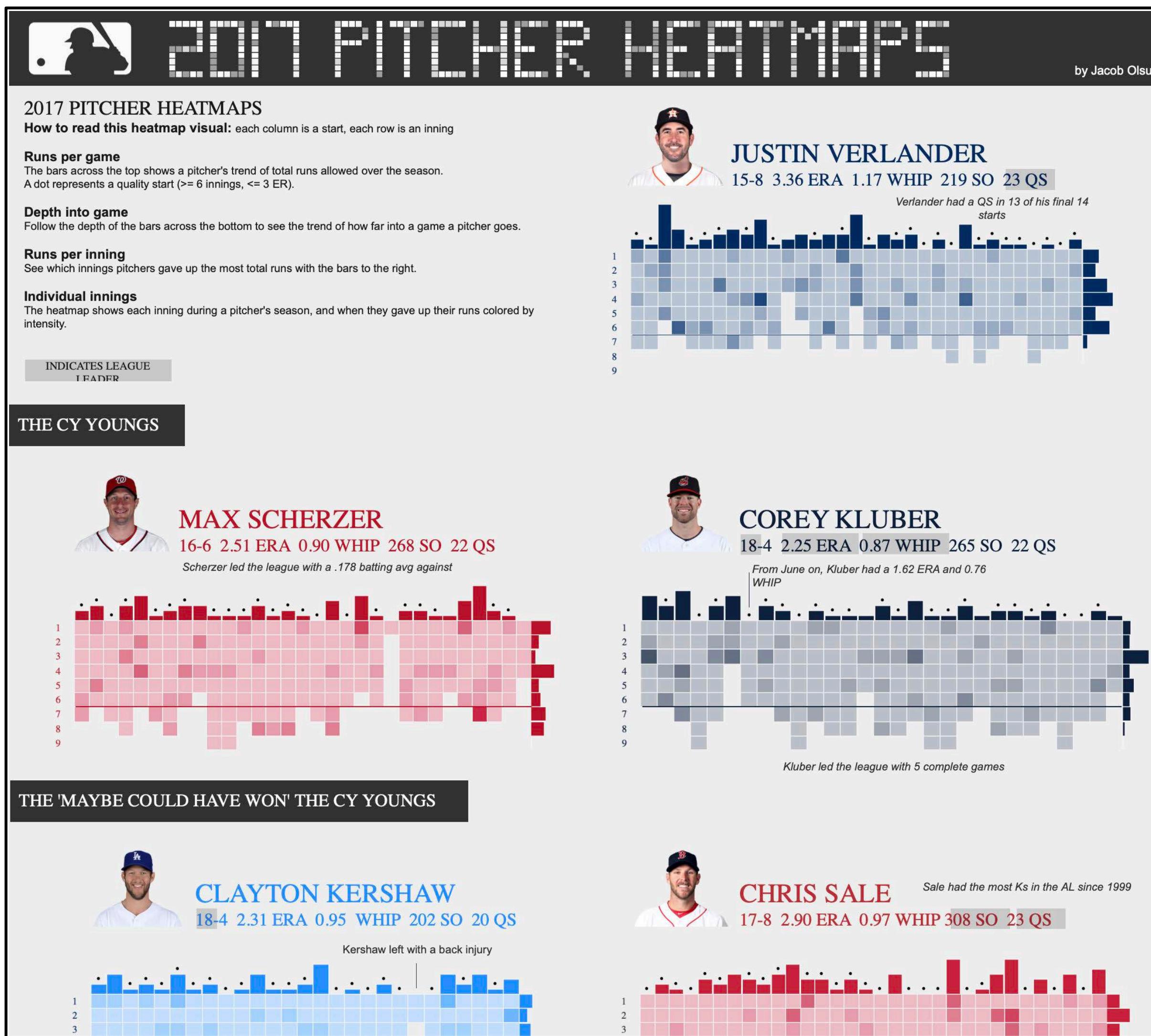
explicit (implicit)



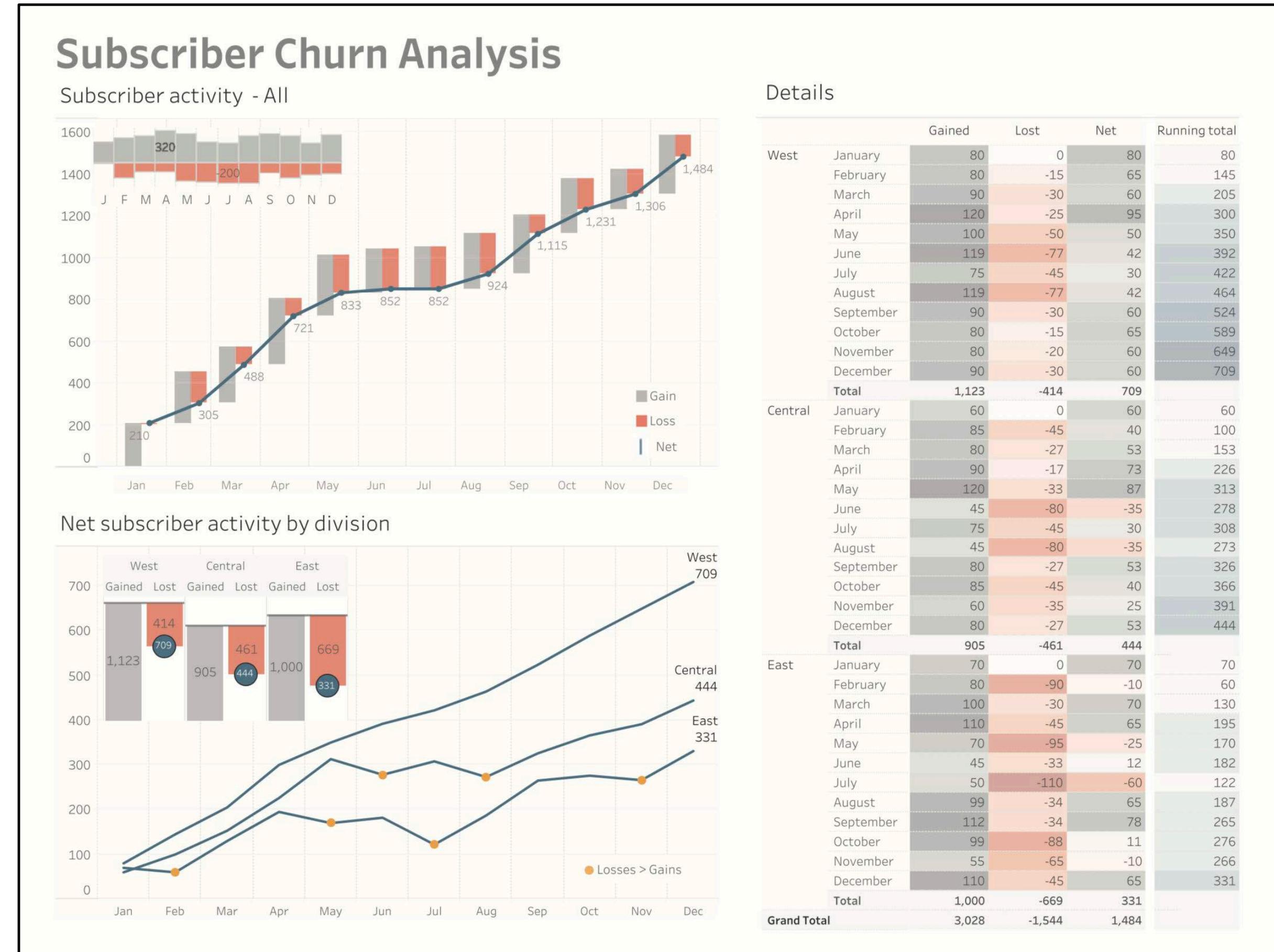
What are information graphics? | *to play the roulette wheel of **bad** examples, just google “infographics”*



# What are information graphics? | *without a narrative, it's just trivia, list of facts*



What are information graphics? | *dashboards, unlike infographics of interest, lack narrative or story*



We differentiated ... “list of fact” infographics from the infographics medium as a whole, and chose to *exclude* them because this specific submedium *lacks authorial narrative*.



---

Riche, co-editors

**TELL A COMPLETE STORY** where the purpose is to inform, entertain or persuade the audience (to act). It should:

clear, focused messages

new, surprising information

credible data sources

visually coherent graphics and narrative, integrated comparisons and contrasts for context, meaning principles of information design, organized

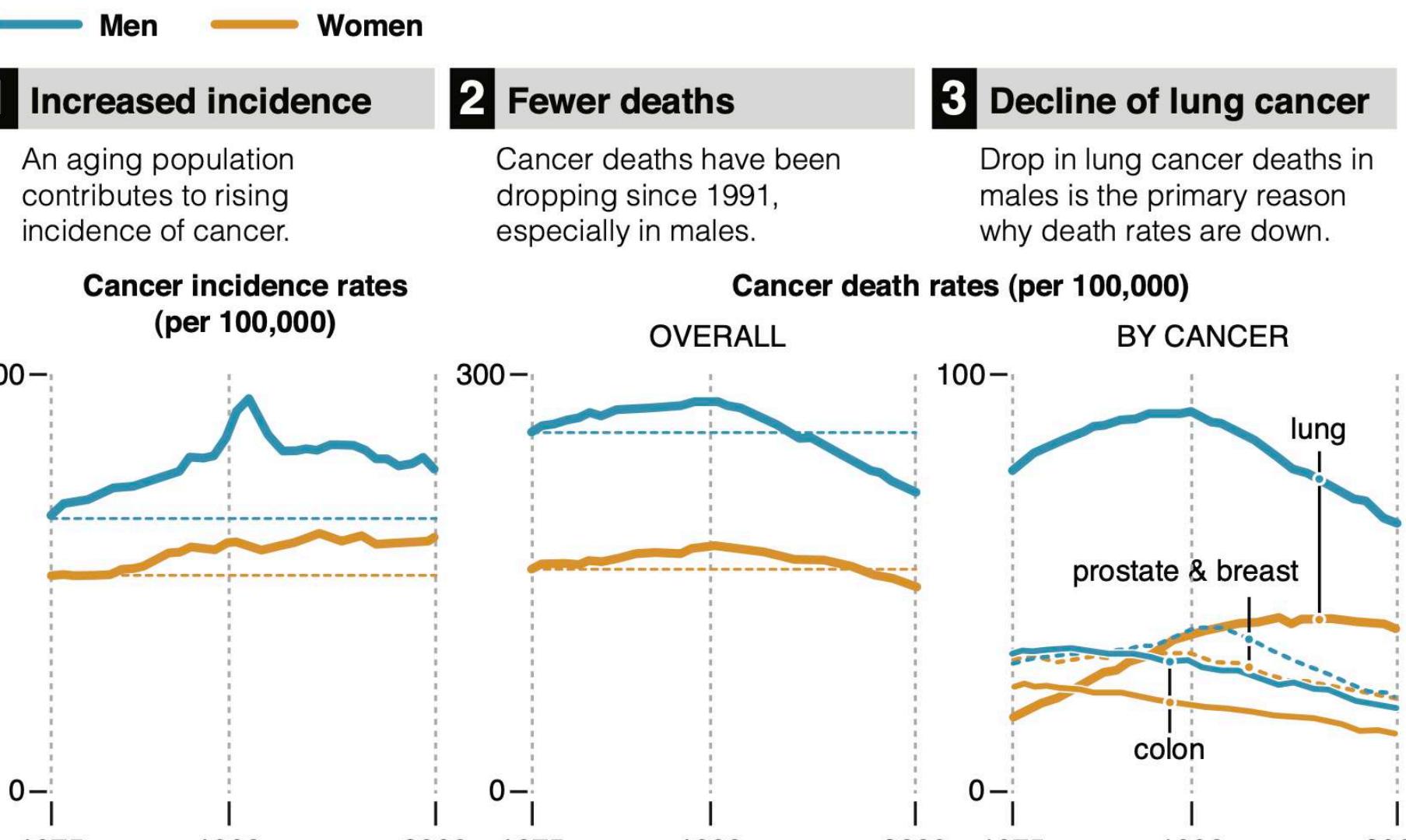
(when) are information graphics appropriate?

# (when) are information graphics appropriate?



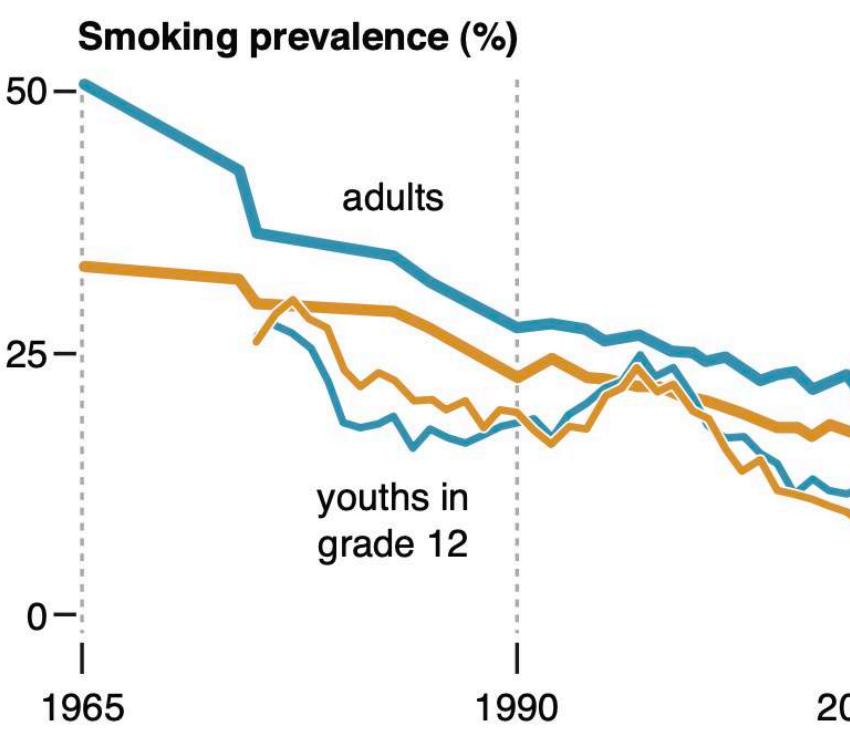
## WHERE THERE'S SMOKE—THERE'S CANCER

Cancer rates are up, but mortality is down. New diagnostics and treatments are responsible for part of this trend. But the greatest single contributing factor is the decline in smoking—rates are at their lowest level in 50 years.



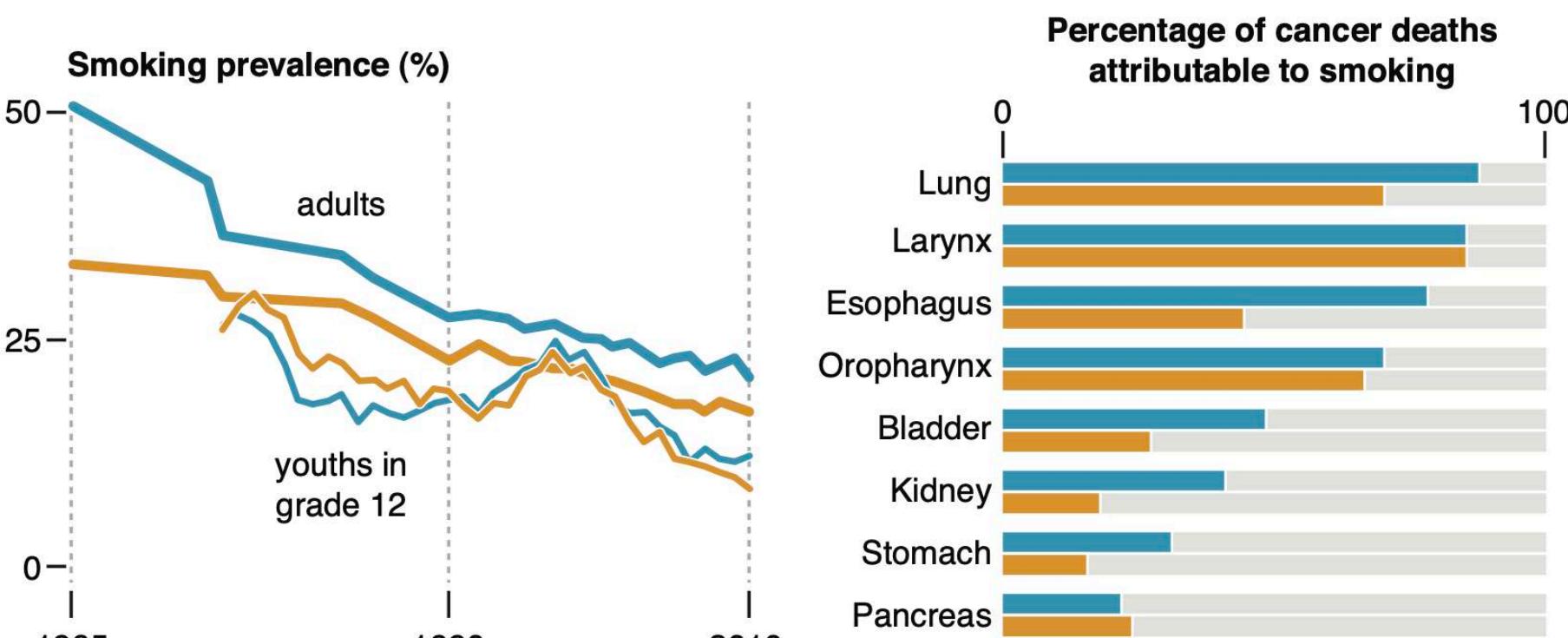
**4 Decline in smoking**

Since the 1964 first Surgeon General's report, smoking rates have been dropping. By 2010, the rate among males was down to 20%, from 50% at its peak. Among youths, rates have been on an even steeper decline since 1997.



**5 Impact of smoking on cancer deaths**

Smoking is a major risk factor for many types of cancer and significant contributor to cancer-related deaths. It remains the single largest preventable cause of disease and premature death in the US.

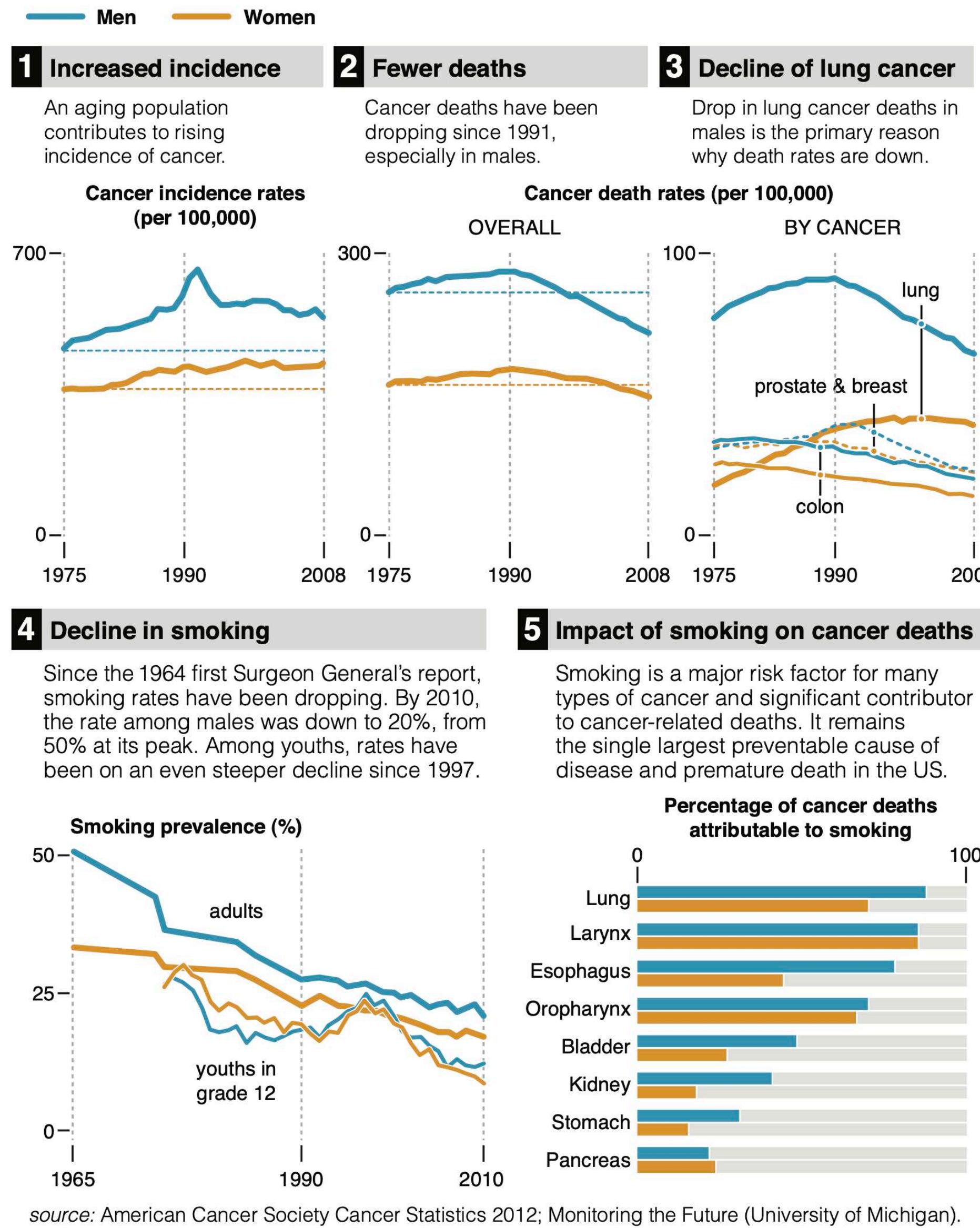


source: American Cancer Society Cancer Statistics 2012; Monitoring the Future (University of Michigan).

# (when) are information graphics appropriate?

## WHERE THERE'S SMOKE—THERE'S CANCER

Cancer rates are up, but mortality is down. New diagnostics and treatments are responsible for part of this trend. But the greatest single contributing factor is the decline in smoking—rates are at their lowest level in 50 years.



infographics examples for discussion

# infographics examples for discussion

## Audience?

Does this infographic seem designed to communicate with an identified audience? If so, who?

## Purpose?

Do you see a purpose? If so, what is it trying to inform, entertain, or persuade the audience to act? Or something else?

## Narrative?

Does it use narrative? If so, what structure? Examples? Metaphors? Test with tools from past lectures.

## Encoding, decoding?

What data is encoded? How? Any issues of perception in decoding?

## Comparison or change?

Does the infographic describe comparisons or change? If so, what?

## Color, coherency?

Is color used? If so, for what purpose(s) are its hue, chroma, or luminance used?

## Hierarchy, annotation?

Does it have a hierarchy of information? If so, how is that hierarchy made? Are data encodings explained? If so, how?

## Layering, layout?

Is the information organized? If so, how?

## Credibility, transparency?

Are data sources identified, explained? Limitations or issues discussed?

# Let's critique

# Get specific

# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

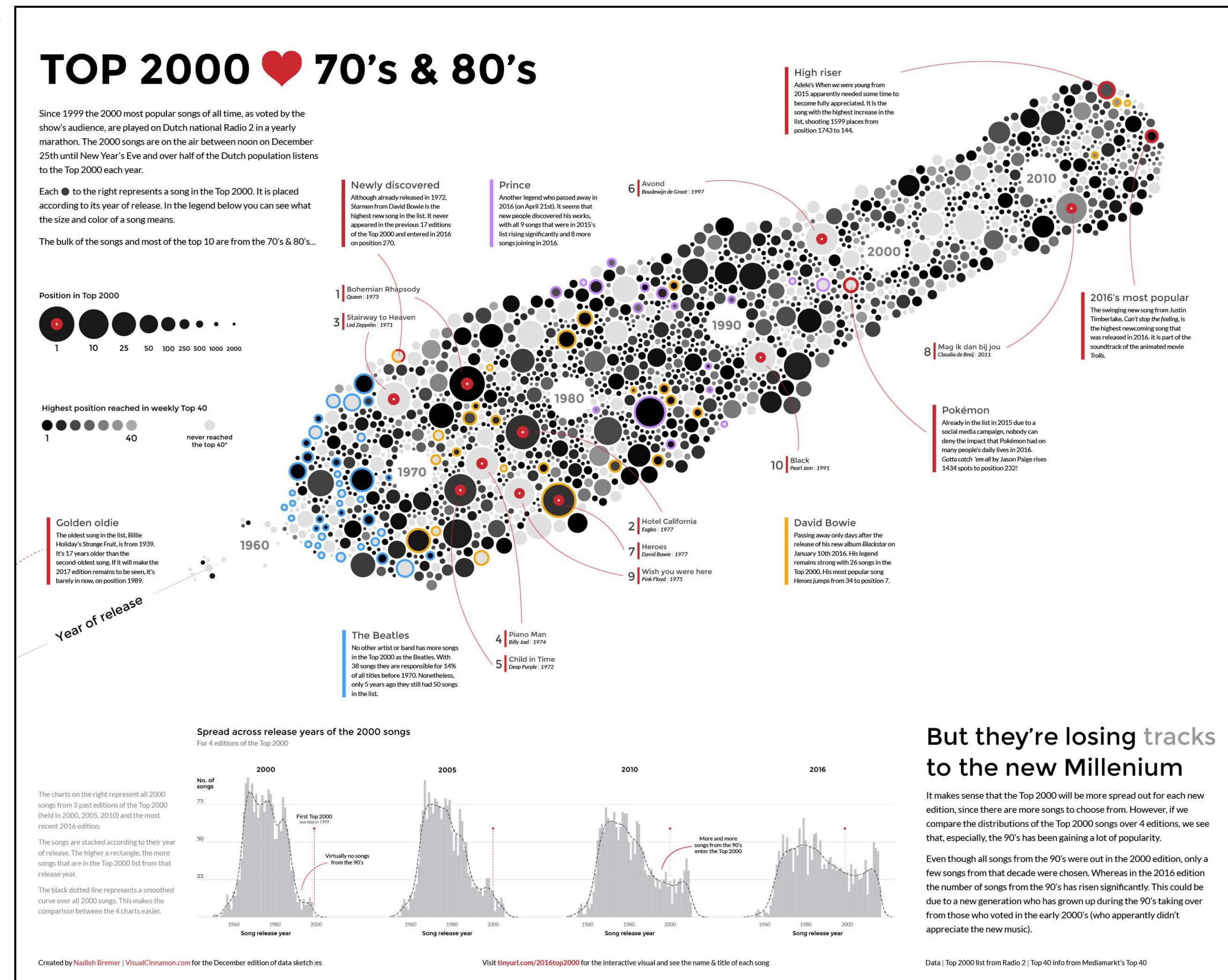
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



But they're losing tracks  
to the new Millennium

It makes sense that the Top 2000 will be more spread out for each new edition, since there are more songs to choose from. However, if we compare the distributions of the Top 2000 songs over 4 editions, we see that, especially, the 90's has been gaining a lot of popularity.

Even though all songs from the 90's were out in the 2000 edition, only a few songs from that decade were chosen. Whereas in the 2016 edition the number of songs from the 90's has risen significantly. This could be due to a new generation who has grown up during the 90's taking over from those who voted in the early 2000's (who apparently didn't appreciate the new music).

# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

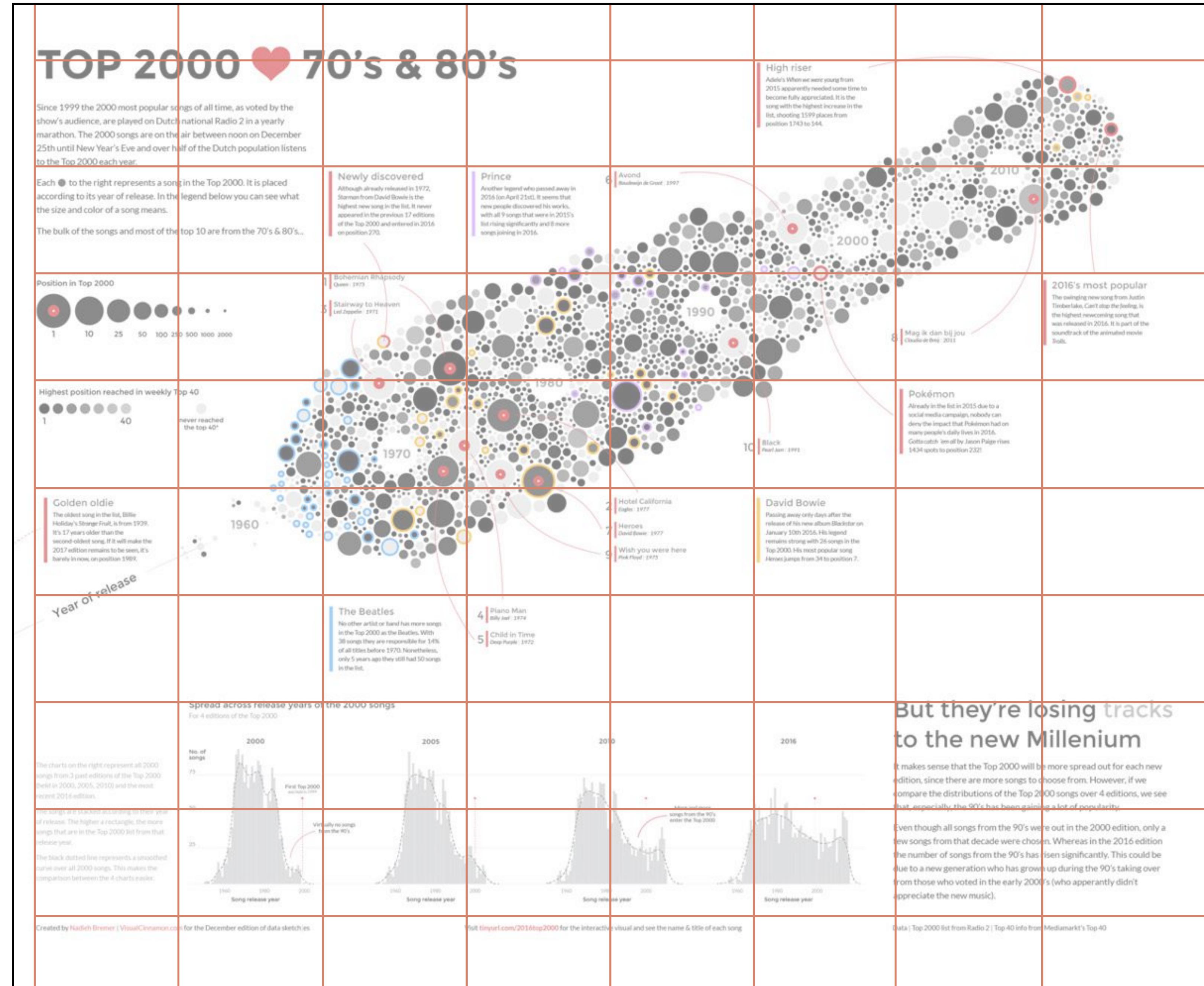
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

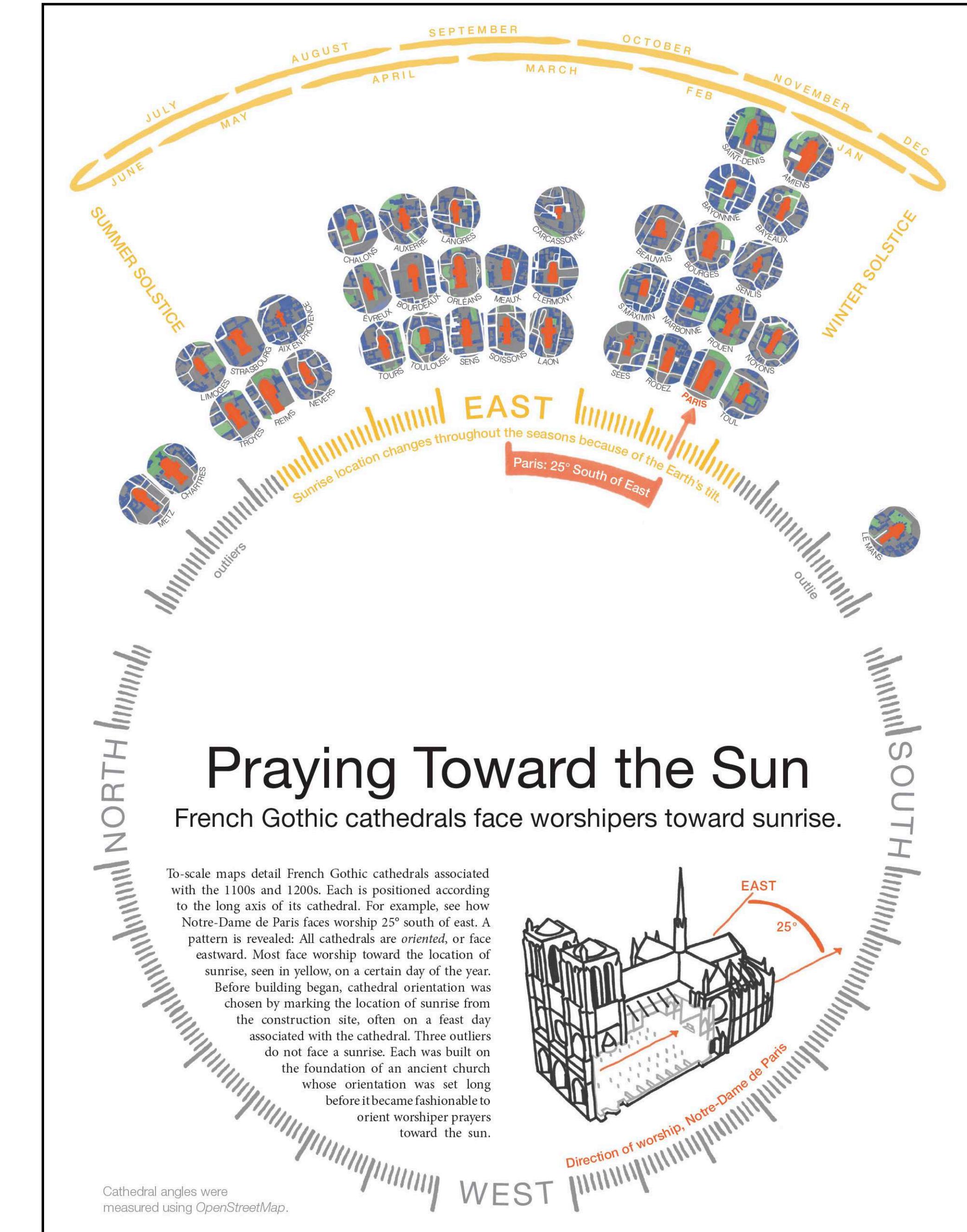
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

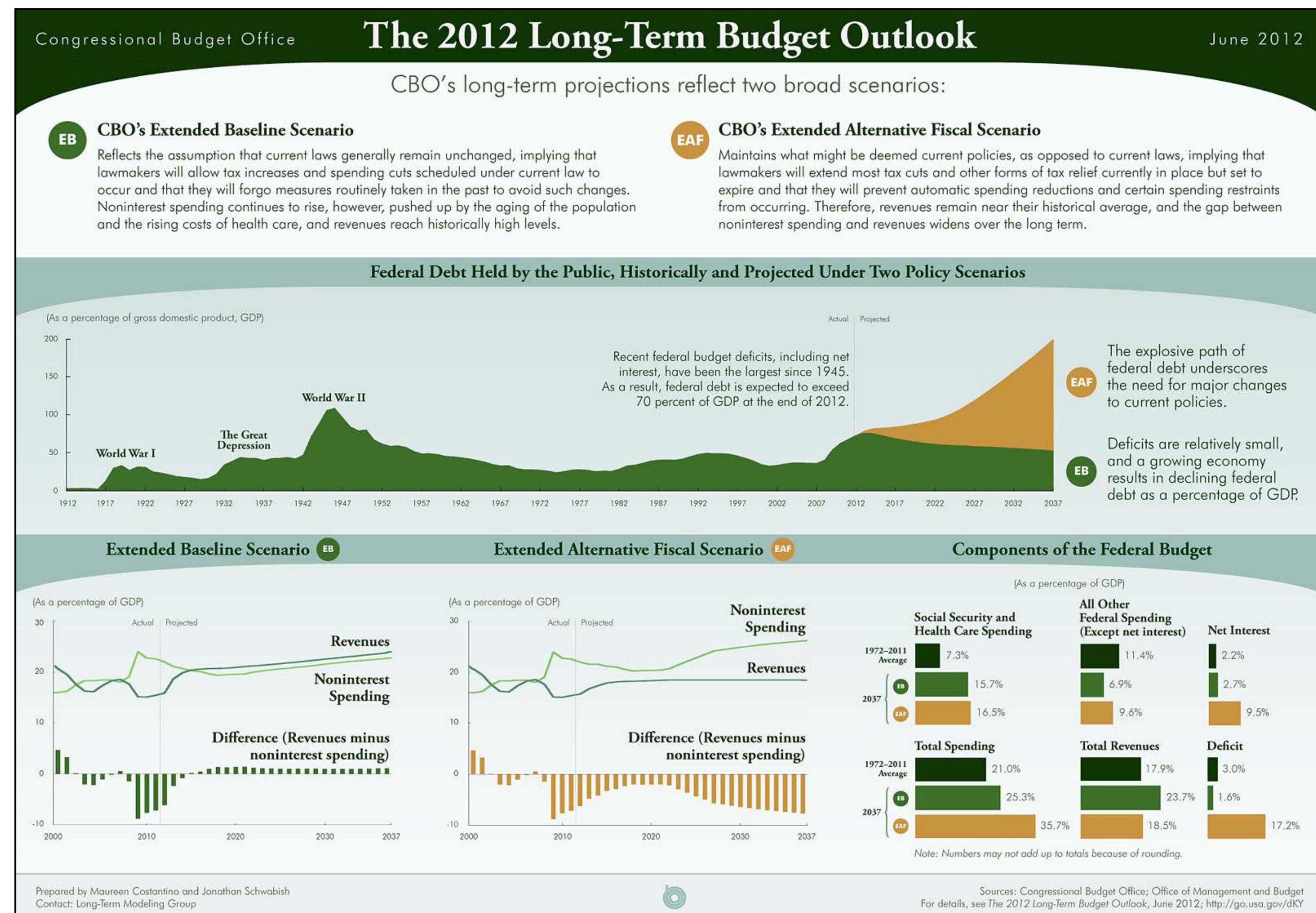
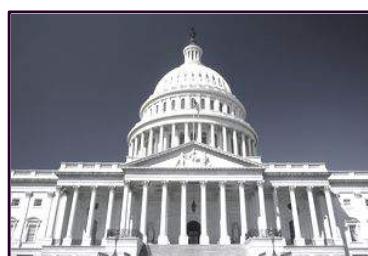
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

Data encodings, decodings?

Comparison or change?

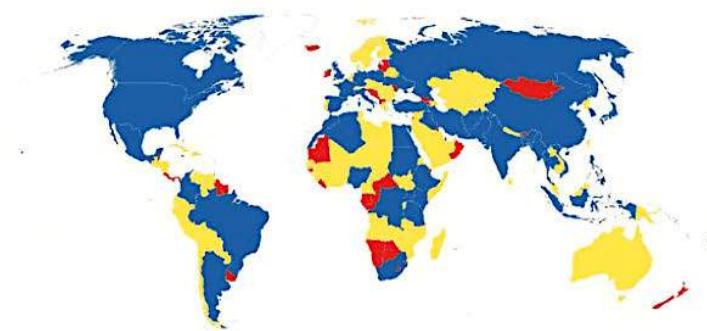
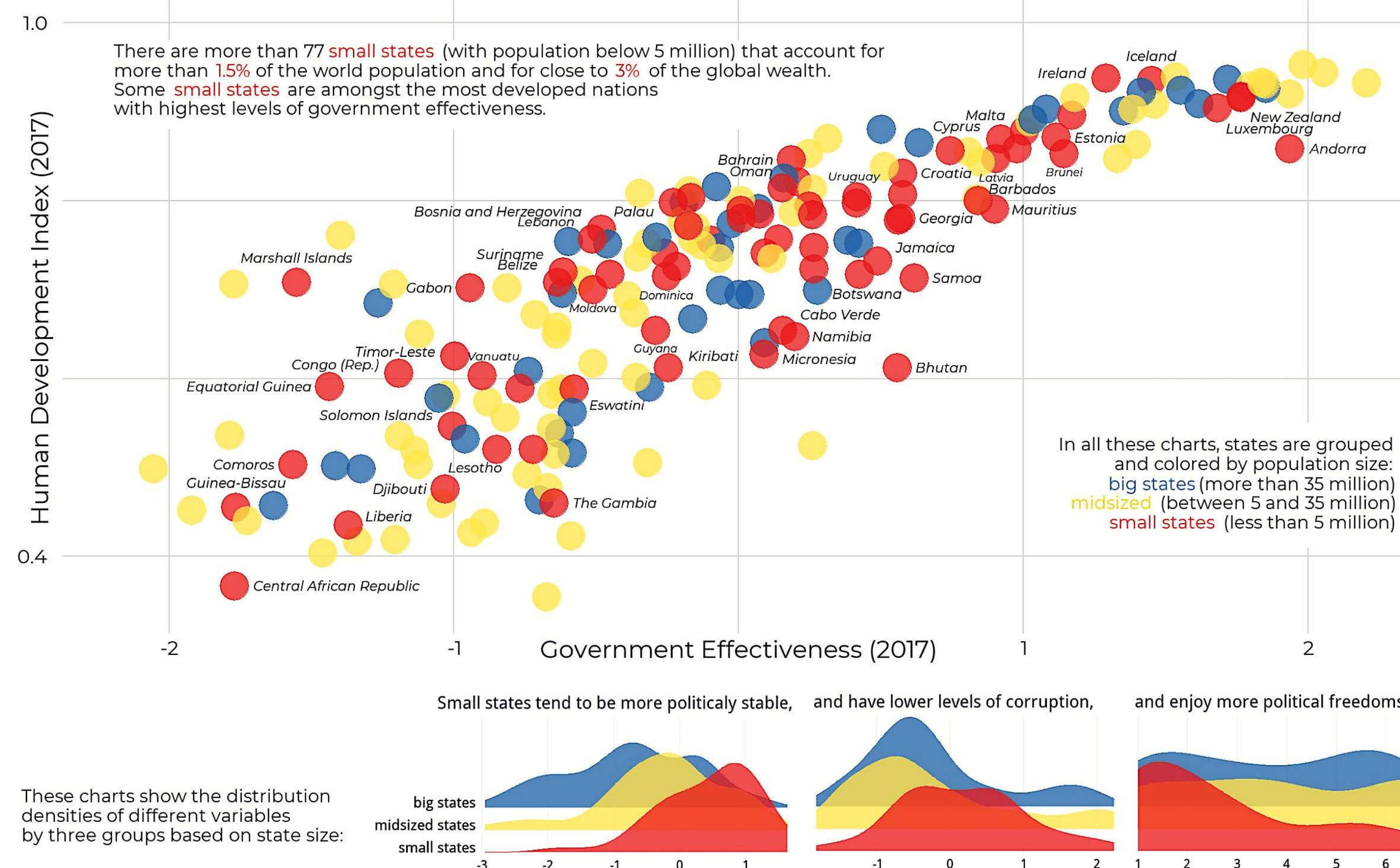
Color, coherency?

Layering, layout?

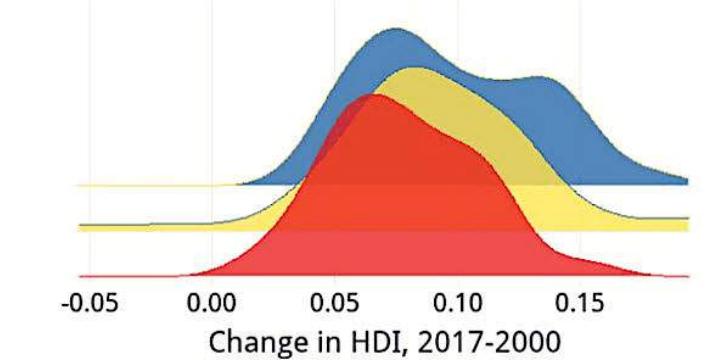
Credibility, transparency?



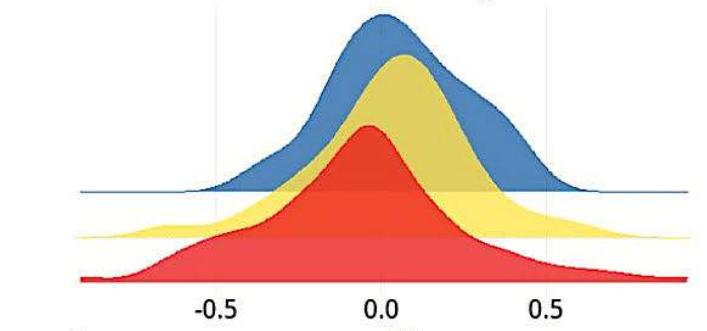
## Small States Can Be Big Players in Development and Good Governance



But small states have improved less



and have even lost some ground.



الجائزة العالمية  
لفن عرض للبيانات  
WORLD DATA  
VISUALIZATION PRIZE

# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

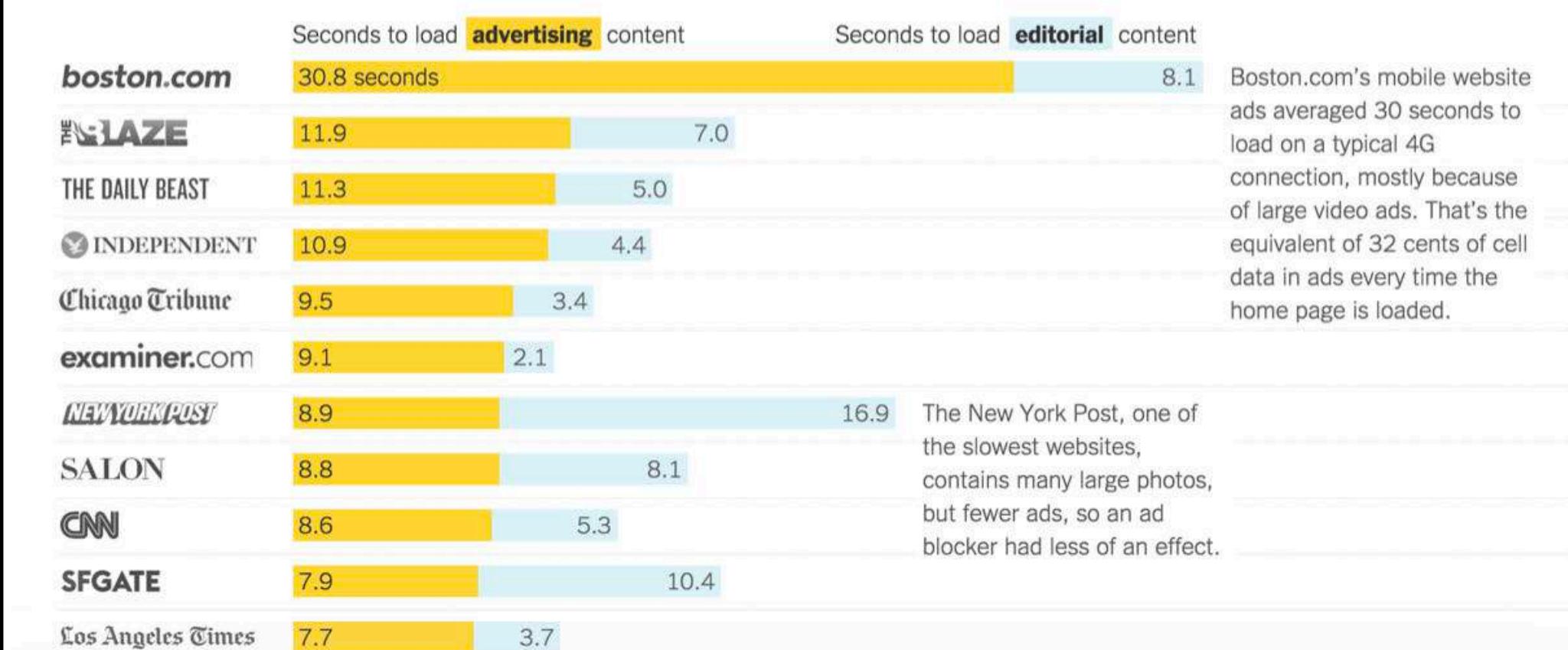
Credibility, transparency?



## The Cost of Mobile Ads on 50 News Websites

By GREGOR AISCH, WILSON ANDREWS and JOSH KELLER OCT. 1, 2015

Ad blockers, which Apple first allowed on the iPhone in September, promise to conserve data and make websites load faster. But how much of your mobile data comes from advertising? We measured the mix of advertising and editorial on the mobile home pages of the top 50 news websites – including ours – and found that **more than half of all data came from ads** and other content filtered by ad blockers. Not all of the news websites were equal. [RELATED ARTICLE](#)

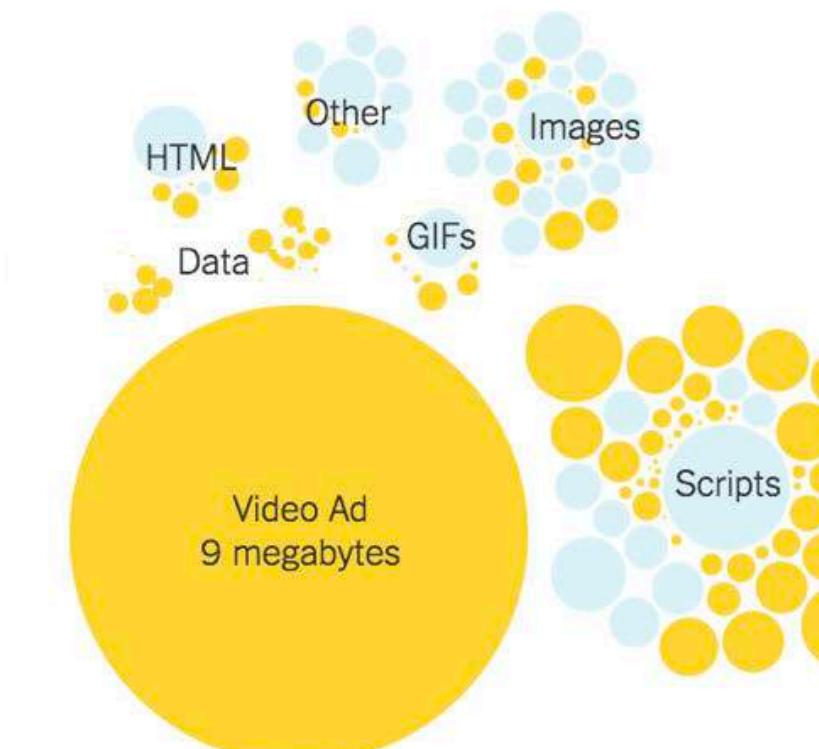


### boston.com

Here are all the files that made up the Boston.com data during one visit, including one large video ad and many script files used by ad networks. With an ad blocker, those files were gone.

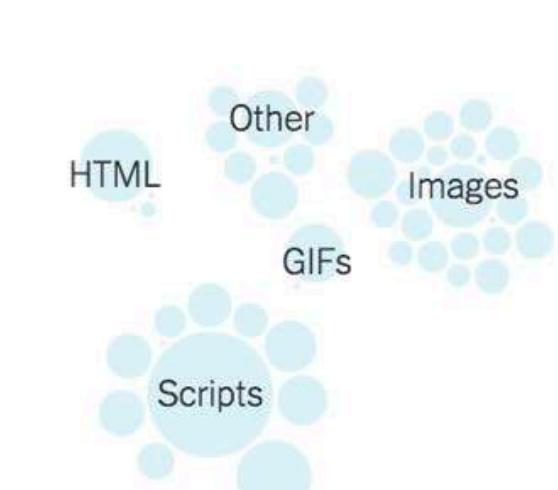
### Without ad blocker

389 files, 16.3 megabytes, 33 seconds



### With ad blocker

52 files, 3.5 megabytes, 7 seconds



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?

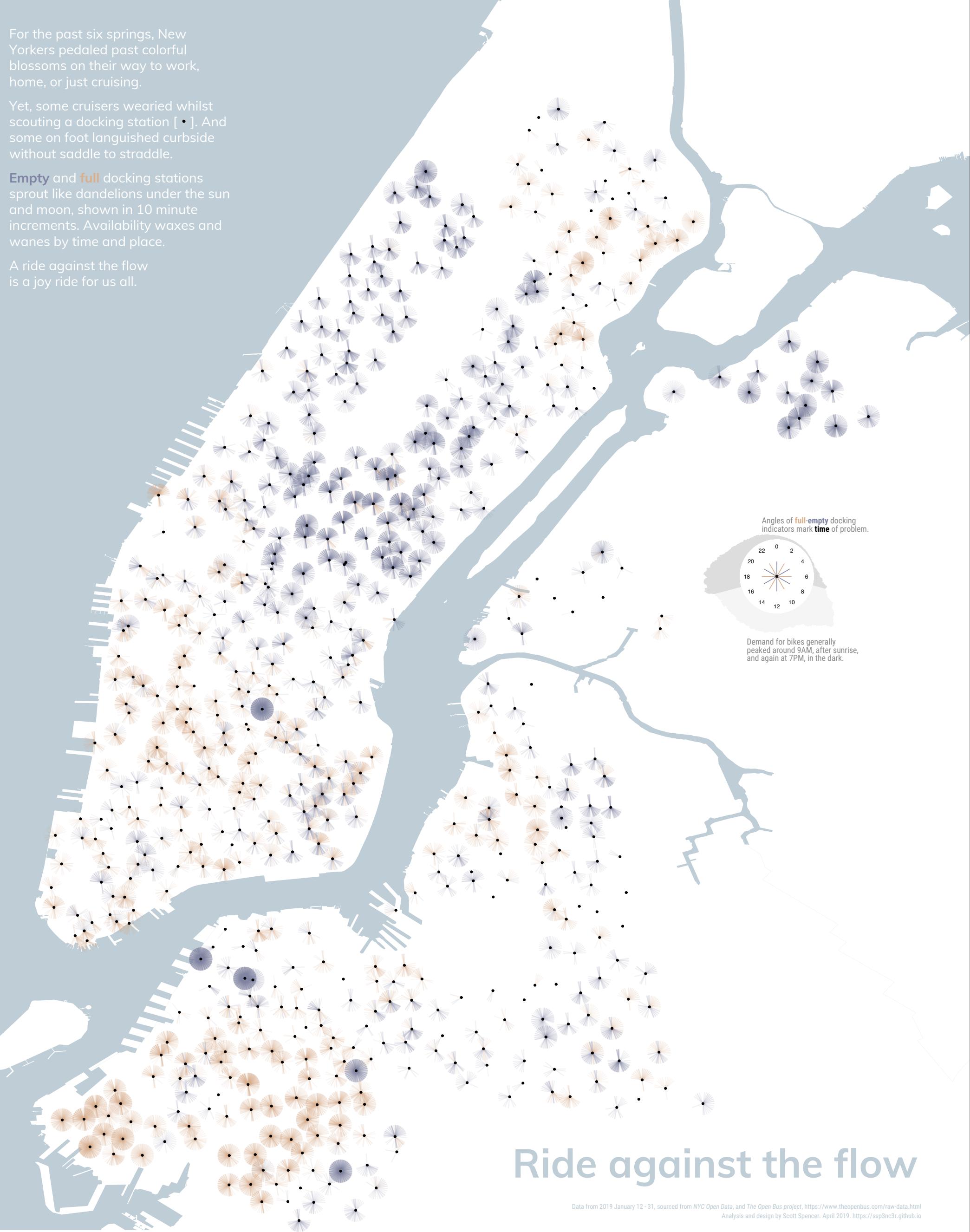


For the past six springs, New Yorkers pedaled past colorful blossoms on their way to work, home, or just cruising.

Yet, some cruisers wearied whilst scouting a docking station [ ]. And some on foot languished curbside without saddle to straddle.

Empty and full docking stations sprout like dandelions under the sun and moon, shown in 10 minute increments. Availability waxes and wanes by time and place.

A ride against the flow is a joy ride for us all.



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

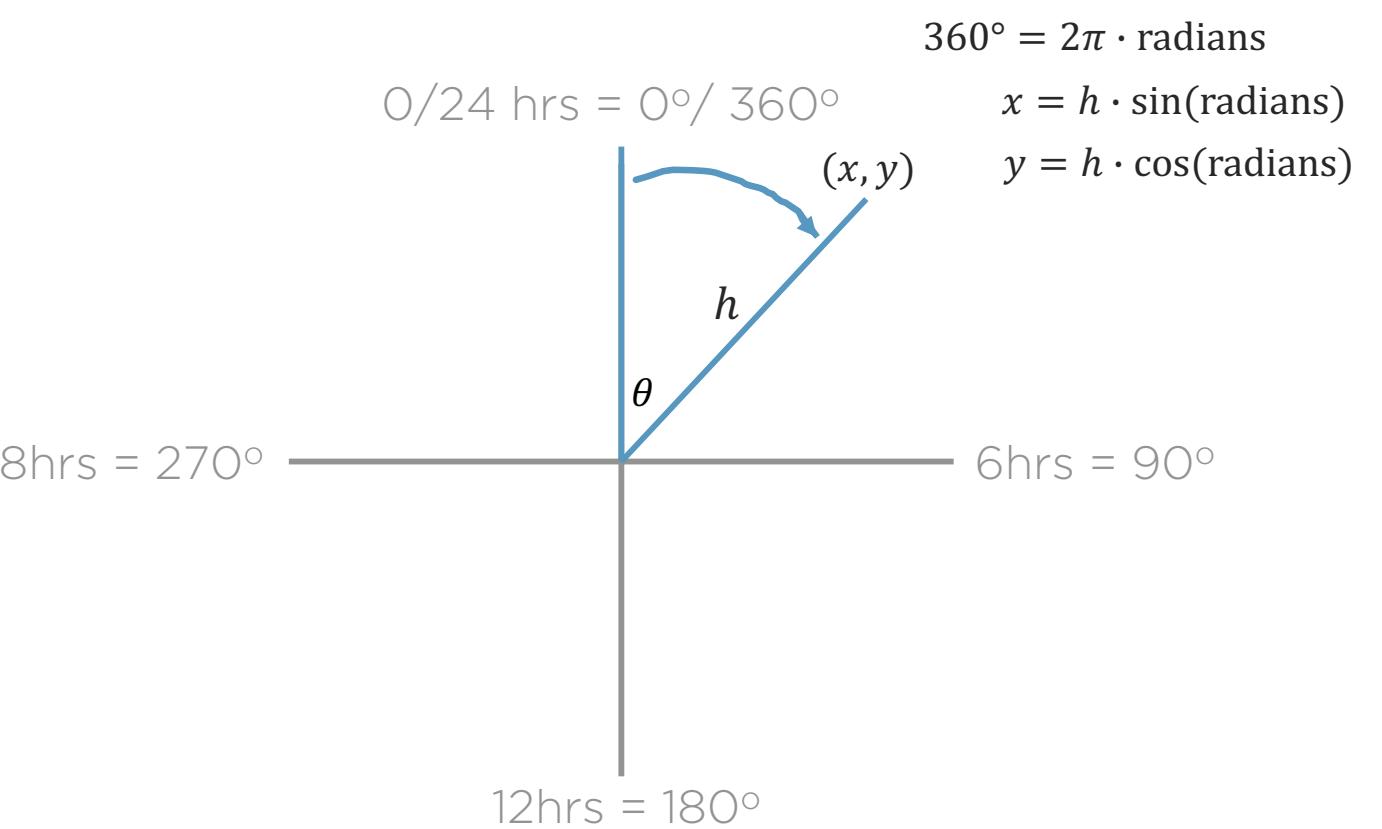
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?

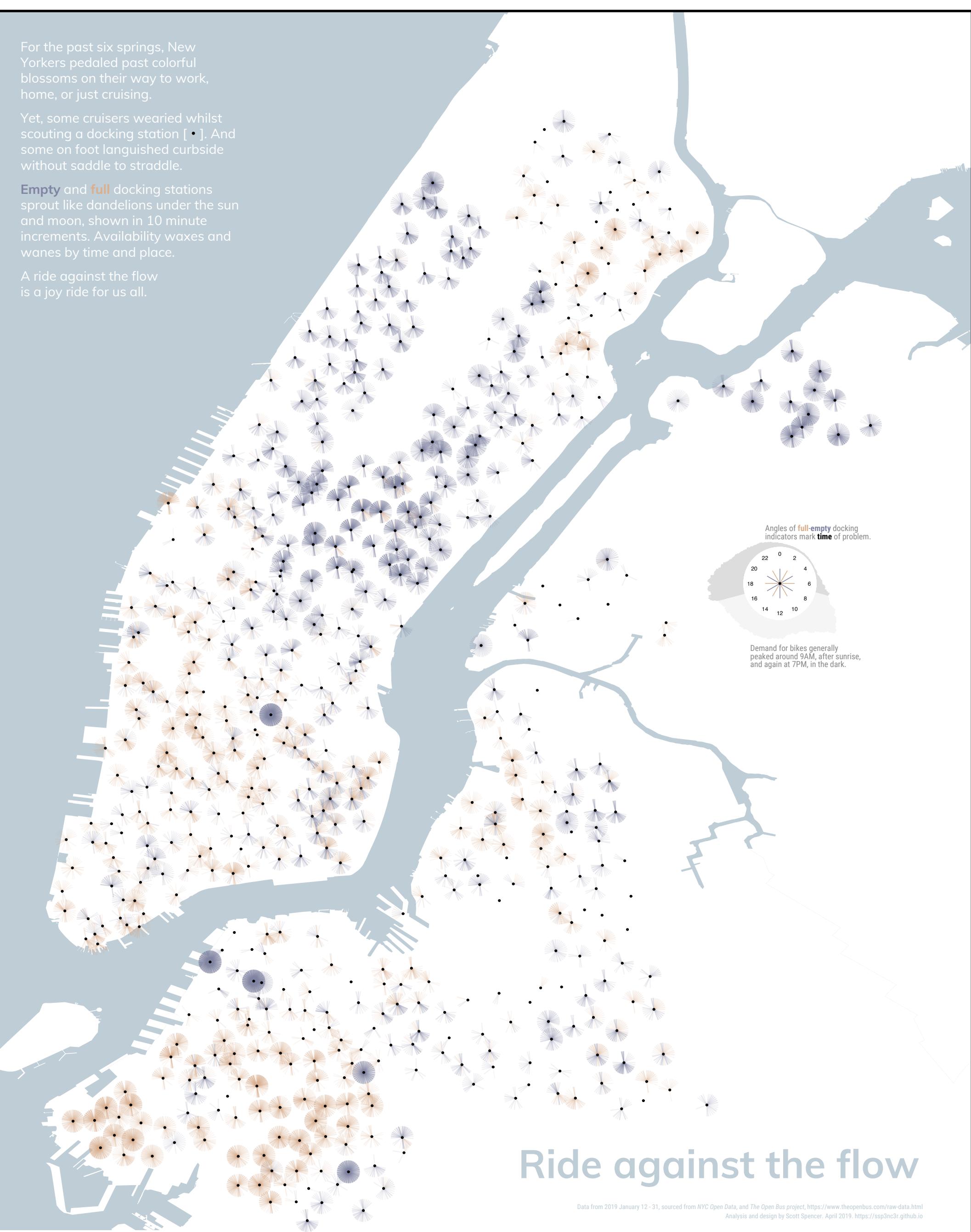


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# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

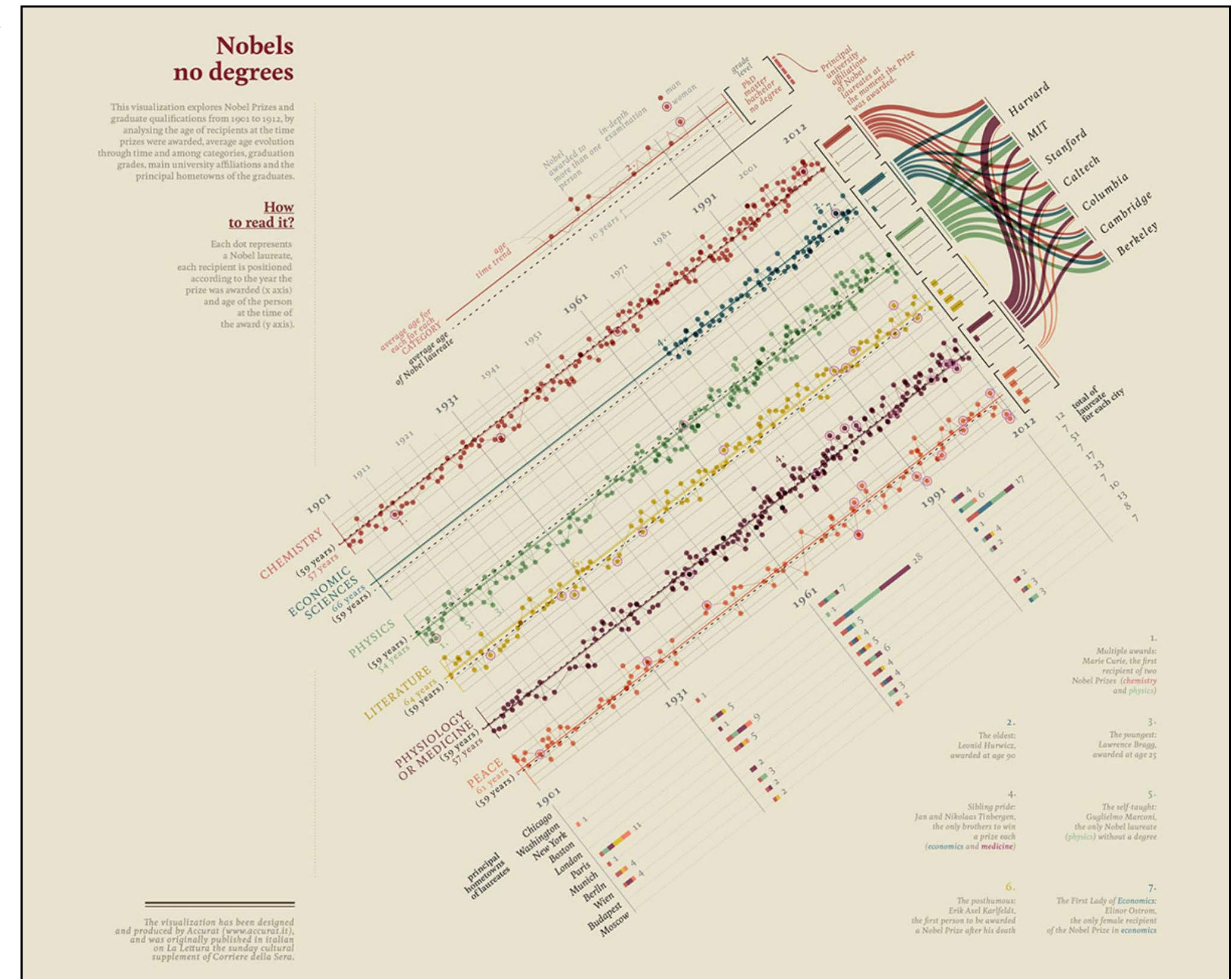
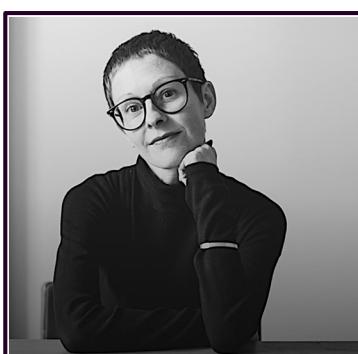
Data encodings, decodings?

Comparison or change?

Color, coherency?

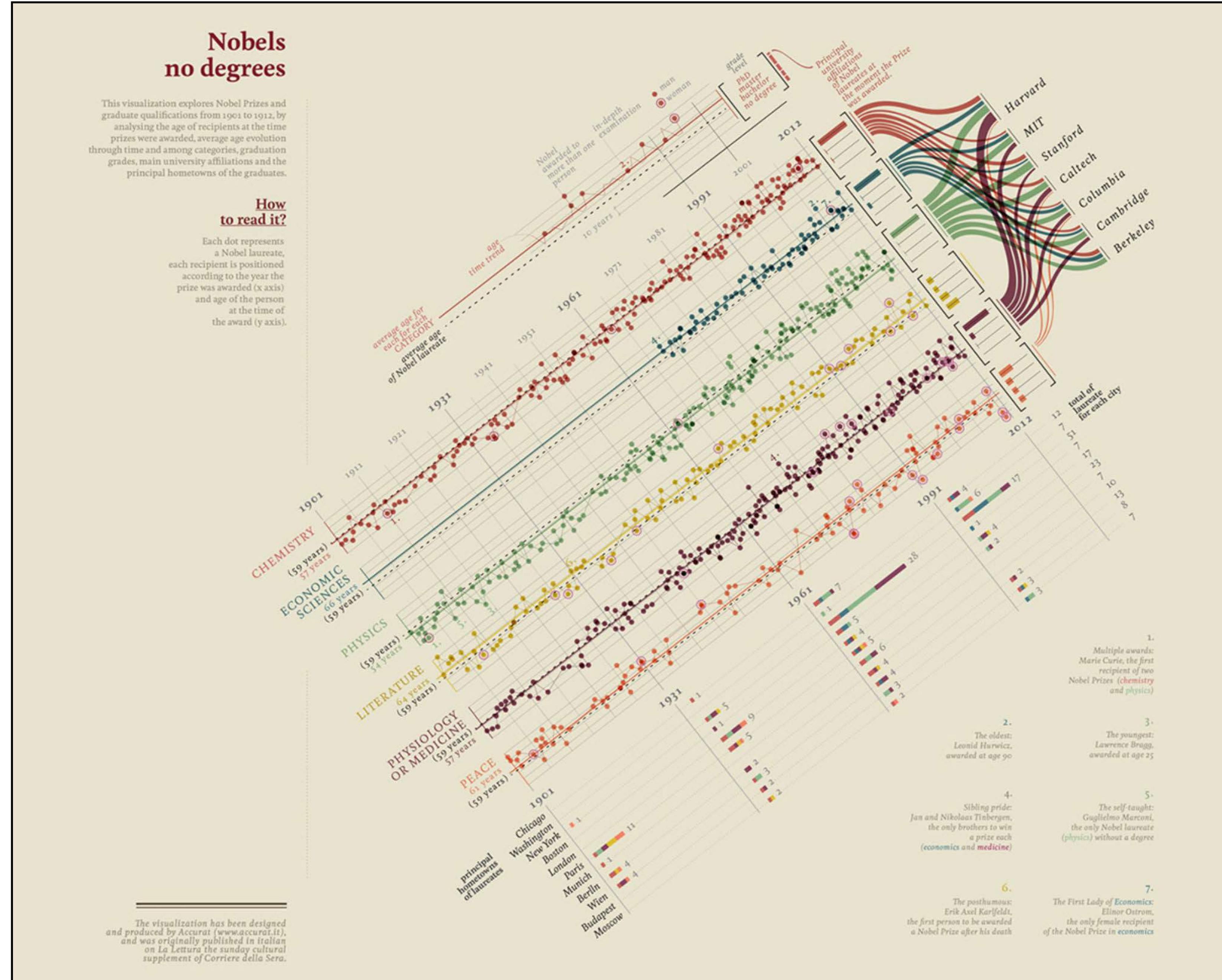
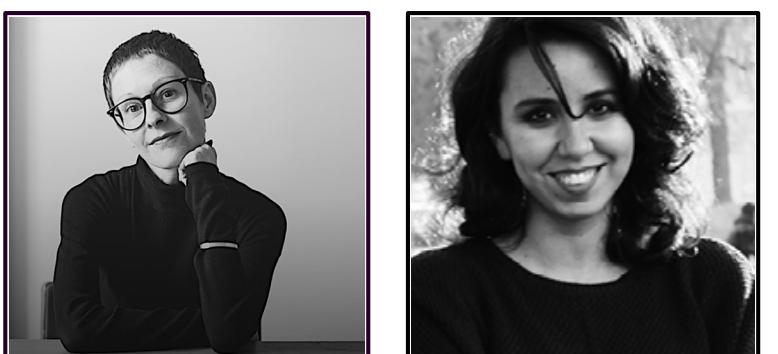
Layering, layout?

Credibility, transparency?



# **practice in the studio**

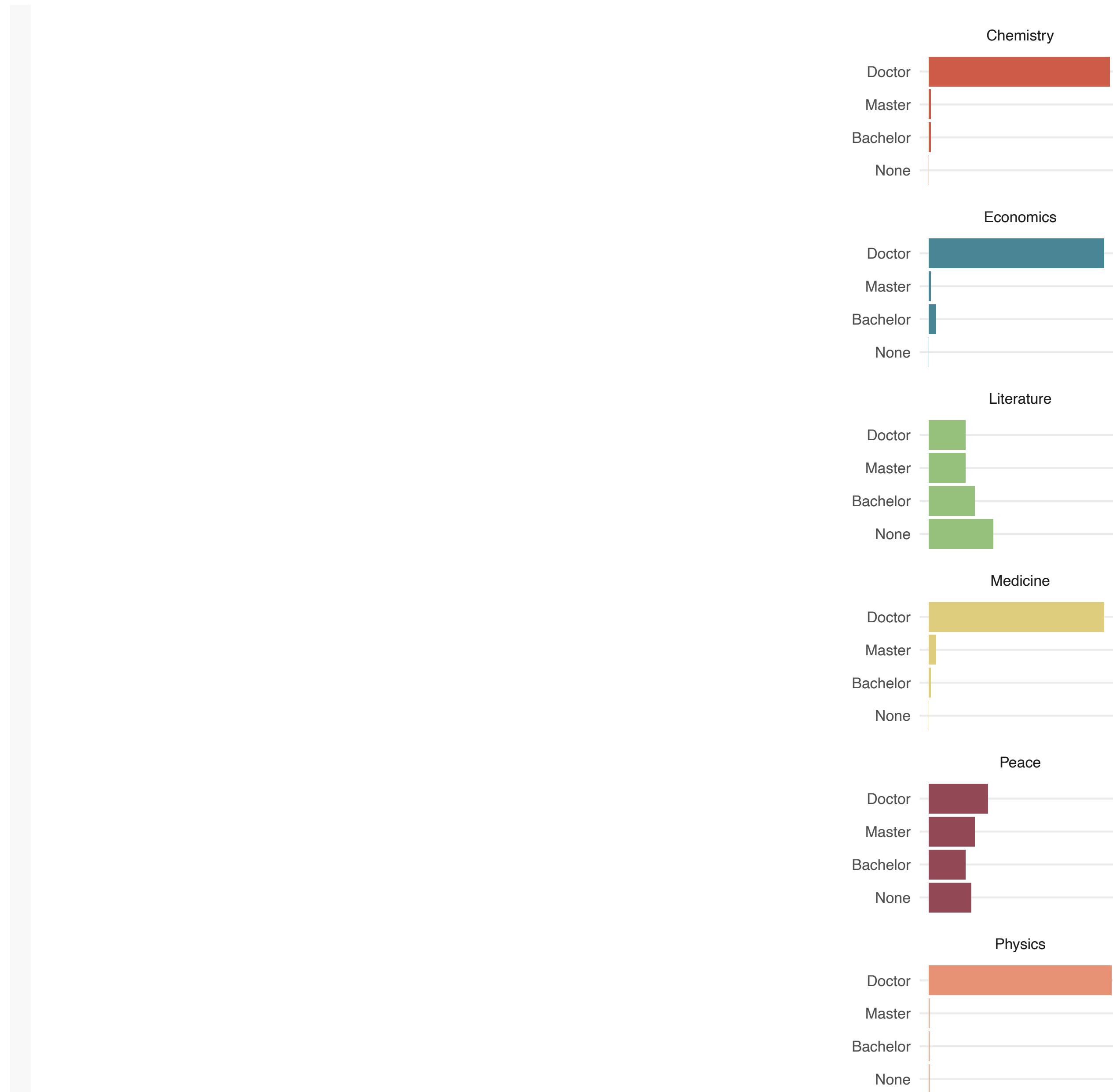
# reconstructing an infographic



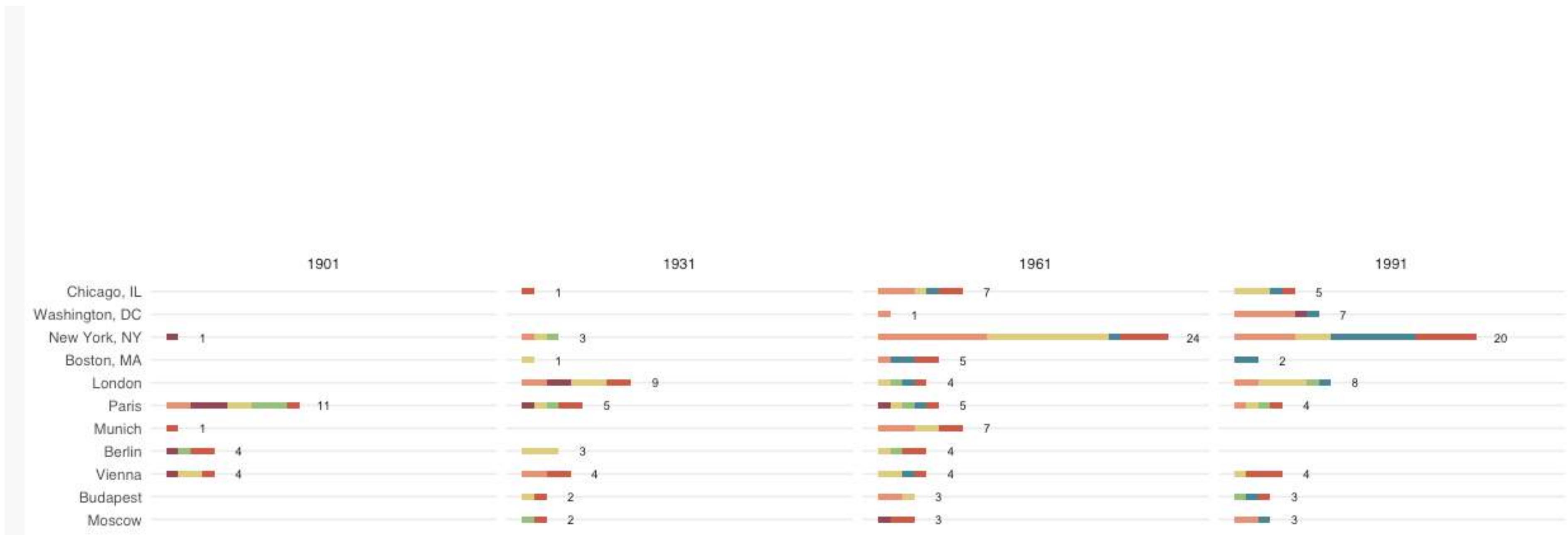
approximating the components | *encoding prizes by color, type, and points and lines by time and age*



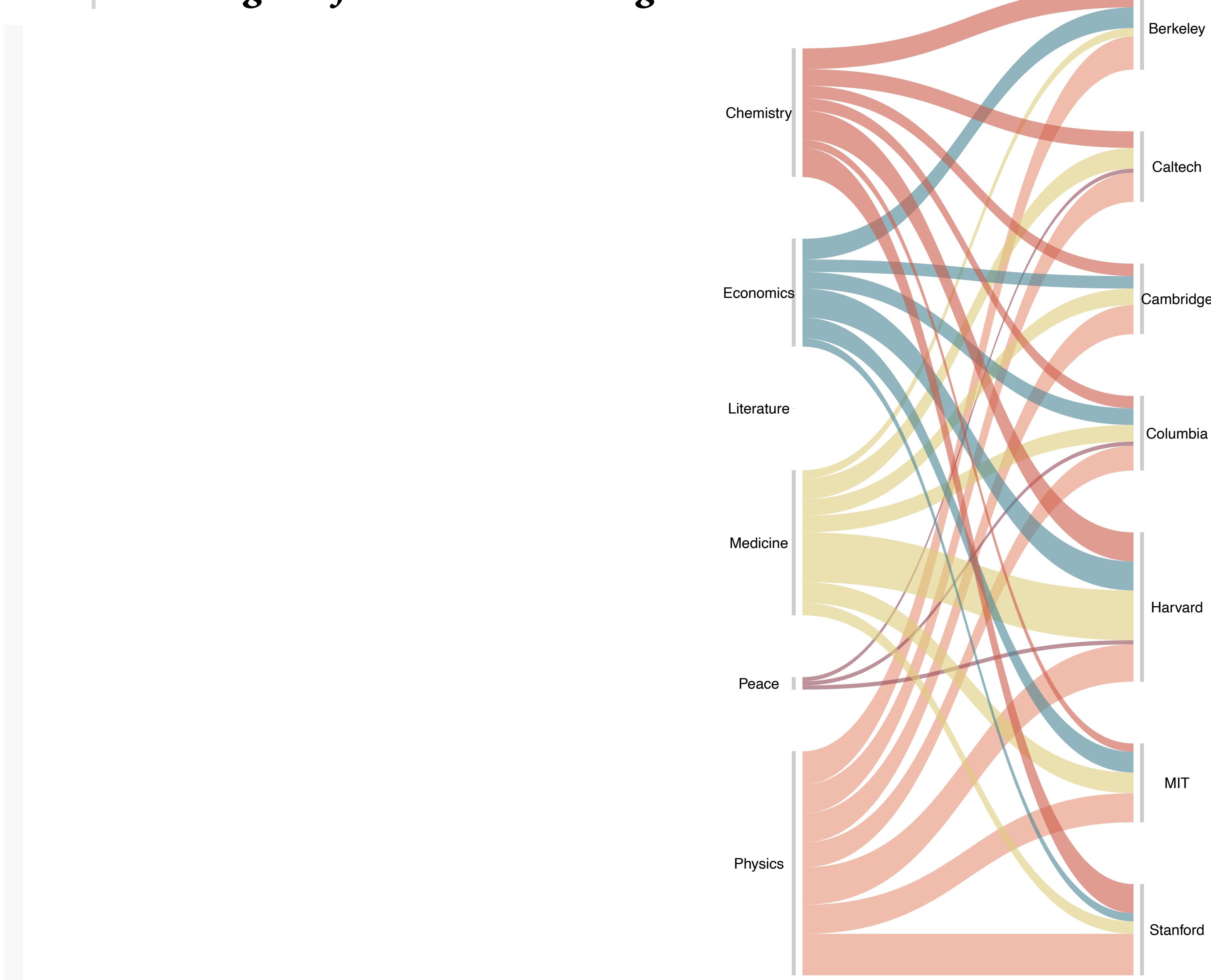
# approximating the components | *encoding prizes by color, type, and histogram length by education type*



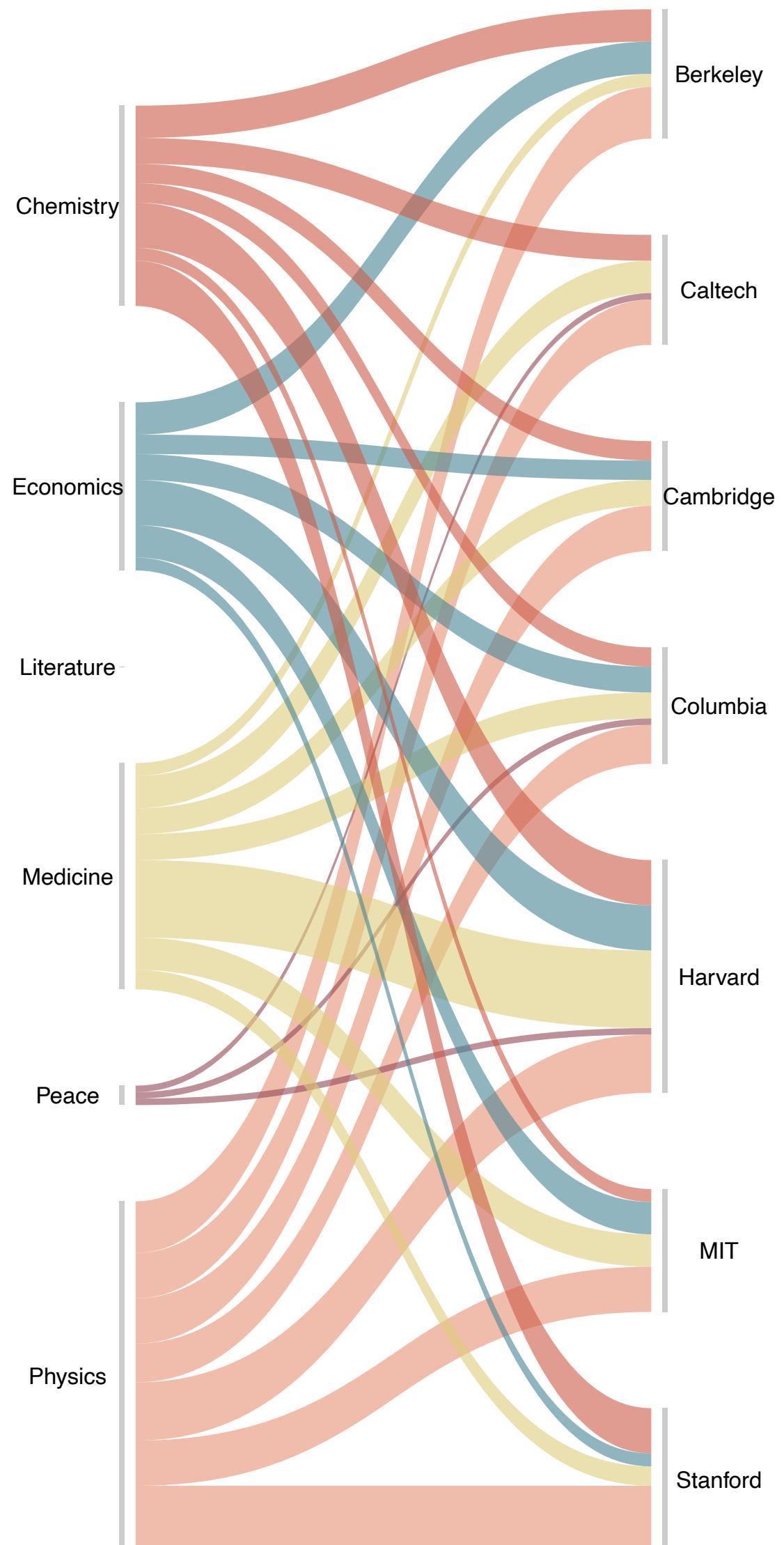
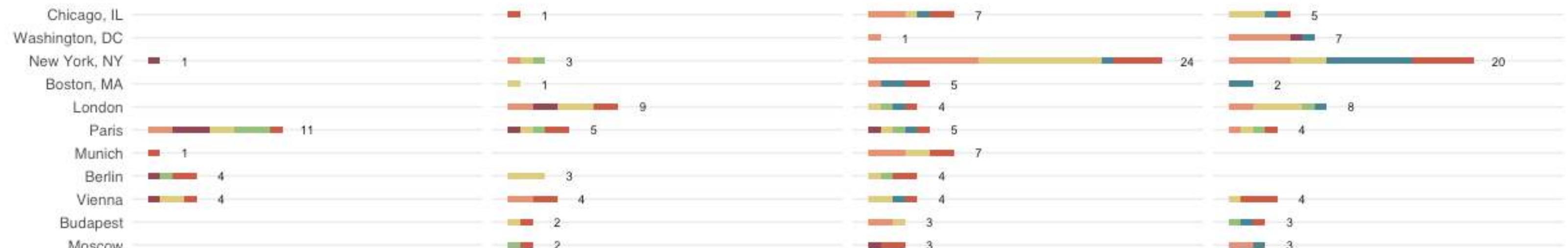
# approximating the components | *encoding prizes by color, decade, and stacked bar length by city*



# approximating the components | *encoding the flow between categories*



# approximating the components | *arranging components and aligning axes*



# approximating the components | *layering in the remaining annotations, linking to graphics*

## Nobels, no degrees

This visualization explores Nobel Prizes and graduate qualifications from 1901 to 2012, by analyzing the age of recipients at the time prizes were awarded, average age evolution through time and among categories, graduation grades, main university affiliations and the principal hometowns of the graduates.

## How to read it?

Each dot represents a Nobel laureate, each recipient is positioned according to the year the prize was awarded (x axis) and age of the person at the time of the award (y axis).

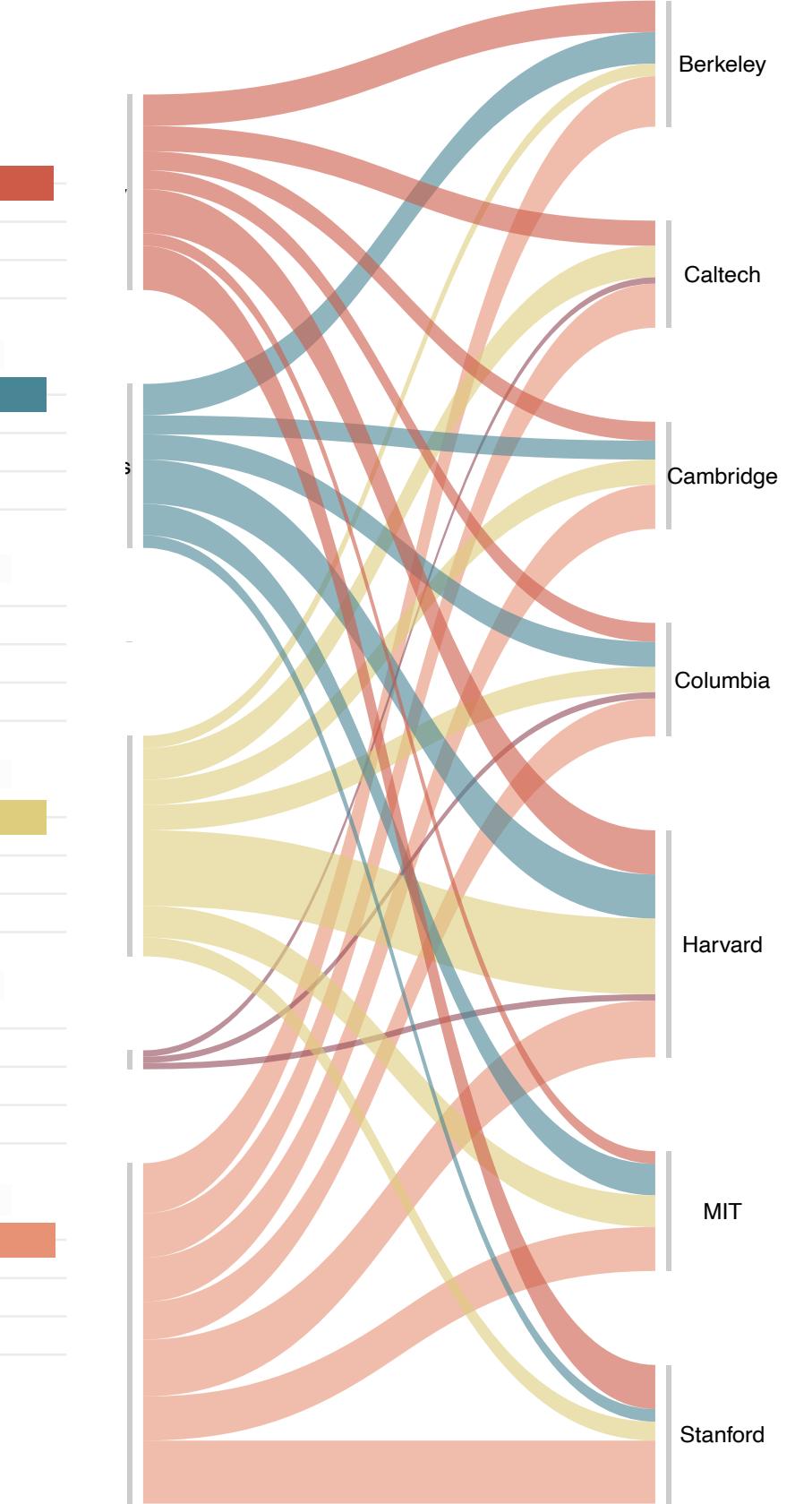


Chicago, IL  
Washington, DC  
New York, NY  
Boston, MA  
London  
Paris  
Munich  
Berlin  
Vienna  
Budapest  
Moscow

1  
3  
1  
9  
5  
11  
4  
4  
2  
2

7  
1  
24  
5  
4  
7  
4  
4  
3  
3

5  
7  
20  
8  
4  
4  
3  
3



1.  
Multiple awards:  
Marie Curie, the first  
recipient of two Nobel  
Prizes (**chemistry** and  
**physics**)

2.  
The oldest:  
Leonid Hurwicz,  
awarded at age 90

3.  
The youngest:  
Lawrence Bragg,  
awarded at age 25

4.  
Sibling pride:  
Jan and Nikolaas Tinbergen,  
the only brothers to win a prize  
each (**economics** and **medicine**)

5.  
The self-taught:  
Guglielmo Marconi,  
the only Nobel laureate  
(**physics**) without a degree

6.  
The First Lady of **Economics**:  
Elinor Ostrom,  
the only female recipient  
of the Nobel Prize in **economics**

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## additional material for discussion

# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

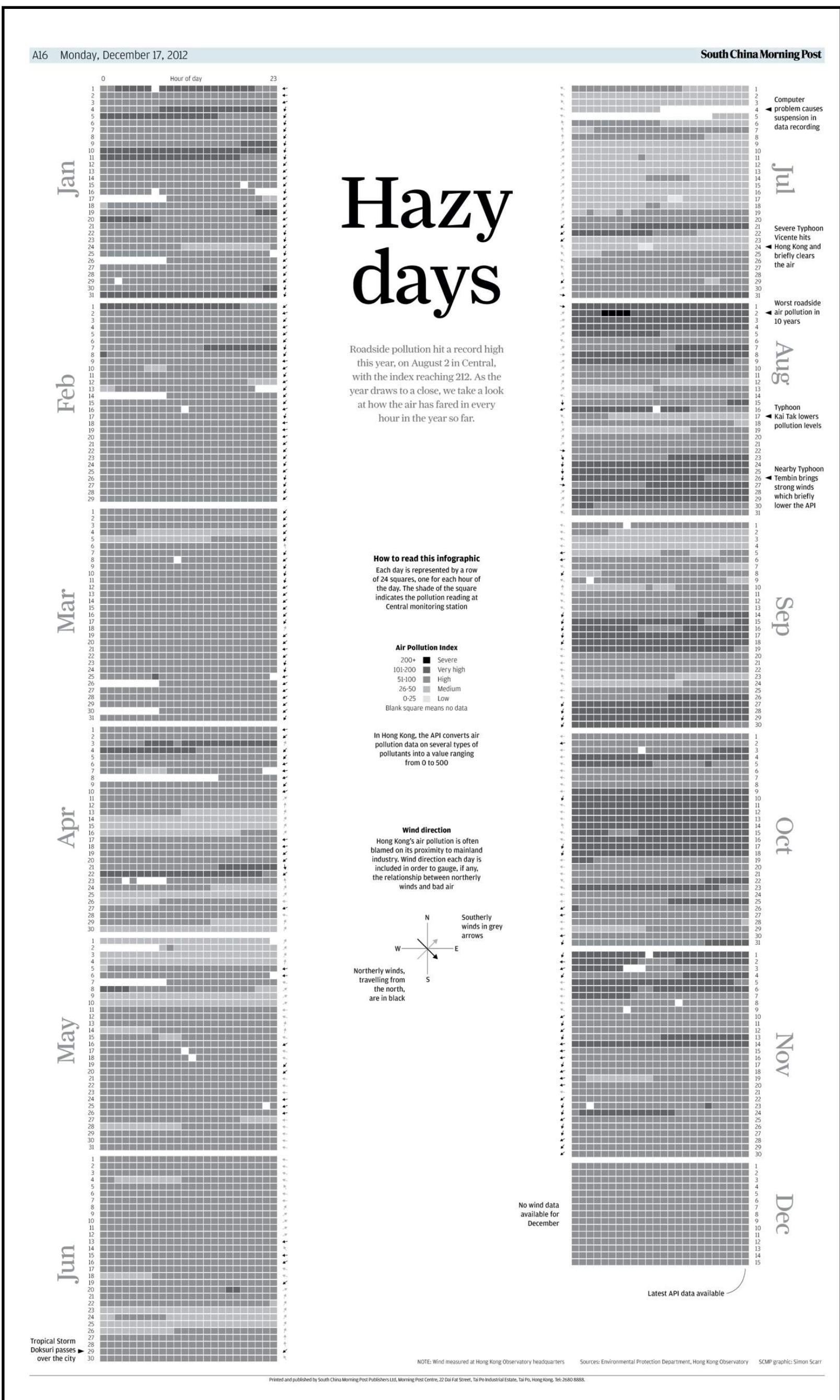
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?

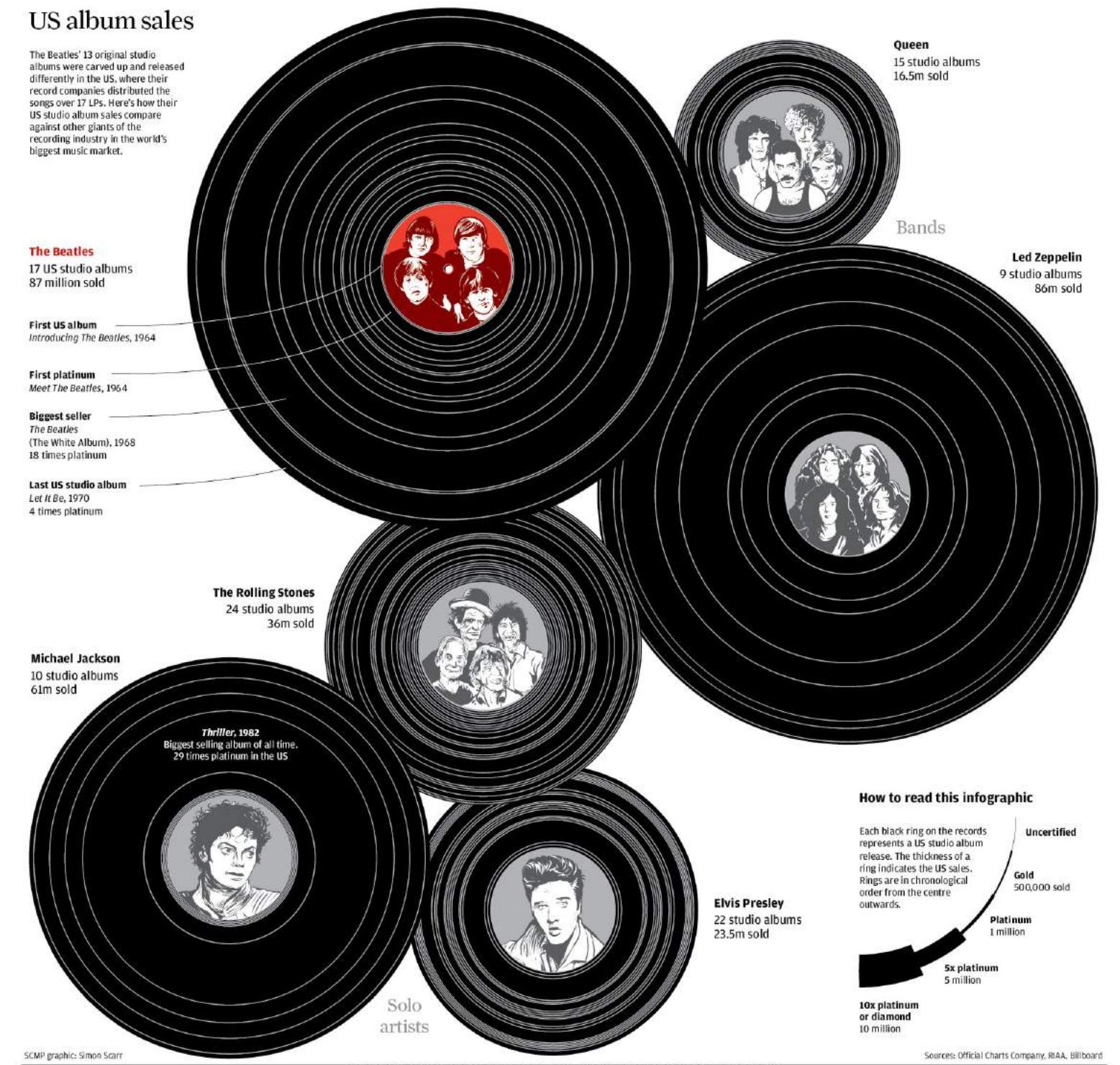
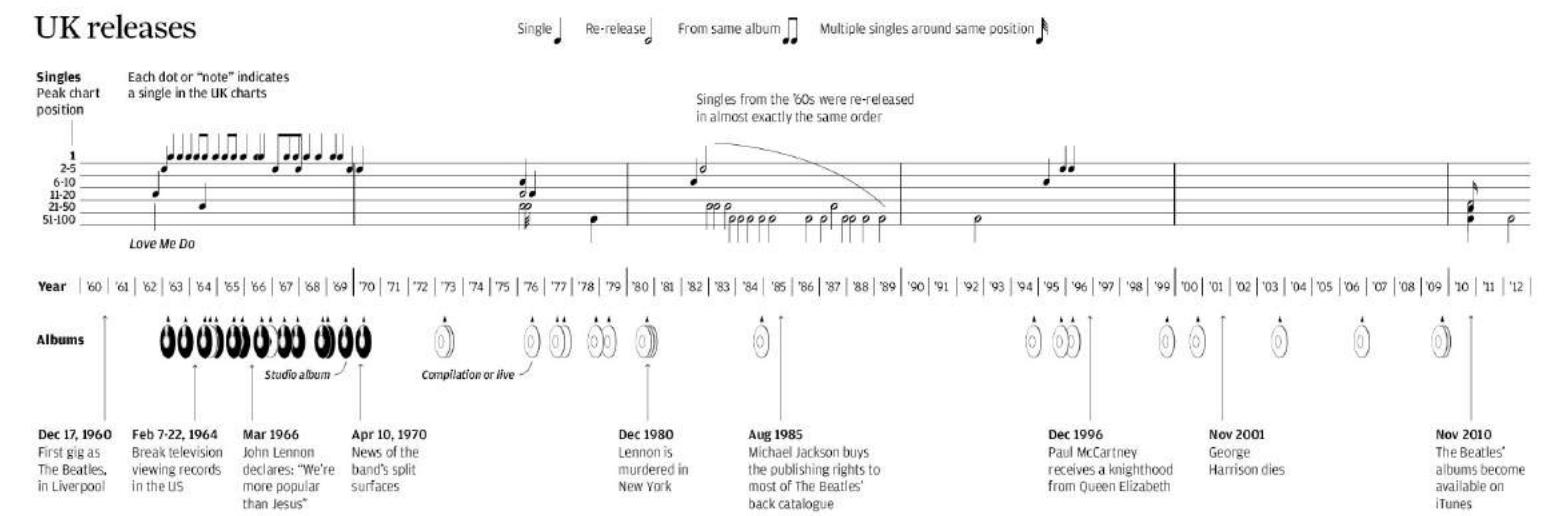
Scarr, Simon

A18 Saturday, October 13, 2012

South China Morning Post

## Love Me Do

Fifty years ago today The Beatles made their chart debut with their first single, *'Love Me Do'*. They would go on to have 17 number one singles in their native Britain and sell over 80 million albums in the United States, all the while changing the face of popular culture.



# (info)graphics examples for discussion

Audience?

Annual report 2018

page 11

Purpose?

## Expansion into the next adjacent segment: Mid-market

Historically, we have been focused on the needs of large multinational merchants. However, we believe that we are well-positioned to also grow the business with mid-market merchants, which we view as the next adjacent segment to enterprise, as a result of the following:

- Industry-leading functionality: All merchants that use our platform gain access to the same performance and functionality as the world's largest multinational companies. This makes the platform attractive to both large domestic merchants and local merchants with international ambitions, allowing them to effectively future-proof their payments.
- Serving local heroes: Over the last 11 years, we've been able to establish a truly global footprint, with 18 offices worldwide, which provide local presence, payment methods and expertise in key markets. This allows us to focus on further serving local mid-market merchants.

Narrative?

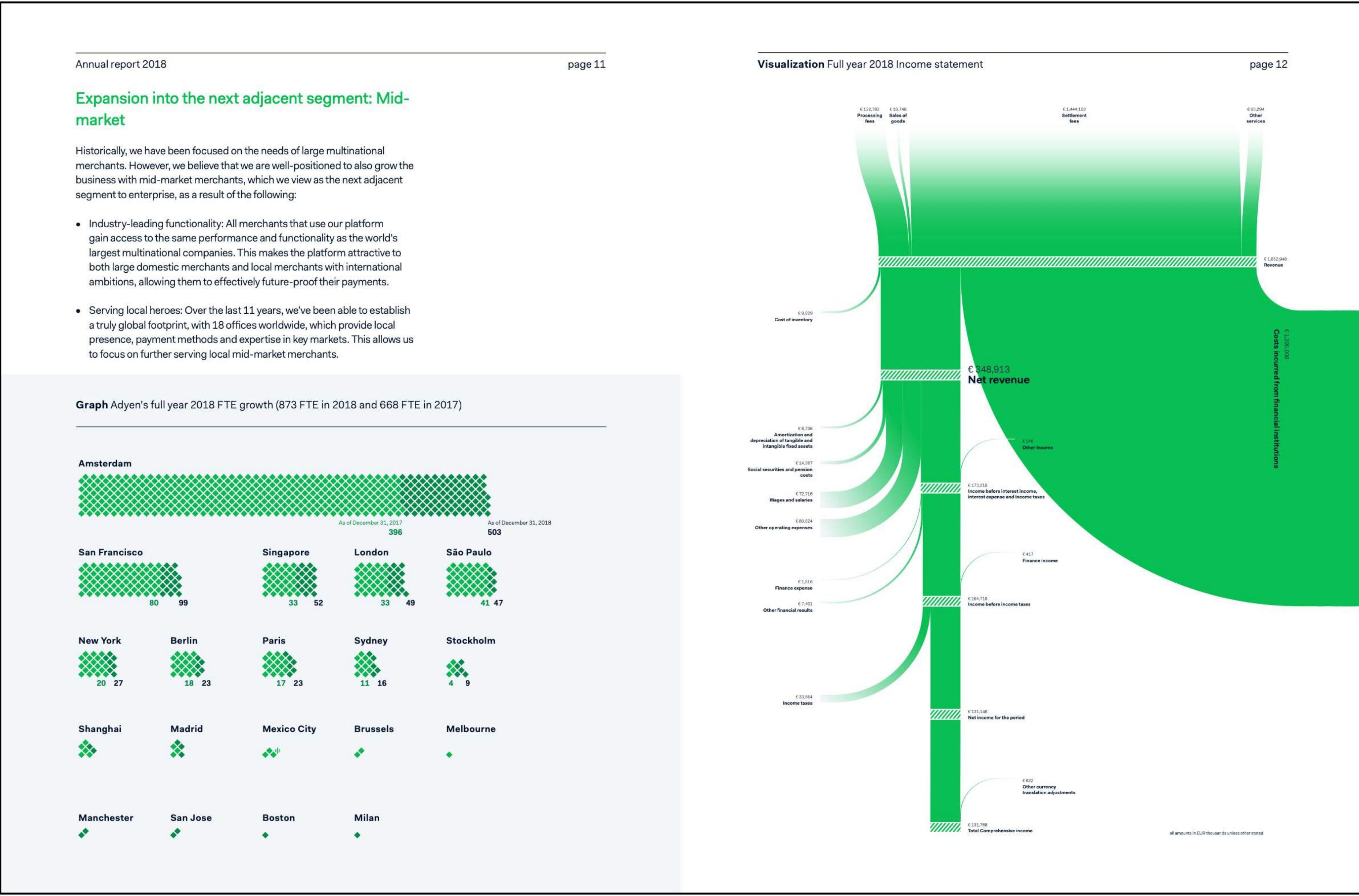
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?

López, Alberto Lucas

A14 Thursday, June 26, 2014

South China Morning Post

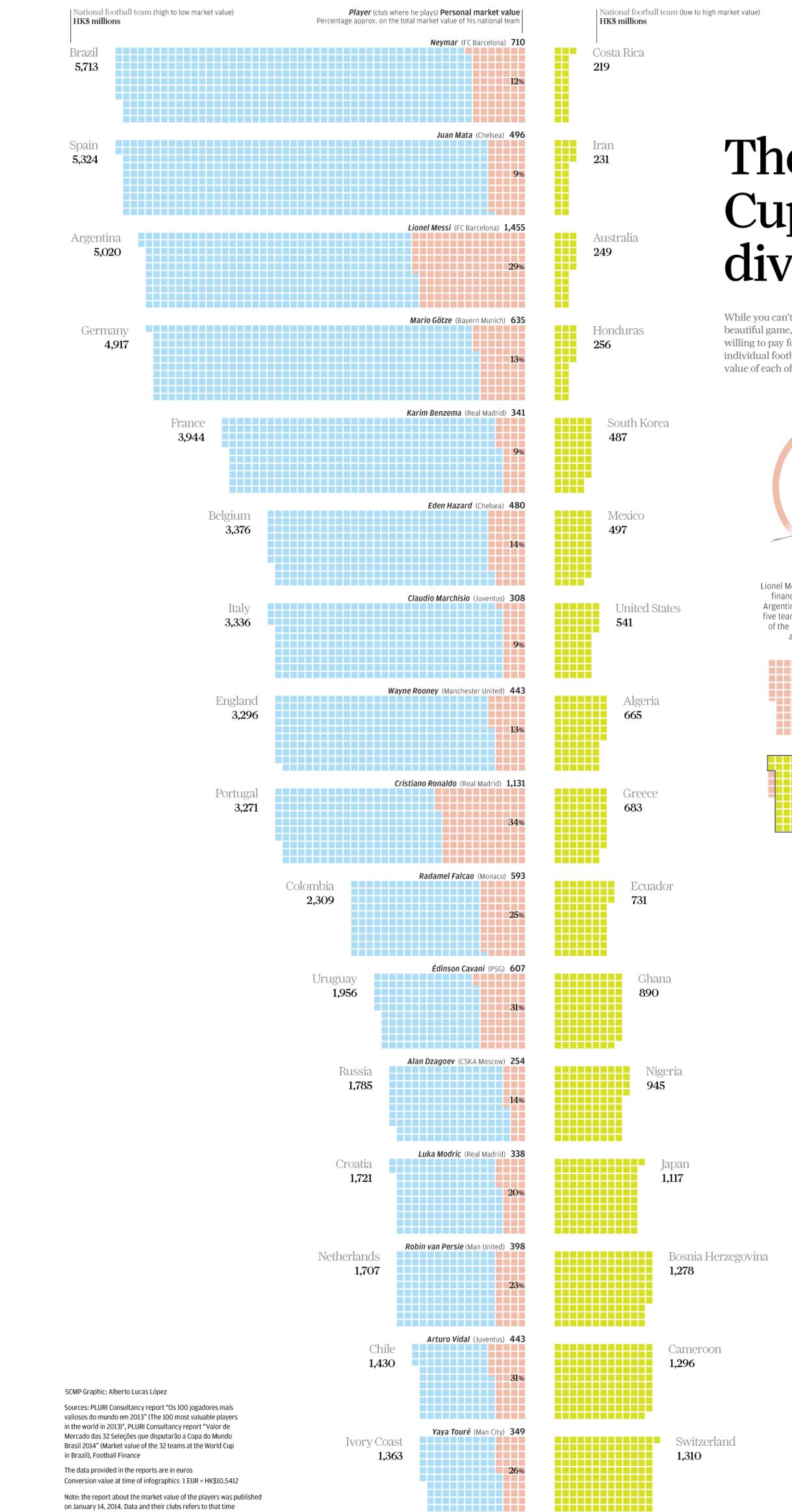
## How to read this infographic

Each square represents HK\$10 million market value. The 16 teams with the highest market value playing at the World Cup. Market value of the highest paid player for the top 16 teams.

The 16 teams with the lowest market value playing at the World Cup.

## Player (club where he plays) Personal market value

Percentage approx. on the total market value of his national team

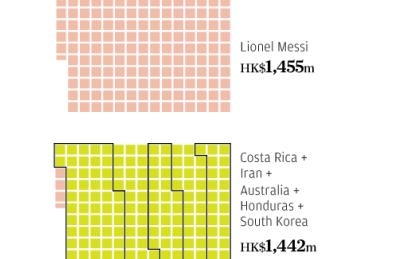


## The World Cup's great divide

While you can't put a price on a fan's passion for the beautiful game, we do know how much clubs are willing to pay for players. By combining the value of individual footballers, we have estimated the market value of each of the 32 teams at the World Cup in Brazil.



**Individual vs country**  
Lionel Messi is the world's most valuable player. Financially, the market value of Argentina's worth alone could finance the five teams with the lowest market value. None of the 16 lowest-ranked teams have players among the top 100 highest paid.



# (info)graphics examples for discussion

Audience?

Purpose?

Narrative?

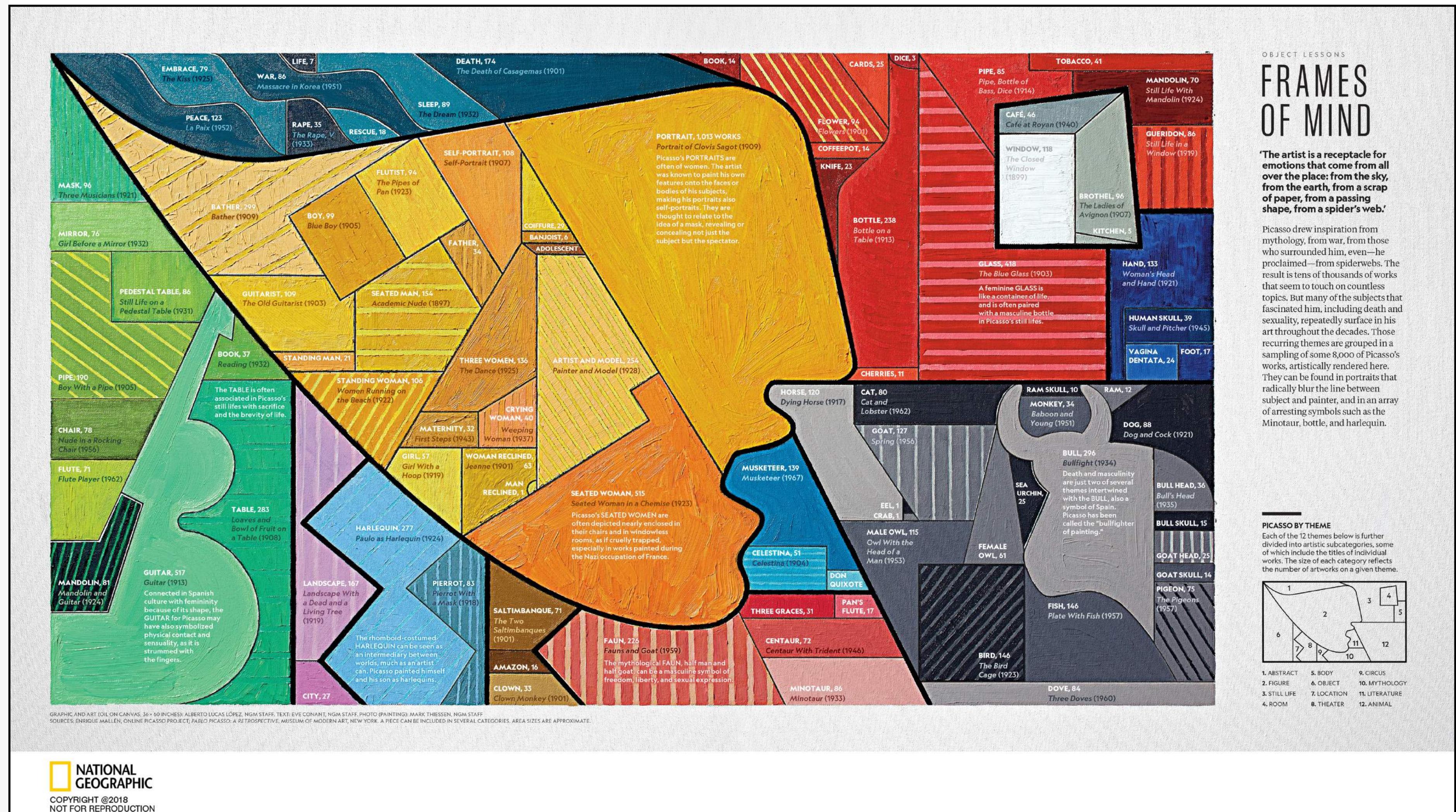
Data encodings, decodings?

Comparison or change?

Color, coherency?

Layering, layout?

Credibility, transparency?



López, Alberto Lucas

# (info)graphics examples for discussion

Audience?

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